3.15 Rocky Run – Subwatershed Condition

3.15.1 Subwatershed Characteristics

The Rocky Run **subwatershed** is located in north central Fairfax County. The headwaters of the subwatershed are in the Tysons Corner area. This 1,673-**acre** (2.61 mi^2) subwatershed is roughly bounded to the west by Towlston Road (Virginia 676) and Leesburg Pike (Virginia 7). The southern tip extends just past the Dulles Access Road to Westpark Drive and includes Exit 16 of the Access Road. The western boundary follows Georgetown Pike (Virginia 193) to the Madeira School property then cuts across Old Dominion Drive (Virginia 738) and through residential areas to Spring Hill Road (Virginia 684).

There are 6.5 miles of stream within the subwatershed. The mainstem of Rocky Run begins as a culvert under the Dulles Access Road and flows north through low-density residential neighborhoods for approximately 3 miles where it is joined by Sharpers Run just to the south of Old Dominion Drive. It continues through lightly developed areas for less than a mile to its **confluence** with Difficult Run, which is not far upstream of Difficult Run's connection with the Potomac River at Great Falls Park. According to historical reports, Rocky Run varies in size from 7 feet wide in the upper reaches to 25 feet wide downstream of Old Dominion Drive (PB 1976).

Refer to DFRR_1 for a map of the Rocky Run Hickory subwatershed highlighting the Subwatershed Characteristics including, existing **land use**, **flood limit**, **wetlands**, **resource protection areas** and **stormwater management**.

3.15.2 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.

Development in the Rocky Run subwatershed is moderately to heavily dense. Sixty-five percent of the subwatershed is low-density or estate residential, 2 percent is high-density residential, and 11 percent is designated as open space. Woodside Lake lies in the central portion of the subwatershed. There are no wetlands located within the subwatershed. Three historic sites are located within the Rocky Run subwatershed, but no large public parks.

Commercial and industrial areas are located primarily in the southern end of the subwatershed and comprise 9 percent of the total subwatershed area. The transportation use, such as roads and highways, are also primarily in the south and make up another 12 percent of the total subwatershed acreage. This southernmost portion of the subwatershed, upstream of the headwaters of Rocky Run, includes Tyco Commercial Park and Exit 16 of the Washington Dulles Access Road, the most heavily traveled roadway in the area.

Total impervious area, including all roads, buildings, residential driveways, and parking lots, is 334 acres, or 20 percent of the total area. This impervious area is predominantly clustered in the southern end of the subwatershed. A summary of land use within the subwatershed can be found in Table 3.25.

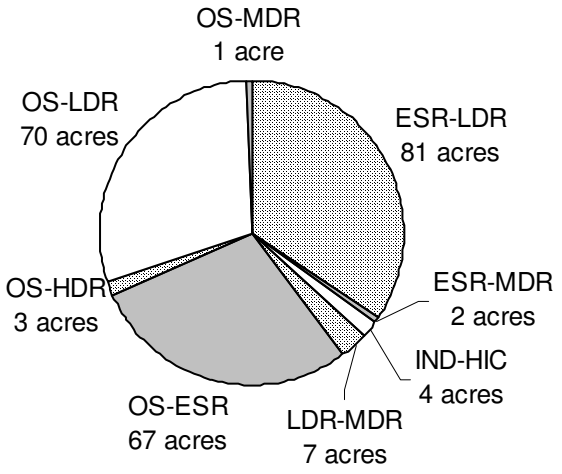
Table 3.25 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open space, parks, and recreational areas	189	11%	47	3%	-142	-8%
Golf Course	0	0%	0	0%	0	0%
Estate residential	435	26%	419	25%	-16	-1%
Low-density residential	654	39%	798	48%	144	9%
Medium-density residential	6	0%	17	1%	11	1%
High-density residential	26	2%	29	2%	3	0%
Low-intensity commercial	15	1%	15	1%	0	0%
High-intensity commercial	82	5%	85	5%	4	0%
Industrial	46	3%	42	3%	-4	0%
Institutional	13	1%	13	1%	0	0%
Transportation	200	12%	200	12%	0	0%
Water	7	0%	7	0%	0	0%
Total	**1,673**	**100%**	**1,673**	**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.

The notable changes between existing land use and future land use are projected in the open space, estate residential, and low-density residential. There are projected losses in open space (-8 percent) and estate residential (-1 percent). .Increases are projected in the low-density residential (+9 percent) and medium-density residential (+1 percent).

Figure 3.17: Changed Land Use



According to Figure 3.17, 83 acres are projected to shift from estate residential in the existing land use to low-density and/or medium-density residential in the future land use. Cumulatively, 141 acres or 60 percent of all land use changes, are projected to shift from open space to a higher-intensity 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.

3.15.3 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 22 **stormwater management facilities** within the Rocky Run subwatershed. Eighty-one percent of the Rocky Run subwatershed was developed before stormwater management regulations were adopted, and is not served by any treatment facility. Seventeen percent of the total area has quantity control only and the remaining 2 percent receives both **quantity and quality control**. A list of all stormwater management facilities in the subwatershed is found in Appendix D.

Although a large percentage of the subwatershed is not served by stormwater management, those areas are generally located in the northern and central areas where the land use is largely estate and low-density residential. Because these areas typically leave some forest canopy intact and are disconnected from the stormwater system they may not require additional stormwater controls.

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 15 stormwater **outfall** pipes discharging into Rocky Run. All located pipes appeared to have minimal impact on the stream and did not warrant repair.

Stream Crossings

Stream crossings, such as bridges and culverts are often locations of erosion and flooding. The combination of aging structures and frequently high stormwater levels can cause downstream stream stability problems and habitat impairment. The Stream Physical Assessment located 23 stream crossings within the subwatershed. Of these crossings, three are footbridges and seven are bridges or box culverts. Most crossings were creating only a minor impact on the stream condition. One crossing, located off of Brook Road in the Woodside Lake Area was having a slightly more significant impact on downstream streambed erosion but does not warrant immediate attention.

3.15.4 Soils

Soils found in the Rocky Run 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 60 percent of the B hydrologic soil group with Glenelg silt loam being the dominant soil type (35 percent). B soils and the Glenelg soil type are compatible with **infiltration** practices and may provide potential stormwater management sites. There is less than one acre of land with unclassified soils in the Rocky Run subwatershed. Soils that cover at least 20 acres within the subwatershed can be found in Appendix A.

3.15.5 Geomorphology

There are approximately 6.5 miles of stream in the Rocky Run 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.

Three stream reaches (2,288 feet) were not assessed because they were not natural **channels**. This includes the culvert under the Dulles Access Road.

All assessed stream reaches in Rocky Run were characterized as Type III. This indicates a generally unstable channel that has eroding banks and is actively widening in response to changes in flow. Most (62 percent) of the total reach length assessed has gravelly substrate while 13 percent is sand/gravel mix and 11 percent is cobble. Refer to DFRR_3 for the stream classifications.

Channel incision was especially notable on several tributaries to Rocky Run and on a segment of the mainstem of Rocky Run in the central portion of the subwatershed. Field crews noted and photographed five erosion points that were having a severe impact on Rocky Run and its tributaries. Four of these erosion points are located on the mainstem of Rocky Run and one on a minor tributary in the upper reaches of Rocky Run. An example is shown in Photo 3.38, which is stream restoration candidate site S92.

Photo 3.38 Significant erosion on the mainstem between Woodside Drive and Orlo Drive (DFRR013.E001).

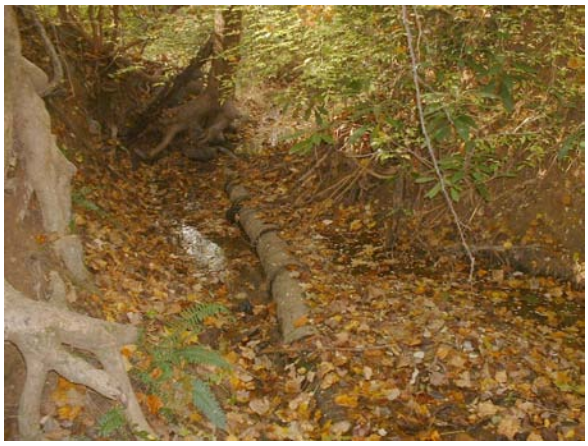


Photo 3.39 Exposed utility located northeast of Old Dominion Drive near Tebbs Lane.

There was one utility pipe of an unknown type in reach on a tributary to Rocky Run as shown in Photo 3.39. This utility pipe is partially buried and did not appear to be causing erosion in the stream channel.

There were 16 sites along the stream within the subwatershed where trees and debris were obstructing flow. Of these, nine were considered significant enough to affect fish passage and three of the 16 had a greater than moderate impact. Photo 3.40 shows a representative blockage on a Rocky Run tributary that may be impeding fish passage.

Photo 3.40 Obstruction located between Tebbs Lane and Cilicia Street (DFRR001.T002).

3.15.6 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, which provides a one time visual inspection. Field crews conducted that assessment in the fall of 2002.

- Of the 6.5 miles of stream assessed, 46 percent has Good habitat for aquatic insects and fish, 31 percent exhibits Fair habitat quality, and 16 percent has Poor habitat quality.
- There are 3.1 miles of stream that are without adequate **riparian buffer** on either the left or right bank. There are 2,650 feet of stream that are missing adequate buffer on both the left and right banks combined.
- All reaches had at least 50 percent vegetative bank cover (usually shrubs and grasses).

3.15.7 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 Rocky Run 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.

The Rocky Run subwatershed is 20 percent impervious, a majority of which is in the portion of Rocky Run south of the Dulles Toll Road and east of Leesburg Pike. This is the location of **catchment** DFRR0001, which has the highest modeled pollutant loads in the subwatershed. Refer to DFRR_4 for the catchment locations. This is a concentrated area of commercial and industrial areas are the most probable source of the high levels of **nitrogen** begin delivered to the stream system.

Two catchments, DFRR9601 and DFRR9801, located in the Springhaven Estates and the Foxhall of McLean areas respectively, were ranked second and third for the subwatershed behind DFRR0001 in nitrogen loading rates. These three catchments also have higher than average **phosphorus** loading rates. Catchment DFRR0001 has the highest runoff volume in Rocky Run with 9.4 inches per year, almost double the amount of the next highest catchment. Results can be found in Table 3.26.

Table 3.26 Existing and Future Modeling

Rocky Run Catchments		Runoff Volume (in/yr)	Peak (cfs/ac)	TSS (lb/ac/yr)	Runoff TN (lb/ac/yr)	Runoff TP (lb/ac/yr)
DFRR0001	E	14.79	0.3	333.9	13.6	1.2
	F	14.14	0.3	321.3	13.8	1.2
	C	-4%	0%	-4%	1%	0%
DFRR0002	E	4.85	0.17	41.5	2.2	0.4
	F	5.53	0.2	52.9	2.8	0.5
	C	14%	18%	27%	27%	25%
DFRR0003	E	2.74	0.13	24.3	1.3	0.3
	F	3.27	0.14	31.7	1.7	0.4
	C	19%	8%	30%	31%	33%
DFRR0004	E	2.03	0.2	16.5	0.9	0.2
	F	2.52	0.21	23.1	1.3	0.3
	C	24%	5%	40%	44%	50%
DFRR0005	E	1.82	0.14	17.9	0.9	0.2
	F	2.04	0.14	21.4	1.1	0.2
	C	12%	0%	20%	22%	0%
DFRR0006	E	1.47	0.13	10.2	0.5	0.1
	F	1.58	0.13	10.9	0.6	0.1
	C	7%	0%	7%	20%	0%
DFRR0007	E	1.6	0.17	11.1	0.6	0.1
	F	1.61	0.17	11.0	0.6	0.1
	C	1%	0%	-1%	0%	0%
DFRR9401	E	1.09	0.1	12.9	0.6	0.1
	F	1.24	0.11	14.3	0.7	0.1
	C	14%	10%	11%	17%	0%
DFRR9501	E	2.03	0.14	19.3	1.1	0.2
	F	2.24	0.15	21.5	1.2	0.3
	C	10%	7%	11%	9%	50%
DFRR9601	E	2.09	0.1	19.0	1.0	0.2
	F	2.21	0.11	20.3	1.1	0.2
	C	6%	10%	7%	10%	0%
DFRR9702	E	2.23	0.12	22.4	1.2	0.3
	F	2.6	0.12	28.0	1.5	0.3
	C	17%	0%	25%	25%	0%
DFRR9801	E	2.68	0.11	28.0	1.6	0.3
	F	2.83	0.12	30.0	1.7	0.4
	C	6%	9%	7%	6%	33%

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

Modeling results for future conditions show increases in flows and runoff **pollutant** loads from most of the catchments in the subwatershed. Percent increases in catchment DFRR0004 are projected to be the highest for all parameters. This catchment has a substantial amount of land changing from open space or estate residential to low density residential. Catchment DFRR0003 also has large predicted percent changes, also for the same land use changes. Many of the land use changes in this subwatershed are along the stream, especially in the headwaters. All of these changes will significantly increase the suspended solids along with the runoff volume and peak.

3.15.8 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.

Four crossings in the subwatershed were overtopped by existing flows. They are listed below in Table 3.27. 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 3.27 Culvert Hydraulic Modeling

Culvert	Crossing		Flood Year						
			100	50	25	10	5	2	1
74	Brook Road	E	x	x	x				
75	Bellview Road	E	x	x	x	x	x		
76	Towlston Road	E	x	x	x	x	x	x	
79	Old Dominion Drive	E	x	x	x				

E – Existing conditions results, x – indicates overtopping

Culvert #74 (Photo 3.41) overtopped for the 25, 50, and 100-year events. Since Brook Road does not allow through traffic, it is classified as a local road, which has to pass the 10-year flow. Since it does pass the 10-year flow, this culvert is not considered a candidate site.

Photo 3.41 Culvert 74 at Brook Road on Rocky Run mainstem.

Photo 3.42 Culvert 75 at Bellview Road on Rocky Run mainstem.

Culvert #75 (Photo 3.42) overtopped for all events except the one and two-year. Bellview Road is a primary road and so must pass the 25-year event.

Culvert #76 (Photo 3.43) overtopped for all events except for the one-year. Primary roads, the classification for Towlston Road, must pass the 25-year event.

Culvert #79 (Photo 3.44) overtopped for the 25, 50, and 100-year events. Old Dominion Drive allows through traffic and is classified as a primary road. This means it must pass the 25-year event.

Photo 3.43 Culvert 76 on Rocky Run mainstem at Old Towlston Road

Photo 3.44 Culvert 79 on Rocky Run mainstem at Old Dominion Drive

3.15.9 Candidate Sites for Improvements

Based on the review of the assessment data and modeling results, the most serious problem areas in the Rocky Run subwatershed are listed below. Refer to DFRR_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

S91 The Stream Physical Assessment identified this site as having severe erosion all with moderate restoration potential near Bellview Road.

S92 This site was identified as having significant erosion and a deficient buffer, where houses are built close to the stream (Photo 3.38).

S93 This site, located near the culvert at Towlston Road, was identified as having a deficient buffer, again because of the proximity to houses.

Hydrology and Water Quality

D18 (Catchment DFRR9601) This catchment has some of the highest modeled runoff volume and nitrogen loading in the subwatershed. Erosion is occurring at the junction between a manmade channel and the natural stream system.

D19 (Catchment DFRR9501) This site has better than average conditions for runoff flows and pollutant loads in the subwatershed. It was selected because it is a proposed site for a regional pond.

D21 (Catchment DFRR9401) This site has better than average conditions for runoff flows and pollutant loads in the subwatershed. Site S93 was identified downstream of this

pond and an exposed utility (Photo 3.39) and obstruction (Photo 3.40) are located in the catchment.

D66 (Catchment DFRR9801) This catchment has above average pollutant loading rates. The reach in this catchment has unstable banks and Poor habitat rating.

C21 (Catchment DFRR0001) This site has higher than average nitrogen and phosphorus loadings. Peak flows and runoff volume are also above average. There are no critical stream problems within the area or immediately downstream.

Flooding

F75 The crossing at Bellview Road overtopped for 5-year and greater events. To meet standards, however, it must pass the 25-year event because it is a primary road (Photo 3.42).

F76 The bridge on Towlston Road, a primary road, overtopped for all events except the one-year. This bridge must pass the 25-year event to meet requirements (Photo 3.43).

F79 The crossing at Old Dominion Drive overtopped for 25, 50, and 100-year events. Old Dominion Drive is classified as a primary road, so it must pass the 25-year event (Photo 3.44).

Preservation

P08 (Catchment DFRR0003) Percent increases between the existing and future conditions are projected to be the highest for all parameters in this catchment due to losses of open space.

P09 (Catchment DFRR0004) This area is projected to experience large changes from open space to estate and low-density residential use. Four out of the five modeled parameters are expected to more than double between the existing and future conditions.

3.16 Rocky Run - Subwatershed Plan Actions

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 3.28 below is a list of all projects proposed in this subwatershed.

Table 3.28 Recommendations for Rocky Run

Project #	Project Type	Candidate Site
DF9019A	Drainage Retrofit	D-19
DF9066A	Pond Retrofit	D-66
DF9121	Pond Retrofit	C21
DF9291	Stream Restoration	S91

3.16.1 Regional Pond Alternative Projects

D19 (DFRR9501)

Site Investigation and Projects:

DF9019A (Drainage Retrofit) This project involves providing additional outlet protection, possibly riprap and/or structural measures, where the storm drain system discharges into natural channels. The project will reduce velocity from the outfall and help reduce erosive potential immediately downstream.

D21 (DFRR0007)

Site Investigation and Projects: See culvert site F76 for projects to address this site.

D66 (DFRR9801)

Site Investigation and Projects:

DF9066A (Pond Retrofit) Retrofits to this pond include installing a multi-stage control structure over the existing outlet to significantly improve peak flow attenuation. The existing facility holds the necessary water quality volume to treat the full drainage area. To enhance the treatment function, the aquatic bench will be extended to encompass the entire perimeter of the facility.

3.16.2 Catchment Improvement Projects

C21 (DFRR0001, DFRR0002)

Site Investigation and Projects: The catchment is fully developed and almost 100 percent impervious. There is very little existing stormwater management and the streams in the catchment have been piped.

DF9121 (Pond Retrofit) The wet pond at the downstream catchment should be retrofited by adding both wet and dry vegetation to the natural channels and surrounding banks. In addition, a sediment forebay constructed in front of the closed storm drain outlet will treat impervious runoff prior to flow entering the stream channel.

3.16.3 Stream Restoration Projects

S91

Site Investigation and Projects: The site investigation showed eroding banks on both sides of the stream with some widening apparent in the upper portion of the reach. The stream is actively meandering and has weak riffle pool morphology. Evidence of a high concentration of fines sediments was observed. One project was identified.

> *DF9291 (Stream Restoration)* The stream would be reconstructed to provide a pattern, dimension, and profile more consistent with that of a natural stream. Streambanks would be stabilized and riffle pool bed morphology would be created.

S92

Site Investigation and Projects: The site investigation showed eroded stream banks and slight incision. The stream appeared to be recovering as was evidenced by narrowing of the baseflow channel and the formation of shallow pools. The site is flanked by residential driveways on both sides. No other buffer deficiency was noted. No project was identified because potential project benefits did not justify the construction impacts that would be incurred.

S93

Site Investigation and Projects: The site investigation did not show significant erosion impairment. No project was identified.

3.16.4 Preservation

Improvement Goals for all Preservation Sites

Preservation goals for all the areas described below 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 the areas listed below are described in Chapter 4.

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