Chapter 4

Bull Neck Run Watershed

4.1 Watershed Condition

The Bull Neck Run Watershed has an area of approximately 1,559 acres as shown on Map 4.1. Approximately three-quarters of that area, or 1,142 acres, drains to Bull Neck Run itself and 417 acres drain directly to the Potomac River from unnamed tributaries. This tributary area has been added to the total watershed area to facilitate planning. The entire watershed is bounded to the west by Portland Place, Belleview Road, and the Madeira School; to the east by Meadow Green Lane, Dominion Reserve, and Canal Drive; to the south by Weller Avenue and Lewinsville Road; and to the north by the Potomac River. There is one major tributary and several small tributaries to Bull Neck Run.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Bull Neck Run Watershed Condition Summary

- **Current imperviousness = Eight percent with the majority of land in low density residential uses.**
- **Future imperviousness = 12 percent**
- **The majority of the residential development is served by on-site sewage disposal systems.**
- **All of the 13 stream crossings have "minor to moderate" impacts.**
- **There are eight BMPs in the watershed.**
- **The majority of the habitat quality is fair with inadequate buffers.**
- **Most of the stream is actively widening and the impact of erosion was observed as "moderate to severe" at three locations.**
- **Three obstruction locations have "moderate to severe" impacts.**
- **One trash dumpsite was observed.**

4.1.1 Watershed Characteristics

The headwaters of Bull Neck Run begin at the Spring Hill District Park, which is located near the intersection of Spring Hill Road and Lewinsville Road. The stream then passes through Bull Neck Stream Valley Park. Bull Neck Run flows from south to north throughout the watershed. The length of Bull Neck Run from its headwaters to its outfall at the Potomac River is approximately 2.5 miles.

One major unnamed tributary, which is located to the west of the main channel, has a length of approximately 7,600 feet and contributes significant runoff and drainage area to Bull Neck Run. There are also two small unnamed streams, with lengths of 1,200 and 2,600 feet, that drain directly into the Potomac River. They are included in the Bull Neck Run watershed to facilitate planning. The terrain in the watershed is moderate with land elevations ranging from 300 to 350 feet in the southern part to elevations of 70 to 80 feet in the northern part. The creek has a moderate-gradient slope of almost two percent.

4.1.2 Existing and Future Land Use

Land use in the upstream portion of the watershed is predominantly low-density residential. Other major land uses are open space downstream of Old Dominion Drive and estate residential land use adjacent to Spring Hill Road. There are currently 147 acres of open space, parks, and recreational areas in the Bull Neck Run Watershed, which account for approximately nine percent of the existing land use. The parks and recreational areas in the Bull Neck Run Watershed include Greenway Heights Park, Bull Neck Stream Valley Park, and Spring Hill District Park. There are 192 acres that are currently vacant or undeveloped and 132 acres that are currently underutilized. Undeveloped and underutilized parcels make up 21 percent of the watershed area and primarily have a future proposed land use of low-density residential. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 1.22 acres of wetlands in this watershed. Table 4.1 summarizes the existing and future land use in the Bull Neck Run Watershed.

Table 4.1 Bull Neck Run Watershed Land Use

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Bull Neck Run				
Open space, parks, and recreational areas	124	11%	151	13%
Estate residential	302	26%	181	16%
Low-density residential	380	33%	621	54%
Medium-density residential	42	4%	42	4%
High-density residential	0	0%	0	0%
Low-intensity commercial	54	5%	54	5%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%

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| Land Use Description[1] | Land Use | | | |
| | Existing | | Future | |
	Area (Acres)	%	Area (Acres)	%
Vacant/Undeveloped	147	13%	0	0%
Road right-of-way (including shoulder areas)	93	8%	93	8%
TOTAL	1,142	100%	1,142	100%
Unnamed Tributaries to the Potomac River				
Open space, parks, and recreational areas	23	6%	23	6%
Estate residential	93	22%	138	33%
Low-density residential	13	3%	13	3%
Medium-density residential	0	0%	0	0%
High-density residential	0	0%	0	0%
Low-intensity commercial	238	57%	238	57%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	45	11%	0	0%
Road right-of-way (including shoulder areas)	5	1%	5	1%
TOTAL	417	100%	417	100%
Total Bull Neck Run Watershed	**1,559**	**100%**	**1,559**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

The current impervious area in this watershed is eight percent of the total area. Together, the predicted land use changes will increase the future imperviousness by four percent for a total of 12 percent imperviousness in the watershed. In the future, under ultimate build out conditions, it is anticipated that most of the vacant/undeveloped land and some estate residential land will be replaced by low-density residential development. In addition to the predicted change in land use, mansionization will increase the impervious area in the watershed by 2.6 acres.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The Fairfax County Comprehensive Plan for land use in the Bull Neck Run Watershed calls for low-density residential development – not to exceed one dwelling unit per five acres – in the watershed and future transportation improvements include installing new trails. The improvements are described in more detail below.

The planned trails for Bull Neck Run Watershed include:
▪ The Potomac Heritage National Scenic trail with a six- to eight-foot-wide natural surface

or stone dust trail along Georgetown Pike.

- A stream valley trail with a six- to eight-foot-wide natural surface or stone dust trail along the Potomac River.
- A major eight-foot-wide asphalt or concrete trail along Spring Hill Road, Old Dominion Drive, and Lewinsville Road.
- A new bike lane at Old Dominion Drive.
- A minor four- to eight-foot-wide asphalt or concrete trail along Bull Neck Run.

4.1.3 Existing Stormwater Management

The headwaters of Bull Neck Run begin near the southern part of the watershed at the outfall pipe of a storm drain system. The remaining portions of Bull Neck Run are conveyed in an open channel to the stream's confluence with the Potomac River. The storm drain systems, which contribute to several minor tributaries of Bull Neck Run, consist of minor networks of storm drain pipes and culverts. These outfalls vary in size, ranging from 12 inches in diameter to a 15-foot by nine-foot box culvert. Most segments of the outfall channels are experiencing minor to moderate erosion due to the culvert crossings.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Map 4.1 shows the location of the crossings and their erosional impacts on the streams. None of the 13 crossings evaluated in the SPA had a "moderate to severe" or "severe to extreme" impact on the stream.

The county's list of master plan drainage projects shows that there are three identified projects in this watershed. Table 4.2 summarizes the type of master plan drainage project, project name/location, project cost and current project status.

Table 4.2 Bull Neck Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/Location	Old Project Number	Cost	Status
Stream stabilization	Bull Neck Run	BN211	$316,000	Keep as CIP project.
Replace culvert at Georgetown Pike	Georgetown Pike	BN411	$464,656	Keep as CIP project.
Add culvert at Alvord Street	Alvord St	BN412	$97,110	Keep as CIP project.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According the MSMD data, three complaints regarding flooding and erosion were registered with the county. The locations of these complaints are shown on Map 4.1. Projects were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the county's MSMD BMP inspection database, there are one private and seven public stormwater management facilities located in the Bull Neck Run Watershed. The single private facility is located near the crossing of Lewinsville Road and Spring Hill Road. The public

facilities are located throughout the upstream portion of the watershed. The area served by stormwater management facilities in this watershed is 271 acres out of the total area of 1,559 acres, or 17 percent of the watershed. The types of facilities are provided in Table 4.3. The facilities in the table are shown on Map 4.1, along with six additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these six sites.

Table 4.3 Bull Neck Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities	
	Privately owned	Publicly owned
Bioretention	-	-
Dry pond	1	6
Manufactured BMP	-	-
Parking lot	-	-
Roof top detention	-	-
Sand filter	-	-
Infiltration Trench	-	-
Underground	-	1
Wet pond	-	-
Total	**1**	**7**

Note: The source of data for this table was the MSMD database.

4.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil group B. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups.

The geomorphology of the stream segments of Bull Neck Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrate in the majority of stream segments is gravel; however, the downstream reaches of Bull Neck Run consist mainly of bedrock.
- The majority of reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.
- The upstream segments are paved with concrete or reinforced with riprap; hence, no geomorphic assessment was performed.
- Portions of the upstream- and downstream-most reaches are of CEM type 4, which means that they are stabilizing and a new channel configuration is developing.

Map 4.2 shows the stream segment CEM type in the watershed. Fallen trees and debris obstructing the flow were observed at three locations along Bull Neck Run. The impact of this debris on the stream is moderate to severe. No head cuts were observed. One dumpsite was identified during the SPA.

4.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality does not have any monitoring stations located on Bull Neck Run. There is one volunteer water quality monitoring site located on Bull Neck Run which is coordinated by the Audubon Naturalist Society. The data collected from this site generally support the findings of the Fairfax County Stream Protection Strategy Baseline Study and indicate the presence of a benthic community that is more diverse than the other Middle Potomac Watersheds. There is also a volunteer water quality monitoring site along Bull Neck Run coordinated by the Northern Virginia Soil and Water Conservation District, but there was no data available for this monitoring site.

The Fairfax County Health Department monitored stream water quality at one sampling site in the Bull Neck Run Watershed, located at Georgetown Pike. In 2002, water samples were collected from this site and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. The average dissolved oxygen concentration for the sampling site on Bull Neck Run was 10.1 mg/l, which is well above the minimum standard of 4.0 mg/l. In 2002, fifty-three percent of the water samples in Bull Neck Run had fecal coliform counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 1400/100 ml. For fecal coliform, a count less than 200/100 ml is considered good water quality and a count of 250,000/100 ml can be considered a direct sewage discharge. Approximately 751 acres of the Bull Neck Run Watershed, or 48 percent, are served by on-site sewage disposal systems. The on-site sewage area covers all of the major development in the Bull Neck Run Watershed except the McLean Hunt Estates and a portion of The Reserve, which are both served by sanitary sewer. The other areas in the watershed not served by on-site systems or sanitary sewer are mostly undeveloped areas such as river valleys and parks. Properties with on-site sewage systems are shown on Map 4.2, but this information is based on the best available data only and may not be completely accurate.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Bull Neck Run received an "excellent" rating. The rating was based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. Bull Neck Run was classified as a Watershed Protection Area due to high biological integrity and habitat quality.

The stream reaches of Bull Neck Run have high gradient slopes and are classified as the riffle/run prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The habitat assessment for Bull Neck Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- In half of the stream reaches, at least four habitat types were common such as large rocks, undercut banks, and deep pools.
- Two upstream channel reaches are made of concrete; hence, no habitat was assessed.

- Dominant substrate in the stream reaches is a mixture of gravel, stones and boulders.
- Sediment deposition is mainly sand and silt with 20 percent of the stream bottom affected in the downstream segments and 40 to 50 percent of the stream bottom affected in the upstream segments.
- Approximately 20 to 30 percent of the stream segments have minor alterations of the channel or banks. One of the two unnamed streams that discharge directly to the Potomac River and the downstream reaches of Bull Neck Run exhibit no channel disturbance.
- Most of Bull Neck Run has a run-to-riffle ratio of 15, which implies a moderate frequency of occurrence of riffles. Increased riffle frequency enhances the diversity of a stream community by producing high-quality habitat.
- For most of Bull Neck Run, the water fills approximately 70 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- Forty-four percent of Bull Neck Run exhibits good habitat quality and 31 percent exhibits excellent habitat quality as depicted on Map 4.1. The remaining stream segments require minor bank stabilization to protect adjacent properties from future problems.
- A majority of the channel banks have approximately 80 percent vegetated cover with few barren or thin areas. Fifteen to 30 percent of the banks have erosional areas. The majority of the deficient stream buffer consists of lawn grass with 50 to 100 feet of buffer width. The locations of deficient buffer areas along the stream corridor are shown on Map 4.2.

4.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the observations are included in the following table. Map 4.1 shows the locations of the problems identified.

**Table 4.4 Problem Locations Identified During Public Forums**

Map ID	Description
BN1	This location and problem could not be verified and was not considered in the watershed plan.
BN2	Location: Spring Hill Recreation Center near Bull Neck Run Problem: This location seems to have too much parking. When this area is redeveloped, an accurate assessment of parking needs and use alternatives to reduce impervious surface should be completed. Observation: LID techniques may help mitigate the effects of the parking area. New LID Project BN9811 has been added at this location.
BN3	Location: Bull Neck Stream Valley Park near McLean Hunt Estates Problem: Trails have not been maintained in 20 years, causing them to break up and the edges to erode. All of the silt is going down into Bull Neck Run and the tributaries. This is also a safety issue for those utilizing the trails for recreational purposes. This site would require more than repaving. If the water did not rush down, but rather it was channeled or absorbed elsewhere, some of the erosion would be stopped. Observation: The asphalt trails are in poor condition. Erosion appeared insignificant along the trail. This issue will be referred to the Fairfax County Park Authority.

4.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Bull Neck Run

Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Bull Neck Run Watershed, which consists of the area draining to Bull Neck Run and a smaller area draining directly to the Potomac River. Eleven subbasins were created for the model in order to provide more detail for the modeling results. The subbasins with the future total phosphorus loading are shown in Figure 4.1.

Figure 4.1 Bull Neck Run Future Total Phosphorous Loading
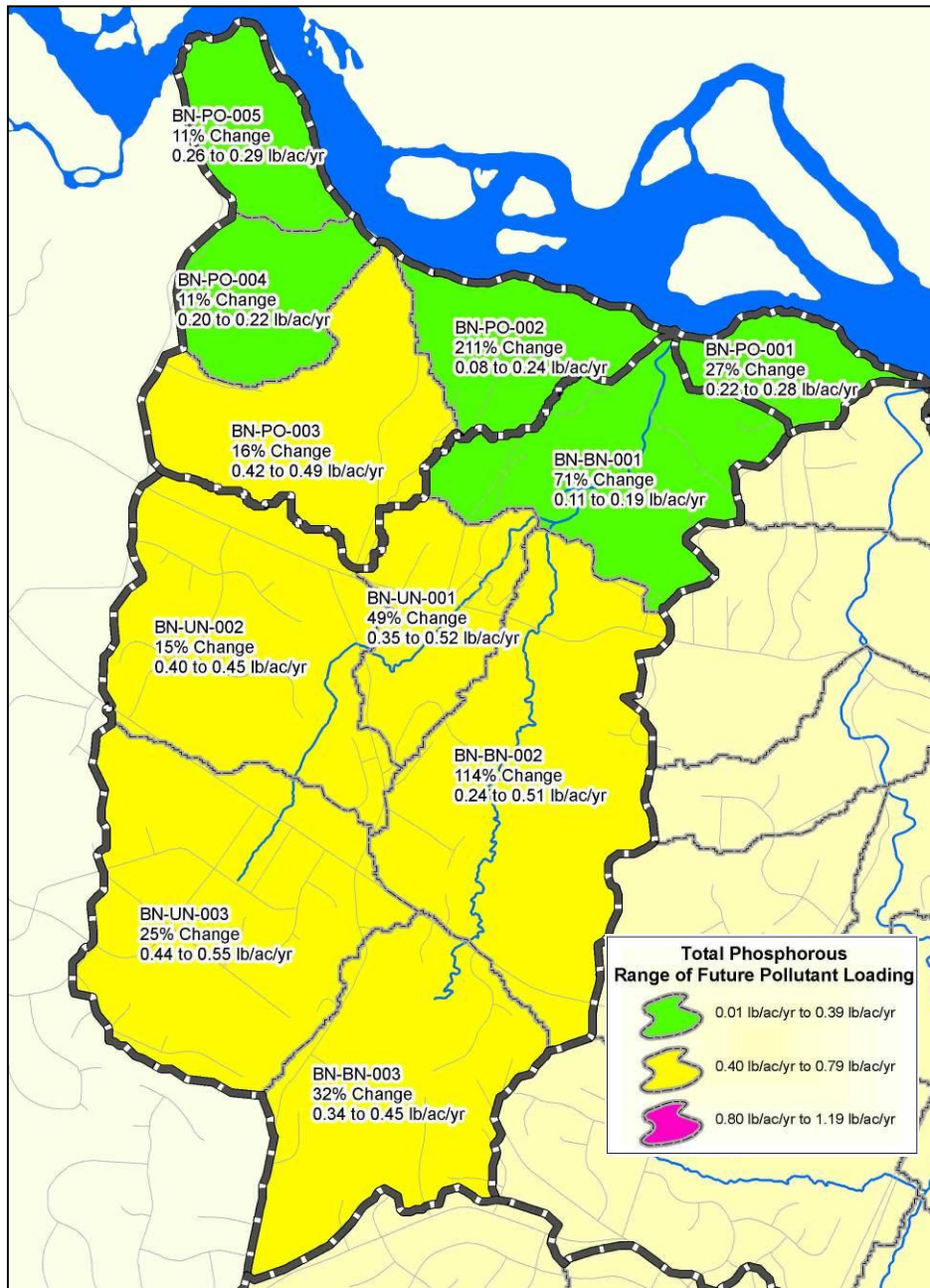
4.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model, the current watershed imperviousness is nine percent, which generates low to moderate peak runoff flows. The predicted increase in peak flows from existing land use conditions to potential future development conditions may be attributed to the predicted increase in imperviousness to 13 percent and future development of vacant parcels to low density residential areas. Table 4.5 shows the cumulative peak runoff flows and the comparison between the peak flows for the existing and future land use conditions for the two and ten-year rainfall events.

Table 4.5 Bull Neck Run Cumulative Peak Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
BN-BN-001C	552	639	16%	1,520	1,600	5%
BN-BN-002C	483	580	20%	1,300	1,370	5%
BN-BN-003C	92	107	16%	237	239	1%
BN-PO-001C	51	54	6%	148	152	3%
BN-PO-002C	62	71	15%	207	219	6%
BN-PO-003C	190	194	2%	428	433	1%
BN-PO-004C	66	66	0%	229	229	0%
BN-PO-005C	88	88	0%	211	211	0%
BN-UN-001C	289	336	16%	720	777	8%
BN-UN-002C	227	270	19%	504	570	13%
BN-UN-003C	152	181	19%	362	386	7%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the large amount of open space. The subbasins that drain to Bull Neck Run have a predominant land use of low density residential for both existing and future land use conditions. The predicted increase in pollutant loads can be attributed to the projected development of vacant parcels to low density residential areas. Table 4.6 shows the comparison of the existing and future pollutant loading rates for the Bull Neck Run Watershed.

Table 4.6 Bull Neck Run Pollutant Loads

Pollutants		Bull Neck Run Subbasins						Potomac Tributary Subbasins				
		BN-BN-001	BN-BN-002	BN-BN-003	BN-UN-001	BN-UN-002	BN-UN-003	BN-PO-001	BN-PO-002	BN-PO-003	BN-PO-004	BN-PO-005
BOD5	Existing (lb/ac/yr)	2.3	6.2	11.7	6.1	12.4	10.9	4.3	1.9	17.8	9.9	13.2
	Future (lb/ac/yr)	3.5	12.4	14.6	10.9	14.8	13.9	5.2	3.9	18.7	9.9	13.2
	% Load Increase	52%	100%	25%	79%	19%	28%	21%	105%	5%	0%	0%
COD	Existing (lb/ac/yr)	13.8	38.3	69.9	33.0	72.7	62.0	24.9	12.2	105.8	59.6	79.0
	Future (lb/ac/yr)	20.1	72.1	86.6	60.3	87.4	78.6	30.2	21.9	110.9	59.6	79.0
	% Load Increase	46%	88%	24%	83%	20%	27%	21%	80%	5%	0%	0%
TSS	Existing (lb/ac/yr)	7.9	16.2	48.4	17.7	52.0	35.6	14.0	7.3	104.0	61.5	81.5
	Future (lb/ac/yr)	11.2	31.8	57.7	32.3	61.8	44.2	16.8	12.0	108.9	61.5	81.4
	% Load Increase	42%	96%	19%	82%	19%	24%	20%	64%	5%	0%	0%
TDS	Existing (lb/ac/yr)	15	29	67	25	66	50	24	16	106	61	81
	Future (lb/ac/yr)	19	46	78	43	80	60	28	19	110	61	81
	% Load Increase	27%	59%	16%	72%	21%	20%	17%	19%	4%	0%	0%
DP	Existing (lb/ac/yr)	0.08	0.21	0.25	0.25	0.28	0.31	0.15	0.05	0.32	0.15	0.20

Pollutants		Bull Neck Run Subbasins						Potomac Tributary Subbasins				
	Future (lb/ac/yr)	0.13	0.40	0.32	0.37	0.32	0.39	0.19	0.17	0.34	0.15	0.20
	% Load Increase	63%	90%	28%	48%	14%	26%	27%	240%	6%	0%	0%
TP	Existing (lb/ac/yr)	0.11	0.24	0.34	0.35	0.40	0.44	0.22	0.08	0.42	0.20	0.26
	Future (lb/ac/yr)	0.19	0.51	0.45	0.52	0.45	0.55	0.28	0.24	0.49	0.22	0.29
	% Load Increase	73%	113%	32%	49%	13%	25%	27%	200%	17%	10%	12%
TKN	Existing (lb/ac/yr)	0.6	1.5	2.0	2.0	2.3	2.4	1.2	0.4	2.7	1.3	1.8
	Future (lb/ac/yr)	1.1	2.9	2.5	2.8	2.5	3.0	1.6	1.4	2.9	1.3	1.8
	% Load Increase	83%	93%	25%	40%	9%	25%	33%	250%	7%	0%	0%
TN	Existing (lb/ac/yr)	0.84	1.87	2.71	2.59	3.11	3.22	1.61	0.58	4.03	2.02	2.68
	Future (lb/ac/yr)	1.43	3.69	3.41	3.75	3.45	3.97	2.06	1.81	4.29	2.02	2.68
	% Load Increase	70%	97%	26%	45%	11%	23%	28%	212%	6%	0%	0%
Cadmium (x 10⁻⁴)	Existing (lb/ac/yr)	1.0	1.8	2.5	2.2	2.6	2.7	1.7	1.0	2.2	0.9	1.2
	Future (lb/ac/yr)	1.5	2.6	3.0	2.9	2.9	3.1	2.1	1.7	2.3	0.9	1.2
	% Load Increase	50%	44%	20%	32%	12%	15%	24%	70%	5%	0%	0%
Copper (x 10⁻³)	Existing (lb/ac/yr)	1.8	3.9	14.9	3.1	16.2	7.5	3.0	1.9	44.6	27.2	36.1
	Future (lb/ac/yr)	2.3	6.1	16.8	5.5	18.9	9.0	3.5	2.3	46.7	27.2	36.1
	% Load Increase	28%	56%	13%	77%	17%	20%	17%	21%	5%	0%	0%
Lead (x 10⁻³)	Existing (lb/ac/yr)	0.8	1.4	2.9	1.0	2.7	2.1	1.2	0.9	3.2	1.8	2.4
	Future (lb/ac/yr)	0.9	1.8	3.3	1.8	3.3	2.5	1.4	0.8	3.3	1.8	2.4
	% Load Increase	13%	29%	14%	80%	22%	19%	17%	-11%	3%	0%	0%
Zinc (x 10⁻²)	Existing (lb/ac/yr)	0.9	2.2	7.6	1.7	8.2	4.0	1.4	0.8	22.3	13.6	18.0
	Future (lb/ac/yr)	1.1	3.4	8.6	3.0	9.7	4.9	1.7	1.2	23.3	13.6	18.0
	% Load Increase	22%	55%	13%	76%	18%	23%	21%	50%	4%	0%	0%

4.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Bull Neck Run from the confluence of its main stem with its southwestern tributary to its confluence with the Potomac River. The hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for the entire modeled length of Bull Neck Run. However, the unnamed tributary to Bull Neck Run showed overtopping for all storm events at a double 24-inch corrugated metal pipe culvert at Spring Hill Road. This location was also identified as a flooding location by the Steering Committee. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor overtopping where there are adjacent and connected floodplains. Since the future land use conditions are nearly the same as the existing land use conditions, the future conditions hydraulic modeling results are consistent with the existing conditions results.

The majority of the 100-year event is contained within the current main channel banks. This is because the main channel has become more incised in response to increased runoff

generated by development in the watershed. However, the floodplains are utilized where they are connected to the stream channel. Floodplains play an important role in reducing flow velocities and it is important that streams remain connected with them wherever possible. The 100-year floodplains for the modeled portions of the stream are consistent with the county's 100-year floodplain data for the majority of Bull Neck Run. At the upstream end of the junction of the main stem and the southwest tributary, the floodplains are narrower when compared to the county's 100-year floodplains, which indicates that the stream is experiencing downcutting due to increased flows and velocities. These results are consistent with the 2001 SPA findings which document that Bull Neck Run is establishing a geometry that can accommodate existing increased flows in the southwest tributary of Bull Neck Run and the upstream portions of Bull Neck Run. No properties had buildings located in the 100-year floodplain in this watershed. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

The velocities produced by the hydraulic model for the two-year rainfall event in the Bull Neck Run Watershed average approximately 5 ft/sec. The average velocity at the southwest tributary is 4.5 ft/sec while the upstream portions of the main stem average only 3.9 ft/sec.

4.2 Management Plan Strategy

This section outlines proposed projects for the Bull Neck Run Watershed. The locations of the projects in this section are shown on Map 4.3. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Bull Neck Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit options in the following project descriptions have been taken from the list above.

Public BMP Retrofits

- Publicly owned dry detention SWM basin at the Spring Hill Recreation Center located at 1239 Spring Hill Road. This facility is located at the headwaters of Bull Neck Run and detains the runoff from surrounding neighborhoods before entering the stream. Adding water quality controls will benefit the downstream conditions. As part of the retrofit project, a watershed education area should be built around the BMP and stream to educate adults and children about watershed issues. Possible retrofit options include 6 and 7. (BMP Retrofit Project BN9105)

Private BMP Retrofits
- Retrofit the wet SWM pond located behind 8198 Hunting Hill Lane owned by the McLean Country Estates Homeowners Association. Residents note that the pond often overflows during rain storms and the outflow is filled with sediment. Possible retrofits include 2, 6, and 7. (BMP Retrofit Project BN9106)

The size of the proposed drainage areas and the benefits from the proposed BMP retrofits are included in Table 4.7.

Table 4.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
BN9105	BN-BN-003	1239 Spring Hill Road	24.1	6.7	0.4
BN9106	BN-UN-002	8198 Hunting Hill Lane	74.5	8.7	2.7

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.
Parks were targeted for LID projects because the land is owned by the county, greatly facilitating implementation, and county facilities should be examples of environmentally friendly design. It is hoped that seeing LID projects on county lands will inspire residents to implement similar measures on their own properties.

- Construct LID demonstration projects at the Spring Hill Recreation Center located at 1239 Spring Hill Road. This recreation center facility is owned by Fairfax County Park Authority. LID options may include installing bioretention in the parking medians and in the landscaped areas especially on the northeast side of the building. Buffers could be installed adjacent to the parking lot and tree box filters may be used to replace the existing drainage structures. (New LID Project BN9811)

The pollutant removal benefit for the proposed LID project is described in Table 4.8.

Table 4.8 Benefits of New LID

Project Number	Subbasin ID	Location	Proposed Drainage Area (Acres)	Total Phosphorus Removal (lbs/yr)
BN9811	BN-BN-003	1239 Spring Hill Road	4.5	4.2

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and

encourage LID practices on private property.
There are no neighborhood LID projects in this watershed.

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.
There are no floodplain restoration projects in this watershed.

Action A1.5: Remove detrimental channel obstructions.
Channel obstructions that block stream flow, like the ones listed below, should be removed. Dumpsites and obstructions in the watershed will vary over time. It may be necessary to clean up future dumpsites and/or obstructions that are not listed below or shown on any of the watershed maps.

- Remove three stream obstructions in Bull Neck Run. One of the three obstructions is located north of Georgetown Pike on Bull Neck Run and the other two sites are located east of Spring Hill Road and south of Old Dominion Drive. The SPA identified logs and other debris in the stream that need to be cleaned up to help restore the flow capacity in the stream. (Dumpsite/Obstruction Removal BN9901)
- Remove stream dumpsite located west of Old Cedar Road at Old Cedar Court, behind 1080 Old Cedar Road. (Dumpsite/Obstruction Removal BN9918)

Action A1.6: Stabilize eroding stream banks using bioengineering methods.
The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.
Improve the existing stormwater infrastructure at the following locations.

- Improve the capacity of the pipe culvert crossing at a tributary to Bull Neck Run at Spring Hill Road. This location has experienced flooding in the past. (Infrastructure Improvement BN9412)
- The trapezoidal channel next to 8344 Old Dominion Drive needs maintenance and repair. It is estimated that approximately 120 feet of the channel needs to be replaced and an additional 40 feet of the channel needs to be cleaned. The current condition of the channel may be causing house flooding at this location. (Infrastructure Improvement BN9419)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.
There are no infrastructure projects of this type in this watershed.

Action A2.3: Protect structures located in the 100-year flood limit from flooding.
There are no flood protection projects in this watershed.

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.
Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Bull Neck Run Watershed using E. coli as the indicator bacteria and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced. (Fecal Coliform Source Study BN9720)

Water samples collected from Bull Neck Run in 2002 exceeded the state's current instantaneous fecal coliform standard stating that no more than 10 percent of the samples collected in a month shall exceed 400 fecal coliforms per 100 milliliter of water. The ultimate goal of the proposed study would be to reduce the amount of fecal coliform bacteria in Bull Neck Run and prevent it from becoming listed as impaired.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.
The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.
The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.
The three deficient buffer locations described in the project below were found during the 2002 SPA (see map 4.2) and are potential locations for buffer restoration. Stream Restoration Project BN9203 is proposed at the fourth location, leaving only 1,550 feet needing buffer restoration. The locations of the stream sections for the project listed below are shown on Map 4.3. It should be noted that the stream reaches identified in the following project description and on the map designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated. Steps to protect existing vegetated buffers are included in Public Education Project BN9913 described later in

this chapter.

- Evaluate the buffer vegetation adjacent to the stream along 1,550 feet of an unnamed tributary located to the west of Bull Neck Run. If necessary, restoration will be done in three segments, 550 feet just upstream of Georgetown Pike, 550 feet near Hunting Hill Lane and 450 feet just upstream of Old Dominion Drive. (Buffer Restoration BN9302).

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
There are no land conservation projects in this watershed.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.
- A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project BN9917)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.
Bull Neck Run is actively widening along the majority of its length and the stream protection strategy composite site condition rating was "excellent". In order to maintain this rating, the proposed stream restoration projects should be carefully executed in order to prevent further erosion and channel widening. The locations of the proposed stream restorations are described below and shown on Map 4.3. It should be noted that the stream reaches identified in the following project description and on the map designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

- Evaluate the bed and banks of 1,500 linear feet of Bull Neck Run in two sections between Weller Avenue and Sparger Street and restore where necessary. These portions of Bull Neck Run are in a transitional phase of stream bank evolution from a stable stream to a widening/stabilizing stream. This type of channel incision is causing a change in the

stream slope. Thirty percent of this stream has been previously disturbed and is imbedded with sediment. Approximately 30 percent of the channel has been altered and the banks are 30 to 50 percent eroded. Proposed activities include channel reconfiguration, trash and debris removal, riparian vegetation planting and some installation of small in-stream habitat improvement structures such as long vanes. All natural materials will be used in the construction of all in-stream structures. All stream crossings should have adequate culvert inlet and outlet protection installed to help prevent erosion. (Stream Restoration BN9203)

- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not included in the SPA will be evaluated in this project. (Stream Assessment Project BN9921)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.
Public Education Project BN9913 will include the following actions:
- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.

- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.

- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.

- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.

- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.

- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.

- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.

- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation (VDOT) Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.
Community Outreach Project BN9914 will include the following actions:
- Establish an on-going relationship with civics and science teachers at middle schools and

high schools who need to provide their students with opportunities for service credits or hands-on projects.

- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.
- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project BN9916 will include the following actions:
- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact Development (LID) practices.
LID Promotion Project BN9915 will include the following actions:
- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries.

4.3 Benefits of Plan Actions

Two BMP retrofit projects and one LID project are proposed for the Bull Neck Run Watershed to help improve the water quality of the stream. The channel erosion control volume to be provided by the BMP retrofit projects will serve approximately 55 percent of the required channel erosion control volume for the 103 acres controlled by the BMPs. The total additional phosphorus removal for all of the proposed projects is estimated to be 20 lbs/year upon successful implementation of these projects.

Approximately 1,500 linear feet of Bull Neck Run will be restored as part of the proposed stream restoration project. This project will help minimize the velocity of the stream as well as reduce the erosion of the stream banks. Approximately 1,550 linear feet of stream buffers will be restored by implementing the buffer restoration project. These projects will increase the

amount of habitat and provide nutrient reduction for Bull Neck Run. The obstruction removal project will help to reduce the flooding of the stream and erosion of the stream banks.

4.4 Implementation of Plan Actions

As explained in Chapter 3, the recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The implementation schedule presented below was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. More detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Bull Neck Run is $1,420,000. The priority projects are summarized in Table 4.9 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 4.9 Summary of Bull Neck Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
BN9105	BMP Retrofit Project	Fairfax County Park Authority (FCPA)	$80,000	3.75	A
BN9811	New LID Project	FCPA	$250,000	3.75	A
BN9302	Buffer Restoration	Private Residential and McLean Country Estates HOA[1]	$80,000	3.55	A
BN9106	BMP Retrofit Project	McLean Country Estates HOA[1]	$340,000	3.25	B
BN9203	Stream Restoration	Private Residential and Dogwoods Addition to Woodhaven Association[1]	$910,000	3.40	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 8.12 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 4.10 Summary of Bull Neck Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
BN9913	Public Education Project	Watershed-wide Project	N/A	A*
BN9914	Community Outreach Project	Watershed-wide Project	N/A	A*
BN9915	LID Promotion Project	Watershed-wide Project	N/A	A*
BN9916	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
BN9921	Stream Assessment Project	Watershed-wide Project	N/A	A*
BN9901	Dumpsite/Obstruction Removal	FCPA and Private Residential[1]	1.95	A
BN9918	Dumpsite/Obstruction Removal	FCPA	1.95	A
BN9917	Wetland Assessment Project	Watershed-wide Project	2.95	C
BN9412	Infrastructure Improvement	VDOT and Private Residential[1]	3.10	**
BN9419	Infrastructure Improvement	FCPA and Private Residential[1]	2.70	D
BN9720	Fecal Coliform Source Study	Watershed-wide Project	2.70	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.

**These projects will be coordinated directly with VDOT.