Chapter 7
Turkey Run Watershed

7.1 Watershed Condition

The Turkey Run Watershed has an area of approximately 1,248 acres as shown on Map 7.1. Approximately half of that area, or 704 acres, drains to Turkey Run before discharging into the Potomac; the remaining 544 acres drain directly to the Potomac River through unnamed tributaries, which have been included to the total watershed area to facilitate planning. The entire watershed is bounded to the west by Ridge Drive and Langley Oaks Park; to the east by Savile Lane; to the south by Georgetown Pike; and to the north by the Potomac River.

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.

Turkey Run Watershed Condition Summary

- **Current imperviousness = 15 percent with the majority of land use as low-intensity commercial.**
- **Future imperviousness = 16 percent**
- **The majority of the developed areas are served by on-site sewage disposal.**
- **All of the seven crossings have "minor to moderate" impacts.**
- **Only one publicly owned dry pond is located in this watershed.**
- **The majority of the habitat quality is excellent, but there are several locations with inadequate buffers.**
- **The stream is actively widening and the impact of erosion was observed as "moderate to severe" at four locations.**
- **Two obstruction locations have "moderate to severe" impacts.**
- **No trash dumps were observed.**

7.1.1 Watershed Characteristics

The headwaters of Turkey Run begin at a natural springs located south of Georgetown Pike.

Turkey Run flows under Georgetown Pike, and then flows in a northerly direction until its confluence with the Potomac River. The length of Turkey Run from its headwaters to its mouth at the Potomac River is approximately 1.7 miles.

There is one unnamed tributary, known locally as Deep Creek, that contributes significant runoff and drainage area to Turkey Run. It has a length of approximately 4,100 feet. We have also included several small perennial streams that drain directly to the Potomac River, with the longest being 4,300 feet, to facilitate planning. The terrain in the watershed is moderate with land elevations ranging from 210 to 230 feet in the southern part to elevations of 55 to 75 feet in the northern part. Turkey Run has a low-gradient slope of 0.7 percent.

7.1.2 Existing and Future Land Use

Land use in the watershed is predominantly low-intensity commercial. Low-intensity commercial currently comprises 40 percent of the total watershed area, with 81 percent of that land draining directly to the Potomac River. The offices of the Central Intelligence Agency (CIA) and the Federal Highway Administration to the east occupy land within the low-intensity commercial category. Low-density residential and forested land uses are located throughout the upstream portions of the watershed. There are currently 461 acres of open space, parks, and recreational areas in the Turkey Run Watershed, which account for approximately 37 percent of the existing land use. The parks and recreational areas in the Turkey Run Watershed include Langley Oaks Park, Langley Fork Park, Clemyjontri Park, Turkey Run Recreation Area, and Claude Moore Colonial Farm. There are 27 acres that are currently vacant or undeveloped and 35 acres that are currently underutilized. Combined, undeveloped and underutilized parcels make up five percent of the watershed area. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 0.42 acres of wetlands in this watershed. Table 7.1 summarizes existing and future land use in the Turkey Run Watershed.

Table 7.1 Turkey Run Watershed Land Use

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Turkey Run				
Open space, parks, and recreational areas	387	55%	386	55%
Estate residential	32	5%	0	0%
Low-density residential	152	21%	206	29%
Medium-density residential	26	4%	26	4%
High-density residential	0	0%	0	0%
Low-intensity commercial	48	7%	52	7%
High-intensity commercial	1	0%	1	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	25	3%	0	0%
Road right-of-way (including shoulder areas)	33	5%	33	5%
TOTAL	704	100%	704	100%

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Unnamed Tributaries to the Potomac River				
Open space, parks, and recreational areas	74	14%	74	14%
Estate residential	2	0%	0	0%
Low-density residential	19	4%	23	4%
Medium-density residential	0	0%	0	0%
High-density residential	0	0%	0	0%
Low-intensity commercial	443	81%	443	81%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	2	0%	0	0%
Road right-of-way (including shoulder areas)	4	1%	4	1%
TOTAL	544	100%	544	100%
Total Turkey Run Watershed	**1,248**	**100%**	**1,248**	**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 15 percent of the total area. In the future, under ultimate build out conditions, estate residential may be replaced by low-density residential development and the future imperviousness may increase to 16 percent. Undeveloped and underutilized parcels have a proposed future land use of low density residential. In addition to the predicted changes in land use, mansionization will increase the impervious area in the watershed by 1.8 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 Turkey Run Watershed calls for compatible residential infill development with a density not exceeding one dwelling unit per acre in the watershed. The Comprehensive Plan also includes future transportation improvements such as adding new trails in the Turkey Run Watershed. The improvements are described in more detail below.

The planned trails for Turkey Run Watershed include:

- The extension of the Mount Vernon Trail along the George Washington Memorial Parkway.
- A stream valley trail with a six-foot- to eight-foot-wide natural surface or stone dust trail along the Potomac River.
- A major eight-foot-wide asphalt or concrete trail along Georgetown Pike, Chain Bridge

Road, and Dolley Madison Boulevard.

- A bike lane at Dolley Madison Boulevard.
- A minor four-foot- to eight-foot-wide asphalt or concrete trail through Claude Moore Colonial Farm from Georgetown Pike to the George Washington Memorial Parkway.

7.1.3 Existing Stormwater Management

Minor storm drain systems collect runoff from the southern portions of the Turkey Run Watershed to form its headwaters at Georgetown Pike. Similarly, other areas of the watershed are drained by small storm drain networks that convey runoff from a few local street networks. The storm drain system outfall pipes range from 15 inches to 42 inches in diameter. Most segments of the outfall channels have been altered with concrete lining or with riprap bed and bank protection. The area surrounding one pipe outfall located at an unnamed tributary to Turkey Run has minor to moderate erosion due to the discharge from the pipe. The composition and extent of the storm drain infrastructure at the CIA facility, which makes up the majority of the drainage area in the watershed, are unknown.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Map 7.1 shows the location of the crossings and their erosional impacts on the streams. None of the seven crossings evaluated in the SPA had a "moderate to severe" or "severe to extreme" erosional impact on the stream.

The county's lists of master plan drainage projects shows that there are four identified projects in this watershed. Table 7.2 summarizes the type of master plan drainage project, project name/location, cost and comments on current project status.

The proposed regional pond project TU101 from the county's list of master plan drainage projects has been evaluated and alternative projects are recommended to take the place of this project. The purpose of the proposed regional pond is to reduce the peak flow of runoff to the stream and to treat the pollutants in the runoff from the upstream development. The proposed location of TU101 is on the east side of Langley High School at the location where two unnamed tributaries to Turkey Run join. The estimated drainage area for TU101 is 127 acres consisting primarily of low density residential land use. Downstream of the proposed location of TU101, Turkey Run has a SCI of 4.0 out of a range from 1.0 to 5.0 with 5.0 being the best condition. From the SPA data, there are two moderate erosion points, one severe erosion point, and approximately 4,750 linear feet of moderate to severe erosion primarily at the stream bends. Constructing TU101 in the stream at this location would destroy the stream habitat without providing substantial water quantity or quality control benefits. We do not anticipate a significant increase in imperviousness in the future due to changes in land use, and the estimated increase in peak flow for the ten-year storm event from existing to future land use conditions is one percent. The alternative projects proposed for the watershed are three LID projects, one BMP retrofit project, three stream restoration projects and one buffer restoration project. The LID and BMP retrofit projects will help to reduce the peak flows and reduce the amount of pollutants in the stream from existing development. The buffer and stream restoration projects will help to remove pollutants from the runoff and the stream restoration projects will reduce the stream flow velocity which will help to reduce the amount of erosion.

Table 7.2 Turkey Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/ Location	Old Project Number	Cost	Status
Regional pond	Turkey Run Mainstem	TU101	$134,460	Recommend replacement by Projects TR9104, TR9201, TR9203, TR9206, TR9308, TR9807, TR9810, and TR9812.
Replace culvert and construct berm	Turkey Run Road	TU401	$170,207	Incorporated into TR9405.
Add culvert and lower invert	Georgetown Pike near Turkey Run Road	TU402	$88,270	Keep as CIP project.
Add culvert	Georgetown Pike	TU403	$41,698	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, two complaints regarding flooding or erosion were registered with the county. The locations of these complaints are shown on Map 7.1. 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 is one publicly owned dry detention stormwater management facility and no privately owned facilities. This information is shown in Table 7.3. The public facility is located downstream of the Langley Oaks Subdivision on the west side of Turkey Run. The area served by this facility is 61 acres out of the total watershed area of 1,248 acres, or five percent of the watershed. This facility is shown on Map 7.1, along with three 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 three sites.

Table 7.3 Turkey Run Watershed Stormwater Management Facilities

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

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

7.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil groups

B and D. 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. Hydrologic soil group D soils have a high potential for runoff, a very low infiltration rate, and consist chiefly of clayey soils or very wet soils.

The geomorphology of the stream segments of Turkey 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 substrates in all the stream segments are gravel, sand, cobble, boulder and bedrock.
- All the reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening, and accelerated bend migration.

Map 7.2 shows the stream segment CEM type in the watershed. Fallen trees obstructing the flow were observed at two locations along Turkey Run. The impact of this debris on the stream is minor. No dumpsites were identified during the SPA.

7.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality does perform monitoring of Turkey Run and there are no volunteer water quality monitoring sites located in the Turkey Run Watershed.

The Fairfax County Health Department monitored stream water quality at one sampling site in the Turkey Run Watershed, located at the George Washington Memorial Parkway. 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 Turkey Run was 10.4 mg/l, which is well above the minimum standard of 4.0 mg/l. The nitrate nitrogen was measured at an average of 1.0 mg/l and the total phosphorus was measured to be 0.1 mg/l. The pH was an average of 7.6. The heavy metals were measured to be well below maximum contaminant levels. Forty-seven percent of the fecal coliform samples had counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 1600/100 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 810 acres of Turkey Run Watershed, or 65 percent, are served by on-site sewage disposal systems. Because the type of treatment systems at the Central Intelligence Agency (CIA) and the Federal Highway Administration (FHWA) facilities were unknown, they were conservatively assumed to be serviced by on-site sewage disposal systems. The next largest areas with on-site systems were three parks – the Turkey Run Recreational Area, the Claude Moore Colonial Farm and Langley Fork Park. The remainder of the on-site systems are scattered throughout the watershed including the Langley Hill and Jarvis Neighborhoods. Properties with on-site sewage systems are shown on Map 7.2, but this information is based on the best available data and may not be completely accurate.

The stream reaches of Turkey Run have high-gradient slopes and are classified as 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 *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Turkey 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. Turkey Run was classified as a Watershed Protection Area due to high biological integrity and habitat quality.

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

- In most of the stream reaches, less than four habitat types such as cobble, large rocks, logs, and pool substrate were present.
- No enlargements of islands or point bars are present. Less than 20 percent of the stream bottom is affected by sand or silt accumulation in the downstream segments and 40 to 50 percent of the stream bottom is affected in the upstream segments.
- Approximately five percent of reaches have channel disturbance. There was no evidence of recent alteration activities of the channel or banks.
- For most of the Turkey Run, the water fills approximately 90 percent of the available channel cross section during normal flow periods.
- A majority of the channel banks are highly unstable with approximately 70 percent of the banks covered by thin vegetated cover and scattered grasses, non-grass plants, and shrubs. Fifteen to 30 percent of the banks have erosional areas.
- Sixty percent of Turkey Run exhibits excellent habitat quality and 30 percent exhibits fair habitat quality as depicted on Map 7.2. Flows were observed in the stream channel for the majority of the creek and no head cuts were observed.
- The majority of the stream buffer is inadequate and consists mainly of lawn grass with a width of 50 to 100 feet. The SPA found that the condition of existing riparian buffers is poor for 60 percent of the stream bank length assessed in the watershed. Some reaches at the upstream end of Turkey Run exhibit a buffer width of 25 to 50 feet with minimal disturbance. The locations of deficient buffer areas along the stream corridor are shown on Map 7.2.

7.1.6 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 7.1 shows the locations of the problems identified.

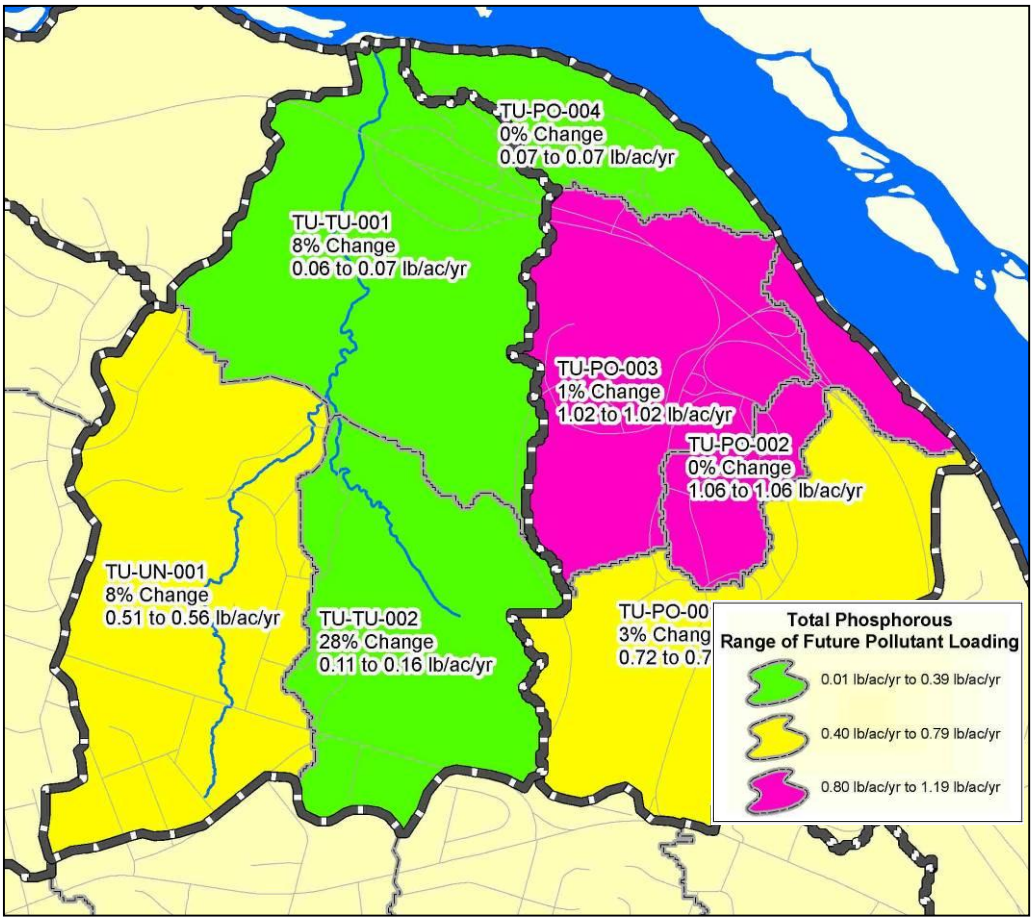
Table 7.4 Problem Locations Identified During Public Forums

Map ID	Description
TR1	Location: Langley High School Problem: The parking lot runoff impacts Turkey Run. There are absolutely no stormwater controls located at this school. The runoff from the school goes into a maintenance yard and then directly into Turkey Run. Trash is also accumulating in this area. Oil slicks are visible in the runoff from the parking lot. Artificial turf is permeable but may not be as permeable as needed so measures of permeability need to be assessed. Artificial turf can contain ground-up old tires and athletic shoes and silica sand, which may run off into the streams. The main thing that leaches out is zinc and this reduces over time but when this goes down, more is added to the top so it continues to leach out. Lead, cadmium, and solvents can also be found in artificial turf. Observation: The parking lot is very large and the runoff goes directly to Turkey Run without any stormwater treatment. A lot of trash has accumulated in the gutter and along the fence line near Turkey Run. There is artificial turf that is environmentally friendly and does not pollute the runoff. An artificial turf subsurface drainage system is usually designed to be more effective at draining surface water than the existing grass and soil substrate. This will be addressed by New LID Project TR9807 at this location.
TR2	Location: Bottom end of the 800 block on Turkey Run Road (locally called "Deep Creek"). Problem: Culvert needs to be replaced with a larger one. Under the road is a typical concrete culvert. It winds around and cuts under again to join the stream. Where it cuts under again, it is too small and gets blocked, which causes flooding, which in turn has caused road deterioration. Observation: The single culvert located downstream was almost completely blocked by silt at its upstream end. The double culverts located upstream were partially blocked by silt. The downstream culvert had less capacity than the two upstream culverts. This will be addressed by Infrastructure Improvement Project TR9405.

7.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Turkey 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 Turkey Run Watershed, which consists of the area draining to Turkey Run and a smaller area draining directly to the Potomac River. Seven 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 7.1.

Figure 7.1 Turkey Run Future Total Phosphorous Loading



7.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model the current watershed imperviousness is 15 percent, which generates moderate peak runoff flows. The predicted increase in peak flows for future development conditions may be attributed to the potential change from estate residential land use to low density residential land use and the projected future development of vacant parcels. Table 7.5 shows the cumulative peak runoff flows and the comparison between the existing and future land use conditions for the two- and ten-year rainfall events.

Table 7.5 Turkey 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
TU-PO-001	234	237	1%	622	627	1%
TU-PO-002	200	200	0%	366	367	0%
TU-PO-003	358	361	1%	694	699	1%
TU-PO-004	110	110	0%	239	239	0%
TU-TU-001	402	416	3%	1,100	1,120	2%

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
TU-TU-002	306	320	5%	814	832	2%
TU-UN-001	192	200	4%	480	486	1%

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. Most of the land in the subbasins that drain directly to the Potomac River (TU-PO-001, TU-PO-002, TU-PO-003 and TU-TU-004) is federally owned. The CIA and FHWA properties are designated as a low intensity commercial land use, whereas the Turkey Run Recreation Park, the Claude Moore Colonial Farm, and Langley Fork Park are designated as open space. The subbasins that drain to Turkey Run have a predominant land use of low density residential for both existing and future conditions. Table 7.6 shows the comparison of the existing and future pollutant loading rates in pounds per acre per year for the Turkey Run Watershed. The pollutant loads increase the most in Subbasin TU-TU-002 because of the many changes from existing to future land use. All of the vacant land in Subbasin TU-TU-002, as well as a portion of the open space and a portion of the estate residential land will be low-intensity residential in the future, which generates more pollutants than the existing land use types.

Table 7.6 Turkey Run Pollutant Loads

Pollutants		Turkey Run Subbasins			Potomac Tributaries			
		TU-TU-001	TU-TU-002	TU-UN-001	TU-PO-001	TU-PO-002	TU-PO-003	TU-PO-004
BOD5	Existing (lb/ac/yr)	2.7	3.9	16.5	30.9	47.8	45.7	3.6
	Future (lb/ac/yr)	2.9	5.2	18.1	31.8	47.8	45.9	3.6
	% Load Increase	7%	33%	10%	3%	0%	0%	0%
COD	Existing (lb/ac/yr)	19.9	25.4	96.4	185.2	286.6	274.1	28.0
	Future (lb/ac/yr)	21.2	32.5	105.3	190.2	286.8	275.6	27.8
	% Load Increase	7%	28%	9%	3%	0%	1%	-1%
TSS	Existing (lb/ac/yr)	12.5	15.2	70.4	186.9	295.4	282.6	18.0
	Future (lb/ac/yr)	13.3	19.1	76.0	192.0	295.7	284.2	18.0
	% Load Increase	6%	26%	8%	3%	0%	1%	0%
TDS	Existing (lb/ac/yr)	30	31	86	188	294	281	47
	Future (lb/ac/yr)	32	36	92	192	294	282	47
	% Load Increase	7%	16%	7%	2%	0%	0%	0%
DP	Existing (lb/ac/yr)	0.04	0.08	0.36	0.50	0.74	0.71	0.05
	Future (lb/ac/yr)	0.05	0.12	0.39	0.52	0.74	0.71	0.04
	% Load Increase	25%	50%	8%	4%	0%	0%	-20%
TP	Existing (lb/ac/yr)	0.06	0.11	0.51	0.72	1.06	1.02	0.07
	Future (lb/ac/yr)	0.07	0.16	0.56	0.74	1.06	1.02	0.07

Pollutants		Turkey Run Subbasins			Potomac Tributaries			
		TU-TU-001	TU-TU-002	TU-UN-001	TU-PO-001	TU-PO-002	TU-PO-003	TU-PO-004
	% Load Increase	17%	45%	10%	3%	0%	0%	0%
TKN	Existing (lb/ac/yr)	0.33	0.63	2.83	4.25	6.37	6.09	0.36
	Future (lb/ac/yr)	0.35	0.85	3.06	4.37	6.37	6.13	0.36
	% Load Increase	6%	35%	8%	3%	0%	1%	0%
TN	Existing (lb/ac/yr)	0.44	0.85	3.95	6.44	9.73	9.31	0.50
	Future (lb/ac/yr)	0.48	1.15	4.27	6.61	9.74	9.36	0.49
	% Load Increase	9%	35%	8%	3%	0%	1%	-2%
Cadmium ($\times 10^{-4}$)	Existing (lb/ac/yr)	1.46	1.54	2.99	3.08	4.42	4.23	2.26
	Future (lb/ac/yr)	1.54	1.73	3.08	3.13	4.43	4.25	2.24
	% Load Increase	5%	12%	3%	2%	0%	0%	-1%
Copper ($\times 10^{-3}$)	Existing (lb/ac/yr)	3.5	4.2	22.5	81.6	130.9	125.2	5.4
	Future (lb/ac/yr)	3.7	4.8	24.2	83.8	131.0	125.9	5.4
	% Load Increase	6%	14%	8%	3%	0%	1%	0%
Lead ($\times 10^{-3}$)	Existing (lb/ac/yr)	1.8	1.8	3.3	5.6	8.7	8.3	2.9
	Future (lb/ac/yr)	1.9	2.0	3.5	5.8	8.7	8.3	2.9
	% Load Increase	6%	11%	6%	4%	0%	0%	0%
Zinc ($\times 10^{-2}$)	Existing (lb/ac/yr)	1.5	1.9	11.5	40.7	65.3	62.4	2.3
	Future (lb/ac/yr)	1.6	2.3	12.4	41.9	65.3	62.8	2.2
	% Load Increase	7%	21%	8%	3%	0%	1%	-4%

7.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Turkey Run from the confluence of the mainstem with the southeastern tributary to the confluence of the mainstem 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 Turkey Run. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor bank 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 model results show no flooding locations for the modeled portion of Turkey Run. There has been roadway flooding at the downstream-most crossing of Turkey Run Road by the unnamed tributary to Turkey Run. This tributary is not included in the hydraulic model.

The majority of the 100-year event is contained within the main channel banks; however, the floodplains are utilized where they are connected to the stream channel. No buildings in the Turkey Run Watershed lie within the 100-year floodplain.

The velocities produced by the model for the two-year rainfall event in the Turkey Run Watershed average approximately 6.5 ft/sec. The velocities are somewhat lower through the

upstream portions and increase as the stream flows north to its confluence with the Potomac River. The model indicates higher and much more erosive velocities at the George Washington Memorial Parkway bridge crossing, which is likely caused by the channelization and constriction of Turkey Run in this area.

According to the county's SPA from 2001, over 1,000 linear feet of erosion along the stream banks was observed in the bends and meanders in the portion of the stream immediately upstream and downstream of the confluence of the mainstem and the southeast tributary to Turkey Run. This characterization is further supported by the results of the stream's hydraulic model that show increased velocities and flow downstream of this confluence. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

7.2 Management Plan Strategy

This section outlines proposed projects for the Turkey Run Watershed. The locations of the projects in this section are shown on Map 7.3. 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 Turkey 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

- Retrofit the dry detention SWM facility located downstream of the Langley Oaks subdivision east of Ridge Drive near 6500 Sunny Hill Court. This pond is located in the Langley Oaks Park and is owned by the Fairfax County Park Authority. The facility was designed to minimize peak flows and detain runoff from the surrounding neighborhoods

and does not have water quality controls. Possible retrofits include 1, 2, 6, and 7. Installing a riser structure with water quality controls and adding a shallow wetland will help provide greater removal of pollutants. The SPA indicated that the stream located downstream of the dry pond has a poor habitat rating. The channel downstream of the dry pond has erosion and should be restored. The buffer area around the facility should be restored with native vegetation to provide additional habitat for wildlife and filtering of stormwater runoff. This project was previously identified as needing dam repairs and is currently in the design phase. (BMP Retrofit Project TR9104)

The size of the proposed drainage areas and benefits from these projects are provided in Table 7.7.

Table 7.7 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)
TR9104	TU-TU-001	6500 Sunny Hill Court	53.6	17.4	1.4

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.

Public LID Projects

Schools were targeted for LID projects because the properties are owned by the county, usually have large impervious areas, most have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues. Parks were also targeted for LID projects because the land is owned by the county, greatly facilitating implementation. Showcasing county facilities as examples of environmentally friendly design could inspire residents to implement similar measures on their own properties.

- Install LID methods at Langley High School located at 6502 Georgetown Pike, which was Problem Location TR1 in Table 7.3. Six bioretention areas with underground trench drains could be constructed in grass areas adjacent to the parking lots. Ten tree box filters could replace some of the curb drop inlets. Sections of the curbs will need to be removed to allow water to flow from parking lot to the detention areas. (New LID Project TR9807)
- Install LID methods at Clemyjontri Park located at 6317 Georgetown Pike. Clemyjontri Park will have improvements constructed in the future that include a stormwater management pond. Adding a bioretention area will help further reduce the amount of runoff and provide greater treatment of pollutants. (New LID Project TR9812)

Private LID Projects

LID projects are recommended for the privately owned place of worship listed below. This site was chosen because it has a large impervious area and does not have existing stormwater management controls.

- Install LID methods at the Korean Orthodox Presbyterian Church at 6519 Georgetown Pike. Bioretention areas could be installed in the landscaped areas near the building and parking lot. (New LID Project TR9810)

The proposed drainage areas and estimated pollutant removal for the LID projects is provided

in Table 7.8.

Table 7.8 Benefits of New LID Projects

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
TR9807	TU-UN-001	6502 Georgetown Pike	19.5	18.1
TR9810	TU-UN-001	6519 Georgetown Pike	1.5	1.0
TR9812	TU-TU-002	6317 Georgetown Pike	4.2	1.0

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. Obstructions in the watershed will vary over time. It may be necessary to clean up future obstructions that are not listed below or shown on any of the watershed maps.

- Remove one obstruction located on the main stem of Turkey Run and remove one obstruction located on the southeast tributary to Turkey Run. (Dumpsite/Obstruction Removal TR9902)

Action A1.6: Stabilize eroding streambanks 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 two culvert crossings in the 800 block of Turkey Run Road. The downstream-most culvert crossing experiences frequent flooding as noted in Problem Location TR2. The flooding appears to be occurring because the culvert is undersized and is often blocked with debris. This project will also include reconstruction of a berm at the upstream crossing of Turkey Run Road. Reconstruction of the berm is in the county's list of master plan drainage projects as TU401. (Infrastructure Improvement TR9405)
- Improve the culvert crossing at the intersection of Turkey Run Road and Bright Mountain Road. This corrugated metal culvert needs to be replaced and resized. A resident noted that one half of the culvert has already been replaced. (Infrastructure Improvement TR9416)

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 Turkey Run Watershed using E. coli as the indicator bacteria and prepare an action plan that will describe how the controllable sources, especially human sources, will be reduced (Fecal Coliform Source Study TR9721).

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.
Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities. The SPA found that the condition of existing riparian buffers is poor for 60 percent of the stream bank length assessed in the watershed. The deficient buffer location described below was found during the 2002 SPA and is a potential location for a buffer restoration project. The location is shown on Map 7.3. It should be noted that the stream reach identified in the following project description and on the map designate a reach that will be further evaluated. Restoration work will be done in required areas, not necessarily along the

continuous length designated. Steps to protect existing vegetated buffers are included in Public Education Project TR9914 described later in this chapter.

- Evaluate the buffer vegetation adjacent to the stream along 800 feet of the main stem of Turkey Run and determine where buffer restoration is necessary. (Buffer Restoration TR9308).

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 and details of this action are presented in Chapter 3.

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

Action B3.5: Protect stream buffer areas from development.
The county should protect Turkey Run from the effects of future development by preserving stream buffers.

- The county should cooperate with the National Park Service to make sure that land under control of the National Park Service is protected from development. Currently the land is leased to the Friends of the Claude Moore Colonial Farm at Turkey Run, Inc. by the National Park Service and is the only privately operated park in the National Park system. The habitat of an unnamed tributary of Turkey Run near the Claude Moore Colonial Farm is in good condition and keeping the Claude Moore Colonial Farm land undeveloped will help ensure future protection of the stream habitat. (Land Conservation Coordination Project TR9913)

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 TR9915)

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.
Turkey Run is actively widening along the majority of its length, but the stream protection strategy composite site condition rating was "excellent". In order to retain this rating, projects should be carefully coordinated with the previously described objectives of reducing the

quantity and improving the quality of runoff in order to prevent further erosion and channel widening. The locations of the proposed stream restoration activities are described below and shown on Map 7.3. It should be noted that the stream reaches identified in the following project descriptions and on the maps designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

- Evaluate the stream banks for a length of approximately 650 linear feet in the vicinity of the George Washington Memorial Parkway Bridge over Turkey Run and determine where stream restoration is necessary. There is severe erosion of the stream bank near one of the bridge pier footings and future erosion may undermine the footing. The county will need to coordinate with the National Park Service on this restoration project. (Stream Restoration Project TR9201)
- Evaluate the stream at the unnamed tributary located on the west side of Turkey Run downstream of the Langley Oaks subdivision and determine where stream restoration is necessary. The stream was assessed as having a poor habitat from the SPA and the restoration will include restoring the habitat for approximately 300 linear feet of stream. (Stream Restoration Project TR9203)
- Evaluate the stream at the southeast branch of Turkey Run for a distance of approximately 4,600 linear feet and determine where stream restoration is necessary. From the SPA, portions of the stream had deficient buffer, erosion locations, and poor habitat. The upstream portion of the stream restoration area is located on federally owned land and the downstream portion is located near Turkey Run Road. The county will need to coordinate with the National Park Service on this restoration project. (Stream Restoration Project TR9206)
- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not evaluated in the SPA will be assessed in this project. (Stream Assessment Project TR9922)

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 TR9914 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 Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.

Community Outreach Project TR9918 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 TR9920 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 TR9919 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.

7.3 Benefits of Plan Actions

One BMP retrofit project and three LID projects are proposed for the Turkey Run Watershed to help improve the water quality of the stream. The channel erosion control volume provided by the BMP retrofit projects will serve 87 percent of the required channel erosion control volume for the 54 acres controlled by the BMPs. The total additional phosphorus removal for all of the proposed projects is estimated to be 38 lbs/year upon the successful implementation of these projects.

Approximately 5,550 linear feet of Turkey Run will be restored as part of the proposed stream restoration projects. These projects will help to minimize the velocity of the stream as well as reduce the erosion of the stream banks. Approximately 800 linear feet of stream buffers will be restored by implementing the buffer restoration project. This project will increase the amount of habitat and provide nutrient reduction along Turkey Run. The stream obstruction removal project will help to reduce the flooding of the stream and erosion of the stream banks.

7.4 Implementation of Plan Actions

The recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The initial implementation schedule 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. 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 Turkey Run is $3,710,000. The priority projects are summarized in Table 7.9 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 7.9 Summary of Turkey Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
TR9807	New LID Project	Fairfax County Public Schools (FCPS)	$940,000	4.20	A
TR9104	BMP Retrofit Project	Fairfax County Park Authority (FCPA)	$190,000	4.10	A
TR9201	Stream Restoration	National Park Service[1]	$500,000	4.00	A
TR9812	New LID Project	FCPA	$60,000	3.95	B
TR9308	Buffer Restoration	FCPS and Private Residential[1]	$40,000	3.90	B
TR9810	New LID Project	Private Organization[1]	$60,000	3.60	C
TR9203	Stream Restoration	FCPA	$260,000	3.45	C
TR9206	Stream Restoration	National Park Service and Private Residential[1]	$2,380,000	3.45	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 7.10 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 7.10 Summary of Turkey Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
TR9914	Public Education Project	Watershed-wide Project	N/A	A*
TR9918	Community Outreach Project	Watershed-wide Project	N/A	A*

Project Number	Type	Land Owner	Score	Year Group
TR9919	LID Promotion Project	Watershed-wide Project	N/A	A*
TR9920	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
TR9922	Stream Assessment Project	Watershed-wide Project	N/A	A*
TR9902	Dumpsite/Obstruction Removal	National Park Service[1]	1.95	A
TR9915	Wetland Assessment Project	Watershed-wide Project	2.95	C
TR9405	Infrastructure Improvement	VDOT and Private Residential[1]	3.55	**
TR9416	Infrastructure Improvement	VDOT and Private Residential[1]	3.50	**
TR9913	Land Conservation Coordination Project	National Park Service[1]	2.60	D
TR9721	Fecal Coliform Source Study	Watershed-wide Project	2.40	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.