Chapter 4
State of Cameron Run and its Subwatersheds

4.1 STATE OF CAMERON RUN WATERSHED

Today, the Cameron Run mainstem is a flood-control channel whose surrounding area is characterized primarily by medium- to high-density urban development. The Cameron Run watershed (Figure 4-1) contains some of the oldest and most highly developed areas in Fairfax County. Nearly 95% of the watershed is developed with homes, strip malls, commercial enterprises, and extensive roadway systems. The major highways in Fairfax County that cross the watershed include the Capitol Beltway, Shirley Highway (I-395), Little River Turnpike (State Route 236), Arlington Boulevard (U.S. Route 50), and Lee Highway (U.S. Route 29). These major arteries contain the largest shopping areas as well as several commercial strip developments on streets throughout the watershed. These include Arlington Boulevard, the intersections of Little River Turnpike and Columbia Pike, and northwest of the Beltway interchange along Gallows Road.

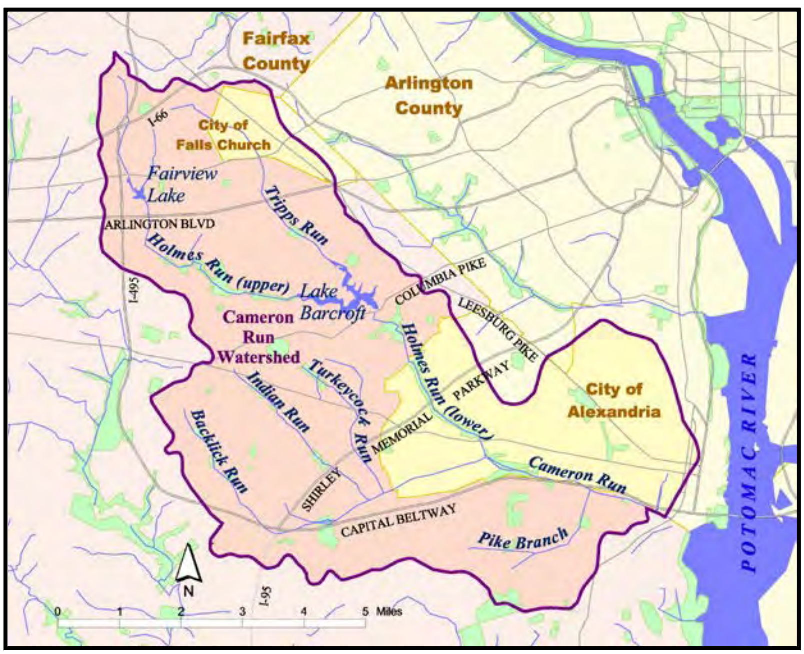

Figure 4-1. Map of Cameron Run watershed

The effects of development are apparent throughout the watershed. The historic floodplain of lower Cameron Run is now primarily a transportation corridor where the Capitol Beltway parallels the stream channel (Woodrow Wilson Bridge Project 2001). Industrial, commercial, and residential areas have replaced the wetlands and forests that once attenuated floodwaters. Small remnants of wetlands remain in the watershed. These include palustrine, lacustrine, and riverine wetlands (associated with tidal wetlands, open water bodies, and free-flowing tributaries, respectively). The channels of Cameron Run and Holmes Run were made into rocklined or concrete channels to remove floodwaters from developed areas quickly. The effects of these alterations are apparent in the degraded water quality within the channels. The channels have experienced an increase in temperature and algal production (potentially leading to lower dissolved oxygen and higher pH), channel instability, and disconnection from the floodplain and wetland areas. Nonpoint-source pollution and urban stormwater runoff greatly affect the health of this watershed.

According to the 2001 SPS Baseline Study, the Cameron Run mainstem and its tributaries "have substantially degraded biological and habitat integrity." The SPS Baseline Study listed Cameron Run as a Watershed Restoration Level II watershed, which is characterized by high-density development, significantly degraded in-stream habitat conditions, and substantially degraded biological communities (Fairfax County SPS 2001). The number of different fish species was small, and stress-tolerant species dominated these communities. The macroinvertebrate community was dominated by highly stress-tolerant midges; sensitive species indicative of high-quality conditions were absent.

The imperviousness within each subwatershed exceeded 23%. Greater than 10% imperviousness has been shown to significantly diminish habitat quality and biological integrity in stream systems (CWP 1998). Streams have been altered extensively to accommodate the large volumes of stormwater runoff from the watershed. These changes reflect the historical view of streams as stormwater conveyance systems.

The SPA study provides watershed-wide information about the habitat conditions, specific infrastructure and problem areas, general stream characteristics, and a geomorphic classification of stream type (CH2M Hill 2004). Parameters analyzed include

- **Instream habitat** measures the amount of substrate that is available as refuge for aquatic organisms. A wide variety and abundance of submerged structures in the stream creates many niches for macroinvertebrates, increasing the potential for species diversity. As the composition and abundance of cover decrease, habitat structure becomes monotonous, species diversity decreases, and the potential for recovery following disturbance decreases.
- **Epifaunal substrate** measures the availability and quality of benthic habitat for macroinvertebrates (insects and snails) in riffle-prevalent streams. Riffle areas are critical for maintaining a healthy variety of insects..
- **Vegetated buffer zone** measures the width and overall condition of the vegetation or land use along a stream reach. This parameter is measured from the edge of the upper streambank out through, and in some cases, beyond the flood plain and riparian zone. The vegetated area serves as a buffer for pollutants entering a stream in runoff and minimizes erosion. Far fewer useful buffer zones occur when roads, parking lots, fields, heavily used paths, lawns, bare soil, rocks, or buildings are near the bank.
- **Inadequate buffer sites** are specific locations that have been identified as having little or no riparian buffer. Information on this parameter can be used to count the number of stream miles that are inadequate, as well as target future restoration efforts to areas that need better riparian buffer protection.

- **Erosion sites** are specific locations along the stream that have been identified as having erosion problems. A severity rating was also recorded to help evaluate the observed erosion problems.
- **Bank instability** measures the existence of or the potential for detachment of soil from the upper and lower streambanks and its movement into the stream. Steep banks are more likely to collapse and erode than are gently sloping banks and, therefore, are considered to be unstable.
- **Channel alteration** measures large-scale changes in or modification of instream habitat, which affects stream biotic integrity and causes erosion of the stream bottom. Channel alteration is present when artificial embankments, rip rap, and other forms of artificial bank stabilization or structures are present; when dredging has altered bank stability; when dams and bridges are present; when banks and channels have been disturbed by livestock, other agricultural practices, or hydrology; and when other changes have occurred.
- **Embeddedness** measures the degree to which cobble, boulders, and other rock substrate are surrounded by fine sediment and silt. Embeddedness relates directly to the suitability of the stream substrate as habitat for macroinvertebrates and for fish spawning and egg incubation.
- **Sediment deposition** measures the amount of soil, sand, and silt that have accumulated on the bottom of the stream and to how the shape of the stream bottom has changed as a result of deposition. Sediment deposition may create an unstable and continually changing environment that becomes unsuitable for many organisms.
- **Dump sites** counts places where trash has been left illegally in or near a stream.

Habitat conditions in the Cameron Run watershed are shown in Figure 4-2. Loss of instream habitat and epifaunal substrate are shown in Figure 4-3. Analysis of the results indicates that the Cameron Run watershed has few adequate riparian buffers, having more than 40 areas of deficient buffer per 10 miles (Figure 4-4). In addition, the watershed also has more than 50 discharge pipes and ditches per 10 miles, as well as a large number of public utility lines and roadway stream crossings compared with other watersheds in the county. Sites of erosion and instability of streambanks within the watershed are shown in Figure 4-5. Current impact ratings for channel alteration, and embeddedness and sedimentation are shown in Figures 4-6 and 4-7, respectively. Dump sites rated minor to moderate are found within the watershed (Figure 4-8). Threatened infrastructure (e.g. exposed sewer pipes and eroded bridges) and changes in the stability of the stream channel are noted (Figure 4-9).

Water quality problems within the watershed include PCBs in aquatic species, excessive levels of fecal coliform bacteria, and acute ammonia levels. Water quality standards are set by the Environmental Protection Agency (EPA) under the Clean Water Act and administered by the

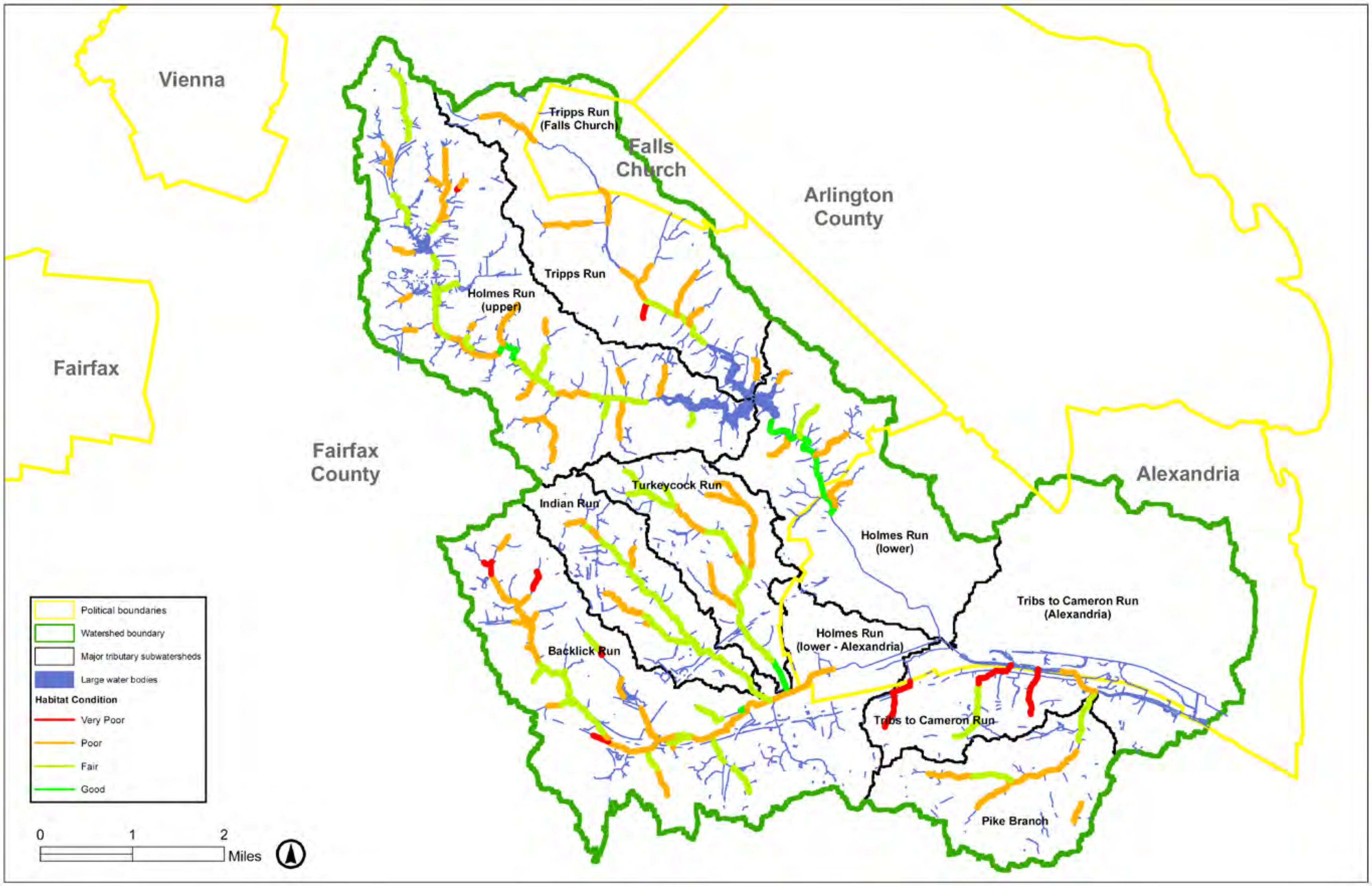

Figure 4-2. Habitat conditions in the Cameron Run watershed

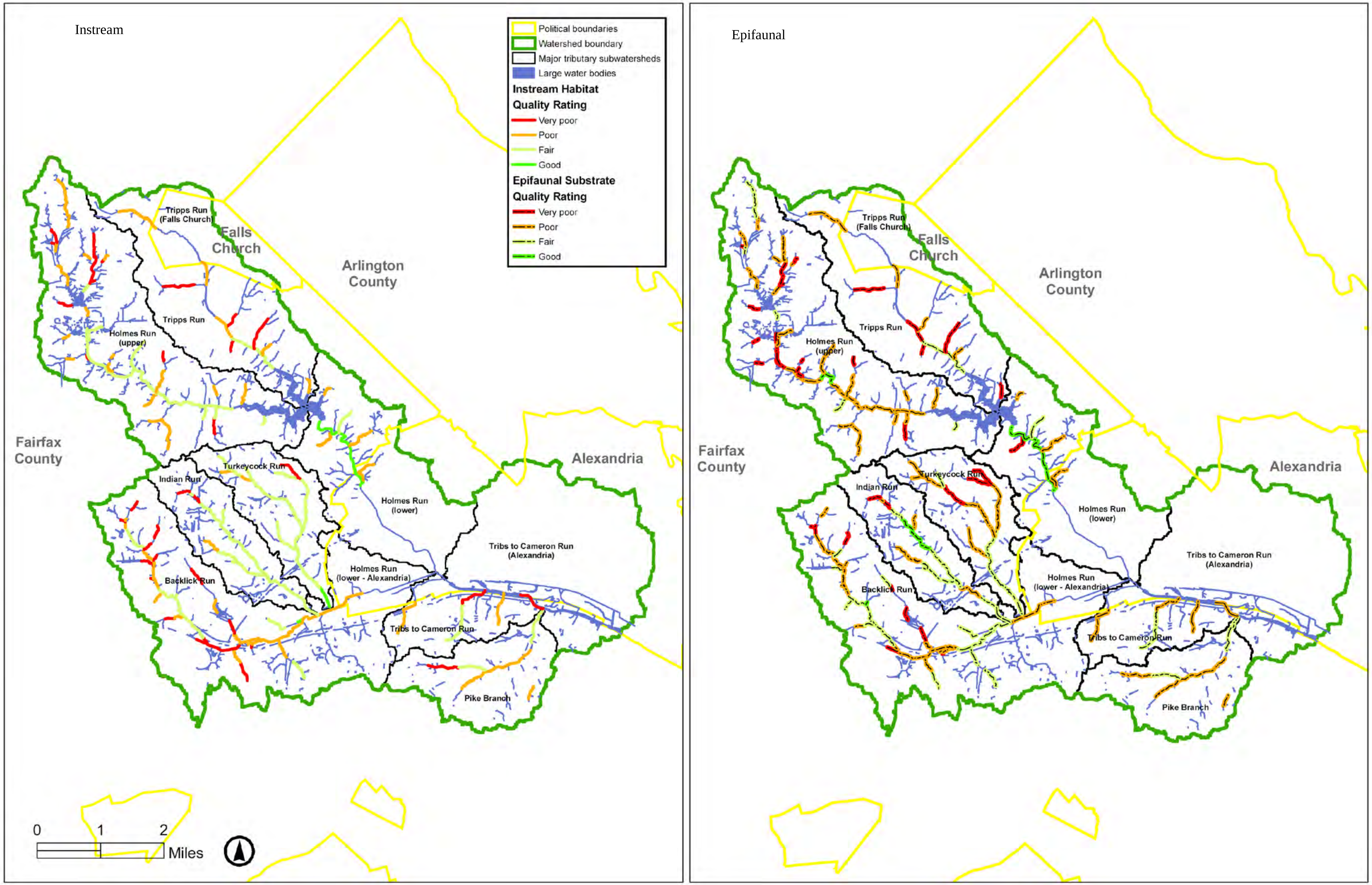

Figure 4-3. Loss of instream habitat and epifaunal substrate in Cameron Run watershed

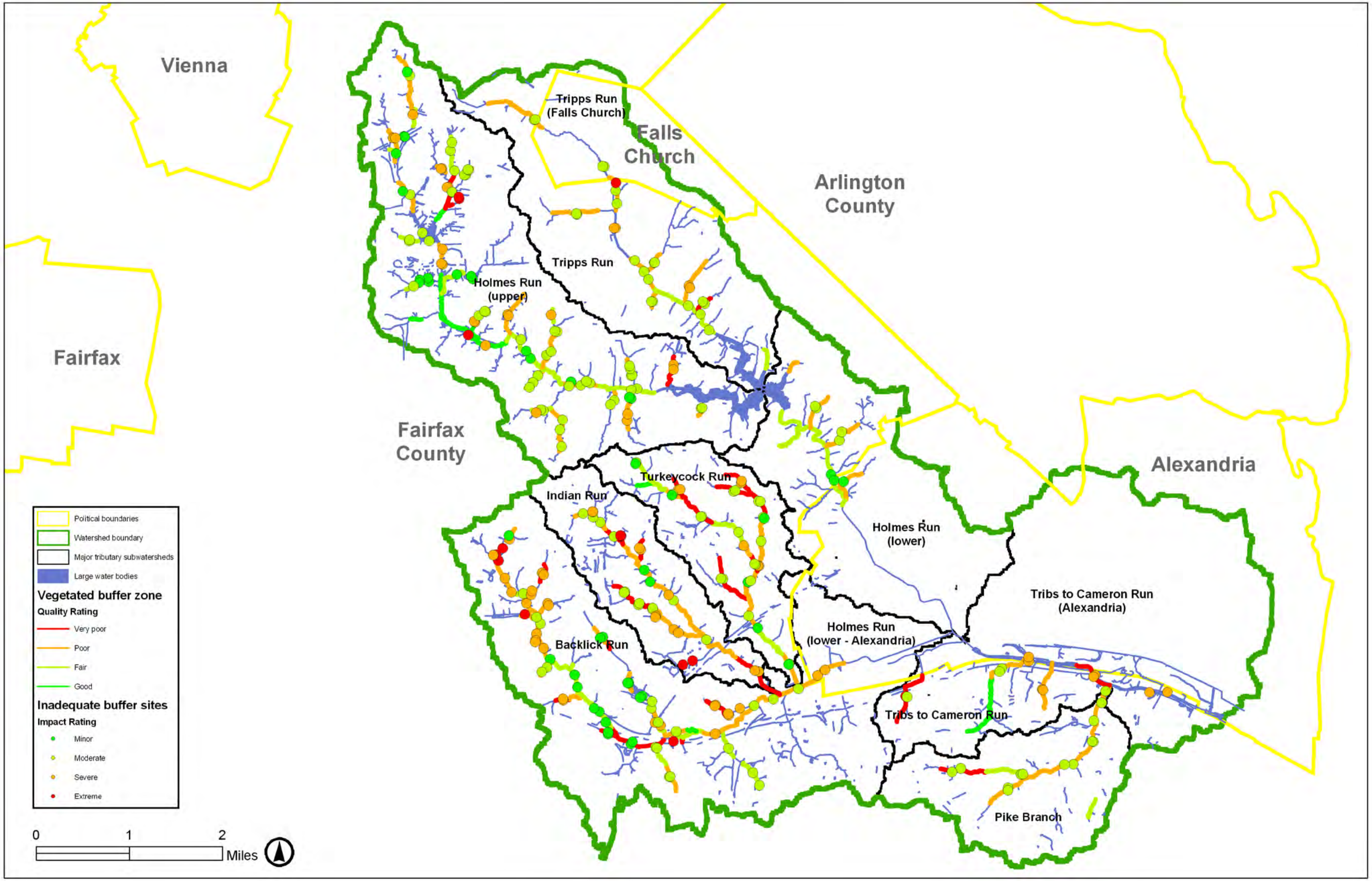

Figure 4-4. Vegetated buffer zone quality rating and inadequate buffer sites in Cameron Run watershed

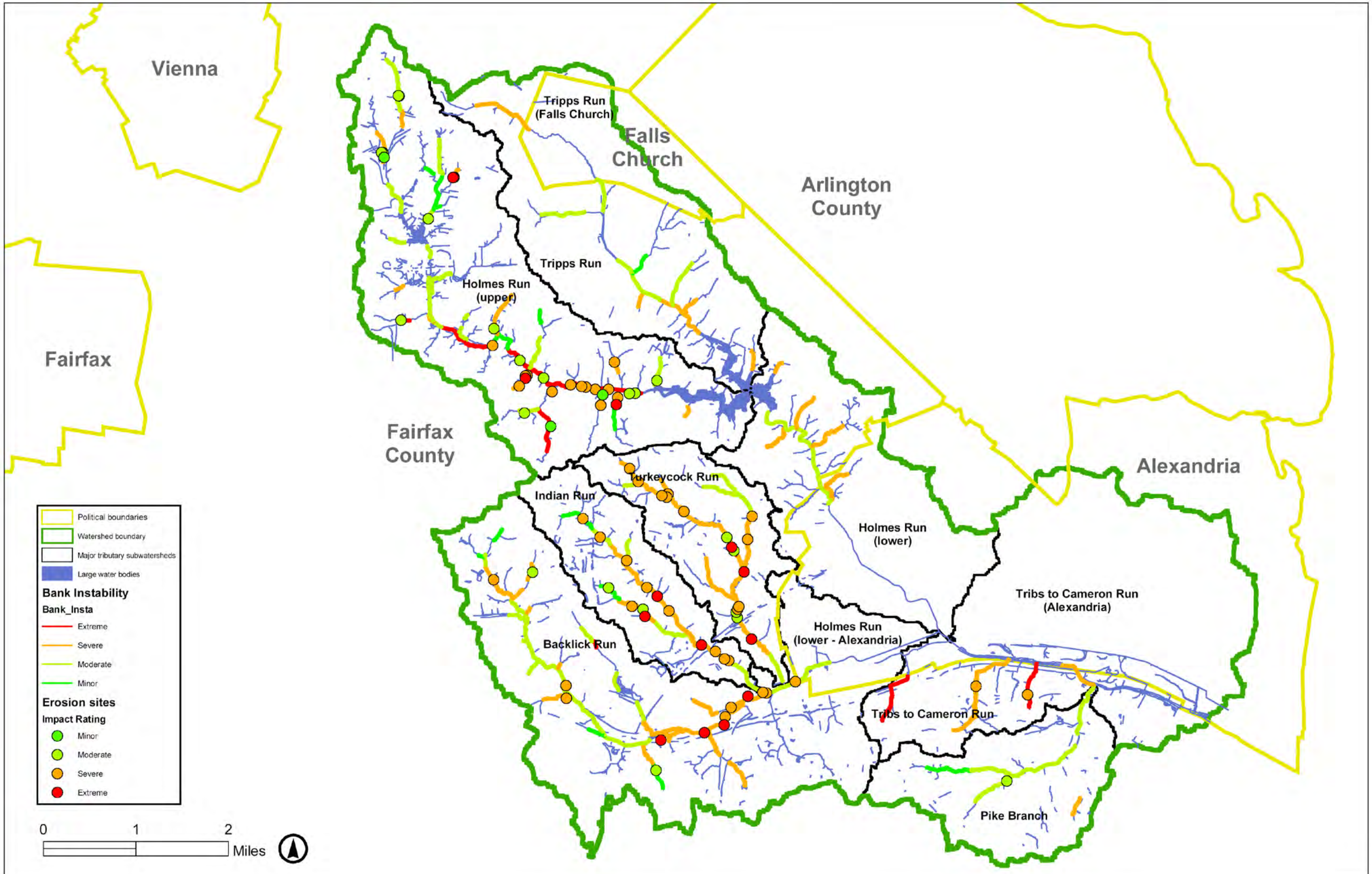

Figure 4-5. Bank instability and erosion sites in Cameron Run watershed

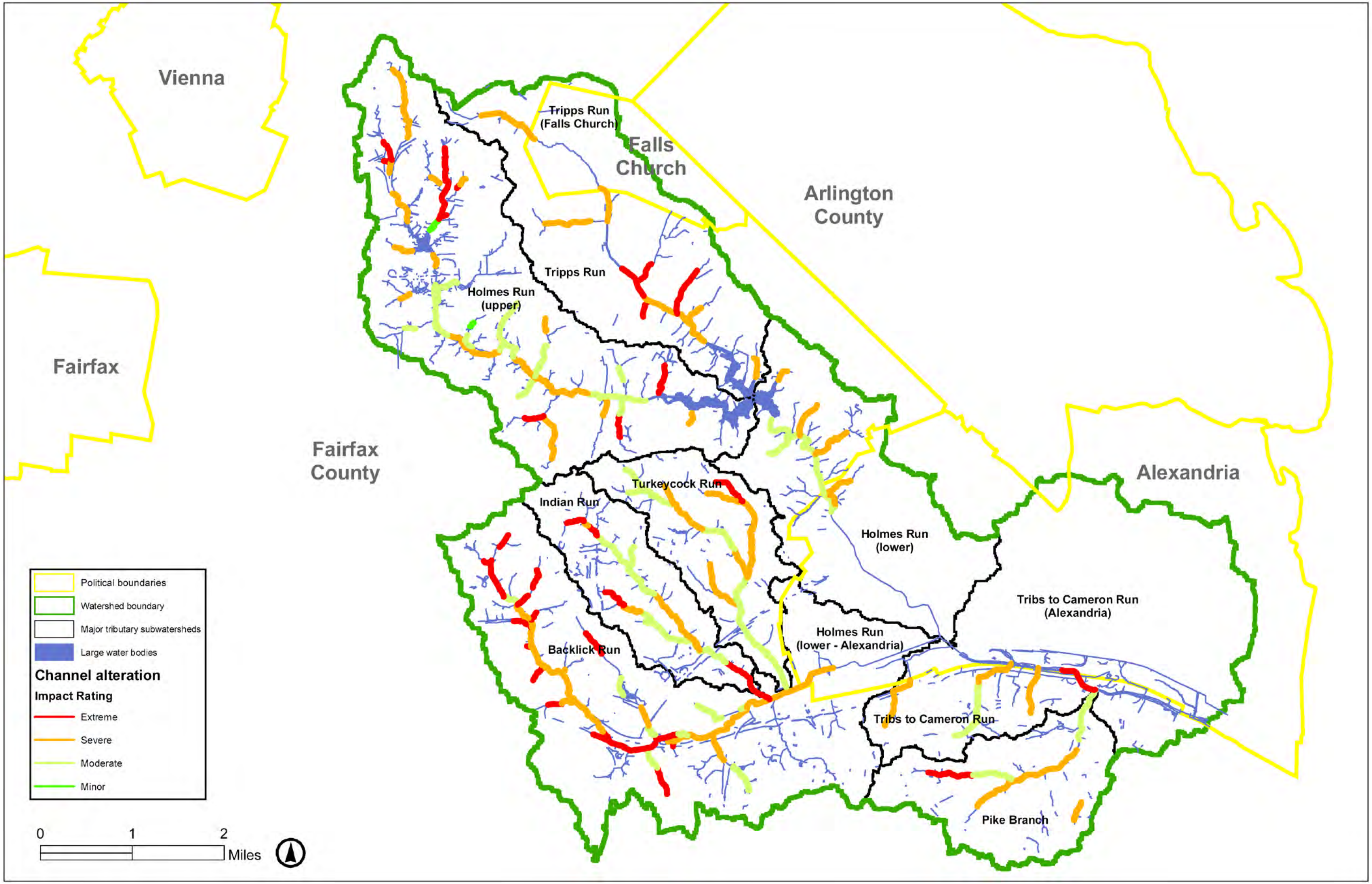

Figure 4-6. Current impact ratings for channel alteration in Cameron Run watershed

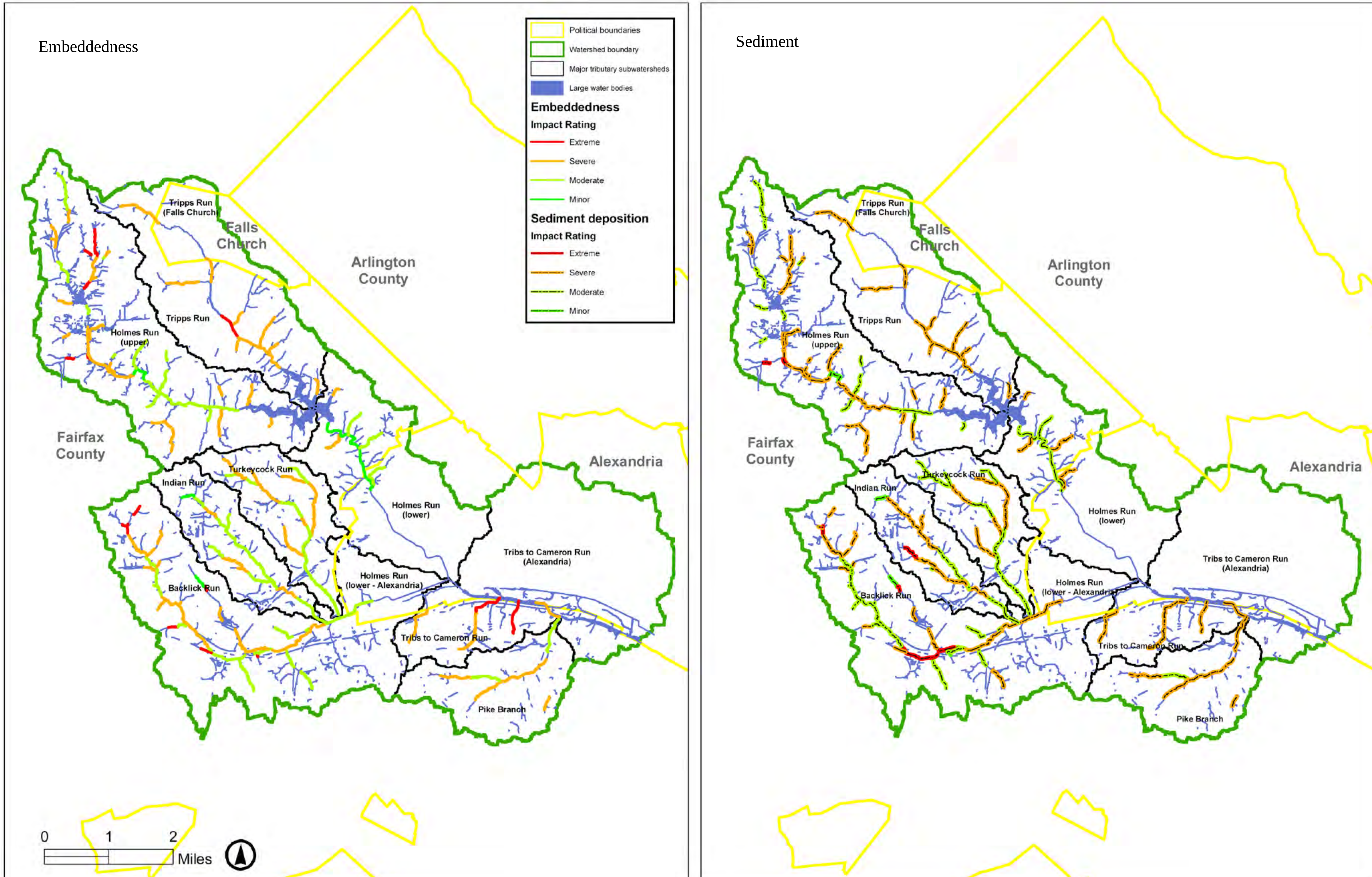

Figure 4-7. Current impact ratings for embeddedness and sediment deposition in Cameron Run watershed

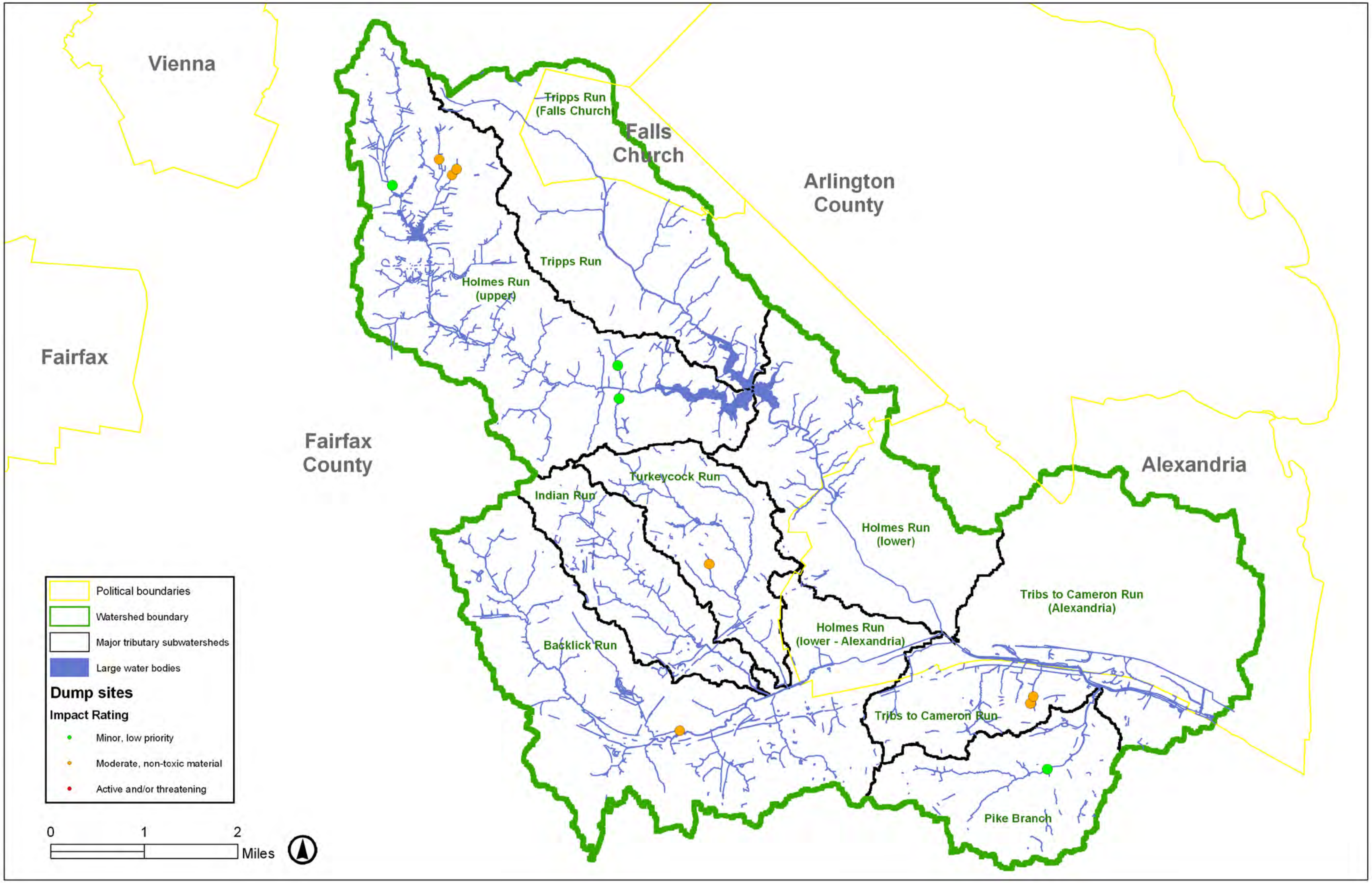

Figure 4-8. Trash dump sites in Cameron Run watershed

Figure 4-9. Threatened infrastructure and Channel Evolution Model (CEM) category in Cameron Run watershed

Virginia Department of Environmental Quality (VADEQ). PCBs were found in white perch, carp, channel cat fish, and American eel, resulting in a health advisory issued by the Virginia Department of Health. Fecal coliform levels were above Virginia's swimmable and fishable water quality standards.

Wildlife habitat conditions in the watershed are favorable for generalists or highly adaptable species. These species include deer, foxes, and raccoons. Large and area-sensitive species have limited habitat in this urban watershed. In 2001, the following wildlife were sighted in the city of Falls Church: raccoons, opossum, rabbits, southern flying squirrels, red and gray foxes, skunks, beavers, deer, muskrats, woodchucks, moles, voles, mice, rats, snapping turtles, and a variety of bats (Parsons Brinckerhoff 1974). This list is representative of wildlife found throughout the watershed.

Vegetation surveys of Cameron Run were conducted in 2001 in the floodplain section between the Metrorail bridge and the Capital Beltway crossing. This section of the stream is characterized by the removal of woody growth from the banks and floodplain, dredging of deposits along the floodplain, rip-rap along the streambanks, and large concrete weirs. There are also storm drains, trash and debris, and large colonies of invasive exotic plants. The sand-and-gravel bars and mudflats support a wide variety of native flora and provide high quality habitat for wildlife. Some of the plant species found growing on the sand-and-gravel bars include floating primrose-willow (*Ludwigia peploides*), marsh seedbox (*Ludwigia palustria*), wing-leaved primrose-willow (*Luswigia decurrens*), bearded flatsedge (*Cyperus squarrosus*), and arrow-leaved tearthumb (*Polygonum sagittatum*) (Bryant et al. 2003).

Land within the watershed is nearly all developed. Approximately 52% of the watershed is occupied by residential land uses (including 5% high-density residential) (Figure 4-10). The watershed has 14% commercial use, and only 1% open water. Open space accounts for 14% of

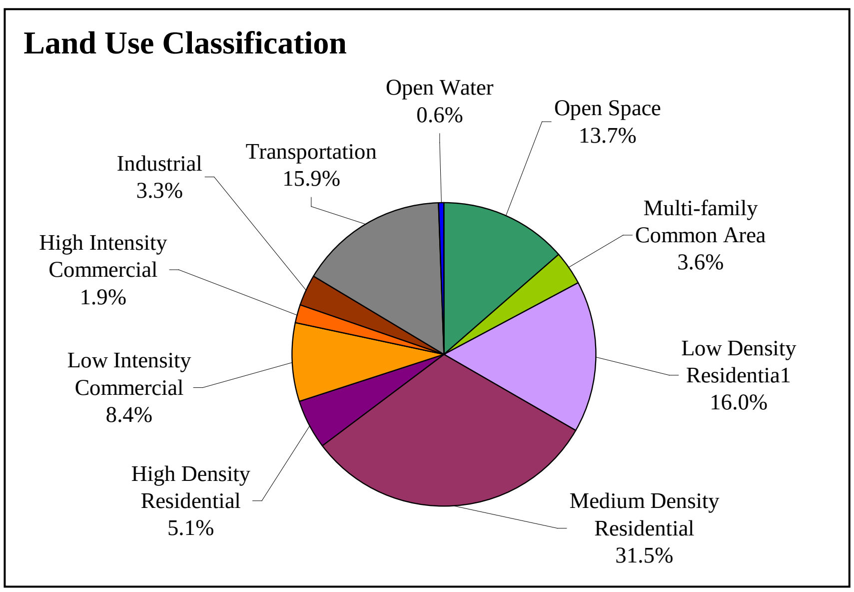

Figure 4-10. Land use in Cameron Run watershed

the watershed, although this land use is highly fragmented throughout the watershed. A few larger areas hold promise for biodiversity conservation (Figure 4-11). Because the watershed is predominantly developed, any new development opportunities involve redevelopment and limited infill. An example of redevelopment could involve converting warehouses into high-rise office buildings. Redevelopment has the potential to create green open space where none previously existed.

Example conditions in the Cameron Run watershed

Stream quality is closely related to the imperviousness of the surrounding landscape. Determining future (ultimate) imperviousness is critical for watershed planning. Fairfax County has developed a robust method for estimating future imperviousness by applying planned or zoned land-use values to underutilized residential/vacant parcels (as determined by the county's comprehensive plan and zoning district designations). Other land parcels are assumed to retain their base-year imperviousness. Figure 4-12 shows estimates of future imperviousness for small subwatersheds within the Cameron Run watershed and its eight large subwatersheds. Table 4-1 combines these values into average imperviousness by large subwatershed and calculates the projected change compared to base-year imperviousness.

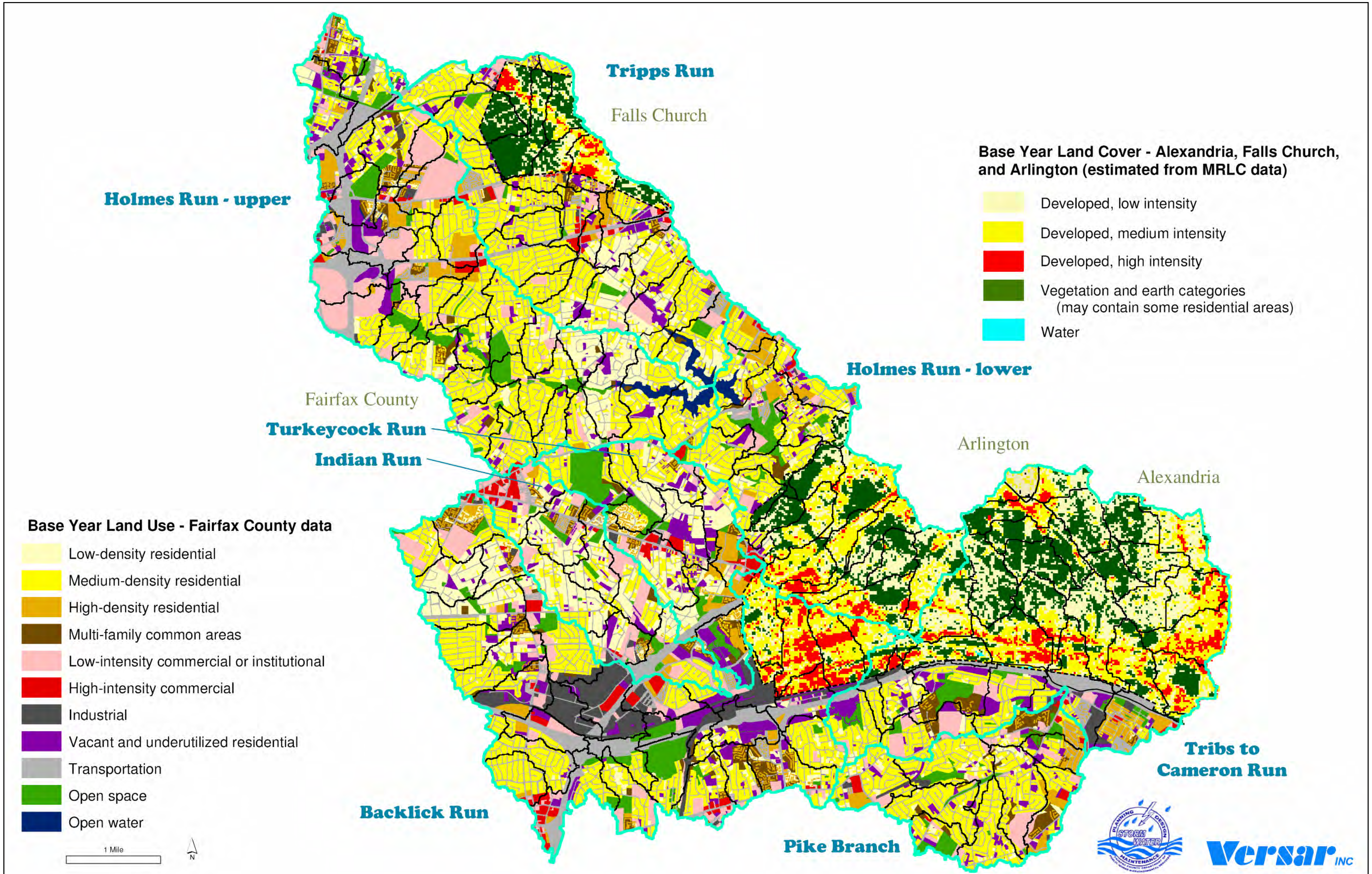

Figure 4-11. Map of land use in the Cameron Run watershed

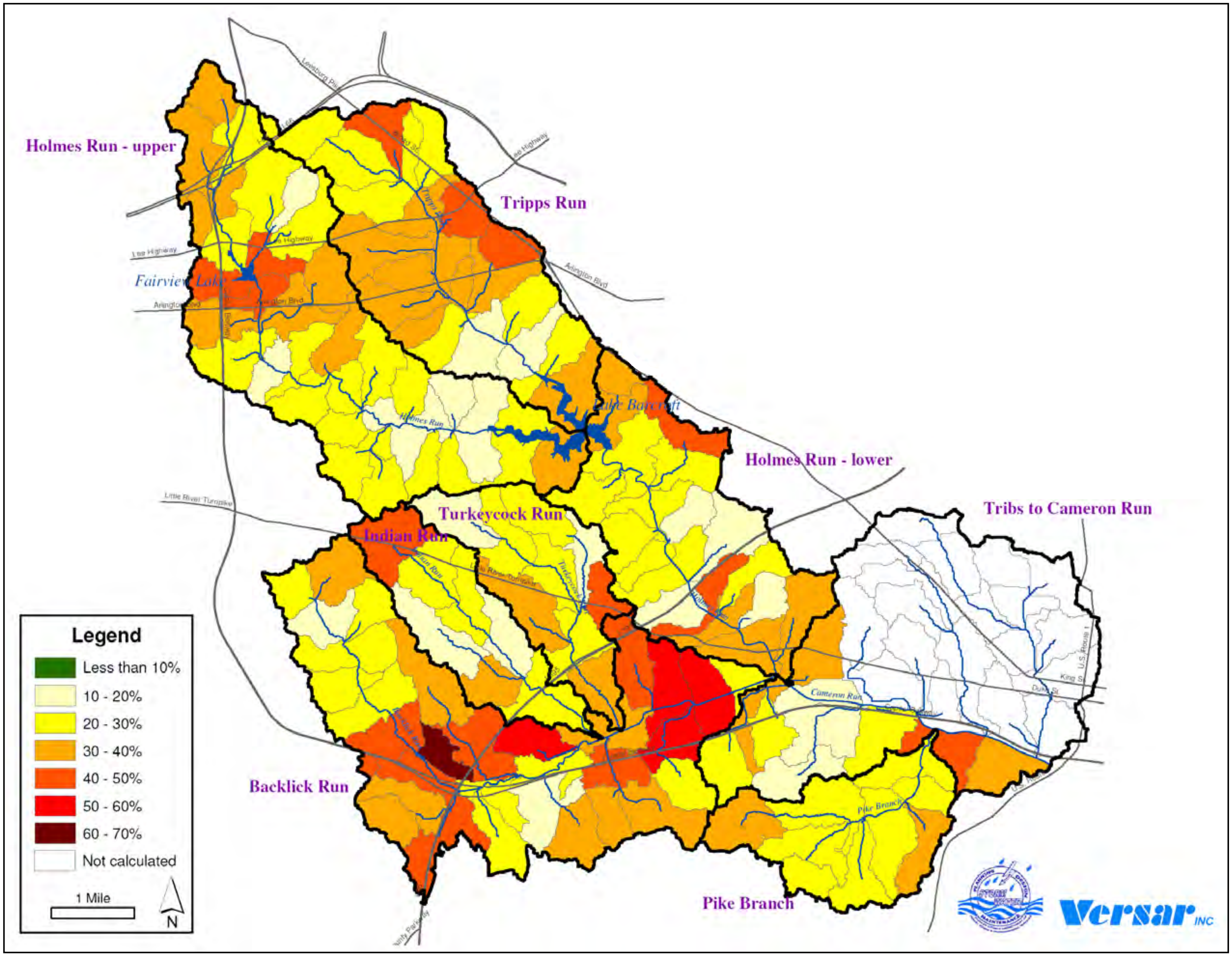

Figure 4-12. Estimates of future imperviousness for small subwatersheds within the Cameron Run watershed

Table 4-1. Cameron Run percent impervious area (Fairfax County area only)			
Subwatershed	**Base Year**	**Future**	**% Increase**
Tripps Run	25.0	29.8	19.1
Holmes Run - Upper	24.5	27.8	13.5
Holmes Run - Lower	25.2	27.5	9.4
Turkeycock Run	21.3	26.3	23.3
Indian Run	25.2	28.6	13.3
Backlick Run	30.7	35.9	16.9
Pike Branch	20.8	25.5	22.5
Tribs to Cameron Run	23.7	29.5	24.6
Weighted Average	25.6	29.8	16.5

As described in Chapter 3 and fully presented in Appendix B, hydrology and pollutant loadings were modeled for the watershed. These models were used to develop estimates of pollutant loads and peak flow for base-year and future conditions in the Cameron Run watershed (Tables 4-2 and 4-3). Peak flows were simulated for storms with estimated recurrence intervals of 1-, 2-, 10-, 25-, and 100-years, which are known as design storms.

Table 4-2. Pollutant loadings in Cameron Run watershed based on SWMM modeling for 1996-1998 hydrologic conditions, for base-year and projected future land use conditions			
	Base Year Land Use (pounds/acre/year)	**Projected Future Land Use** (pounds/acre/year)	**Percent Change**
Total nitrogen	9.8	10.7	9.6%
Total phosphorus	1.14	1.24	8.8%
Dissolved phosphorus	0.81	0.9	11.5%
Biological oxygen demand	64	70	10.5%
Chemical oxygen demand	321	354	10.2%
Total suspended sediment	227	243	6.9%
Lead	0.014	0.015	8.2%
Copper	0.066	0.071	8.1%
Zinc	0.341	0.371	8.8%
Cadmium	0.00056	0.00060	6.2%
Total dissolved solids	276	305	10.3%

Table 4-3. Design storm peak flows in Cameron Run for base year and projected future land use (Fairfax County only)			
Design Storm	**Base Year Land Use** (cfs)	**Projected Future Land Use** (cfs)	**Percent Change**
1-yr	217	229	5.5%
2-yr	287	298	3.8%
10-yr	669	676	1.0%
25-yr	763	779	2.1%
100-yr	1,054	1,089	3.2%

Members of the Advisory Committee and the general public identified the following additional areas of concern for specific locations within the Cameron Run watershed.

- **Sediment inputs and sedimentation**
  - Cameron Run mainstem along I-495
  - Stormwater settling within corrugated pipes located in Falls Church
  - Lake Barcroft dump sites
- **Impervious surfaces (paved land cover)**
  - Baileys Crossroads area, Eisenhower Avenue and Van Dorn Street in Alexandria
  - Cities of Falls Church, Alexandria, and Annandale
  - Seven Corners area, I-395, I-495, and mixing bowl
- **Biological and habitat degradation of good areas**
  - Lake Barcroft area past Columbia Pike (Holmes Run subwatershed)
  - Winkler Pond (Holmes Run subwatershed)
- **Bank erosion and channel instability (with infrastructure impacts)**
  - Tripps Run in Poplar Heights area
  - Inside Mason District Park
  - Backlick Run in the Brookhill area
- **Toxic polluted runoff**
  - Edsall Road Industrial Park
  - Falls Church cement plant
  - Eisenhower trash cogenerator in Culmore
- **High and flashy peak flows**
  - Backlick Run area
- **Riparian buffer loss**
  - Mason District Park
- **Bacteria and pathogens**
  - Dog parks on Eisenhower, Duke Street, and Cameron Station
  - Backlick Run area

- **Flooding**
  - Falls Church
  - Lower/Upper Tripps Run
  - Backlick Road
- **Direct storm inflow**
  - Specific example not given, but members indicated that the city of Falls Church demonstrates all problem issues
- **Trash/dump sites near streams**
  - Culmore area
  - East Telegraph Road
  - Lake Barcroft area
- **Channel alteration of streams**
  - Upper Tripps Run just before entering Falls Church
- **Obstructions in streams**
  - Lake Barcroft area
  - Mainstem obstructions via several dams eastward to Holmes Run
- **Wetlands loss and degradation**
  - Wetlands are virtually nonexistent in Cameron Run watershed
  - Could be loss of wetlands downstream of Alexandria in the Belle Haven watershed

4.2 STATE OF THE SUBWATERSHEDS

Cameron Run watershed comprises the following eight subwatersheds: Tripps Run, Upper Holmes Run, Lower Holmes Run, Turkeycock Run, Indian Run, Backlick Run, Pike Branch, and the Cameron Run mainstem and its direct tributaries. To gain a better understanding of overall conditions in Cameron Run, issues such as flow and contaminant contributions from each of these subwatersheds were evaluated. A detailed examination of these smaller subwatersheds enabled the identification of problem areas and opportunities for conservation, as well as the development of site-specific recommendations targeting such areas. The following sections describe the important characteristics of each subwatershed and summarize land use, stream condition, and problem areas.

4.2.1 State of Tripps Run

4.2.1.1 Subwatershed Characteristics

Tripps Run drains the northern portion of the watershed above Lake Barcroft (Figure 4-13). It covers 14.9 % of the Cameron Run watershed. Its course begins in Fairfax County just north of the Washington and Old Dominion Railroad. Flowing southeast, the stream passes through Falls Church for about one mile (3,000 feet partially underground), reenters Fairfax County adjacent to a commercial area on Lee Highway, and completes its four-mile journey by becoming the north fork of Lake Barcroft. (Before the impoundment was constructed, Tripps Run merged with Holmes Run).

Figure 4-13. Tripps Run subwatershed

The natural stream channel is well defined. During normal, dry-weather flow, the water is about one foot deep. Stream banks rise vertically, averaging about three to four feet above the channel. The stream follows an essentially straight course with gentle curves. Meandering is restricted to the section just above Lake Barcroft. Bottom composition in the natural reaches is a mixture of sand, gravel, and cobble.

The Tripps Run drainage area is the oldest and most developed portion of the watershed, and the stream has suffered from this urbanization. Twenty-five percent (25%) of the subwatershed is impervious; this is estimated to increase to 30% in the future. Medium-density residential development dominates land use within the subwatershed (Figure 4-14). Table 4-4 shows land use, percentages of impervious area for base-year and future conditions, and percent change in land use for the subwatershed. Much of the natural vegetation of the stream valley was cleared during construction; the original woodlands that shaded the stream were replaced with lawns and low brush. The removal of vegetation exacerbated the erosion problems evident throughout the channel. Furthermore, the channel itself was modified. In addition to the 3,000 feet that are piped underground, several sections of Tripps Run in Falls Church are lined with concrete. In Fairfax County, a 4,500-foot section was straightened and lined with concrete from Annandale Rd. to about 3,000 feet upstream of Arlington Blvd. (Parsons Brinckerhoff 1974). In addition, the channel is badly littered with debris, particularly near the commercial area south of Falls Church.

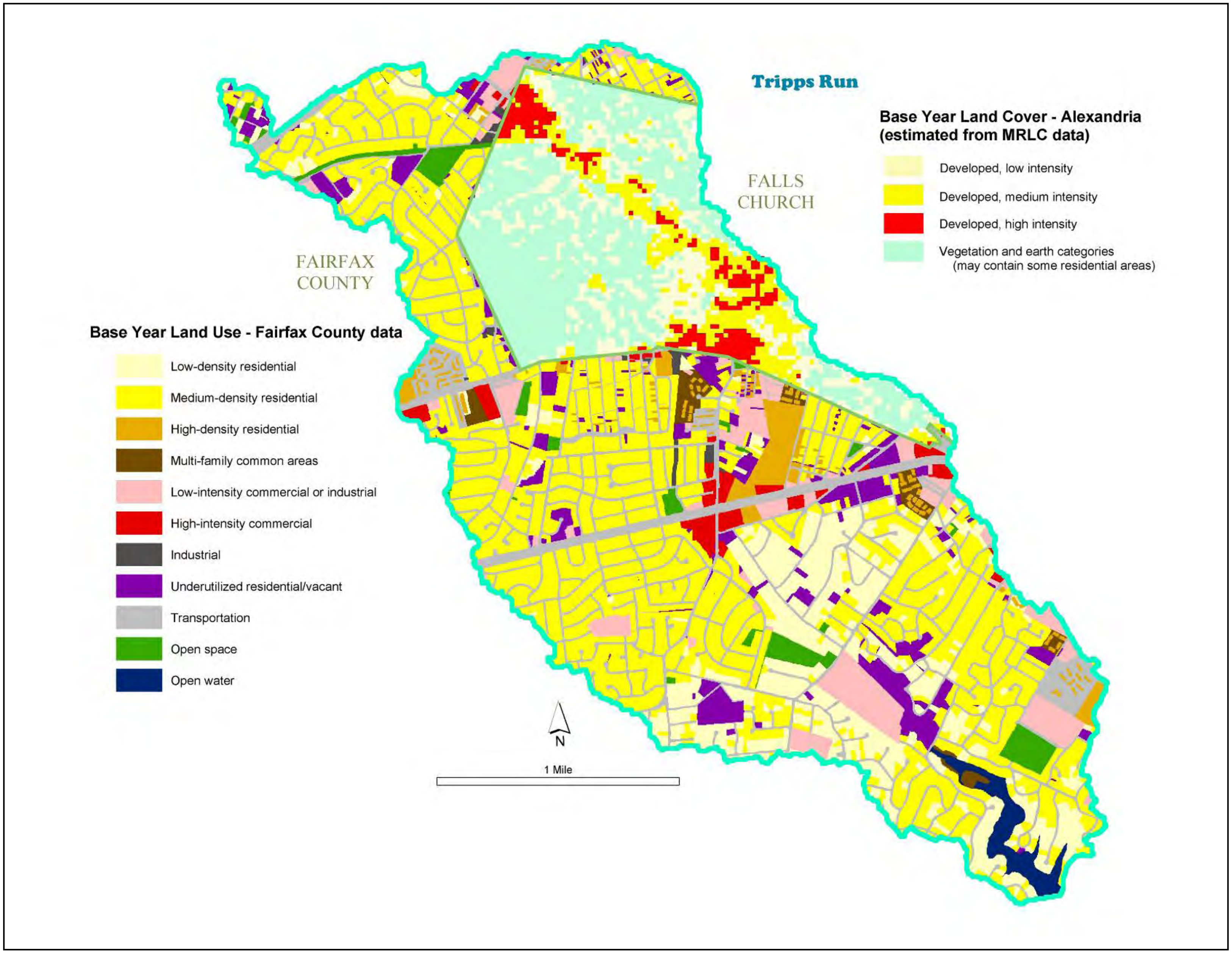

Figure 4-14. Land use map of Tripps Run subwatershed

Table 4-4. Estimates of future land use and percentage of impervious area in the Tripps Run subwatershed			
Subwatershed Area (acres)	3,704		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	16	13.2	-17.3
Multifamily common area	1.7	1.2	-28
Low-density residential	18.7	18	-3.6
Medium-density residential	37.9	41	8.2
High-density residential	2.8	2.9	3.8
Low-intensity commercial	5.55	5.57	0.4
High-intensity commercial	1.6	2.4	45.5
Industrial	0.45	0.37	-16.8
Transportation	14.3	14.3	0
Open water (Lake Barcroft only)	1.1	1.1	0
Impervious area	25	29.8	19.1

Previous watershed planning studies (e.g., *Cameron Run Environmental Baseline Report*, *Immediate Action Plan Report for the Cameron Run Watershed*, and *Future Basin Plan Report for the Cameron Run Watershed)* have identified several drainage projects that are included in the county's master plan. The county's list of drainage projects shows that 7 of the 12 projects in this subwatershed have been completed; 1 project is active with partial funding, and the remaining 4 projects are inactive. Table 4-5 summarizes the kind of drainage project, project name/location, and current status. No cost estimates were available for these projects.

In 2005, homeowners and other community stakeholders in the Poplar Heights and Falls Hill neighborhoods began working with Fairfax County to address problems with stormwater management and flooding in these neighborhoods bordering Tripps Run. A Stormwater Action Committee was formed to propose a feasible, comprehensive approach for resolving stormwater problems in the neighborhoods. Through an extensive series of meetings, work sessions, and other efforts, the committee developed a comprehensive plan in March 2007 that consisted of values ranked according to priority, overarching principles, and 11 recommended projects. These projects included encouraging LID on private property, planting trees, several focused studies to develop solutions for complex areas, and recommendations for immediate county action at specific sites.

Table 4-6 summarizes the condition of Tripps Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition of Tripps Run is very poor.

Table 4-5. Drainage projects in the Tripps Run subwatershed	
Type of Work	**Project Name/Location**
Active Project - Partially Funded	
Replace culvert/streambank stabilization	Falls Hill subdivision
Completed	
Streambank stabilization	Upstream of Sleepy Hollow
Riprap/stabilization	Juniper/Valley
Floodproof house	Juniper Lane
Floodproof houses	Poplar Drive, Falls Hill Subdivision
Gabion/stabilization	Bolling Way, Mason Terrace Subdivision
Streambank stabilization	Tripps Run
Streambank stabilization	Upstream of Annandale
Inactive	
Streambank stabilization	Tripps Run
Culvert addition/streambank stabilization	Tripps Run
Streambank stabilization	Juniper/Tripps
Streambank stabilization	Tripps Run

Table 4-6. Summary of 2001 SPS Baseline Study and SPA results for the Tripps Run subwatershed			
SPS Results		**SPA Results**	
Condition rating	V. Poor	Inadequate buffers (ft.)	37,850
Index of Biotic Integrity score	V. Poor	Eroded streambanks (ft.)	0
Fish taxa richness	V. Low	Habitat assessment	Poor
Base year % impervious	32	Stormdrain pipes	18
		Dumping sites	0
		Headcuts	0
		Exposed utilities	2
		Obstructions	0
		Road crossings	25

4.2.1.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, numerous stormdrain pipes, and exposed utilities (Figure 4-15).

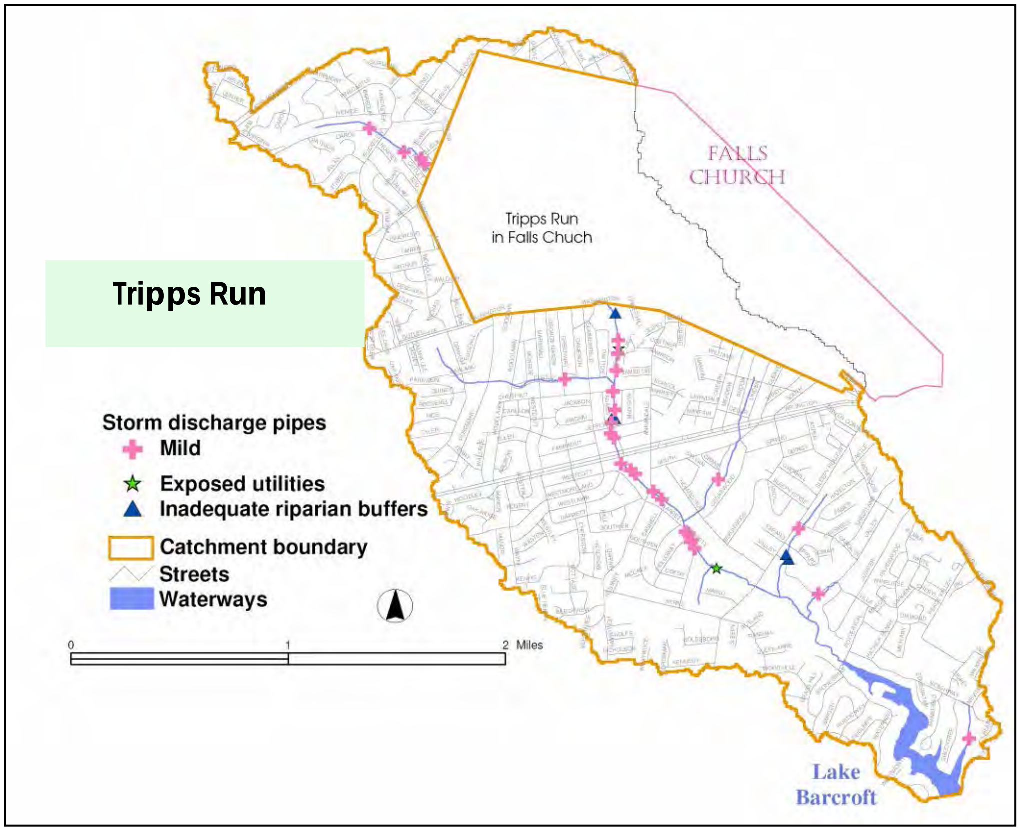

Figure 4-15. Locations of major problems in Tripps Run subwatershed as indicated by SPA data

4.2.1.3 Problem Areas Identified by the Public

Public input about problem areas within Tripps Run was obtained through forums and other avenues. Table 4-7 describes problem areas and potential solutions that were discussed during these meetings.

Channelized portion of Tripps Run

Table 4-7. Problem areas in the Tripps Run subwatershed identified by the public		
Location of Problem	**Description of Problem**	**Potential Solutions**
Between Great Oak Square and adjoining apartment complex	Erosion of stream bank at stormwater drainage and at the entry to Tripps Run.	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering and natural stream channel design approaches to stabilize streambanks and bed and improve habitat conditions.
Tripps Run	Channelization throughout the stream	Minimize or mitigate the effects of channelization, especially during maintenance and renovation work, by mimicking natural channel features and function.
Tripps Run (North of Rt. 50)	Channelization	Minimize or mitigate the effects of channelization, especially during maintenance and renovation work, by mimicking natural channel features and function.
Tributary perennial stream from Seven Corners to Tripps Run (Nicholson Lane past Valley Lane along Sleepy Hollow Road)	Spot flooding because the stream receives many storm sewer pipes	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows.
Tributary perennial stream from Seven Corners to Tripps Run (Nicholson Lane past Valley Lane along Sleepy Hollow Road)	Extensive open and closed concrete channels	Minimize or mitigate the effects of channelization, especially during maintenance and renovation work, by mimicking natural channel features and function.
Tripps Run in Poplar Heights area	Bank erosion and channel instability along Tripps Run	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering and natural stream channel design approaches to stabilize streambanks and bed, and improve habitat conditions.
Sleepy Hollow area near tributary to Tripps Run	Hazardous waste dumping in tributary to Tripps Run, severe high water flow, erosion, partial concrete channelization	Contact appropriate enforcement officials; provide community hazardous waste collections; install signage with information on collections and consequences of dumping. Provide owners/residents with (1) professional environmental advice, (2) riparian plantings, (3) stormwater controls, (4) retrofitting of concrete channels, (5) pollution monitoring equipment, and (6) neighborhood environmental watch groups.
Far side of Tripps Run behind Bill Page Honda and U.S. Post Office, Annandale Road, and Route 50.	Trash and chemicals in Tripps Run	Implement street sweeping and inlet trash collection program; organize community trash collection events (adopt-a-highway/ adopt-a-stream programs); provide trash receptacles and educational information. Identify chemical source.

Table 4-7. (Continued)		
Location of Problem	**Description of Problem**	**Potential Solutions**
Tributary perennial stream from Seven Corners to Tripps Run (Nicholson Lane past Valley Lane along Sleepy Hollow Road)	Chronic trash pollution in streams	Implement street sweeping and inlet trash collection program; organize community trash collection events (adopt-a-highway/ adopt-a-stream programs); provide trash receptacles and educational information.
Sleepy Hollow	Channelization Storm sewer runoff Pollution	Educate residents about: a) plantings b) stormwater controls c) pollution monitoring equipment d) neighborhood watch and environmental groups e) improving habitat conditions
Poplar Heights	Severe bank erosion Storm runoff	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering and natural stream channel design approaches to stabilize streambanks and bed, and improve habitat conditions; construct LID retrofits upstream.
Fairfax County portion of Tripps Run	Stream channelization	Investigate retrofit opportunities and stream restoration.
Custis Parkway	Stream erosion	Stabilize the streambank.
Trips Run south of Holmes Run Road between Annandale and Sleepy Hollow	Abandoned sewer line that occasionally leaches pollutants and other material	Clean up old sewer line.
Opposite side of Tripps Run behind Bill Page Honda and U.S. Post Office, Annandale Road and Route 50	Chemicals and trash in Tripps Run	Find chemical source and clean-up trash.
Potters Drive	Sedimentation	Stabilize streambank and dredge accumulated sediment.
Broad Street office building	Redevelopment of existing office building	Establish controls to minimize deduction of stream and habitat.

4.2.1.4 Modeling Results

Hydrologic modeling for Tripps Run indicates that stormwater runoff is about average within Cameron Run. Imperviousness is slightly below the average for Cameron Run as a whole, but this area has the lowest percentage of area with stormwater controls. The increase in discharges expected due to future development is the highest of the subwatersheds. Table 4-8 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Tripps Run with peak velocity greater than this value are 44% and 54% for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 208 for the portion of Tripps Run within Fairfax County. Table 4-9 shows the number of roadway crossings in Fairfax County that will be overtopped by storms of various sizes under base-year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-8. Peak runoff flows in the Tripps Run subwatershed

Drainage Area (acres)	3,704		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	225	298	673
Future peak flow (cfs)	243	317	697
Percent increase in peak flow	8.0	6.3	3.6

Table 4-9. Number of roadway crossings (bridges) overtopped by design flows for Tripps Run subwatershed

	Present	**Future**
1-year	1	1
2-year	1	1
10-year	2	3
25-year	3	3
100-year	4	4

The Tripps Run subwatershed has an average sediment loading rate among the eight subwatersheds. The subwatershed has slightly above average loadings of total nitrogen and phosphorus. Based on anticipated future land-use conditions, the total nitrogen and phosphorus loading rates are predicted to increase by 6.4% and 5.8%, respectively. Table 4-10 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-10. Average annual pollutant loadings (pounds/acre/year) in the Tripps Run sub-watershed

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	10.1	1.2	222	0.013	0.054	0.293
Future	10.8	1.3	233	0.014	0.057	0.309
% Increase	6.4	5.8	4.7	5.2	5.2	5.5

4.2.2 State of Upper Holmes Run

4.2.2.1 Subwatershed Characteristics

Upper Holmes Run and its tributaries form a major subwatershed draining the northern portion of the Cameron Run watershed (Figure 4-16). It covers 19% of the watershed and includes part of the Lake Barcroft community. Twenty-five percent (25%) of the subwatershed is impervious; imperviousness is estimated to increase to 28% in the future. Medium-density residential development dominates land use within the subwatershed (Figure 4-17). Table 4-11 shows land use, percentage of impervious area for base-year and future conditions, and percent change in land use for the subwatershed. The headwaters of Upper Holmes Run originate just north of Interstate Route 66 in the northernmost section of Cameron Run watershed. The upper reach flows for 7.2 miles in a southerly direction paralleling the Capitol Beltway. It then winds eastward and empties into the south fork of Lake Barcroft. This stream section is marked by meandering areas with an associated pattern of scour and deposition. The channel bottom is composed of varying proportions of sand, gravel, cobble, and, in some areas, boulders (Parsons Brinckerhoff 1974).

Figure 4-16. Upper Holmes Run subwatershed

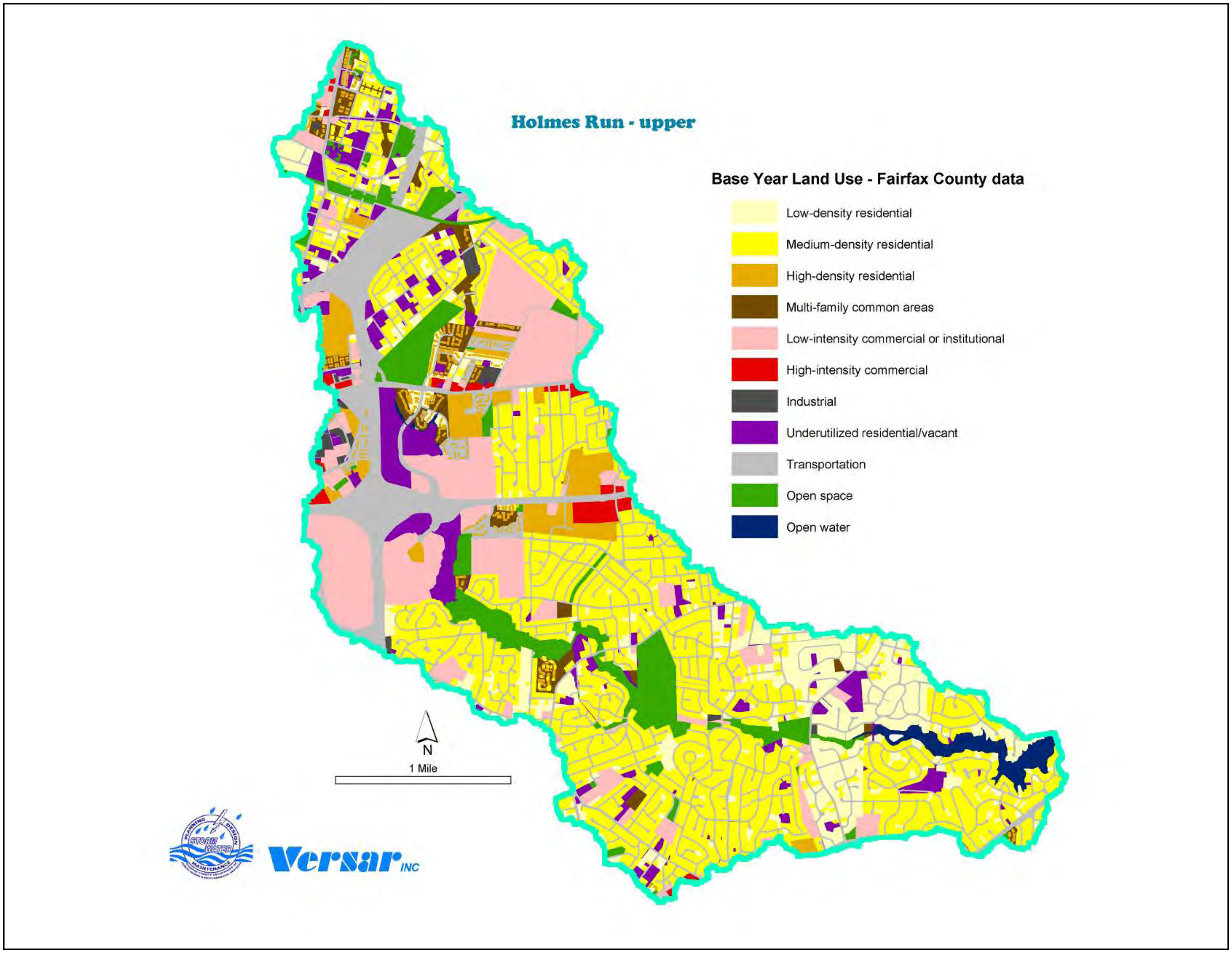

Figure 4-17. Land use map of Upper Holmes Run subwatershed

Table 4-11. Estimates of future land use and percentage of impervious area in the Upper Holmes Run subwatershed			
Subwatershed Area (acres)	5,400		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	9.7	7.1	-27.1
Multifamily common area	3.5	2.4	-31.4
Low-density residential	12.2	11.7	-4.7
Medium-density residential	33.3	37.2	11.6
High-density residential	4.75	4.82	1.4
Low-intensity commercial	13.2	12.5	-5.2
High-intensity commercial	1.1	1.4	27.6
Industrial	0.7	1.4	121.1
Transportation	19.9	19.9	0
Open water (Lake Barcroft and Fairview Lake)	1.7	1.7	0
Impervious Area	24.5	27.8	13.5

The county's list of drainage projects shows that 7 of the 26 projects in this subwatershed have been completed; 1 project is active with full funding, 2 projects are active with partial funding, 14 projects are inactive, and the status of the remaining 2 projects is not given. Table 4-12 summarizes the kind of drainage project, project name/ location, and current status. No cost estimates were available for these projects.

Table 4-12. Drainage projects in the Upper Holmes Run subwatershed	
Type of Work	**Project Name/Location**
Active Project - Fully Funded	
Replace culvert	Emma Lee Street
Active Project - Partially Funded	
Floodproof houses	Dearborn Drive
Streambank stabilization	Kings Glen Subdivision
Completed	
Streambank stabilization	Holmes Run Phase 1
Stream restoration	Holmes Run E""
Channel improvements	Locker Street
Reservoir construction	Holmes Run Reservoir 2A
Flood relief	Brush Drive
Regional detention pond	Morgan Lane
Regional detention pond	Pinewood Pond

Table 4-12. (Continued)	
Type of Work	**Project Name/Location**
Inactive	
Streambank stabilization with wall	Raleigh Rd. Ph. II
Streambank stabilization	Crest Drive
Streambank stabilization	Shadybrook
Streambank stabilization	Raleigh Road
Streambank stabilization	Brookcrest Place
Streambank stabilization	Rose Lane Holmes Run Ph II
Storm sewer and swale	Locker Street
Floodproof house	Hockett Street
Floodproof houses	Arnold Lane
Gabion/stabilization	Bradley Circle
Streambank stabilization	Annandale Road
Streambank stabilization	Arnold Lane
Streambank stabilization	Crosswoods Drive
Streambank stabilization	Holmes Run Upper
No Status	
Remediation of structure flooding	Holmes Run Upper
Road raising	Holmes Run Upper

Table 4-13 summarizes the condition of Upper Holmes Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS, the overall condition of Upper Holmes Run is very poor.

Table 4-13. Summary of 2001 SPS Baseline Study and SPA results for the Upper Holmes Run subwatershed

SPS Results		**SPA Results**	
Condition rating	V. Poor	Inadequate buffers (ft.)	93,950
Index of Biotic Integrity score	V. Poor	Eroded streambanks (ft.)	4,590
Fish taxa richness	Variable	Habitat assessment	Fair
Base year % impervious	28	Stormdrain pipes	124
		Dumping sites	6
		Headcuts	0
		Exposed utilities	11
		Obstructions	26
		Road crossings	68

4.2.2.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, eroded streambanks, and trash dumpsites (Figure 4-18).

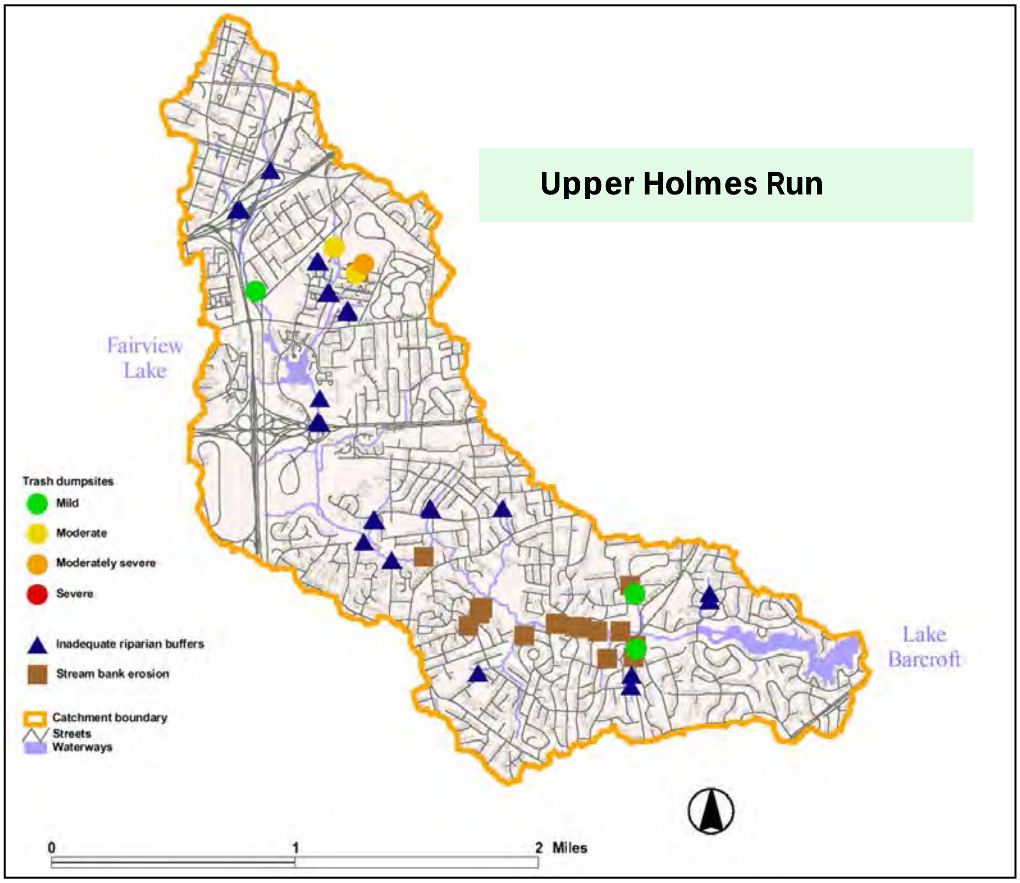

Figure 4-18. Location of major problem areas in Upper Holmes Run subwatershed as indicated by SPA data

4.2.2.3 Problem Areas Identified by the Public

Streambank erosion in Upper Holmes Run

Public input about problem areas within Upper Holmes Run was obtained through forums and other avenues. Table 4-14 describes problem areas and potential solutions discussed during these meetings.

Table 4-14. Problem areas in the Upper Holmes Run subwatershed identified by the public

Location of Problem	Description of Problem	Potential Solution
Holmes Run above Route 29	Dump site	Contact appropriate enforcement officials; provide community hazardous waste collections; install signage with information on collections and consequences of dumping.
Lowemans Plaza	Impervious surface, staging area for winter salting and de-icing	Require clean-up of salt and sand after release by dump trucks (street sweeping).
Valleycrest Drive	Streambank erosion	Stabilize the streambank.
Parcel A of Cloisters	Steep bank erosion	Streambank stabilization.
Glavis Property	Opportunity	Purchase Glavis property land for conservation easement.

4.2.2.4 Modeling Results

Hydrologic modeling for Upper Holmes Run indicates that stormwater runoff is lower than average for the Cameron Run watershed. Upper Holmes Run has a slightly lower than average percentage of imperviousness and the third largest percentage of area with stormwater controls. The expected increase in discharges due to future development is slightly less than average compared with the eight other subwatersheds. Table 4-15 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-15. Peak runoff flows in the Upper Holmes Run subwatershed			
Drainage Area (acres)	5,400		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	209	276	647
Future peak flow (cfs)	217	285	649
Percent increase in peak flow	4.2	3.1	0.3

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Upper Holmes Run with peak velocity greater than this value are 42% and 49%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 280 for Upper Holmes Run. Table 4-16 shows the number of roadway crossings overtopped by design storms of various sizes design for base-year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-16. Number of roadway crossings (bridges) overtopped by design flows in the Upper Holmes Run subwatershed		
	Present	**Future**
1-year	0	0
2-year	2	2
10-year	2	2
25-year	2	2
100-year	2	2

The Upper Holmes Run subwatershed has a slightly higher than average sediment loading rate, possibly due to the presence of the highest percentage of low-intensity commercial/ institutional area in Cameron Run. The Upper Holmes Run subwatershed has slightly higher than average annual loadings of total nitrogen and phosphorus. For future land use conditions, the total nitrogen and phosphorus loadings are predicted to increase by 6.3% and 5.7%, respectively. Table 4-17 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-17. Average annual pollutant loadings (pounds/acre/year) in the Upper Holmes Run subwatershed						
Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	10.0	1.16	236	0.013	0.068	0.350
Future	10.6	1.23	247	0.014	0.072	0.370
% Increase	6.3	5.7	4.7	6.7	4.9	5.7

4.2.3 State of Lower Holmes Run

4.2.3.1 Subwatershed Characteristics

Lower Holmes Run starts below the Barcroft Dam at Columbia Pike (Figure 4-19). The subwatershed covers 12.9% of the Cameron Run watershed and includes most of the Lake Barcroft community. Twenty-five percent (25%) of the subwatershed is impervious; imperviousness is predicted to increase to 28% in the future. Medium-density residential development dominates land use within the subwatershed (Figure 4-20). Table 4-18 shows land use, percentages of impervious area for the base-year and the future, and the percent change in land use for the subwatershed. Lower Holmes Run flows southeast toward its confluence with the mainstem of Cameron Run near the Cameron Station Military Reservation in Alexandria. Only a short portion of this stream lies in Fairfax County proper. This portion of the stream is relatively straight and wide; nevertheless, a few small bends have collected debris and are sites of severe erosion and heavy siltation (Parsons Brinckerhoff 1974).

Figure 4-19. Lower Holmes Run subwatershed

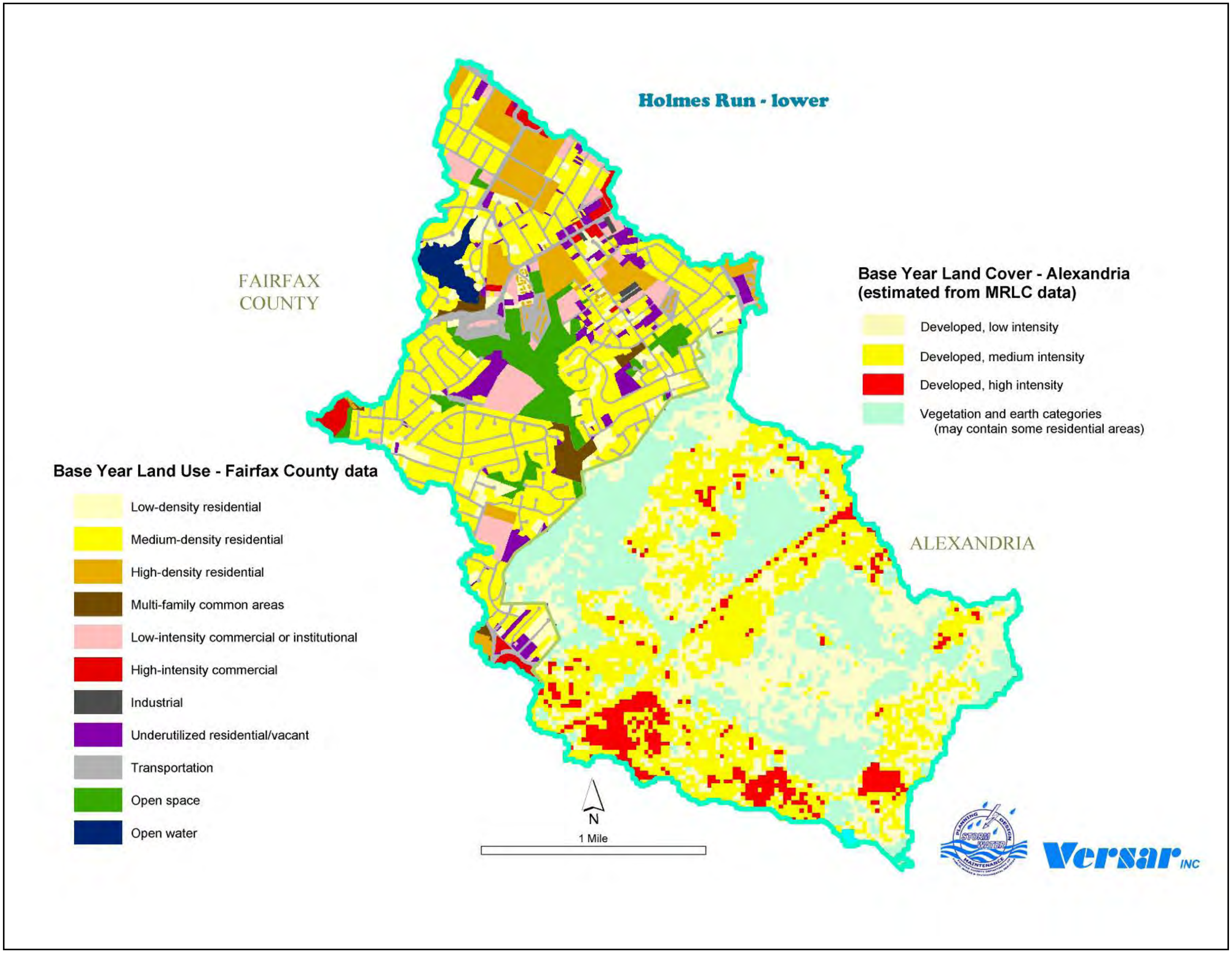

Figure 4-20. Land use map of Lower Holmes Run subwatershed

Table 4-18. Estimates of future land use and percentage of impervious area in the Lower Holmes Run subwatershed			
Subwatershed Area (acres)	3,201		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	23	20.5	-11.2
Multifamily common area	1	0.8	-22.2
Low-density residential	22.3	22	-1.5
Medium-density residential	34	36.8	8.1
High-density residential	5.40	5.60	3.7
Low-intensity commercial	4.37	4.44	1.7
High-intensity commercial	1.6	1.8	11.2
Industrial	0.7	0.6	-9.4
Transportation	6.7	6.7	-0.1
Open water # (Lake Barcroft only)	0.9	0.9	0
Impervious area	25.2	27.5	9.4

The county's list of drainage projects shows that one of the four projects in this subwatershed has been completed; one project is active with partial funding, and the remaining two projects are inactive. Table 4-19 summarizes the kind of drainage project, project name/location, and current status. No cost estimates were available for these projects.

Table 4-19. Drainage projects in the Lower Holmes Run subwatershed	
Type of Work	**Project Name/Location**
Active Project - Partially Funded	
Flood protection	Magnolia Lane PhII
Completed	
Gabion/stabilization	Downstream of Columbia Pike
Inactive	
Streambank stabilization	Alexandria City Line
Streambank stabilization	Drummond Drive

Table 4-20 summarizes the condition of Lower Holmes Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition of Lower Holmes Run is very poor.

Table 4-20. Summary of 2001 SPS Baseline Study and SPA results for the Lower Holmes Run subwatershed			
SPS Results		**SPA Results**	
Condition rating	V.Poor	Inadequate buffers (ft.)	10,300
Index of Biotic Integrity score	Fair	Eroded streambanks (ft.)	0
Fish taxa richness	Low	Habitat assessment	Fair
Base year % impervious	28	Stormdrain pipes	10
		Dumping sites	0
		Headcuts	0
		Exposed utilities	1
		Obstructions	1
		Road crossings	3

4.2.3.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers and numerous stormdrain pipes (Figure 4-21).

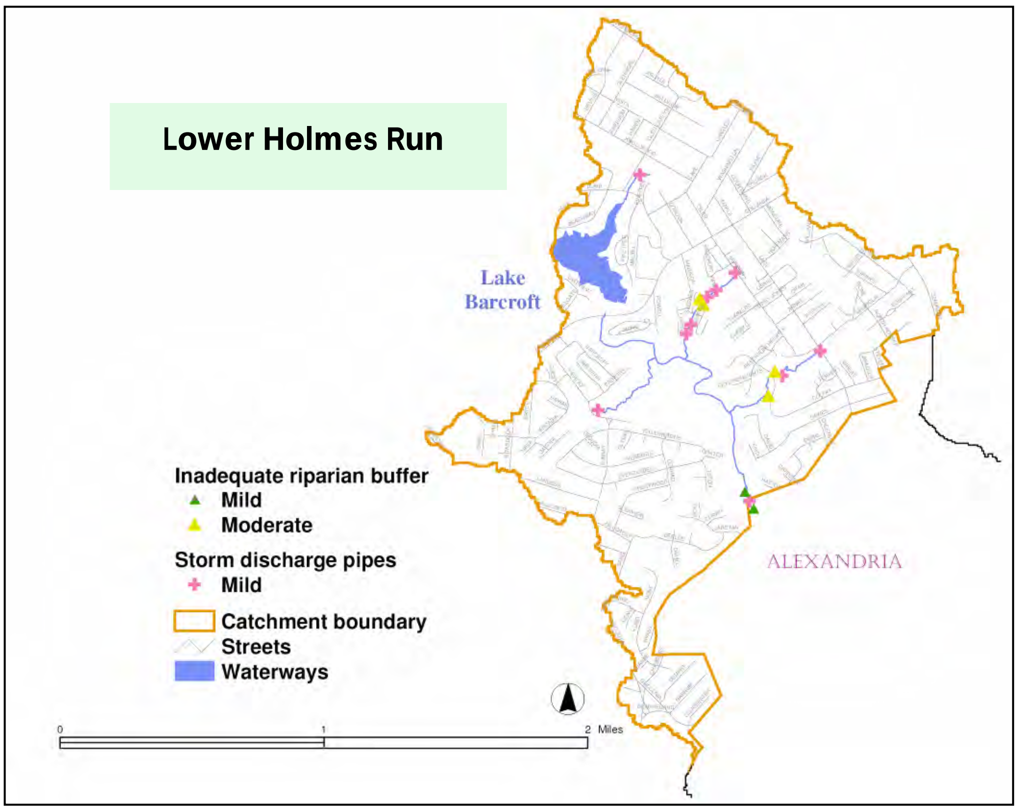

Figure 4-21. Location of problem areas in Lower Holmes Run subwatershed as indicated by SPA data

4.2.3.3 Problem Areas Identified by the Public

Public input about problem areas within Lower Holmes Run was obtained through forums and other avenues. Table 4-21 describes problem areas and potential solutions discussed during these meetings.

Table 4-21. Problem areas in the Lower Holmes Run subwatershed identified by the public

Location of Problem	Description of Problem	Potential Solution
Culmore Residential Area behind Culmore Shopping Center (along Glen Carlyn Road, off Route 7, down to Blair Rd. area)	Trash and oil on street; oil and auto fluids dumped into storm drains	Contact appropriate enforcement officials; provide community hazardous waste collections; install signage with information on collections and consequences of dumping.
Lower Holmes Run Park (below Lake Barcroft)	Degradation of habitats and bank erosion	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering and natural stream channel design approaches to stabilize streambanks and bed, and improve habitat conditions.
Culmore Creek	High bacteria levels in stream	Find source.
JEB Stuart Stream Valley	Invasives	Remove invasives and re-establish riparian buffer.
Marshall Property	Uncontrolled dumpsite	Clarify zoning issues and inspect the dumpsite.
"Barcroft Blight" Apartment Complex	Trash Undercut banks	Stabilize the streambank and remove trash.
Holmes Run Trail (below Barcroft Dam) Columbia Pike to Old Towne Alexandria to the Potomac River (ADC map 16/E13 is where the trail stops)	The trail runs from below the Lake Barcroft Dam to the Potomac except where the trail ends around the private pool.	Extend the walking path.
JEB Stuart High School Parking Lot	Excessive runoff	Install permeable pavers and bioretention areas.

4.2.3.4 Modeling Results

Hydrologic modeling for Lower Holmes Run indicates that stormwater runoff is about average. Imperviousness is also about average compared to Cameron Run as a whole. The increase in discharges due to future development is a little above average compared to the other subwatersheds. Table 4-22 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-22. Peak runoff flows in Lower Holmes Run			
Drainage Area (acres)	3201		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	219	292	674
Future peak flow (cfs)	232	303	675
Percent increase in peak flow	5.9	3.9	0.1

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Lower Holmes Run with peak velocity greater than this value are 86% and 89%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 16 for the portion of Lower Holmes Run that lies within Fairfax County. No roadway crossings were overtopped by storms of various sizes for base-year or future conditions in Lower Holmes Run. Complete modeling details and results are provided in Appendix B.

The Lower Holmes Run subwatershed has the second lowest sediment loading rate of the eight subwatersheds because it has smaller areas of commercial and industrial development. This subwatershed also has the second lowest annual loadings of total phosphorus and nitrogen of the eight subwatersheds. This can be attributed to the relatively small percentage of highly developed land in the watershed. This subwatershed is among the least in proportion of industrial development. For future land use conditions, the annual loadings of nitrogen and phosphorus are predicted to increase by 10.0% and 9.6%, respectively. Table 4-23 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-23. Average annual pollutant loadings (pounds/acre/year) in Lower Holmes Run subwatershed

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	8.9	1.1	201	0.012	0.061	0.27
Future	9.8	1.2	215	0.013	0.065	0.295
% Increase	10.0	9.6	6.7	6.9	7.3	7.7

4.2.4 State of Turkeycock Run

4.2.4.1 Subwatershed Characteristics

This subwatershed covers 6.1% of the Cameron Run watershed and includes the Mason District Park (Figure 4-22). Twenty-one percent (21%) of the subwatershed is impervious; future imperviousness is estimated to be 26%. Medium-density residential development dominates land use within the subwatershed (Figure 4-23). Table 4-24 shows land use, percentage of impervious area for the base year and the future, and the percent change in land use for the subwatershed. Turkeycock Run is formed by the confluence of two tributaries below Little River Turnpike. The stream follows a southeasterly course toward its confluence with Backlick Run, just north of the Southern Railroad embankment.

Figure 4-22. Turkeycock Run subwatershed

The stream can be divided into three sections defined by changes in character. (1) From Edsall Road to Backlick Run, the stream was straightened, and the channel is about 40 feet wide. There is little vegetative cover within the largely commercial flood plain. The banks are lined with riprap to control erosion. Heavy areas of sedimentation are common due to deposits transported from upstream reaches. (2) The stream meanders extensively in a 20-foot wide channel above Edsall Road and below Little River Turnpike, except for a section that was straightened and passes through culverts under I-395. Below I-395, the stream passes through a relatively undeveloped area; above the highway the land is largely residential. In this section the flood plain is relatively flat, and the vegetative cover varies from dense underbrush to cropped lawn cover. The pattern of meander in this section is accompanied by severe erosion and heavy

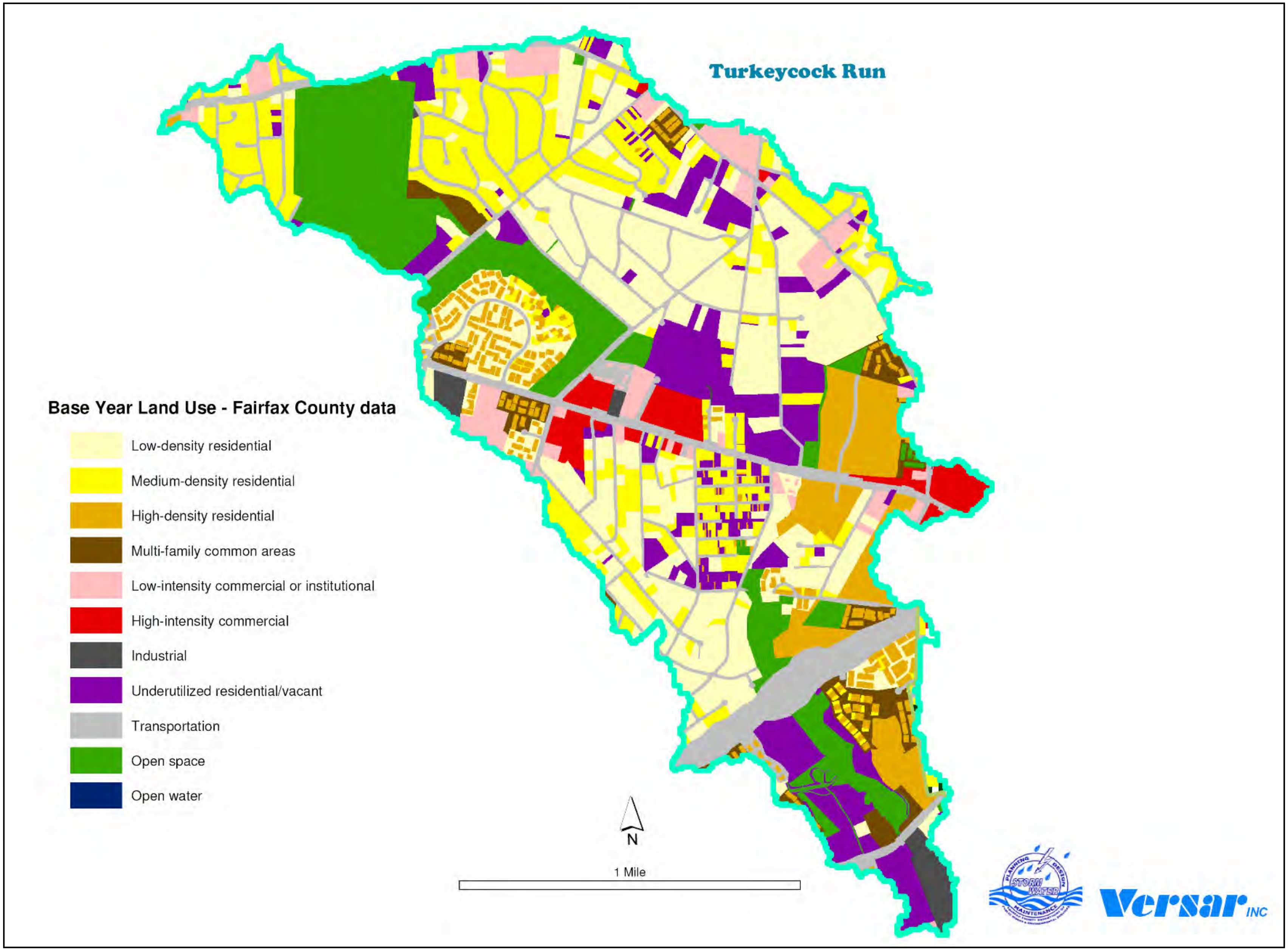

Figure 4-23. Land use map of Turkeycock Run subwatershed

Table 4-24. Estimates of future land use and percentage of impervious area in Turkeycock Run subwatershed			
Subwatershed Area (acres)	1,725		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	21.4	8.8	-59
Multifamily common area	7.2	4.4	-38.6
Low-density residential	23.0	27.5	19.8
Medium-density residential	15.9	23.2	46.1
High-density residential	9.5	9.6	1.6
Low-intensity commercial	4.5	7.6	69.9
High-intensity commercial	2.9	3.2	9.1
Industrial	1.4	1.4	-0.2
Transportation	14.4	14.4	0
Impervious area	21.3	26.3	23.3

sedimentation. (3) In the tributary headwaters, meander is greatly attenuated, and erosion is correspondingly reduced. The channel's inability to accommodate increased surface runoff causes minor flooding in many areas (Parsons Brinckerhoff 1974).

The county's list of drainage projects shows that 3 of the 11 projects in this subwatershed have been completed, and the remaining 8 projects are inactive. Table 4-25 summarizes the type of drainage project, project name/location, and current status. No cost estimates were available for these projects.

Table 4-25. Turkeycock Run Master Plan drainage projects

Type of Work	**Project Name/Location**
Completed	
Gabion and riprap/stabilization	Turkeycock Creek
Floodproof houses	Chowan Avenue
Streambank stabilization	6481 Seventh Street
Inactive	
Streambank stabilization	Chowan Avenue
Streambank stabilization	Eighth St
Stormdrain improvement/reinforced concrete box culvert	Holyoke-Piney Lane
Culvert addition	Braddock Road
Culvert addition	Old Columbia Pike
Streambank stabilization	Edsall/Shirley Highway
Streambank stabilization	Downstream of Braddock Road
Streambank stabilization	Upstream of Braddock Road

Table 4-26 summarizes the condition of Turkeycock Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition Turkeycock Run is poor.

Table 4-26. Summary of 2001 SPS Baseline Study and SPA results for the Turkeycock Run subwatershed

SPS Results		SPA Results	
Condition rating	Poor	Inadequate buffers (ft.)	51,615
Index of Biotic Integrity score	V.Poor	Eroded streambanks (ft.)	4,295
Habitat score	Fair	Habitat assessment	36
Fish taxa richness	Low	Stormdrain pipes	1
Base year % impervious	23	Dumping sites	2
		Headcuts	4
		Exposed utilities	11
		Obstructions	38
		Road crossings	51,615

4.2.4.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, eroded streambanks, and obstructions of stream flow (Figure 4-24).

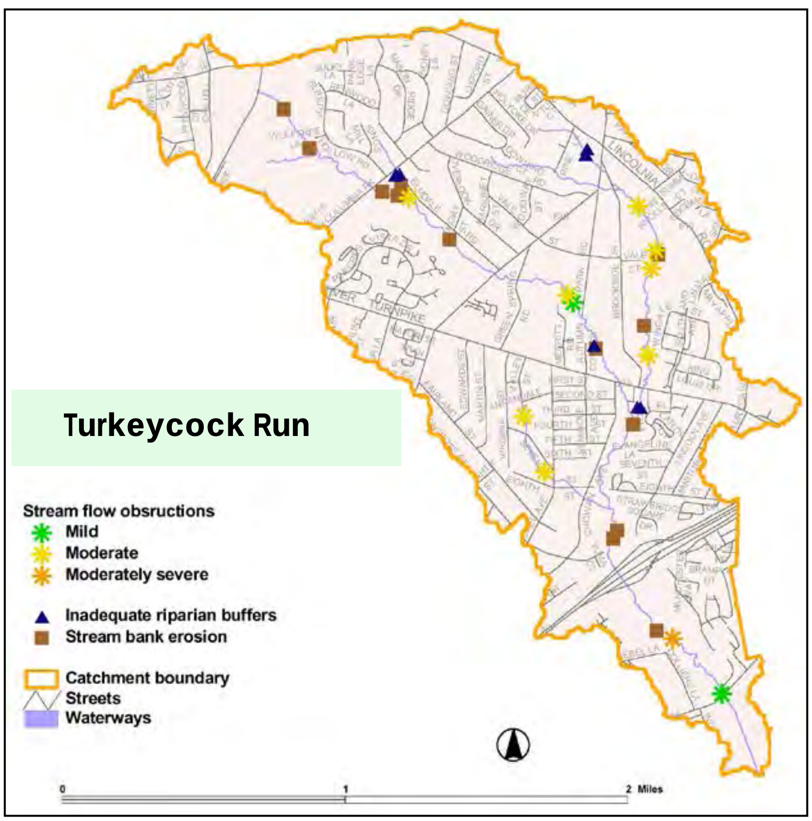

Figure 4-24. Location of major problems in Turkeycock Run subwatershed as indicated by SPA data

4.2.4.3 Problem Areas Identified by the Public

Public input on problem areas within Turkeycock Run was obtained through watershed forums and other avenues. Table 4-27 describes problem areas and potential solutions that were discussed during these meetings.

Streambank erosion along Turkeycock Run

Table 4-27. Problem areas in the Turkeycock Run subwatershed identified by the public

Location of Problem	Description of Problem	Potential Solution
Predominantly industrial area/ boating companies	Collection of upstream trash.	Organize stream clean-up.
Turkeycock/Braddock Rd.	Dog walking. Look into golf course management. Lots of geese, bad water quality downstream of golf course.	Doggy mitts/clean-up.
Mason District Park	Bank erosion and channel instability. Riparian buffer loss in the park.	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering and natural stream channel design approaches to stabilize streambanks and bed, and improve habitat conditions. Plant riparian vegetation along stream.

4.2.4.4 Modeling Results

Hydrologic modeling indicates that stormwater runoff in the Turkeycock Run subwatershed is the lowest within Cameron Run due to the lower density of development in this area. This subwatershed has the second lowest imperviousness within Cameron Run as a whole and the greatest percentage of area with stormwater controls. The increase in discharges due to future development is also lowest compared to the other subwatersheds. Table 4-28 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-28. Peak runoff flows in the Turkeycock Run subwatershed			
Drainage Area (acres)	1,725		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	182	244	611
Future peak flow (cfs)	185	242	614
Percent increase in peak flow	1.9	-0.7	0.5

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Turkeycock Run with peak velocity greater than this value are 36% and 59%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 46 for Turkeycock Run. No roadway crossings were overtopped by storms of various sizes for base-year or future conditions in Turkeycock Run. Complete modeling details and results are provided in Appendix B.

The Turkeycock Run subwatershed has the lowest sediment loading rate of the eight subwatersheds due to the lower density of development in the area. Turkeycock Run subwatershed also has the lowest annual loadings of total nitrogen and phosphorus of the eight subwatersheds. For future land use conditions, the total nitrogen and phosphorus loadings are predicted to increase by 19.7% and 19.0%, respectively. This is the greatest anticipated increase in loadings within Cameron Run and is due to the greater increase in development expected in the subwatershed. Table 4-29 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-29. Average annual pollutant loadings (pounds/acre/year) in the Turkeycock Run subwatershed.						
Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	8.0	1.0	176	0.011	0.057	0.253
Future	9.6	1.1	203	0.012	0.067	0.303
% Increase	19.7	19.0	15.1	12.7	18.2	19.6

4.2.5 State of Indian Run

4.2.5.1 Subwatershed Characteristics

Indian Run subwatershed covers 5.6% of the Cameron Run watershed (Figure 4-25). Twenty-five percent (25%) of the subwatershed is impervious; future imperviousness is estimated to increase to 29%. Medium-density residential development dominates land use within the subwatershed (Figure 4-26). Table 4-30 shows land use and percentages of impervious area for base-year and future conditions, and percent change in land use for the subwatershed. The headwaters of Indian Run originate near Little River Turnpike. From there, the stream flows southeast for approximately 3.6 miles toward its confluence with Backlick Run near Bren Mar Park. Streambank cover below Bren Mar Drive is dense, consisting mainly of low brush and trees. From Bren Mar Drive to Edsall Road the stream flows through a residential park, where the floodplain is covered with cropped lawn.

Severe stream meanders, along with erosion and sedimentation, are characteristic of Indian Run and its main tributary, Poplar Run. Severe erosion, sedimentation, and debris restricts flow at a large bend in the stream about 300 feet upstream of Edsall Road (Parsons Brinckerhoff 1974).

Figure 4-25. Indian Run subwatershed

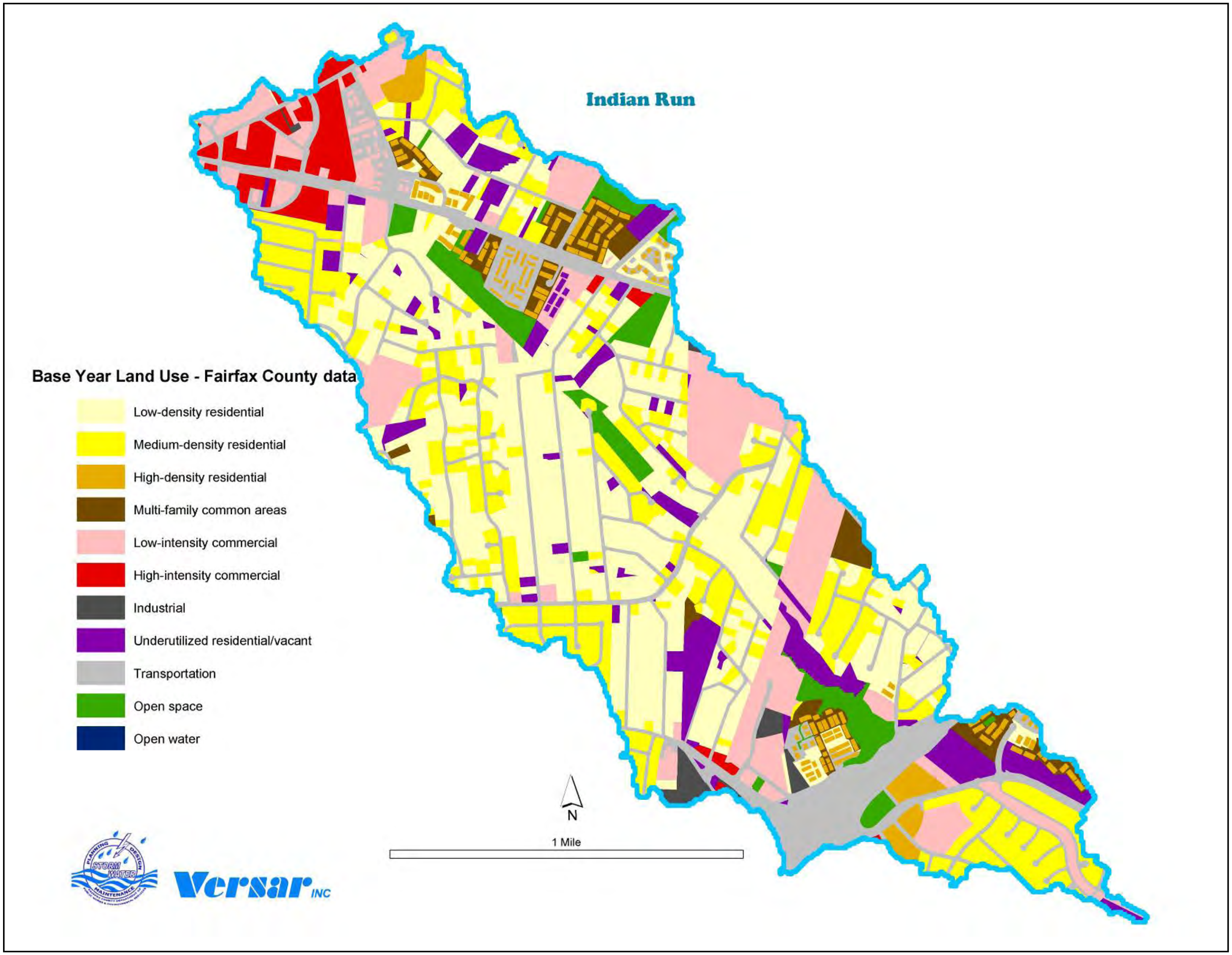

Figure 4-26. Land use map of Indian Run subwatershed

Table 4-30. Estimates of future land use and percentage of impervious area in the Indian Run subwatershed			
Subwatershed Area (acres)	1,586		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	8.2	4	-51.7
Multifamily common area	4.1	2.8	-30.3
Low-density residential	30.8	32.5	5.2
Medium-density residential	17.8	20.6	15.8
High-density residential	3.7	3.7	0
Low-intensity commercial	13.2	11.8	-10.8
High-intensity commercial	3.2	4.7	45.8
Industrial	0.9	1.9	109.2
Transportation	18	18	0
Impervious area	25.2	28.6	13.3

The county's list of drainage projects shows that 6 of the 16 projects in this subwatershed have been completed; 1 project is active with full funding, and the remaining 9 projects are inactive. Table 4-31 summarizes the kind of drainage project, project name/location, and status. No cost estimates were available for these projects.

Table 4-31. Drainage projects in the Indian Run subwatershed	
Type of Work	**Project Name/Location**
Active Project - Fully Funded	
Streambank stabilization	Indian Run Ph IV
Completed	
Gabion and rip rap/stabilization	Indian Run Ph II
Gabion/stabilization	Upstream of Braddock, Randolph
Streambank stabilization	Indian Run Ph I
Floodproof houses	Ridgewood
Retaining wall	Indian Run, Bren Mar Subdivision
Streambank stabilization	Brekke Property
Inactive	
Stream restoration	Spring Vall
Streambank stabilization	Braddock Hills
Streambank stabilization	Upstream of Braddock Road, Willow Run Subdivision
Channel improvements	Birch Lane
Streambank stabilization	Indian Run Ph III
Install retaining walls	Indian Run
Streambank stabilization	Bren Mar Ph II
Streambank stabilization	Fairland
Streambank stabilization	Indian Run

Table 4-32 summarizes the condition of Indian Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition of Indian Run is very poor.

Table 4-32. Summary of 2001 SPS Baseline Study and SPA results for the Indian Run subwatershed

SPS Results		SPA Results	
Condition rating	V.Poor	Inadequate buffers (ft.)	42,850
Index of Biotic Integrity score	Fair	Eroded streambanks (ft.)	4,840
Fish taxa richness	Very Low	Habitat assessment	Fair
Base year % impervious	27	Stormdrain pipes	25
		Dumping sites	0
		Headcuts	0
		Exposed utilities	6
		Obstructions	9
		Road crossings	29

4.2.5.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, eroded streambanks, storm discharge pipes, and obstructions of stream flow (Figure 4-27).

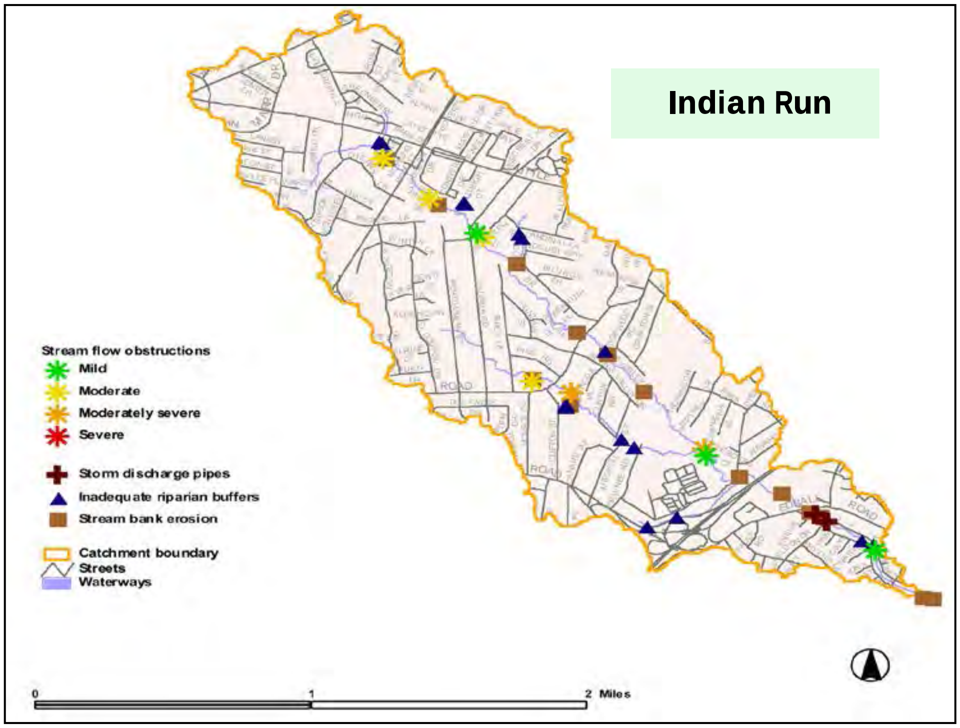

Figure 4-27. Location of the major problem areas in Indian Run subwatershed as indicated by SPA data

4.2.5.3 Problem Areas Identified by the Public

Public input about problem areas within Indian Run was obtained through watershed forums and other avenues. Table 4-33 describes problem areas and potential solutions that were discussed during these meetings.

Bank erosion and inadequate buffer along Indian Run

Table 4-33. Problem areas in the Indian Run subwatershed identified by the public

Location of Problem	Description of Problem	Potential Solution
Dog park	Concern about management	Review management of dog park.
Wooded lots below Holmes Middle School	Streambank erosion and high flows within nice wooded areas south of Holmes Middle School	Stormwater control upstream to increase the good areas.
Turkeycock/Braddock Rd.	Dog walking. Look into golf course management. Lots of geese, bad water quality downstream of golf course.	Doggy mitts/clean-up
Cherokee Rd, Shawnee Rd, Windy Hill Community	Pollution from "abandoned" Atlantic Research site, possibly polluting Indian Run	Investigate potential pollution source and identify opportunities to improve water quality from this site.

4.2.5.4 Modeling Results

Hydrologic modeling indicates that stormwater runoff in the Indian Run subwatershed is the greatest in Cameron Run due to dense development in the upper portions of the area. Overall, imperviousness in the subwatershed is about average compared to all of Cameron Run. The expected increase in discharges due to future development is average compared to the other subwatersheds. Table 4-34 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-34. Indian Run peak runoff flows

Drainage Area (acres)	1586		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	263	349	809
Future peak flow (cfs)	277	361	818
Percent increase in peak flow	5.0	3.3	1.2

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Indian Run with peak velocity greater than this value are 49% and 58%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 60 for Indian Run. Table 4-35 shows the number of roadway crossings overtopped by storms of various sizes for base-year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-35. Number of roadway crossings (bridges) overtopped by design flows for Indian Run subwatershed

	Present	**Future**
1-year	1	1
2-year	1	1
10-year	2	2
25-year	2	2
100-year	2	2

The Indian Run subwatershed has a sediment loading rate a little below average among the eight subwatersheds and average annual loadings of total nitrogen and phosphorus. This subwatershed contains the greatest proportion of low-density commercial development. For future land use conditions, the total nitrogen and phosphorus loadings are predicted to increase by 9.3% and 8.6%, respectively. Table 4-36 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-36. Average annual pollutant loadings (pounds/acre/year) in the Indian Run subwatershed

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	9.6	1.1	218	0.012	0.063	0.332
Future	10.5	1.2	234	0.014	0.068	0.359
% Increase	9.3	8.6	7.6	11.4	6.6	8.2

4.2.6 State of Backlick Run

4.2.6.1 Subwatershed Characteristics

Backlick Run subwatershed covers 19.9% of the Cameron Run watershed (Figure 4-28). Thirty-one percent (31%) of the subwatershed is impervious; imperiousness is estimated to increase to 36% in the future. Medium-density residential development dominates land use within the subwatershed (Figure 4-29). Table 4-37 shows land use and percentage of impervious area for base-year and future conditions, and percent change in land use for the subwatershed. Backlick Run and its tributaries drain the southwest portion of Cameron Run watershed. Turkeycock and Indian runs are the two major tributaries of this system. The headwaters of Backlick Run originate in the vicinity of Ravensworth Road. The stream flows southeast toward the "mixing bowl," the interchange of I-95, I-395, and I-495, and then east toward its confluence with Holmes Run in Alexandria, a length of 7.2 miles.

Figure 4-28. Backlick Run subwatershed

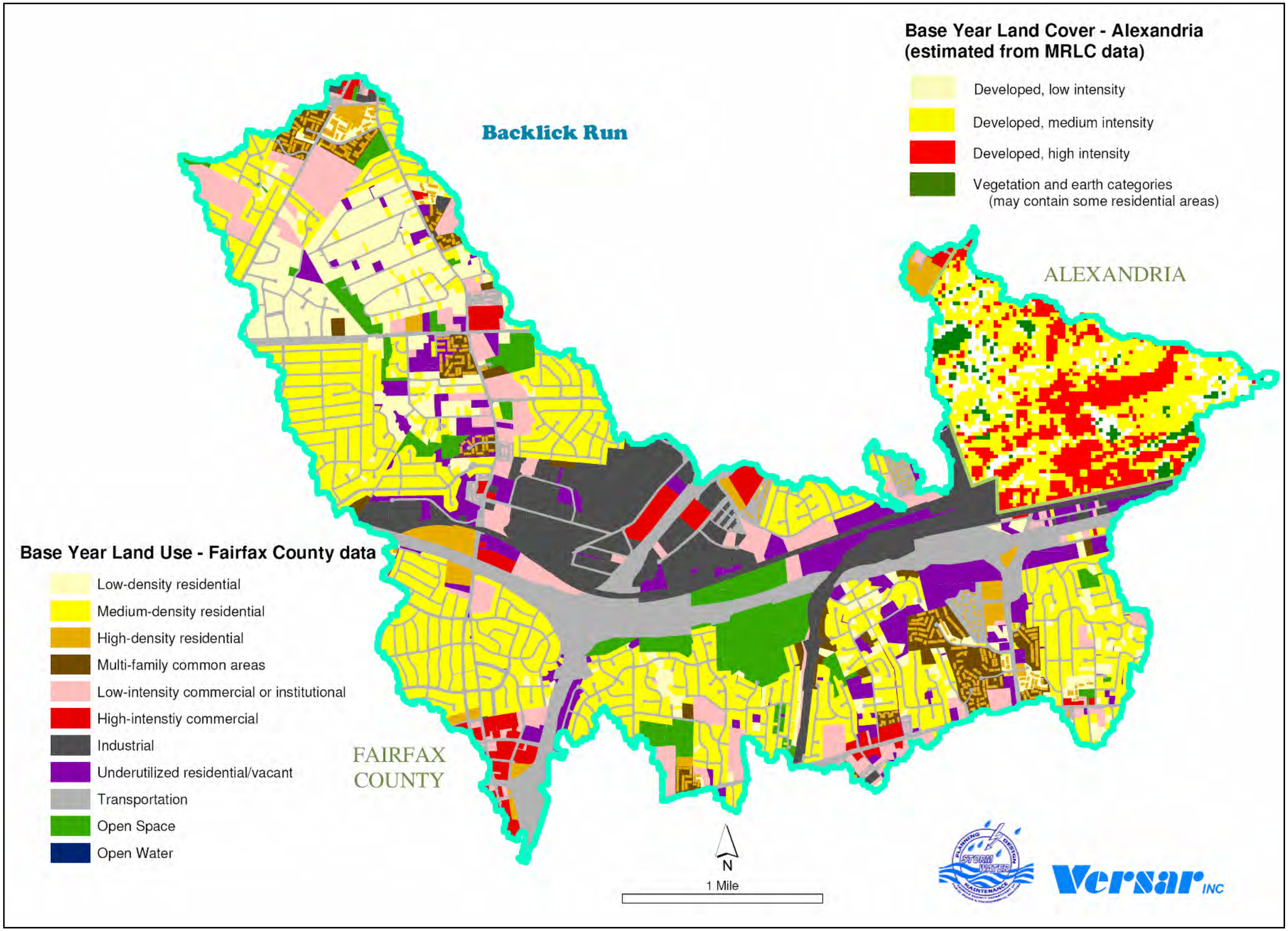

Figure 4-29. Land use map of Backlick Run subwatershed

Table 4-37. Estimates of future land use and percentage of impervious area in the Backlick Run subwatershed			
Subwatershed Area (acres)	5,659		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	10.8	6.4	-40.7
Multifamily common area	3.4	2.6	-21.8
Low-density residential	11.7	11.9	1.8
Medium-density residential	29.5	31.5	6.7
High-density residential	5.1	5.2	2.4
Low-intensity commercial	7.7	7.7	0.2
High-intensity commercial	2.9	3.3	14.2
Industrial	10.7	13.1	22.3
Transportation	18.1	18.1	0
Impervious area	30.7	35.9	16.9

In the uppermost section of the stream, northwest of Backlick Road, the stream passes through a lightly populated area and wooded stream valleys. From Backlick Road to the mouth of Indian Run, the stream is flanked by the Southern Railroad and the Capitol Beltway. The railroad and highway act as barriers against the encroachment of development. The section of the stream passing through Fairfax County (from the mouth of Indian Run to the confluence with Holmes Run) was channelized when the railroad was built in 1850 and passes through an intensely developed area (Parsons Brinckerhoff 1974).

The county's list of drainage projects shows that 4 of the 15 projects in this subwatershed have been completed; 1 project is active with partial funding, and the remaining projects are inactive. Table 4-38 summarizes the kind of drainage project, project name/location, and status. No cost estimates were available for these projects.

Table 4-38. Drainage projects in the Backlick Run subwatershed	
Type of Work	**Project Name/Location**
Active Project - Partially Funded	
Regional pond	Vine Street - 2
Completed	
Storm sewer	Valley View Drive
Gabion and rip rap/stabilization	Backlick Run
Streambank stabilization	Backlick Run Ph. 4
Gabion/stabilization	Wilburdale Park

Table 4-38. (Continued)	
Type of Work	**Project Name/Location**
Inactive	
Storm sewer	Leewood Subdivision
Storm sewer	Old Rolling/Nedra
Streambank stabilization	Southern Railroad
Streambank stabilization	Southern Railroad/South Van Dorn/Runnymeade
Storm sewer, ditch and berm	Clemons Court
Construction of earthen berm	Bren Mar Drive
Streambank stabilization	Shirley Highway
Streambank stabilization and gabion	RR
Streambank stabilization	Downstream of Backlick Run
Streambank stabilization study	Annandale Acres

Table 4-39 summarizes the condition of Backlick Run. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition of Backlick Run is very poor.

Table 4-39. Summary of 2001 SPS Baseline Study and SPA Results for the Backlick Run subwatershed

SPS Results		**SPA Results**	
Condition rating	V.Poor	Inadequate buffers (ft.)	70,485
Index of Biotic Integrity score	Poor	Eroded streambanks(ft.)	3,725
Fish taxa richness	Low	Habitat assessment	Fair
Base year % impervious	30	Stormdrain pipes	2
		Dumping sites	1
		Headcuts	2
		Exposed utilities	4
		Obstructions	7
		Road crossings	59

4.2.6.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, eroded streambanks, exposed utilities, storm discharge pipes, and obstructions of flow (Figure 4-30). Backlick Run was included on EPA's list of impaired waters for fecal coliform contamination.

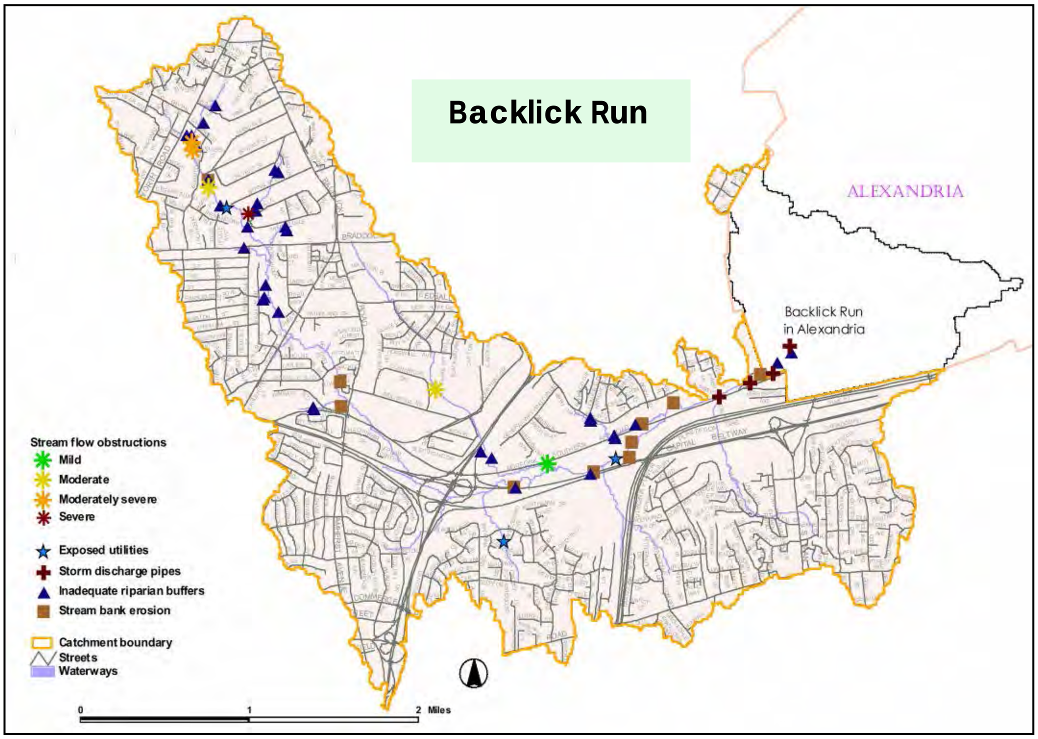

Figure 4-30. Location of major problem areas in Backlick Run subwatershed as indicated by SPA data

4.2.6.3 Problem Areas Identified by the Public

Public input about problem areas within Backlick Run was obtained through forums and other avenues. Table 4-40 describes problem areas and potential solutions discussed during these meetings.

Backlick Run at Interstate 495

Table 4-40. Backlick Run problem areas from public forum		
Location of Problem	**Description of Problem**	**Potential Solution**
Backlick Run in the Brookhill area	Bank erosion and channel instability along Backlick Run	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering approaches and natural stream channel design to stabilize streambanks and bed, and improve habitat conditions.
Edsall Road Industrial Park	Toxic polluted runoff	Implement pollution prevention programs; install stormwater controls to capture and treat runoff.
Cameron Run mainstem	Channelized ditch	River edge park/ dechannelizing (ex. Four Mile Run is in the process of retrofits)
Wilburdale Park	Urbanized stream	Earth Sangha - Stream planting project
Calvert Street.	Severe erosion	Stabilize the streambank.
Wilburdale Park, Backlick Run	Stream degradation and erosion of Backlick Run	Provide additional stormwater controls in upland areas to reduce the magnitude and frequency of flows; apply bioengineering approaches and natural stream channel design to stabilize streambanks and bed, and improve habitat conditions.
I-395 and I-495 intersection at Backlick Run	Impervious surfaces of I-395, I-495, and three industrial parks force heavy runoff into the floodplain area.	Install additional stormwater controls to capture, detain, and treat highway runoff.

4.2.6.4 Modeling Results

Hydrologic modeling indicates that stormwater runoff in the Backlick Run subwatershed is relatively high due to dense development in the middle and lower portions of this subwatershed; this subwatershed also has the largest percentage of impervious area within Cameron Run, at 30.7% overall. The estimated increase in discharges due to future development is average compared to the other subwatersheds. Table 4-41 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-41. Peak runoff flows in the Backlick Run subwatershed			
Drainage Area (acres)	5,659		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	212	277	622
Future peak flow (cfs)	224	289	626
Percent increase in peak flow	5.4	4.2	0.6

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicates the potential for channel erosion. The percentages of stream channels in Backlick Run with peak velocity greater than this value are 52% and 55%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 108 for the county portion of Backlick Run. Table 4-42 shows the number of roadway crossings overtopped by storms of various sizes for base-year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-42. Number of roadway crossings (bridges) overtopped by design flows for Backlick Run subwatershed

	Present	**Future**
1-year	0	0
2-year	0	0
10-year	3	3
25-year	3	3
100-year	4	4

The Backlick Run subwatershed has the highest sediment loading rate of the eight subwatersheds due to the larger commercial and industrial areas present. The Backlick Run subwatershed also has large annual loadings of total phosphorus. This can be attributed to the relatively high percentage of developed land in the watershed. This subwatershed contains the greatest proportion of industrial development. For future land use conditions, the nitrogen and phosphorus loadings are predicted to increase by 10.0% and 8.9%, respectively. Table 4-43 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-43. Average annual pollutant loadings (pounds/acre/year) in the Backlick Run subwatershed

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	10.1	1.1	250	0.016	0.075	0.419
Future	11.1	1.3	265	0.017	0.082	0.459
% Increase	10.0	8.9	6.3	8.8	8.6	9.5

4.2.7 State of Pike Branch

4.2.7.1 Subwatershed Characteristics

Pike Branch subwatershed covers 6.4% of the Cameron Run watershed (Figure 4-31). Twenty-one percent (21%) of the subwatershed is impervious; imperviousness is estimated to increase to 26% in the future.. Medium-density residential development dominates land use within the subwatershed (Figure 4-32). Table 4-44 shows land use, percentage of impervious area for base-year and future conditions, and percent change for the subwatershed. Pike Branch drains the extreme southeastern section of the watershed and flows northeast to Cameron Run. Telegraph Road parallels the stream most of the way.

The portion of Pike Branch mainstem that lies to the east of Telegraph Road passes through a developed area. The channel was straightened. About 150 feet of channel have sheet-metal sides and a concrete bottom; concrete walls line 450 feet. Although the improvements have reduced erosion, they have also considerably altered the stream.

The lowest reach of Pike Branch, west of Telegraph Road, shows the effects of its passage through a highly developed commercial area. Upstream of the confluence with Cameron Run, the stream falls sharply at the end of a concrete-lined section, causing bed scour. A sheet of corrugated metal in the channel has created a deep pond (Parsons Brinckerhoff 1974).

Figure 4-31. Pike Branch subwatershed

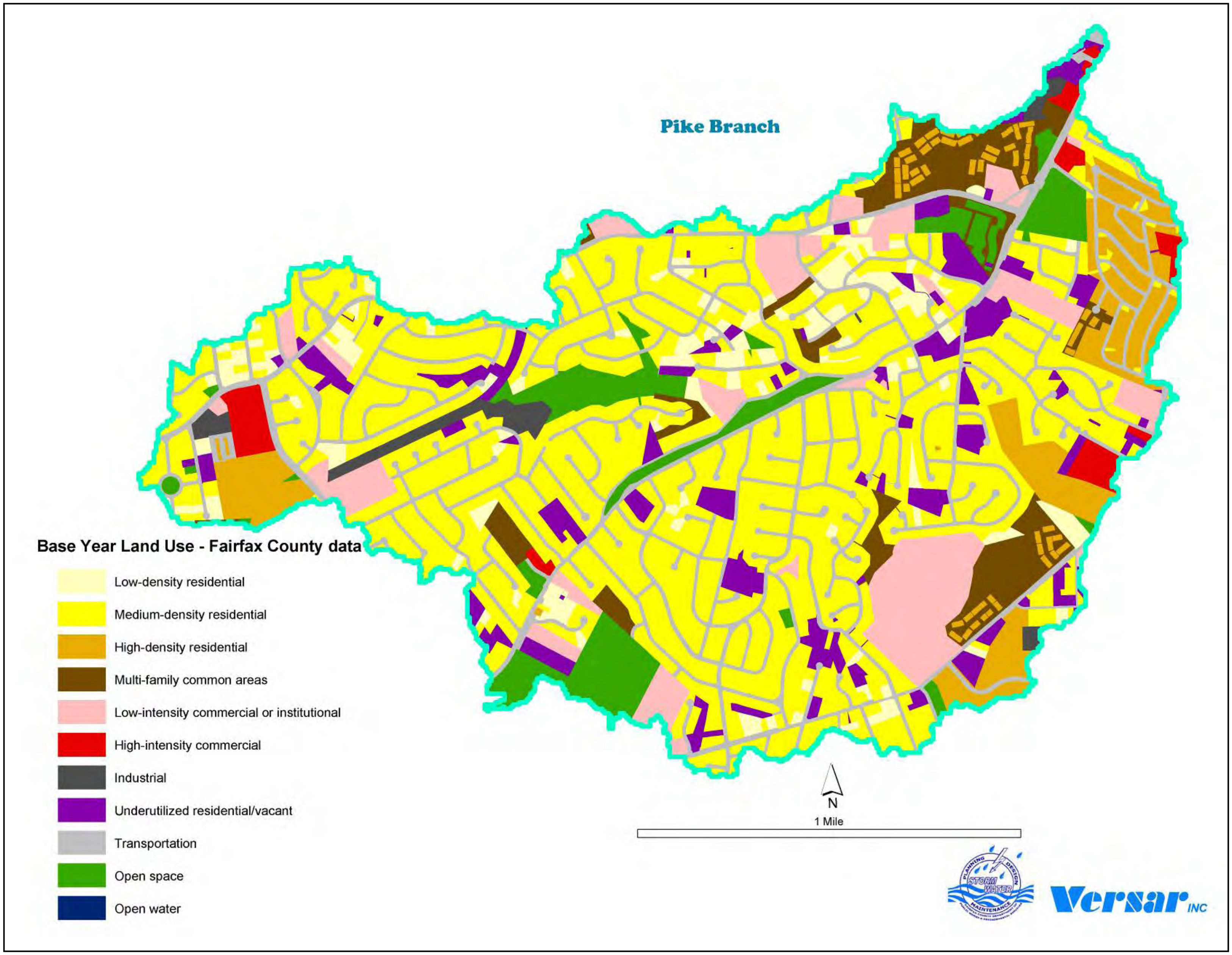

Figure 4-32. Land use map of Pike Branch

Table 4-44. Estimate of future land use and percentage of impervious area in the Pike Branch subwatershed			
Subwatershed Area (acres)	1,814		
Land Use	**Base Year**	**Future**	**% Change**
Open space	7.6	4.2	-44.3
Multifamily common area	6.7	5.2	-22.3
Low-density residential	7.8	5.4	-31.1
Medium-density residential	44.4	51.0	14.8
High-density residential	7.3	7.4	1.5
Low-intensity commercial	8.5	9.0	5.2
High-intensity commercial	1.7	1.8	7.6
Industrial	1.4	1.4	0
Transportation	14.6	14.6	0
Impervious area	20.8	25.5	22.5

The county's list of drainage projects shows that four of the nine projects in this subwatershed have been completed, and the remaining five projects are inactive. Table 4-45 summarizes the kinds of drainage projects, project name/location, and current status. No cost estimates were available for these projects.

Table 4-45. Drainage projects in the Pike Branch subwatershed	
Type of Work	**Project Name/Location**
Completed	
Floodproof house	Wilton Road, Pike Branch Ph 2
Gabion/stabilization	Tipton Lane, Sunny Ridge Estate
Gabion/replace culvert	Pike Branch Ph I
Stream stabilization/gabion repair	Pike Branch I00216
Inactive	
Streambank stabilization	Pike Branch Ph III
Channel improvements	Franconia/Leewood
Channel improvements	Wilton Woods
Stream restoration and stabilization	Pike Branch
Streambank stabilization	Pike Branch

Table 4-46 summarizes the condition of Pike Branch. This information is based on data from the 2001 SPS Baseline Study and the SPA. According to the SPS the overall condition of Pike Branch is very poor.

Table 4-46. Summary of 2001 SPS Baseline Study and SPA results for the Pike Branch Run subwatershed

SPS Results		**SPA Results**	
Condition rating	V.Poor	Inadequate buffers (ft.)	27,450
Index of Biotic Integrity score	Fair	Eroded streambanks (ft.)	75
Fish taxa richness	V.Low	Habitat assessment	Fair
Base year % impervious	25	Stormdrain pipes	29
		Dumping sites	1
		Headcuts	0
		Exposed utilities	2
		Obstructions	5
		Road crossings	13

4.2.7.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, obstructions of stream flow, and stormdrain pipes (Figure 4-33).

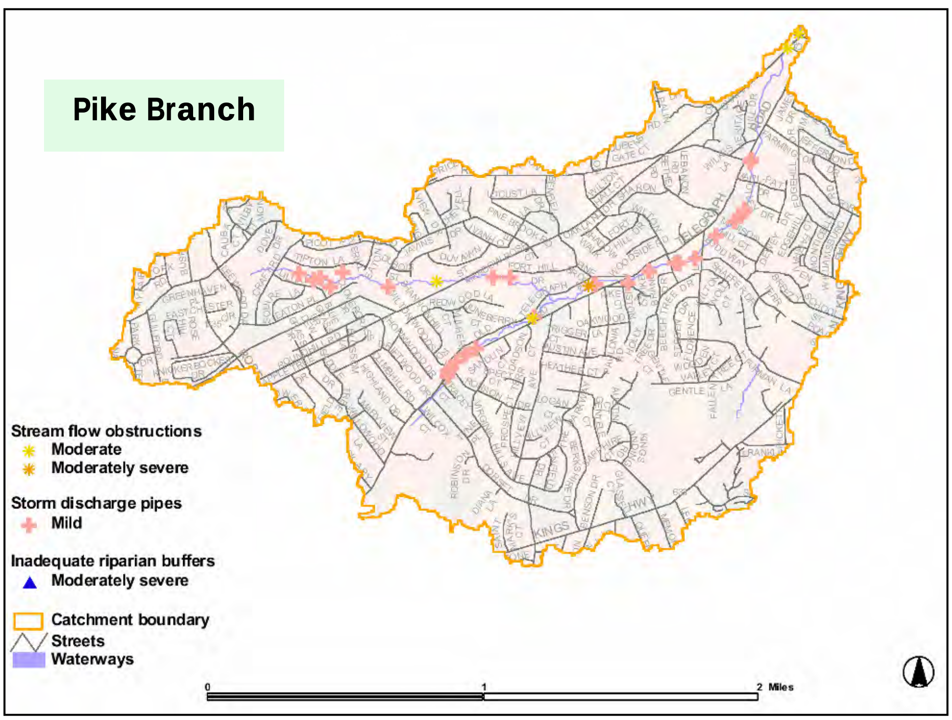

Figure 4-33. Location of major problem areas in Pike Branch subwatershed as indicated by SPA data

4.2.7.3 Problem Areas Identified by the Public

Public input about problem areas within Pike Branch was obtained through forums and other avenues. Table 4-47 describes problem areas and potential solutions discussed during these meetings.

Channelization in Pike Branch

Table 4-47. Problem areas identified by the public in the Pike Branch subwatershed

Location of Problem	Description of Problem	Potential Solution
Pike Branch at Burgundy Road crossing	Concrete wall across stream and banks overrun with porcelain berry; area is part of Woodrow Wilson Bridge Project.	Control exotic plants with assistance from existing or newly formed native plant group; provide resources to replant with native species.
Pike Branch intersection with Cameron Run	Construction run off due to Wilson Bridge project	
Jefferson Manor neighborhood (and many others)	Trash, leaves, and runoff going down stormdrains (many times intentionally)	Stencil stormdrains.
Jefferson Manor Park	Channelized stream	Dechannelize and retrofit (ex. Four Mile Run is in the process of being retrofitted).

4.2.7.4 Modeling Results

Hydrologic modeling indicates that stormwater runoff in the Pike Branch subwatershed is about average among the subwatersheds of Cameron Run, although Pike Branch has the lowest imperviousness within Cameron Run as a whole. The predicted increase in discharges due to future development is average compared to the other subwatersheds. Table 4-48 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-48. Peak runoff flows in the Pike Branch subwatershed

Drainage Area (acres)	1,814		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	221	297	742
Future peak flow (cfs)	235	308	742
Percent increase in peak flow	6.4	3.6	0

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for storms of various sizes. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Pike Branch Run with peak velocity greater than this value are 13% and 38%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 22 for Pike Branch Run. Table 4-49 shows the number of roadway crossings overtopped by various size design storms for base year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-49. Number of roadway crossings (bridges) overtopped by design flows for Pike Branch subwatershed

	Present	**Future**
1-year	0	0
2-year	0	0
10-year	0	0
25-year	0	0
100-year	3	3

The Pike Branch subwatershed has an average sediment loading rate among the eight subwatersheds and relatively high annual loadings of total nitrogen and phosphorus. This can be attributed to the relatively high percentage of medium-density residential development in the watershed. For future land use conditions, the total nitrogen and phosphorus loadings are predicted to increase by 10.1% and 9.2%, respectively. Table 4-50 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-50. Average annual pollutant loadings (pounds/acre/year) in the Pike Branch subwatershed

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	10.1	1.2	222	0.13	0.065	0.314
Future	11.2	1.3	240	0.014	0.071	0.345
% Increase	10.1	9.2	8.1	8.0	9.5	9.9

4.2.8 State of Cameron Run Mainstem and Direct Tributaries

4.2.8.1 Subwatershed Characteristics

The subwatershed of Cameron Run and its direct tributaries covers 18.8% of the Cameron Run watershed (Figure 4-34). Medium-density residential development dominates land use within the subwatershed (Figure 4-35). Table 4-51 shows land use and percentages of impervious area for base-year and future conditions, and percent change for the subwatershed. The mainstem of Cameron Run is the portion of stream that flows from the confluence of Holmes and Backlick runs to a point just upstream of the Jefferson Davis Highway crossing. The stream from here to the Potomac River is known as Hunting Creek and receives drainage from the Belle Haven watershed.

Throughout its length, the stream flows through an area of dense development. The section upstream of Pike Branch is similar to the disturbed, downstream reaches of Backlick Run. The channel is wide, straight, and shallow, with only sporadic vegetative cover. Sections of concrete lining are found throughout the course of the stream.

The tidal effect of the Potomac River is pronounced, extending upstream as far as Telegraph Road. At high tide, this influence is significant in bringing poorer quality water into the lower reaches of the basin. The stream quality is further degraded by the sediment load delivered to this area. It is the heaviest in the basin, having accumulated from upstream feeder tributaries. Concrete walls protect streambanks from scouring in critical areas; consequently, erosion is not a significant problem. The stream receives flows from Alexandria, has tidal influence near the

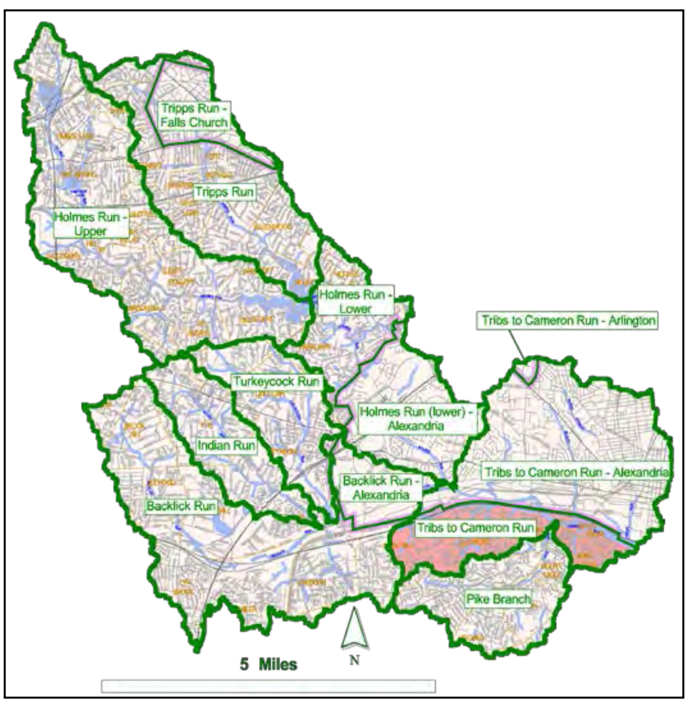

Figure 4-34. Cameron Run subwatershed

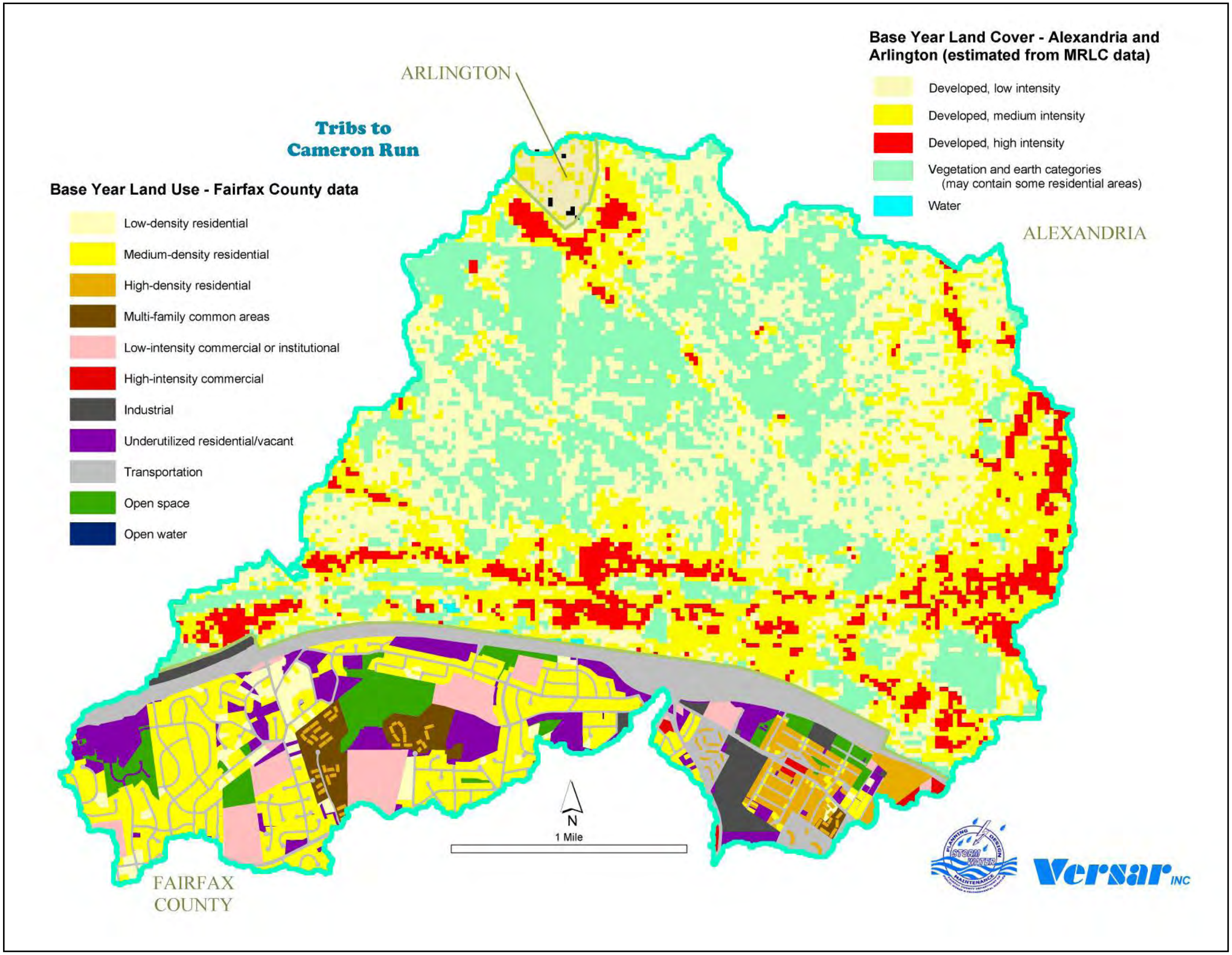

Figure 4-35. Land use map of Cameron Run subwatershed

Wilson Bridge, and includes the proposed Huntington Stream Valley Trail along its mainstem. Many streams are buried or channelized (especially in the lower Capitol Beltway area), disconnecting them from their floodplains (Parsons Brinckerhoff 1974).

Table 4-51. Estimates of future land use and percentage of impervious area in the Cameron Run mainstem and direct tributaries.*

Subwatershed Area (acres)	1,708		
Land Use	**Base Year (% area)**	**Future (% area)**	**% Change**
Open space	16.8	7.8	-53.7
Multifamily common area	6.1	4.0	-34
Low-density residential	12.8	11.0	-14.2
Medium-density residential	28.2	39.2	39
High-density residential	5.8	6.0	5.1
Low-intensity commercial	8.1	9.5	17.8
High-intensity commercial	0.9	1.0	20.6
Industrial	3.9	3.9	0
Transportation	17.5	17.5	-0.1
Impervious area	23.7	29.5	24.6

* Includes area in Alexandria upstream of USGS gage on Cameron Run

The county's list of drainage projects shows that three of the seven projects in this subwatershed have been completed, and the remaining four projects are inactive. Table 4-52 summarizes the kind of drainage project, project name/location, and current status. No cost estimates were available for these projects.

Table 4-52. Drainage projects in the Cameron Run mainstem and direct tributaries

Type of Work	**Project Name/Location**
Completed	
Streambank stabilization	Norton Road
Storm sewer system	Clermont Drive
Streambank stabilization	Burgundy Manor
Inactive	
Infrastructure replacement	Elmwood Drive
Floodwall construction	Arlington Terrace
Streambank stabilization	Telegraph Road/Beltway
Streambank stabilization	Norton Villa

During June, 2006, intense tropical downpours resulted in significant flooding of the Arlington and Huntington communities located adjacent to the Cameron Run mainstem. Approximately 160 duplex homes in the area were severely damaged during the storm.

In September 2006, Fairfax County entered into an agreement with the U.S. Army Corps of Engineers to complete a flood-damage-reduction study for Huntington. This study will investigate structural and combination structural/non-structural alternatives for reducing the effects of flooding and include an economic analysis of various alternatives. The study will be completed in approximately 18 months and will include a 65% engineering design for the recommended improvement.

Table 4-53 summarizes the condition of Cameron Run. This information is based on data from the Fairfax County SPA. The 2001 SPS Baseline Study did not include sites within this subwatershed.

Table 4-53. Summary of SPA results for the Cameron Run subwatershed

Inadequate buffers (ft.)	27,500
Eroded streambanks (ft.)	800
Habitat assessment	Poor
Stormdrain pipes	9
Dumping sites	2
Headcuts	1
Exposed utilities	0
Obstructions	2
Road crossings	17

4.2.8.2 Problems Areas Identified from SPA Data

An analysis of the SPA data indicates that the major problems within the subwatershed are inadequate buffers, trash dumpsites, and stormdrain pipes (Figure 4-36). These waters are included on EPA's list of impaired waters for acute ammonia and fecal coliform contamination. PCBs were found in fish tissues, which prompted the Virginia Department of Health to issue a health advisory. A 1985 study in Alexandria identified poor groundwater conditions (high sodium chloride, iron, and total dissolved solids), which can influence baseflow water quality.

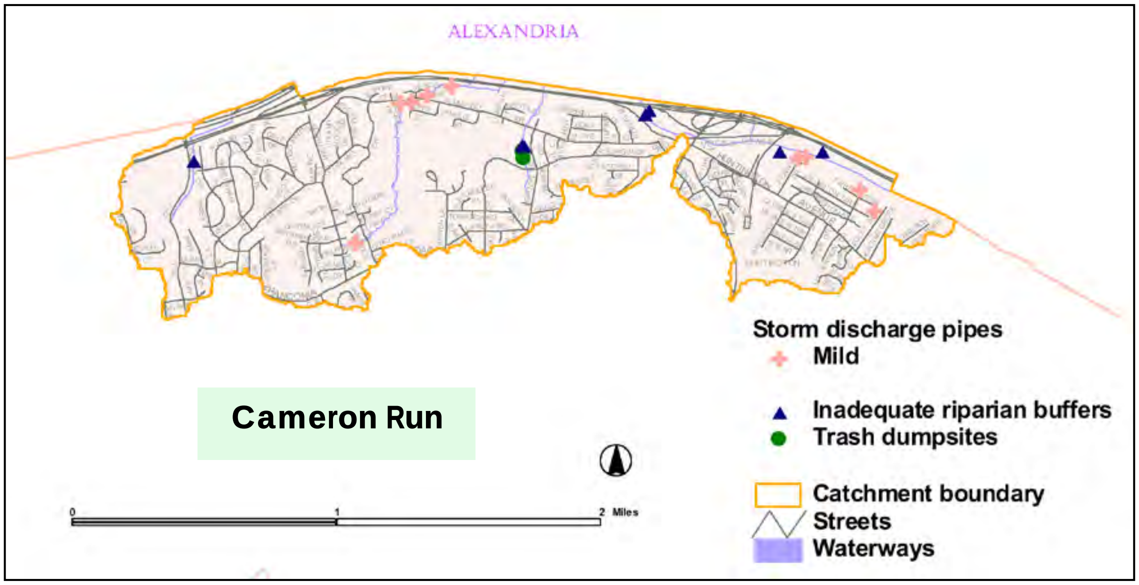

Figure 4-36. Location of major problem areas in Cameron Run subwatershed as indicated by SPA data

A view of Cameron Run facing upstream

4.2.8.3 Problem Areas Identified by the Public

Public input about problem areas within Cameron Run mainstem and direct tributaries was obtained through forums and other avenues. Table 4-54 describes problem areas and potential solutions that were discussed during these meetings.

Table 4-54. Problem areas identified by the public in Cameron Run mainstem and direct tributaries

Location of Problem	Description of Problem	Potential Solution
Cameron Run along Eisenhower Avenue in Alexandria	Cameron Run is an ugly, boulder strewn wasteland; trail is too far from water; water provides no benefit to trail users.	Integrate recreational and aesthetic amenities, as well as stormwater controls, into Cameron Run trail projects during maintenance and upgrade cycles.
Huntington Avenue and Telegraph Road	Woodrow Wilson Bridge construction degrades the area.	Coordinate with the Woodrow Wilson Bridge consultants to discuss and mitigate construction impacts.
Cameron Run mainstem	Lack of recreation opportunities	Integrate recreational and aesthetic

Table 4-54. Problem areas identified by the public in Cameron Run mainstem and direct tributaries		
Location of Problem	**Description of Problem**	**Potential Solution**
	along the Cameron Run mainstem	amenities into future stormwater and flood control projects. Acquire new parkland if possible, and improve existing parks.
Urban areas along Cameron Run, such as Eisenhower East	Along the Cameron Run mainstem, there are no urban areas to enjoy the waterfront.	Integrate recreational, commercial, and aesthetic amenities into an urban redevelopment project along mainstem Cameron Run that will encourage the adoption of Cameron Run as a community focal point.
Cameron Run between Holmes Run and Hunting Creek	Already identified as severely degraded habitat	Add recreational amenities in addition to environmental remedies. Light boating and kayaking could be readily accomplished in conjunction with the Northern Virginia Regional Park Authority.
Cameron Run	Between Telegraph Road and Route 1 access to stream is available only by car.	Create pedestrian walk along the stream and across the stream to Eisenhower Ave.
Tributary to Cameron Run	No public access to stream	

4.2.8.4 Modeling Results

Hydrologic modeling indicates that stormwater runoff in the mainstem of Cameron Run is about average due to the average density of development in this subwatershed. Imperviousness in this area is below average compared to the entire watershed. The predicted increase in discharges due to future development is relatively high compared to the other subwatersheds. Table 4-55 compares the existing and future 1-, 2- and 10-year peak discharges in the subwatershed.

Table 4-55. Peak runoff flows in Cameron Run mainstem			
Drainage Area (acres)	1708		
	1-Year Storm	**2-Year Storm**	**10-Year Storm**
Existing peak flow (cfs)	231	306	711
Future peak flow (cfs)	249	322	731
Percent increase in peak flow	,8.1	5.3	2.8

The HEC-RAS stream hydraulic model was used to simulate peak water velocity and water levels in stream channels in Cameron Run for various size rainfall events. Peak stream velocities greater than 5 feet per second (fps) indicate the potential for channel erosion. The percentages of stream channels in Cameron Run mainstem with peak velocity greater than this value are 50% and 66%, for the 1-year and 2-year design storms, respectively. The number of buildings estimated to be in or touching the 100-year floodplain is 8 for the portion of the Cameron Run mainstem that lies within Fairfax County. Table 4-56 shows the number of roadway crossings overtopped by storms of various sizes for base-year and future conditions. Complete modeling details and results are provided in Appendix B.

Table 4-56. Number of roadway crossings (bridges) overtopped by design flows for Cameron Run mainstem and tributaries

	Present	**Future**
1-year	0	0
2-year	0	0
10-year	0	1
25-year	1	1
100-year	1	1

The Cameron Run mainstem subwatershed has an average sediment loading rate among the eight subwatersheds due to the average percentage of commercial areas and higher percentage of industrial areas in the subwatershed. This subwatershed receives average loadings of total nitrogen and phosphorus. For future land use conditions, the total nitrogen and phosphorus loadings are predicted to increase by 14.9% and 14.0%, respectively. Table 4-57 compares the existing and future annual average pollutant loadings in the subwatershed.

Table 4-57. Average annual pollutant loadings (pounds/acre/year) in the Cameron Run mainstem

Pollutant	**Total Nitrogen**	**Total Phosphorus**	**Total Suspended Solids**	**Lead**	**Copper**	**Zinc**
Base year	9.9	1.2	229	0.014	0.068	0.343
Future	11.4	1.3	254	0.015	0.076	0.387
% Increase	14.9	14.0	11.0	9.9	12.4	12.9

THIS PAGE INTENTIONALLY LEFT BLANK