3.25 Wolftrap Creek – Subwatershed Condition

3.25.1 Subwatershed Characteristics

The Wolftrap Creek **subwatershed** has an area of approximately 3,631 **acres** (5.67 mi^2). It is located in central Fairfax County just north of Vienna. Leesburg Pike (Virginia 7) runs along the northeast boundary. The Dulles Toll Access Road (Virginia 267) bisects the upper portion of the subwatershed and Beulah Road (Virginia 675) provides an approximate western boundary. Cedar Lane (Virginia 698) and Vienna Technical Park create the boundary.

Wolftrap Creek subwatershed is located in the east-central portion of the Difficult Run watershed. There are 13.1 miles of stream in this subwatershed. Many other subwatersheds border Wolftrap Creek on its northwestern course to intersect the mainstem of Difficult Run.

Refer to DFWC_1 for a map of the Wolftrap Creek subwatershed highlighting the Subwatershed Characteristics including, existing **land use**, **flood limit**, **wetlands**, **resource protection areas** and **stormwater management**.

3.25.2 Existing and Future Land Use

The type and density of land use in a subwatershed can affect the downstream water quality and stream condition. While each land use type introduces issues to the natural stream system, more intense land use types, such as high-density residential, commercial and industrial, can have high levels of **impervious** surface and contribute **runoff** and **pollutants** to the stream system. Less intense types such as open space and estate residential are generally less impervious, have more natural vegetation and therefore have less impact on stream quality.

The Wolftrap Creek subwatershed is one of the more dense subwatersheds in the Difficult Run watershed. Twenty-six percent is developed as low-density or estate residential. Six percent of the subwatershed is developed for commercial or industrial uses, and 28 percent is developed for medium or high-density residential. The largest **land use** category is medium-density residential, which constitutes 25 percent of the subwatershed's acreage. There are 536 acres, or 15 percent of the subwatershed, used for transportation use such as roads and highways. Total impervious area for the subwatershed, which includes all roads, parking lots, residential driveways and buildings, is approximately 839 acres, or 23 percent of the total subwatershed area.

Seventeen percent of the land in this subwatershed is preserved for open space or parks. Major parks include the Wolftrap Stream Valley Park, the Wolftrap Farm Park, the Wolf Trails Park, the Spring Lake Park, Foxstone Park, the Westwood Golf Course, and Briarcliff Park. There are 12 historical sites that lie within the subwatershed. A summary of land use within the subwatershed can be found in Table 3.44.

Table 3.44 Existing and Future Land Use

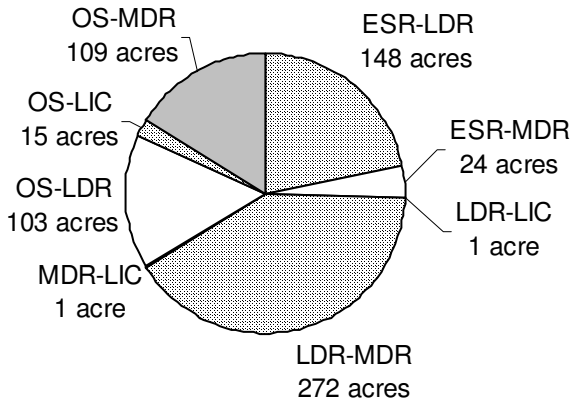
Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open space, parks, and recreational areas	601	17%	373	10%	-228	-6%
Golf Course	136	4%	136	4%	0	0%
Estate residential	213	6%	41	1%	-171	-5%
Low-density residential	718	20%	696	19%	-22	-1%
Medium-density residential	906	25%	1310	36%	403	11%
High-density residential	101	3%	101	3%	0	0%
Low-intensity commercial	69	2%	86	2%	17	0%
High-intensity commercial	161	4%	161	4%	0	0%
Industrial	9	0%	9	0%	0	0%
Institutional	178	5%	178	5%	0	0%
Transportation	536	15%	536	15%	0	0%
Water	3	0%	3	0%	0	0%
Total	**3,631**	**100%**	**3,631**	**100%**		**0%**

Changes in the land use that result in higher intensity uses in the future can present problems for streams. For example, if the land use shifts from open space to high-intensity commercial use, additional buildings, roadways and parking lots may replace the forest and open fields and impact stream condition.

When comparing existing land use to future land use, the notable changes are projected in the medium-density residential, open space, and estate residential categories. Medium-density residential acreage is projected to increase by 403 acres, while estate residential acreage is projected to decrease by 171 acres. There is a loss of commercial acreage anticipated, but an increase in industrial land. Open space land is projected to decrease by 6 percent.

According to Figure 3.22, 272 acres are projected to shift from low-density residential in the existing land use to medium-density residential in the future land use. One hundred and forty-eight acres will shift from estate residential to low-density residential. One hundred and nine acres shifted from open space in the existing land use to medium-density residential in the future land use. One hundred and three acres are anticipated to shift from open space to low-density residential. Cumulatively, 227 acres, or 33 percent of all land use changes, are projected to shift from open space to a higher density use. This does not guarantee that the open space will become developed – it suggests that these areas of open space can be used for development/ redevelopment in the future.

Figure 3.22: Changed Land Use



The largest shifts in land use from existing to future illustrate the demand for accommodating new residential uses in Fairfax County. Other shifts show an exchange of a lower-intensity use for a higher-intensity use except for a few cases. The 6 percent loss of open space primarily stems from the addition of medium-density residential (403 acres) land uses in the future to accommodate housing.

3.25.3 Existing Stormwater Management

Stormwater management provides treatment of otherwise uncontrolled runoff to reduce the harmful effects of increased stormwater flows and stormwater runoff pollution. County records indicate that there are 45 **stormwater management facilities** within the Wolftrap Creek subwatershed. Seventy-five percent of the Wolftrap Creek subwatershed is not served by any stormwater management facility. Twenty-one percent of the total area has quantity control only and the remaining 4 percent receives both **quantity and quality control**.

The difference between the amount of total developed area in the subwatershed (81 percent) and the area served by stormwater management (25 percent) indicates a possible need for additional management efforts, specifically in the low-density and medium density residential areas, which account for 45 percent of the area. Additional information on the location of the stormwater management facilities in the Wolftrap Creek subwatershed is found in Appendix D.

Outfalls

The storm drainage system connects the developed portions of the land to the stream system. Stormwater outfalls are located where the stormwater system ends and the natural channel begins. Outfalls may be sources of pollutants and excessive stormflow from pipes can cause erosion at the outfall and downstream. During the Stream Physical Assessment, field crews located 57 **outfall** pipes discharging into the Wolftrap Creek subwatershed. All pipes were smaller than 48 inches. All of these pipes were considered to have minimal impact on the stream condition.

Stream Crossings

Stream crossings, such as bridges and culverts are often locations of erosion and flooding. The combination of structures and frequently high stormwater levels can cause downstream stream stability problems and habitat impairment. The Stream Physical Assessment identified 57 stream crossings in the Wolftrap Creek subwatershed. Of this total, only one was considered to have a moderate impact on the stream character; the remaining crossings were having a minimal impact on the stream.

3.25.4 Soils

Soils found in the Wolftrap Creek subwatershed belong primarily to the Glenelg – Elioak – Manor association. This association consists of rolling and hilly landscapes, which can generate rapid **runoff**, and **micaceous** soils, which are erodible. The **groundwater** is fairly shallow with numerous natural springs. The subwatershed contains 41 percent of the B hydrologic soil group with Glenelg silt loam being the dominant soil type (23 percent). B soils and the Glenelg soil type are compatible with **infiltration** practices and may provide potential stormwater management sites. There are 877.5 acres of land with unclassified soils in the Wolftrap Creek subwatershed. Soils that cover at least 20 acres within the subwatershed can be found in Appendix A.

3.25.5 Geomorphology

There are approximately 10.9 miles (57,554 feet) of stream in the Wolftrap Creek subwatershed that were assessed and assigned a **Channel Evolution Model** classification as part of the Stream Physical Assessment. The classification indicates the stream channel's physical condition and stability as a response to disturbances such as upstream land use changes. Ten reaches were not assessed because they were wetlands or stormwater ponds, not listed, piped channels, or too channelized (made of concrete).

- Sixty-three percent of the total reach length is Type III, which is indicative of an unstable channel that is actively widening in response to changes in flow. The widening reaches are located on the lower portion of the reach below the Dulles Toll Road and upstream of Chain Bridge Road. Thirteen percent is type IV, which is the beginning stage of stream stabilization after disturbance, and the remaining 7 percent of assessed channel is Type V which is development of a new stable channel within the original and larger channel.
- Most of the channel substrate throughout the subwatershed is gravel with smaller amounts of cobble and silt present. The remaining channel consists of a previously restored stream reach that is dominated by boulder.
- There were no specific erosion points noted in the subwatershed, however 44 percent of the stream length is moderately unstable with high erosion potential during **flood** events.
- There were five stream blockages, primarily trees. Four of these blockages are likely restricting fish movement within the stream system. All stream obstructions were having a significant impact on stream condition. Photo 3.79 shows an obstruction that is candidate site S124.

Photo 3.79 A severe obstruction located upstream of Chain Bridge Road near Echols Street (DFWC028.T001).

- There were two utility lines (one sanitary, one unknown) both crossing the stream and partially buried, or within the buffer. Both were somewhat exposed, but stabilized and anchored to the bank, thus, having a very minor impact on the stream.

3.25.6 Stream Habitat and Water Quality

All stream reaches are of moderate to high slope and are generally characterized as having a predominance of **riffle** and **run** stream type. The stream reaches have the following stream habitat and water quality characteristics as taken from the Stream Physical Assessment, conducted in the fall of 2002, which provides a one time visual inspection.

Of the assessed reaches, 3 percent provides Excellent habitat for aquatic insects and fish, 66 percent provides Good habitat, 20 percent is Fair, and 11 percent is Poor habitat for aquatic insects and fish. The areas considered to be Poor were noted mostly on the tributaries north of the Dulles Toll Road.

There is 55,800 feet, or 40 percent of the total stream miles, of riparian buffer encroachment (this length includes left and right banks combined). Out of this total, 34,975 feet (63 percent) of impact is from lawn, 19,275 feet (35 percent) is lawn/pavement mix, 1,050 feet (< 2 percent) is forbs, and 500 feet (<1 percent) is trees.

- 7,725 feet of the buffer encroachment is having a significant impact on the stream condition and habitat quality. Photos of an example are shown below in Photos 3.80 and 3.81 that are located at candidate site S123.
- Most (66 percent) of the total buffer encroachment has good restoration potential.

Photo 3.80 Buffer encroachment with high impact near Maple Avenue. (DFWC019.B002).

Photo 3.81 Buffer impact near Maple Avenue (DFWC019.B001).

- Forty-seven percent of the assessed stream length has between 50 percent and 70 percent of both stream banks covered by vegetation. Typically this vegetation is scattered grasses, shrubs and forbs.

3.25.7 Hydrology and Water Quality Modeling

The water quality and quantity were modeled for each subwatershed and **catchment** in the Difficult Run watershed to provide estimates that can be used for planning. The models used in Wolftrap Creek incorporate data on the amount, character and location of the land use, impervious cover, topography, vegetation, streams and stormwater management to generate estimates of water quality and quantity in the streams. Water quality modeling includes **pollutant loading** estimates for total **nitrogen** (TN), total **phosphorus** (TP) and total **suspended solids** (TSS). Because changes in land use effect the amount of runoff, streamflow, the quantity modeling estimates the amount of runoff generated by the land during rainfall and the peak streamflow or **discharge** that results.

Modeling of future conditions generally uses the same data inputs and estimates the same parameters but does so with future land use information. The future land use is a prediction of how land use would change based on the current zoning designations and the Comprehensive Plan. The difference between the existing and future model results identifies areas that will need additional management measures.

In the Wolftrap Creek subwatershed, 23 percent of the land is covered by impervious surface. This is higher than the majority of the other subwatersheds because several catchments are found within the limits of the Town of Vienna.

The catchment with the poorest modeled water quality is DFWC0001. Along with large commercial areas, this catchment contains several high and medium-density residential areas. Refer to DFWC_4 for the catchment locations. Results are found in Table 3.45.

Table 3.45 Existing and Future Modeling

Wolftrap Creek Catchments		Runoff Volume (in/yr)	Peak (cfs/ac)	TSS (lb/ac/yr)	Runoff TN (lb/ac/yr)	Runoff TP (lb/ac/yr)
DFWC0001	E	9.18	0.25	201.3	7.8	1.0
	F	9.66	0.27	225.7	8.8	1.1
	C	5%	8%	12%	13%	10%
DFWC0002	E	6.39	0.15	106.5	4.8	0.8
	F	7.32	0.19	144.7	6.6	1.1
	C	15%	27%	36%	38%	38%
DFWC0003	E	6.7	0.26	143.6	6.2	0.8
	F	6.97	0.28	151.4	7.3	0.9
	C	4%	8%	5%	18%	13%
DFWC0004	E	8.66	0.33	143.2	6.2	0.9
	F	9.34	0.36	161.6	7.6	1.2
	C	8%	9%	13%	23%	33%
DFWC0005	E	4.24	0.16	65.2	3.3	0.6
	F	4.96	0.19	84.3	4.4	0.8
	C	17%	19%	29%	33%	33%
DFWC0008	E	3.37	0.13	55.4	2.8	0.5
	F	3.73	0.14	63.4	3.2	0.6
	C	11%	8%	14%	14%	20%
DFWC0009	E	6.91	0.25	77.1	3.9	0.7
	F	6.94	0.24	77.9	3.9	0.7
	C	0%	-4%	1%	0%	0%
DFWC0010	E	4.18	0.12	68.8	3.2	0.5
	F	4.54	0.13	75.1	3.5	0.5
	C	9%	8%	9%	9%	0%
DFWC0011	E	5.51	0.17	66.7	3.1	0.5
	F	5.82	0.18	74.0	3.5	0.6
	C	6%	6%	11%	13%	20%
DFWC0012	E	2.45	0.16	27.0	1.5	0.3
	F	2.59	0.16	29.5	1.6	0.3
	C	6%	0%	9%	7%	0%
DFWC0015	E	2.19	0.16	19.5	1.1	0.2
	F	2.4	0.17	21.9	1.2	0.2
	C	10%	6%	12%	9%	0%
DFWC8901	E	1.53	0.17	22.3	1.0	0.2
	F	2.54	0.2	37.9	1.8	0.3
	C	66%	18%	70%	80%	50%

Wolftrap Creek Catchments		Runoff Volume (in/yr)	Peak (cfs/ac)	TSS (lb/ac/yr)	Runoff TN (lb/ac/yr)	Runoff TP (lb/ac/yr)
DFWC9001	E	2.21	0.11	22.6	1.2	0.3
	F	3.15	0.14	37.8	2.1	0.5
	C	43%	27%	67%	75%	67%
DFWC9101	E	4.15	0.14	44.4	2.4	0.5
	F	4.25	0.15	47.2	2.5	0.5
	C	2%	7%	6%	4%	0%
DFWC9201	E	4.57	0.17	61.4	3.3	0.6
	F	4.74	0.18	65.0	3.5	0.7
	C	4%	6%	6%	6%	17%
DFWC9301	E	4.76	0.16	115.5	5.4	0.7
	F	4.75	0.16	115.4	5.4	0.7
	C	0%	0%	0%	0%	0%
DFWC9401	E	3.16	0.16	38.3	2.0	0.4
	F	3.86	0.17	51.7	2.8	0.6
	C	22%	6%	35%	40%	50%
DFWC9501	E	2.47	0.14	24.5	1.3	0.3
	F	5.38	0.24	84.3	4.5	0.9
	C	118%	71%	244%	246%	200%
DFWC9801	E	5.63	0.2	72.8	3.7	0.7
	F	6.5	0.24	97.0	5.0	1.0
	C	15%	20%	33%	35%	43%
DFWC9802	E	1.92	0.15	19.6	1.0	0.2
	F	1.93	0.15	20.1	1.0	0.2
	C	1%	0%	3%	0%	0%

E – Existing conditions results, F – Future conditions results, C – Change between existing and future shown as a percentage of the existing condition. Value is based on unrounded figures

For the future modeling, the catchment predicted to have the largest percent increase in pollutant loadings is catchment DFWC9501. There are areas changing from low density residential to medium density residential in this catchment. Similar changes are taking place in DFWC0001, DFWC0002, DFWC0003, DFWC0004, DFWC0005, and DFWC9801. Loads increase in DFWC9001 and DFWC9401 due to forecast changes from estate residential to low density residential.

3.25.8 Hydraulic Modeling

Hydraulic modeling combines topography with information concerning the stream system, the stream crossings and culverts to estimate the depth and speed of flow within the stream for various storm events. The model results indicate where overtopping of culverts may occur. The flows at this site exceed the capacity of the culvert. These sites can present a hazard and are considered candidate sites for improvement, further study and possibly a project to replace or retrofit the culvert.

Three crossings in the Wolftrap Creek subwatershed overtopped for at least one event. These are shown in Table 3.46. Road crossings that experience overtopping are listed in Appendix F and it is anticipated that improvements will be pursued with VDOT independent of the watershed planning process.

Table 3.46 Culvert Hydraulic Modeling

Culvert	Crossing		Flood Year						
			100	50	25	10	5	2	1
28	Beulah Road	E	x	x	x	x	x	x	x
48-A	Creek Crossing Road	E	x	x	x	x	x	x	x
49	Old Courthouse Road	E	x	x	x	x	x	x	x

E – Existing conditions results, x – indicates overtopping

Culvert #28 (Photo 3.82) overtopped for all events. As Beulah Road is a through road, it can be classified as a primary road. This means that it must pass the 25-year event.

Culvert #48-A (Photo 3.83) overtopped for all events. Creek Crossing Road can also be used as a through road, so it too can be classified as a primary road. Primary roads must pass the 25-year event.

Photo 3.82 Wolftrap Creek Mainstem at Beulah Road.

Photo 3.83 Wolftrap Creek Tributary at Creek Crossing Road.

Culvert #49 (Photo 3.84) also overtopped for all events. Classified as a primary road, Old Courthouse Road is required to pass the 25-year event.

Photo 3.84 Wolftrap Creek Mainstem at Old Courthouse Road.

3.25.9 Candidate Sites for Improvements

Based on the review of the assessment data and modeling results, the most serious problem areas in the Wolftrap Creek subwatershed are listed below. Refer to DFWC_4 for site numbers and locations. (S - stream sites, C - catchment sites, D – unconstructed regional pond replacement sites, F – flooding sites, and P – preservation sites).

Streams

S59 The Stream Physical Assessment survey found unstable banks and Poor habitat. The reach is located in the Lucky Estates and Wolf Den area near Cricklewood Court.

S60 Found between Sibelis Drive and Shouse Drive, this stream assessment found Poor habitat and unstable stream banks.

S123 There is insufficient buffer near the intersection of Maple Avenue and Beulah Road. This area was determined to have low to moderate restoration potential (Photo 3.80 and 3.81).

S124 The Stream Physical Assessment survey found buffer encroachment in the form of lawns at this site. There was also a stream blockage found (Photo 3.79).

S125 This stream reach was assigned Poor habitat quality and is missing buffer along the entire reach.

S126 Buffer encroachment in the form of lawns in residential areas was found at this site. There are also multiple pipes discharging directly into the stream.

Hydrology and Water Quality

D17 (Catchment DFWC9001) This site has better than average conditions for the subwatershed for runoff flows and pollutant loads. It was selected because it is a proposed site for a regional pond.

D28 (Catchment DFWC9401) Stream reaches upstream and downstream of the site show signs of widening with erosion causing unstable banks.

D54 (Catchment DFWC9101) This site has better than average conditions for the subwatershed for runoff flows and pollutant loads. It was selected because it is a proposed site for a regional pond.

D65 (Catchment DFWC8901) This site has below average pollutant loadings. Peak flows and runoff volume are average. There are no critical stream problems within the area or immediately downstream. It was selected because it is a proposed site for a regional pond.

C16 (Catchment DFWC9201) The catchment has average pollutants. Approximately half of the streams in the catchment have been assigned a Poor habitat rating.

C17 (Catchment DFWC9301) The catchment has above average pollutant loads with very little stormwater management in place. S60 is incised with unstable banks due to erosion.

C20 (Catchment DFWC0009) The catchment has average runoff volume and peak flows. Pollutant loads are below average.

C31 (Catchment DFWC0004) The catchment has the second highest runoff volume in the subwatershed due to the amount of impervious surface. The stream has active widening and a deficient buffer at S123.

C32 (Catchment DFWC0003) This catchment has above average runoff and pollutants. There is active channel widening throughout the catchment.

C33 (Catchment DFWC0001) This catchment has the highest modeled runoff volume and pollutant loadings in the subwatershed. Pond WP-1A drains the whole catchment.

C58 (Catchment DFWC0005) The catchment has average runoff volume and peak flows. There are areas of buffer deficiency and pipes discharging into the stream located at S126.

C67 (Catchment DFWC9801) Pollutants and runoff are average for this catchment. Streams within this catchment are actively widening and have buffer deficiency at S124.

Flooding

F28 The bridge on Beulah Road that passes over Wolftrap Creek overtops for all events. Beulah Road is classified as a primary road, so it must pass the 25-year event (Photo 3.82).

F48 The culvert that flows Wolftrap Creek under Creek Crossing Road overtops for all events. Creek Crossing is a primary road, so it must pass the 25-year event (Photo 3.83).

F49 The culvert under Old Courthouse Road that passes Wolftrap Creek also overtops for all events. Old Courthouse Road is classified as a primary road, so it must pass the 25-year event (Photo 3.84).

Preservation

P27 (Catchment DFWC9501) More than 80 percent of the catchment is changing land use from the existing to future conditions. The majority of the changes are from estate residential areas changing to low-density residential.

3.26 Wolftrap Creek – Subwatershed Plan Action

In the previous subwatershed condition section, information from stream assessments, monitoring studies, and watershed modeling was presented to identify the location and severity of watershed impairments. For the subwatershed action plan section that follows, the candidate sites for improvement are discussed in terms of the specific impairment, a description of the project, and the goal of the project. Table 3.47 below is a list of all projects proposed in this subwatershed.

Table 3.47 Recommendations for Wolftrap Creek

Project #	Project Type	Candidate Site
DF9017A	Pond Retrofit	D-17
DF9017B	Drainage Retrofit	D-17
DF9028A	Drainage Retrofit	D-28
DF9028B	Culvert Retrofit	D-28
DF9028C	Pond Retrofit	D-28
DF9054A	Drainage Retrofit	D-54
DF9054B	New Pond	D-54
DF9065A	New Pond	D-65
DF9065B	Drainage Retrofit	D-65
DF9116A	Pond Retrofit	C16
DF9116B	Pond Retrofit	C16
DF9117	Pond Retrofit	C17
DF9133A	Pond Retrofit	C33
DF9133B	Pond Retrofit	C33
DF92124	Buffer Restoration	S124
DF92125	Buffer Restoration	S125
DF92126	Streambank Stabilization	S126
DF9520A	Culvert Retrofit	C20
DF9520B	Culvert Retrofit	C20
DF9531B	Culvert Retrofit	C31
DF9532A	Culvert Retrofit	C32
DF9532B	Culvert Retrofit	C32
DF9558	Culvert Retrofit	C58
DF9716	Drainage Retrofit	C16
DF9731	Drainage Retrofit	C31
DF9758	Drainage Retrofit	C58
DF9831	LID Retrofit	C31
DF9831B	LID Retrofit	C31
DF9832	LID Retrofit	C32
DF9833	LID Retrofit	C33

3.26.1 Regional Pond Alternative Projects

D17 (DFWC9001)

Site Investigation and Projects:

DF9017A (Pond Retrofit) This project consists of improving the existing in-stream pond to provide more runoff detention and water quality features, such as forebays

and aquatic vegetation. A multi-stage riser will improve the peak flow reduction function of this pond.

DF9017B (Drainage Retrofit) These distributed projects are designed to provide energy dissipation at outfalls where the piped storm drain system discharges into a natural channel. Possible energy dissipaters include riprap and plunge pools.

D28 (DFWC9401)

Site Investigation and Projects:

DF9028A (Drainage Retrofit) These distributed projects are designed to decrease the momentum of the flow due to elevation drops at outfalls where the piped storm drain system or paved ditches discharge into a natural channel.

DF9028B (Culvert Retrofit) This project consists of redesigning a culvert for the purpose of providing channel protection downstream. Water quality features should also be incorporated if possible, including micro-pools and vegetation.

DF9028C (Pond Retrofit) This project includes excavating within the pond footprint to maximize the available storage, and modifying the riser to convert this dry pond to a wet marsh. Significant improvement in peak flow reduction and water quality treatment will be provided.

D54 (DFWC9101)

Site Investigation and Projects:

DF9054A (Drainage Retrofit) These distributed projects are designed to provide re-design and reconstruction of outlet protection to reduce scour and the amount of sediment transported downstream.

DF9054B (New Pond) This project is the implementation of the planned regional facility (D-54). The location has been refined to provide maximum benefit with the least amount of impact to the natural system. This pond would detain the higher frequency storms, thus reducing the peak velocities that cause scour and erosion in streams.

D65 (DFWC8901)

Site Investigation and Projects:

DF9065A (New Pond) This project is the implementation of the planned regional facility. To provide greater access to the pond, it is proposed to site it upstream of the original location. The project would increase detention time in the catchment and reduce peak flows, thus reducing or eliminating the scour and erosion in the receiving stream channel.

DF9065B (Drainage Retrofit) This project would be the addition of outlet protection at locations where paved channels transition to natural channels. This energy reduction would improve the stability in the channels by reducing high velocity flows.

3.26.2 Catchment Improvement Projects

C16 (DFWC9201)

Site Investigation and Projects: This area is single-family residential, and most of the original stream network has been converted into a storm sewer, or pipe network.

DF9716 (Drainage Retrofit) This project involves \ replacing the concrete drainage ditches throughout the catchment with dry swales to reduce volume and velocity, and to provide water quality treatment.

DF9116A (Pond Retrofit) The goal of this retrofit is to revise the pond outlet characteristics to improve channel protection through extended detention. Adding wetland vegetation would improve water quality as well.

DF9116B (Pond Retrofit) The goal of this retrofit is to improve channel protection through extended detention and improve water quality by converting the pond to a stormwater wetland.

C17 (DFWC9301)

Site Investigation and Projects: The catchment is developed with single-family residential land uses. An existing stormwater management pond treats most of the volume of runoff in the area.

DF9117 (Pond Retrofit) The pond retrofit includes realignment of the drainage system so all the storm sewers drain into the pond with forebays at each location for outfall protection. The embankment and riser should be reconstructed. Better wetland vegetation, a safety bench, and a fishing pier would enhance the community's use of the facility.

C20 (DFWC0009)

Site Investigation and Projects: The catchment is developed with single-family residential land uses with few opportunities for retrofits outside the stream channel,

DF9520A (Culvert Retrofit) This project would retrofit the culvert under Bois Avenue, directly upstream of project DF9520B. This area would provide storage for channel protection within this catchment.

DF9520B (Culvert Retrofit) Located directly upstream of the Dulles Toll Road, this project would retrofit the culvert to provide storage to improve channel protection

C31 (DFWC0004)

Site Investigation and Projects: The catchment is highly developed with a mixture of commercial and residential properties. The primary stream is laterally constrained, and in many cases the natural channel has been changed to a concrete channel. There is no apparent stormwater management within this catchment.

DF9531B (Culvert Retrofit) This site is located at the outlet of this catchment, above Creek Crossing Road. The retrofit could take advantage of the dual culverts under the road as well as the relatively flat floodplain area. The design should take into account any improvements necessary to eliminate overtopping of Creek Crossing Road (Site F48).

DF9831 (LID Retrofit) This project would retrofit the existing rear parking lot of the southwestern parcel associated with the Navy Federal Credit Union Complex on Follin Lane. Removal or renovation of this parking lot would allow a natural floodplain buffer, reduce imperviousness and reduce runoff velocities directly into the stream.

DF9831B (LID Retrofit) This project is located alongside another LID retrofit, project DF9830, and would retrofit the area of the Maple Avenue and Wolftrap Shopping

Centers, which is highly impervious. Retrofitting the area with LID would help reduce the runoff volume and the pollutant load on the streams.

DF9731 (Drainage Retrofit) This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream.

C32 (DFWC0003)

Site Investigation and Projects: This catchment consists of both commercial (large facility) and single-family detached residential land uses. The drainage area coming to this catchment is relatively large resulting in a need to provide hydrographic restoration through small detention/uptake facilities in series.

DF9532A (Culvert Retrofit) This site is located at the bottom of this catchment on the upstream side of the crossing at Follin Lane. This retrofit would increase the detention time within this drainage area and protect channels downstream from high flow. This project would also use the wooded floodplain area to settle solids and provide for nutrient uptake.

DF9532B (Culvert Retrofit) This site is located on the upstream side of the crossing at Woodford Road. This retrofit would provide a detention structure that will use the wooded floodplain for storage to reduce energy in the stream, increase the uptake of nutrients by plants, and allow sediment to settle.

DF9832 (LID Retrofit) This project would be located on the parcel occupied by Notre Dame and Our Lady of Good Counsel Catholic Church. The existing development results in an almost total impervious area. The LID retrofit would reduce the runoff volume and improve water quality from these properties.

C33 (DFWC0001)

Site Investigation and Projects: This catchment is a fairly small, highly developed catchment at the headwater of Wolftrap Creek. Land uses include attached residential and commercial areas with some areas of open space, particularly along the stream corridor. There are two large ponds at the outlet to this catchment that have the potential to be retrofitted for additional performance.

DF9133A (Pond Retrofit) This site (or sites) is located at the outlet to Catchment 33. The existing pond would be improved by installing a multi-stage weir in front of the headwall. Although there is no wet storage at this location, extended detention time of runoff from storm events will provide some treatment for water quality.

DF9133B (Pond Retrofit) Significant improvement in peak flow attenuation and pollutant load reduction can be made by replacing the existing weir with a multi-stage control structure and excavating to maximize the available storage volume. Additional wetland planting will improve uptake of nutrients, pollutant removal, and settling of sediments.

DF9833 (LID Retrofit) The upper third of this catchment consists of dense residential/commercial land uses. The goal is look for places where the impervious surface of this highly developed area could be disconnected or replaced with pervious cover. Structural controls such as bioretention or swales would also be implemented.

C58 (DFWC0005)

Site Investigation and Projects: This catchment consists primarily of small lot, single family detached dwellings with a large, flat natural buffer to the stream area that includes a sanitary main trunk in close proximity to the channel. This catchment has a relatively large contributing drainage area and is substantially downstream from the headwaters of this stream. Projects in this catchment should focus on the restoration of pre-developed hydrologic extremes (i.e. provide attenuation of discharges, extension of the time of concentration and provide an environment that is conducive to natural stream functions such as sediment transport, fish passage, etc.)

DF9758 (Drainage Retrofit) This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream.

DF9558 (Culvert Retrofit) This site is located at the outfall from this catchment, on the upstream side of Old Courthouse Road. This retrofit would provide water quality treatment through extended detention on to the floodplain as part of a stormwater treatment train with the other projects of this catchment.

3.26.3 Stream Restoration Projects

S59

Site Investigation and Projects: The site investigation showed a recovering stream with a well-developed baseflow channel and significant floodplain reestablishment. Some homeowner stabilization was observed. A completed restoration consisting of a stacked stone wall, live stakes, and fiber matting was noted at the downstream end of the reach. No project was identified because of these stabilization measures and the nested floodplain development.

S60

Site Investigation and Projects: The site investigation showed a severely incised stream with moderate to severe bank erosion. The stream is confined between residential properties on both sides. However, the streambed is stable and the aquatic channel is well defined at baseflow conditions. The upstream end of the reach is a concrete flume that is unstable and has formed a large scour pool. Constraints associated with adjacent utilities, access, residential encroachment, forest clearing and wetlands impacts outweigh the benefits of reconnecting the stream with a floodplain and reducing streambank erosion. No stream restoration project was identified; however, the headwater of the stream is a stormwater management pond, which is proposed for retrofit as project DF9117. The retrofit should improve conditions in the upstream reach and reduce high stream velocities causing erosion in this area.

S123

Site Investigation and Projects: The site investigation showed that the buffer deficiency was due to parking lots on both sides of the stream. Removing parking lots of existing businesses to establish a forested buffer is not always feasible, however a project for this purpose (DF9831 - LID Retrofit) has been added to site C31.

S124

Site Investigation and Projects: The site investigation showed a non-forested riparian zone on the right side of the stream on two residential parcels. One project was identified

DF92124 (Stream Restoration) The proposed restoration would involve regrading and creating a nested channel with a bench to restore habitat and floodplain access. The riparian buffer would be planted with native trees and shrubs on the two residential properties.

S125

Site Investigation and Projects: The site investigation showed a small stream with a non-forested riparian buffer located on a golf course. One project was identified.

DF92125 (Buffer Restoration) The non-forested riparian buffer would be planted with native trees and shrubs to the maximum extent possible given the current adjacent land use.

S126

Site Investigation and Projects: The site investigation showed moderate stream bank erosion with slight incision. The streambed was not observable due to storm flow. Much of the riparian zone is not forested. The reach is located in Wolftrap Stream Valley Park and has several stormwater outfalls directly connected to the stream. One project was identified.

DF92126 (Stream Restoration) The proposed project would provide certain demonstration benefits given its location adjacent to a trail in a stream valley park. Streambanks would be reshaped and stabilized and limited floodplain benches would be excavated. Portions of the riparian zone would be planted with native trees and shrubs. Stormwater outfalls would be retrofitted. The project should also include adjustments to the existing asphalt trail and flood-proofing of the sanitary sewer main.

3.26.4 Preservation

Improvement Goals for all Preservation Sites

Preservation goals for all the candidate sites include reducing runoff volume, peak flows, and pollutant loads by preserving open space and forested land in key areas of the catchment such as headwaters.

Site Investigation and Projects

No site investigation was undertaken for preservation projects, and no specific proposals have been made for each area. Actions and policy changes needed to implement preservation for all candidate sites are described in Chapter 4.