

## 6.0 Benefits of Plan Implementation

For the 10-year plan, projects that might have a measurable impact on the watershed hydrology (rate and timing of flows) or hydraulics (stream water level) were selected for additional modeling. For the Lower Occoquan projects, only stormwater pond retrofit projects were assumed to have a measurable effect on the hydrology. Therefore, only the stormwater pond retrofit projects were modeled in the hydrologic model, SWMM. Once the projects had been modeled in SWMM, the resulting flows were input into the hydraulic model, HEC-RAS.

### 6.1 Hydrology

A total of 7 pond projects were modeled both individually in SWMM and in a combined model. The model shows a decrease in peak flows as a result of these projects. A detailed discussion of the hydrologic modeling can be found in Appendix B. An overview of the existing, “future without,” and “future with projects” flows can be found in Table 6.1.

### 6.2 Hydraulics

Flows from the combined model, which included all relevant projects from the 10-year plan, were input into the hydraulic model for the watershed. As the stormwater retrofit projects in the 10-yr plan are all located in Giles Run and the nearby unnamed tributary watersheds, differences in the modeled water surface elevations between the “future without” and “future with projects” conditions are only seen along these streams. The 100-year (a storm that has a 1 percent probability of occurring in a given year) and the 10-year (a storm with a 10 percent annual chance) floodplains were mapped. An analysis was performed to determine the affected structures located inside or within 15 feet of the floodplain boundaries.

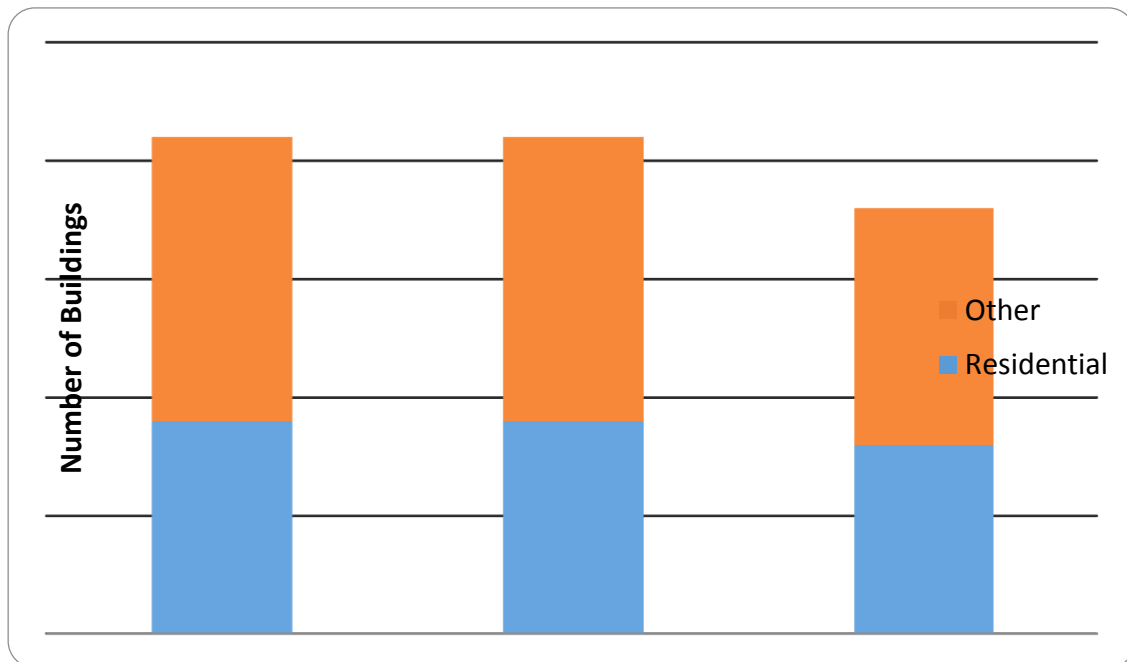


Figure 6-1: Buildings located in the 100-year floodplain

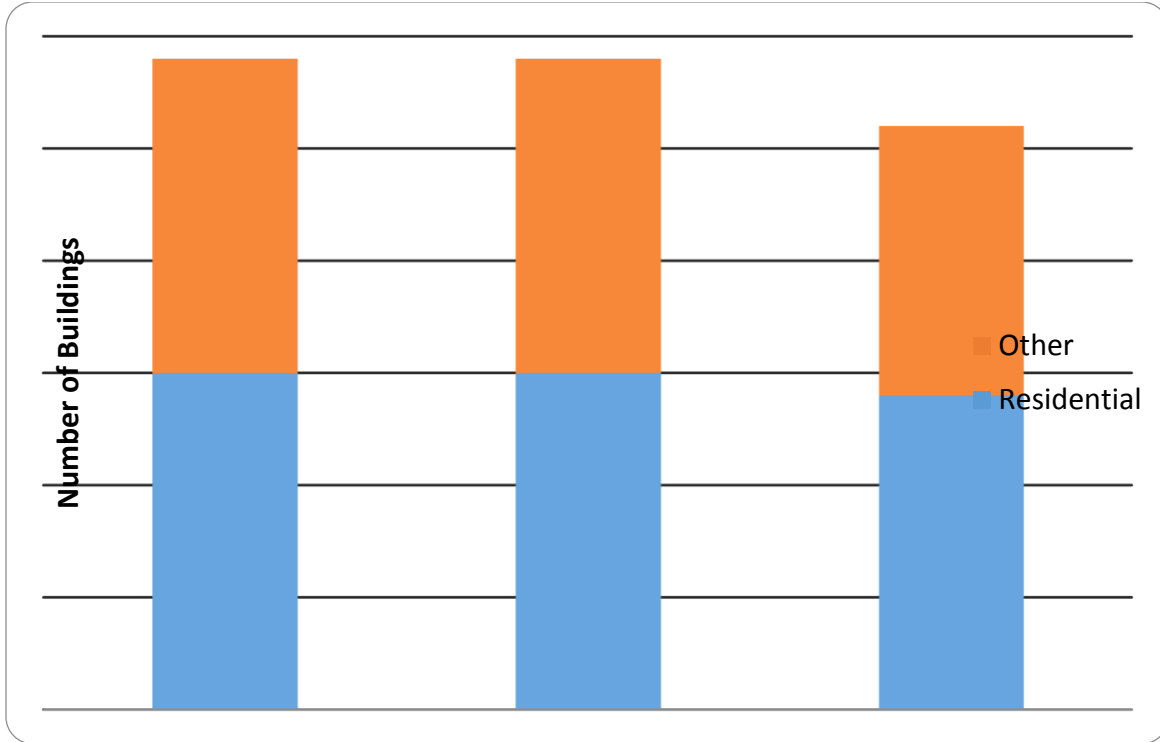


Figure 6-2: Buildings located within 15 feet of the 100-year floodplain

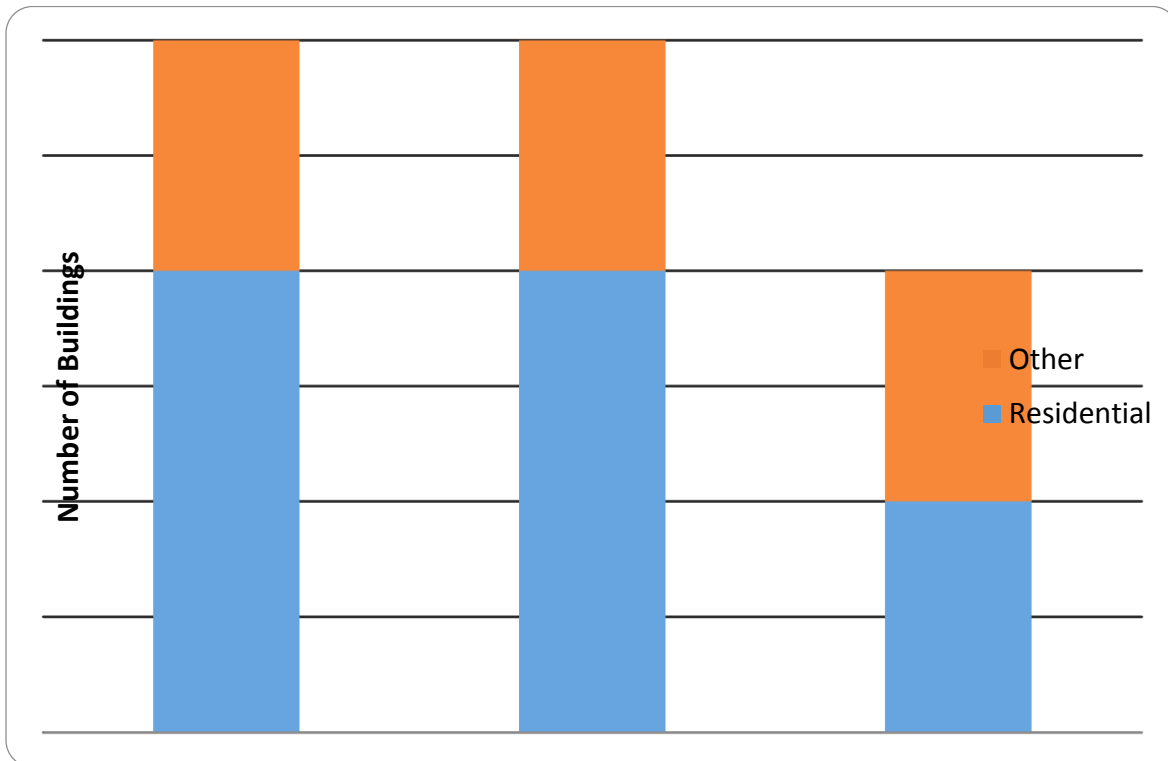
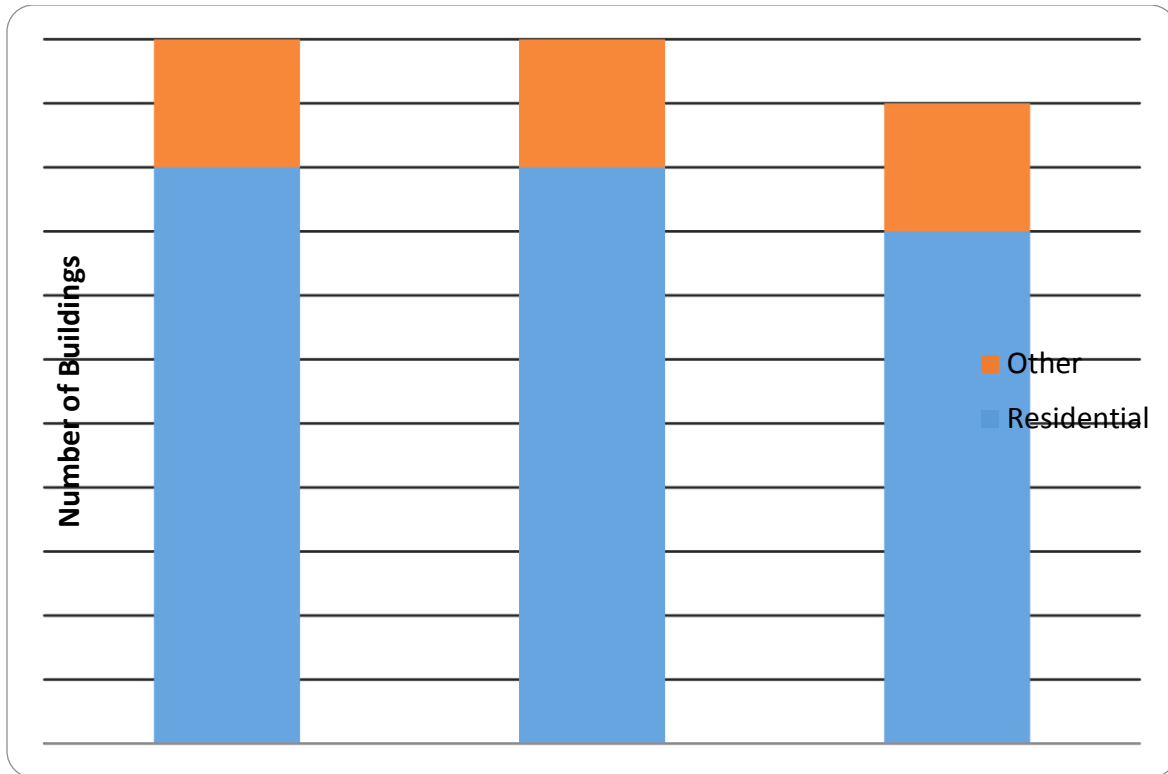


Figure 6-3: Buildings located within the 10-year floodplain



**Figure 6-4: Buildings located within 15 feet of the 10-year floodplain**

The analysis shows that the number of structures in or near the floodplain decreases between “future” conditions and “future with projects” conditions. A more detailed discussion of the hydraulic analysis can be found in Appendix B.

### 6.3 Pollutant Loading

Pollutant loads at the subwatershed level were modeled using STEPL, a water quality model. Additionally streambank erosion was calculated for affected reaches per guidance from the County. The streambank erosion pollutant loads were broken down into subwatershed loads and added to the STEPL subwatershed pollutant loads. The model generates estimated pollutant loads based on land use. Various types of stormwater treatment facilities can be modeled by applying reductions to these loads based on the treatment type and area treated. Detailed results from the STEPL model can be found in Appendix B. Table 6.1 includes a summary of the “existing,” “future without,” and “future with proposed projects” pollutant loadings by WMA.

### 6.4 Plan Costs and Benefits

The total cost of the 10-year plan (includes structural projects only) is \$12 million. The additional cost to implement the structural projects in the 25-year plan is \$50 million, which combined gives a total cost of \$62 million. The benefits to the county are wide-ranging. The yearly total suspended sediment load will be reduced by 260 tons if the 10-year plan is implemented, 1,050 tons if the entire 25-year plan is implemented. Likewise, the yearly load of nitrogen and phosphorus will be reduced by over 420 pounds and over 170 pounds, respectively, for the 10-year plan, and 1670 pounds and 630 pounds for the entire 25-year plan. These benefits will help attain the goals set by the County to improve water quality and stream conditions in the Lower Occoquan watershed.

**Table 6-1: Pollutant Loading & Flow Reduction Table (High Point)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
High Point	3,555	Existing Condition	1.070	2.755	0.162	0.412	280.42	1.84	0.35
		Future Without Projects	1.085	2.775	0.178	0.442	274.19	1.93	0.36
		Future With Projects (10-Yr)	1.085	2.775	0.178	0.442	274.19	1.93	0.36
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	274.19	1.93	0.36
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0.00	0.00	0.00

**Table 6-2: Pollutant Loading & Flow Reduction Table (Kane Creek)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Kane Creek	3,075	Existing Condition	1.218	2.937	0.195	0.552	418.15	1.91	0.38
		Future Without Projects	1.227	2.948	0.201	0.564	414.78	2.08	0.40
		Future With Projects (10-Yr)	1.227	2.948	0.201	0.564	408.89	2.08	0.40
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	316.79	2.01	0.37
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	5.89	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	97.99	0.07	0.02

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions

**Table 6-3: Pollutant Loading & Flow Reduction Table (Mill Branch - Giles Run North)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Mill Branch - Giles Run North	2,002	Existing Condition	1.279	2.830	0.241	0.576	607.70	4.52	0.78
		Future Without Projects	1.318	2.874	0.258	0.601	611.40	4.69	0.80
		Future With Projects (10-Yr)	1.271	2.817	0.251	0.575	611.22	4.69	0.80
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	559.45	4.64	0.77
		Reduction (10-year Plan)	0.048	0.057	0.007	0.026	0.18	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	51.95	0.05	0.03

**Table 6-4: Pollutant Loading & Flow Reduction Table (Mill Branch - Giles Run South)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Mill Branch - Giles Run South	2,327	Existing Condition	1.563	3.368	0.255	0.632	711.12	6.93	1.05
		Future Without Projects	1.609	3.427	0.273	0.664	672.80	6.51	1.02
		Future With Projects (10-Yr)	1.517	3.321	0.237	0.603	653.35	6.48	1.01
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	653.34	6.48	1.01
		Reduction (10-year Plan)	0.092	0.105	0.036	0.061	19.45	0.03	0.02
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	19.46	0.03	0.02

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions

**Table 6-5: Pollutant Loading & Flow Reduction Table (Mill Branch)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Mill Branch	1,268	Existing Condition	1.532	3.329	0.315	0.773	617.1 <sub>1</sub>	6.50	0.95
		Future Without Projects	1.543	3.340	0.326	0.787	617.3 <sub>0</sub>	6.60	0.96
		Future With Projects (10-Yr)	1.543	3.340	0.326	0.787	617.3 <sub>0</sub>	6.60	0.96
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	522.7 <sub>5</sub>	6.53	0.94
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	94.54	0.07	0.02

**Table 6-6: Pollutant Loading & Flow Reduction Table (Occoquan)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Occoquan	2,126	Existing Condition	1.008	2.665	0.254	0.738	491.3 <sub>6</sub>	3.55	0.57
		Future Without Projects	1.071	2.740	0.304	0.833	444.8 <sub>0</sub>	3.35	0.55
		Future With Projects (10-Yr)	1.071	2.740	0.304	0.833	444.8 <sub>0</sub>	3.35	0.55
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	413.9 <sub>7</sub>	3.32	0.54
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	30.83	0.03	0.01

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions

**Table 6-7: Pollutant Loading & Flow Reduction Table (Old Mill Branch)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Old Mill Branch	2,723	Existing Condition	1.075	2.747	0.218	0.647	325.09	1.48	0.29
		Future Without Projects	1.085	2.759	0.222	0.660	321.48	1.55	0.30
		Future With Projects (10-Yr)	1.085	2.759	0.222	0.660	321.48	1.55	0.30
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	220.95	1.47	0.26
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	100.53	0.07	0.04

**Table 6-8: Pollutant Loading & Flow Reduction Table (Ryans Dam)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Ryans Dam	2,261	Existing Condition	0.975	2.627	0.190	0.600	440.10	1.50	0.32
		Future Without Projects	0.985	2.639	0.194	0.611	434.31	1.58	0.33
		Future With Projects (10-Yr)	0.985	2.639	0.194	0.611	434.31	1.58	0.33
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	434.31	1.58	0.33
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0.00	0.00	0.00

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions

**Table 6-9: Pollutant Loading & Flow Reduction Table (Sandy Run)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Sandy Run	5,198	Existing Condition	1.038	2.756	0.142	0.435	390.69	2.71	0.47
		Future Without Projects	1.052	2.772	0.145	0.439	385.13	2.78	0.47
		Future With Projects (10-Yr)	1.052	2.772	0.145	0.439	375.21	2.78	0.45
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	342.28	2.75	0.44
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	9.92	0.00	0.02
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	42.86	0.03	0.04

**Table 6-10: Pollutant Loading & Flow Reduction Table (Wolf Run)**

WMA	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/ac/yr) <sup>3</sup>	TP (lb/ac/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Wolf Run	3,761	Existing Condition	0.968	2.633	0.147	0.438	818.33	2.71	0.55
		Future Without Projects	0.979	2.643	0.149	0.440	812.18	2.78	0.56
		Future With Projects (10-Yr)	0.979	2.643	0.149	0.440	705.23	2.69	0.55
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	553.84	2.58	0.52
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	106.95	0.09	0.01
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	258.34	0.20	0.03

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions



**Table 6-11: Pollutant Loading & Flow Reduction Table (Lower Occoquan Watershed)**

Water-shed	Area (ac)	Scenario <sup>1</sup>	Runoff Volume (in) <sup>2</sup>		Peak Flow (cfs/ac) <sup>2</sup>		TSS (lb/ac/yr) <sup>3</sup>	TN (lb/a/c/yr) <sup>3</sup>	TP (lb/a/c/yr) <sup>3</sup>
			2-Year	10-Year	2-Year	10-Year			
Lower Occoquan	28,300	Existing Condition	1.131	2.822	0.195	0.543	493.7 <sub>1</sub>	3.01	0.52
		Future Without Projects	1.151	2.847	0.206	0.563	483.5 <sub>4</sub>	3.04	0.53
		Future With Projects (10-Yr)	1.140	2.834	0.202	0.556	465.2 <sub>4</sub>	3.02	0.52
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	409.1 <sub>7</sub>	2.98	0.51
		Reduction (10-year Plan)	0.011	0.013	0.003	0.007	18.29	0.01	0.01
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	74.36	0.06	0.02

1. 25-year projects were not evaluated in the hydrologic model
2. Flow is cumulative
3. Loads are representative of individual land area contributions

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