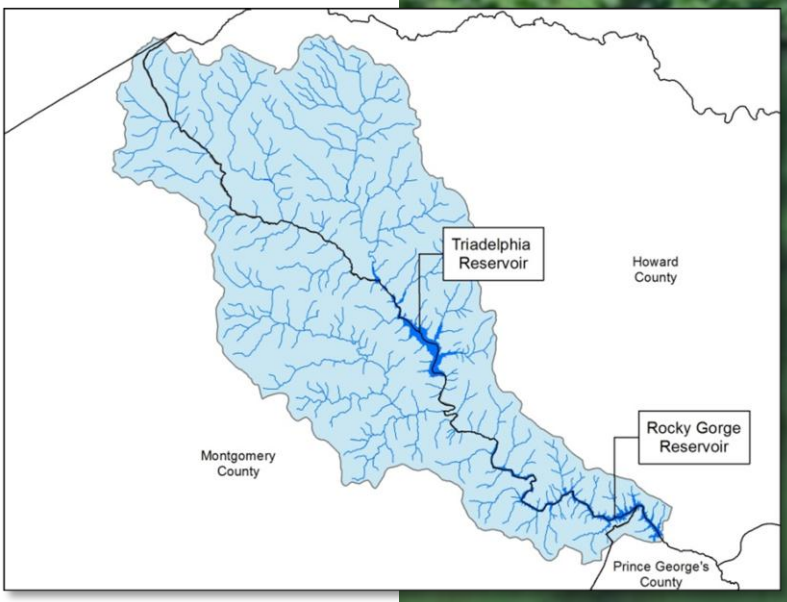
Prepared for:

Washington Suburban Sanitary Commission
14501 Sweitzer Lane
Laurel, Maryland
20707-5902

WSSC's Patuxent Reservoirs Water Supply Protection Buffer Property:

Current Conditions and Potential Enhancements



Prepared by:

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8 NOV 2012

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GLOSSARY AND ABBREVIATIONS

ATV	All-Terrain Vehicle
AWWA	American Water Works Association
BMP	Best Management Practice
CEM	Chesapeake Environmental Management, Inc.
COMAR	Code of Maryland Regulations
EA	EA Engineering, Science, & Technology, Inc.
GIS	Geographic Information System
GPS	Global Positioning System
HES	Highly Erodible Soils
IBI	Index of Biotic Integrity
MCL	Maximum Contaminant Level
MDA	Maryland Department of Agriculture
MDCR	Massachusetts Department of Conservation and Recreation
MDNR	Maryland Department of Natural Resources
MDE	Maryland Department of the Environment
MSL	Mean Sea Level
MWRA	Massachusetts Water Resource Authority
NRCS	Natural Resources Conservation Services
NRDC	Natural Resources Defense Council
RMC	Resource Management Concepts, Inc.
SPU	Seattle Public Utilities
SSURGO	Soil Survey Geographic Databases
SWS	Spartanburg Water System
TMDL	Total Maximum Daily Load
USDA	Unites States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WsPA	Massachusetts Department of Conservation and Recreation's Watershed Protection Act
WSSC	Washington Suburban Sanitary Commission

EXECUTIVE SUMMARY

In December 2011, EA was contracted by the WSSC to conduct an independent evaluation of the WSSC owned buffer property surrounding the Rocky Gorge and Triadelphia reservoirs, and provide recommendations on current and future uses and management of the property that might affect or improve water quality, and reduce storage capacity losses.

This report provides an overview of the approximately 5,500 acres of WSSC-owned buffer property surrounding the Rocky Gorge and Triadelphia reservoirs with specific discussions of soil erosion, water quality impairments, and impacts from public uses of the WSSC watershed buffer property. The report summarizes the results of field observations by EA staff to evaluate the condition of the WSSC Access Roads and buffer property trails, the results of a desktop analysis to map highly erodible soils (HES) within the buffer, and provides recommendations for reducing the potential for negative impacts to reservoir water quality. Information from two public stakeholder meetings conducted as part of the project is also discussed.

The report also presents the results from a limited survey of several national water supply utilities in order to characterize the range of source water protection policies that other organizations are taking in different regions of the country to protect reservoir water quality. The focus was on policies related to recreational uses and shoreline buffer restrictions. It is clear from this survey that there are no consistent recommendations for what is required to reasonably achieve source water protection from specific recreational uses. Nevertheless, the existence of such restrictions acknowledges the special protection that is afforded to drinking water supply sources.

EA's report then presents detailed observations and maps of all the existing trails, WSSC Access Roads, and public access points within the Rocky Gorge and Triadelphia reservoir buffer properties. The report summarizes results from the approximately 80 miles of GPS trail mapping, slopes and observed erosion impact zones, suitability of specific trails for equestrian riding, public parking at designated access areas, safety issues, trail alignment and location of highly erodible soils (HES), and observations of trash, horse manure, and signage. One of the study's major findings is that the vast majority of actively used shoreline trails is unauthorized. The same is true for the old interior horse trails within the Rocky Gorge buffer property that were closed in May 2011, but were found to still be actively used.

The report concludes with detailed discussions of the results and observations from the study, and recommendations to better manage the Commission's buffer property to maintain and improve reservoir water quality. Topics include: observations and results from the stakeholder meetings, an evaluation of erosion potential and relative sediment loadings, suitability of the Access Road and interior trails for equestrian use, policing and enforcement, forest and reservoir management issues and a variety of specific property management issues. Key observations and recommendations from this study are then summarized in the final section of the report.

1 Introduction and Background

1.1 Introduction and Study Goals

In December 2011 EA Engineering, Science, and Technology, Inc. (EA) was contracted by the Washington Suburban Sanitary Commission (WSSC) to conduct a study of the property that WSSC owns around the Patuxent Reservoirs. Much of this property bordering the Triadelphia and Rocky Gorge Reservoirs was purchased in the 1940s and 1950s, respectively, by WSSC on behalf of its customers to serve as a water supply protection buffer.

The purpose of this study was to conduct an independent evaluation of the buffer property and provide recommendations on current and future uses and management of the property that might affect or improve water quality, and reduce storage capacity losses. The discussions and recommendations presented in this report are based upon EA's field observations of the 5,500 acre WSSC-owned buffer property including assessments of the existing WSSC Access Roads and certain trails designated for recreational use, reviews of policies and practices enacted in other national and regional drinking water reservoir watersheds, and the information obtained during two stakeholder meetings conducted for this study. This study does not directly discuss the broader 85,000 acre Patuxent watershed; although a Plan Outline was prepared internally by WSSC staff that includes a second phase of this program to address these broader watershed issues.

1.2 Need for Reservoir Protection

WSSC provides drinking water to 1.8 million customers residing in Montgomery and Prince George's Counties. The drinking water supplied to customers must be safe and protective of public health. To achieve this, the U.S. Environmental Protection Agency (USEPA) has developed a Multiple Barrier Approach against contamination of drinking water, with Risk Prevention being its first barrier. This barrier is described by the USEPA as quoted below (http://www.epa.gov/ogwdw/smallsystems/pdfs/guide_smallsystems_mba_09-06-06.pdf).

> *"Barrier #1: Risk Prevention*
> *The first barrier in a water system's multiple barrier approach is risk prevention. Risk prevention focuses on the selection and protection of drinking water sources. Systems should be aware of potential contamination caused by agricultural drainage, urban runoff, organic materials, and other factors.*
>
> *When selecting sources, systems should examine:*
> - *The quality of the raw water (e.g., does it contain pathogens, chemicals, radionuclides, nitrates, or high turbidity?)*
> - *The risk of contamination (e.g., will development encroach on the water source?)*
> - *The ability of the supply to meet current and future needs.*
>
> *Water systems, unless they are new systems, rarely have the opportunity to select their water source. But existing systems can and should take steps to protect their water sources, including:*

- *Identifying sources of contamination in watersheds and recharge areas*
- *Identifying the conditions under which the risks increase*
- *Developing and implementing source water protection strategies.*

By properly selecting and protecting its water source, a system can reduce its need for and reliance on treatment and increase the reliability of its water quality and quantity.

The financial incentive for systems to prevent risks is significant. It is almost always more cost-effective for a water system to protect its source water from contamination than to remove or inactivate contamination during treatment."

WSSC owns and operates two drinking water supply reservoirs within the Patuxent River watershed, the Triadelphia Reservoir and the T. Howard Duckett (Rocky Gorge) Reservoir. Together these reservoirs hold approximately 11 billion gallons of water and provide approximately one-third of the drinking water supply for WSSC's 1.8 million customers. Although water quality in the reservoirs is affected by all activities that occur within the entire 85,000-acre Patuxent River watershed draining to the reservoirs (i.e., all the land upstream of the T. Howard Duckett Dam), it is important to recognize that WSSC only has control over approximately 5,500 acres of land that it owns surrounding the reservoirs – land which serves as a buffer against water quality degradation. WSSC is responsible for maintaining and protecting the long-term water quality and the storage capacity for these drinking water sources. Therefore, WSSC must manage its buffer property to minimize the introduction of sediments, nutrients, hazardous chemicals, microbial contaminants and invasive species into the reservoirs. These reservoirs are non-renewable resources and their ability to meet current and future needs (as envisioned by USEPA's Multiple Barrier Approach) can be threatened by water quality degradation and capacity loss due to sedimentation. It is also recognized that the ability of reservoirs to meet current and future needs can be significantly impacted by accidental or intentional contamination.

Along with their role as a major regional drinking water source, the two reservoirs also provide managed recreational opportunities under policies established by WSSC. Recreational use of domestic water supply reservoirs is an important national issue, and for this reason a policy has been developed by the American Water Works Association (AWWA), the primary professional organization addressing public water supply issues in the United States, to manage recreational use of water supply reservoirs in a manner that is consistent with USEPA's risk prevention framework. AWWA's Statement on Policy for Recreational Use of Domestic Water Supply Reservoirs (2012) reads:

"The American Water Works Association (AWWA) supports the principle that water of the highest quality should be used as the source of supply for public water systems. Accordingly, the risks and potential mitigation requirements of any recreational activity on domestic source water reservoirs should be identified and evaluated. In the evaluation, utility- and customer-determined acceptable levels of risk should be given the highest consideration. No recreation should be permitted on finished-water reservoirs under any circumstances.

Protection of public health and drinking water quality should be the highest priority in operational decisions for reservoirs used jointly for water supply and recreation. Decisions on recreational use of domestic water supply reservoirs should be consistent with the intent of the source water protection program developed and implemented by the utilities and other responsible parties.

Recreational uses of domestic water supply reservoirs and the land-based infrastructure necessary to support such uses can add sources of microbial, physical, and chemical contaminants to the drinking water produced from the reservoirs. Water utility decisions on permitting recreational uses of water supply reservoirs should consider the following issues: (1) the potential for water quality degradation, (2) the public health risk, (3) the acceptance of such health risk by the customers, (4) the current level of treatment, and (5) additional treatment requirements, uncertainties, and costs that may be incurred. Recreational uses should be prohibited in those instances where a scientifically-based risk assessment, or in the absence of a risk assessment, the best available scientific data demonstrates a probable or imminent degradation of water quality or hazard to public health that cannot be controlled or mitigated in a cost effective manner.

When considering proposals for recreational use of domestic water supply reservoirs, the water utility should work with stakeholders to develop an integrated reservoir management plan, including appropriate water quality monitoring, to evaluate and, if necessary, mitigate water quality impacts and to minimize increased risks. Body-contact recreation (e.g., swimming, waterskiing, wind surfing) and use of gasoline engines on boats should be strongly discouraged because of potential contamination with fecal microorganisms and hazardous chemicals. In addition, boat inspection/washing stations and restrictive use of live bait should be mandated to prevent the introduction of foreign and invasive species (such as zebra mussels or non-native algal species) that could potentially destabilize a reservoir's ecology and water quality. Shoreline recreation such as picnicking, horseback riding and dog walking should be discouraged because contaminants such as feces and trash could be washed into the water supply. Where such recreational uses are allowed, costs for monitoring, evaluations, and mitigation should be borne by those proposing or benefiting from the recreational activity, not by the utility or its customers.

If recreation already exists on a reservoir, the water utility should work or continue to work with stakeholders to develop an integrated reservoir management plan and associated implementation actions to mitigate water quality impacts and to minimize increased risks." Policy adopted by the AWWA Board of Directors June 13, 1971, reaffirmed Jan. 28, 1979, and Jan. 25, 1987, revised June 23, 1996, June 13, 2004, and Jan. 25, 2009, June 2012.

This AWWA policy serves as a useful guide for the evaluation of public uses of WSSC's Patuxent reservoir properties.

WSSC publishes specific regulations for the purpose of preventing contaminants from entering the Rocky Gorge and Triadelphia reservoirs associated with public access. These regulations affect the buffer land owned by WSSC, which is termed the WSSC Watershed [for current regulations see http://www.wsscwater.com/home/jsp/content/watershed.faces]; the regulations do not apply to land within the broader Patuxent River drainage basin (or watershed) that is not owned by the Commission. These regulations also provide for the protection of WSSC's property surrounding the reservoirs against damage from vandalism, fire, and soil erosion, while authorizing the limited use of portions of the reservoir property for fishing, recreational boating, picnicking, hunting, and horseback riding during designated seasons. Users of the watershed (except picnickers) must obtain and carry a WSSC-issued watershed permit which is subject to specific conditions and annual fees for the activity [http://www.wsscwater.com/home/jsp/content/watershed.faces#permitfees].

All recreational uses have the *potential* to negatively impact trails. WSSC is particularly concerned about negative impacts from horseback riding due to connections between horse use and vegetation loss, trail widening, erosion and runoff, muddiness, informal trail development and manure on trails (USFS, 2005). Such impacts could result in water quality impacts, substantial costs for the maintenance and rehabilitation of trails, as well as the need for policing and visitor management programs (USFS 2005).

It is recognized that these recreational opportunities are allowed only to the extent that they do not interfere with the purpose for which the reservoirs were created – that of providing and protecting a valuable regional public drinking water supply. The WSSC regulations explicitly state that:

> *"The WSSC reserves the right, without prior notice, to close a portion of the watershed or close it entirely if the water levels drop to unacceptable levels, or for any other reason that in the WSSC's sole discretion may place the health and safety of the watershed, WSSC's systems or WSSC's customers at risk."*

WSSC has authorized specific recreational trails for shoreline fishing and equestrian use. However, in May 2011 WSSC enacted revised watershed regulations prohibiting equestrian use of all interior trails due to concerns of erosion and water quality impacts, and transferred horseback riding to a 10.1 mile stretch of the WSSC Access Road along the southern perimeter of the WSSC-owned buffer of the Rocky Gorge reservoir. WSSC then authorized EA to conduct reconnaissance-level surveys to inventory existing trails and recreational uses around both reservoirs, and evaluate the potential for reducing water quality impacts to the reservoirs associated with authorized trail uses.

The report sections below present the following:

- Section 2 provides an overview of the Rocky Gorge and Triadelphia reservoirs with discussion of water quality impairments, public uses of the WSSC watershed buffer property, Total Maximum Daily Loads (TMDLs) adopted by Maryland Department of the Environment (MDE) and USEPA, and microbial/parasitic contaminants.

- Section 3 addresses existing WSSC reports and summarizes the field methods used by EA staff to evaluate the condition of the WSSC Access Roads and buffer property trails, and assess their potential for impacting reservoir water quality. Information about the stakeholder meetings is also presented in this section.
- Section 4 discusses the policies and procedures that other regional and national water supply utilities are using to protect drinking water reservoir water quality.
- Section 5 contains detailed descriptions of the nature of the trails and access points surveyed as part of this study.
- Section 6 presents the results and observations of the studies and EA's recommendations for actions that could improve water quality that are consistent with USEPA’s risk prevention guidance.

2 Patuxent Reservoirs Description

WSSC owns and operates two drinking water supply reservoirs, the Rocky Gorge (T. Howard Duckett) Reservoir and the Triadelphia Reservoir. The reservoirs are located in the upper, non-tidal reaches of the Patuxent River (Figure 2-1). WSSC also owns and manages approximately 5,500 acres of reservoir buffer that represents about 5 percent of the total Patuxent River watershed drainage area of approximately 85,000 acres. The buffer areas were purchased during creation of the reservoirs and were fully paid for using funds provided by the WSSC customers for the sole purpose of protecting the reservoirs' water quality and storage capacity. The reservoirs' watershed drainage area exists primarily in Howard and Montgomery Counties, with a small portion located in Prince George's and Frederick Counties. These reservoirs are primarily used as a drinking water supply for more than 600,000 WSSC customers, mostly residing in Montgomery and Prince George's Counties, but also serving a small population within Howard County. A big challenge to protection of these reservoirs is that WSSC controls, via its property holdings surrounding the reservoirs, only 5 percent of the total Patuxent River watershed.

2.1 Rocky Gorge Reservoir and Public Uses

Rocky Gorge Reservoir (basin code 02-13-11-07) is located on the Patuxent River in Howard County, Montgomery County and Prince George's County (Figure 2-2). It was created in 1952 by the construction of the T. Howard Duckett Dam on the Patuxent River. Rocky Gorge Reservoir has a surface area of approximately 773 acres (MDE 2008).

WSSC currently authorizes recreational use in designated areas of its Rocky Gorge property. Approved recreational activities at Rocky Gorge include picnicking, fishing, boating, horseback riding, and hunting. Most recreational activities require a watershed use permit, and are subject to activity-specific and seasonal regulations that are subject to change with or without prior notice.

2.2 Triadelphia Reservoir and Public Uses

The Triadelphia Reservoir (basin code 02-13-11-08) is located on the Patuxent River in Howard County and Montgomery County (Figure 2-3). The reservoir was created by construction of the Brighton Dam in 1943 on the Patuxent River. Located upstream of the Rocky Gorge Reservoir, the Triadelphia Reservoir has a surface area of approximately 800 acres (MDE 2008).

WSSC currently authorizes recreational uses in designated areas of the Triadelphia property. Approved recreational activities at Triadelphia include picnicking, fishing, boating, and hunting. Horseback riding is not currently allowed on WSSC-owned property surrounding the Triadelphia Reservoir. Most recreational activities require a watershed use permit, and are subject to activity-specific and seasonal regulations that are subject to change with or without prior notice.

2.3 Water Quality Impairments and Total Maximum Daily Loads (TMDLs)

There are a number of potential threats to surface waters, some of which include chemicals, animal and human wastes, microbial pathogens, and naturally-occurring substances that can

contaminate drinking water supply sources. WSSC's mission is to provide safe and reliable drinking water in an ethically, environmentally and financially responsible manner.

The Triadelphia and Rocky Gorge Reservoirs are designated by MDE as Use IV-P and Use 1-P waterbodies, respectively (COMAR 26.08.02.08M), and were identified on the State's Clean Water Act §303(d) list as being water quality impaired for nutrients (in 1998); and impacts to the biological community (in 2002 and 2004). In addition, the Triadelphia Reservoir was listed as impaired by sediments in 1998. As a result of these listings, MDE issued a TMDL for the Triadelphia Reservoir to manage loads of phosphorus and sediments, and a TMDL for the Rocky Gorge Reservoir for phosphorus (MDE 2008), which was approved by USEPA in November 2008. The intent of the nutrient TMDL is to reduce high chlorophyll-*a* concentrations that reflect excessive algal blooms, and maintain dissolved oxygen concentrations that support designated uses for aquatic life. The sediment TMDL for Triadelphia is intended to maintain the long-term storage capacity of the reservoir.

Additionally, the Triadelphia Reservoir is also listed by MDE under Category 2 as impaired for mercury (in fish tissue), but no TMDL is required at this time because there are insufficient data to determine if water quality standards are being violated. The 1st through 4th order streams feeding the reservoir are also listed by MDE under Category 2 for biological impairment (fish and benthic IBI metrics, cause unknown), but no TMDL is required at this time because there are insufficient data to determine if water quality standards are not being met (MDE 2011).

Similarly, the 1st through 4th order streams feeding the Rocky Gorge Reservoir are listed by MDE under Category 5 for biological impairment (fish and benthic IBI metrics, cause unknown), meaning that the streams are impaired and a TMDL is required. In 2010 MDE listed the reservoir as impaired for mercury in fish tissues (Category 5) meaning that the waterbody is impaired and a TMDL is required. MDE notes that the "cause is unknown" for these elevated fish tissues (MDE 2011). Note that these §303(d) water quality impairment listings are unchanged in MDE's 2012 draft listing.

Another important issue that must be addressed by water utilities is microbiological contamination from fecal material that is transported into public water supplies from animals and humans. The most notable concerns are: *Crytposporidium, Giardia lamblia,* and the fecal coliform bacteria *Escherichia coli.*

- *Cryptosporidium* is a single-celled protozoan parasite found in lakes and rivers, especially when the water is contaminated with sewage or animal waste. The parasite is protected by an outer shell that allows it to survive outside the host body for long periods of time and makes it very resistant to chlorine disinfection. This parasite is introduced to the environment primarily in fecal matter. While this parasite can be spread in several different ways, exposure via drinking water and recreational waters are the most common methods of transmission. *Cryptosporidium* is one of the most frequent causes of waterborne disease among humans in the United States. It can cause gastrointestinal illness (e.g., diarrhea, vomiting, cramps), and flu-like symptoms. There have been notable outbreaks of *Cryptosporidium* recently. In 2009 an outbreak at a summer camp in North Carolina infected 46 individuals. More recently, in March 2012 there was an

outbreak of cryptosporidiosis infecting 97 individuals who swam at the Edgewater Resort and Water Park in Duluth, MN. While these are relatively recent, the most notable outbreak was in 1993 in Milwaukee, WI that infected over 403,000 individuals and at least 104 deaths that were attributed to the outbreak (MacKenzie 1994, Corso 2003).

- *Giardia lamblia* is a single-celled protozoan parasite that lives in the intestine of infected animals and humans, and is transmitted to the environment via fecal materials. The disease it causes, giardiasis, is most frequently associated with the consumption of contaminated water. The associated ailments caused by *Giardia lamblia* include nausea, cramps and diarrhea that can last as long as 2 weeks. The parasite is protected by an outer shell that allows it to survive outside the host body for long periods of time, and while this parasite can be spread in several different ways, exposure via drinking or recreational waters are the most common methods of transmission.

- Coliforms are a group of bacteria that occur naturally in the environment, and while not usually harmful they are used as an indicator for other potentially harmful pathogens that may be present in drinking waters. Coliform presence, specifically fecal coliforms and *Escherichia coli*, indicate that water may be contaminated with human or animal wastes. *Enterococci* are also a bacterial indicator for fecal contamination. Disease-causing bacteria in fecal wastes can cause illnesses such as diarrhea, cramps, nausea, and may pose a special health risk for infants, young children, and people with weakened immune systems.

Under the Safe Drinking Water Act, USEPA has established numeric standards (Maximum Contaminant Levels, MCLs) in finished drinking waters to ensure that these microorganisms are below levels which have known or expected to be a risk to human health. MCLs for these constituents are presented in 63 Fed Reg 69478-69521 (December 16, 1998). Minimizing the introduction of these microbial contaminants from the adjacent lands into reservoirs is the first barrier in USEPA's multi-barrier approach for source water protection, with successive barriers provided by the water treatment and distribution systems that are designed to produce and deliver safe finished drinking water.

2.4 Water Quality Studies

WSSC conducts a large water quality monitoring program and each year publishes a Patuxent Watershed Annual Report (and an accompanying detailed Supplemental Documentation report) that is posted on WSSC's website. The Annual Reports and Supplemental Documentation for the years 2005 through 2011 are included on WSSC's website at: http://www.wsscwater.com/home/jsp/content/prcireports.faces?pgurl=/Communication/env-reports.html

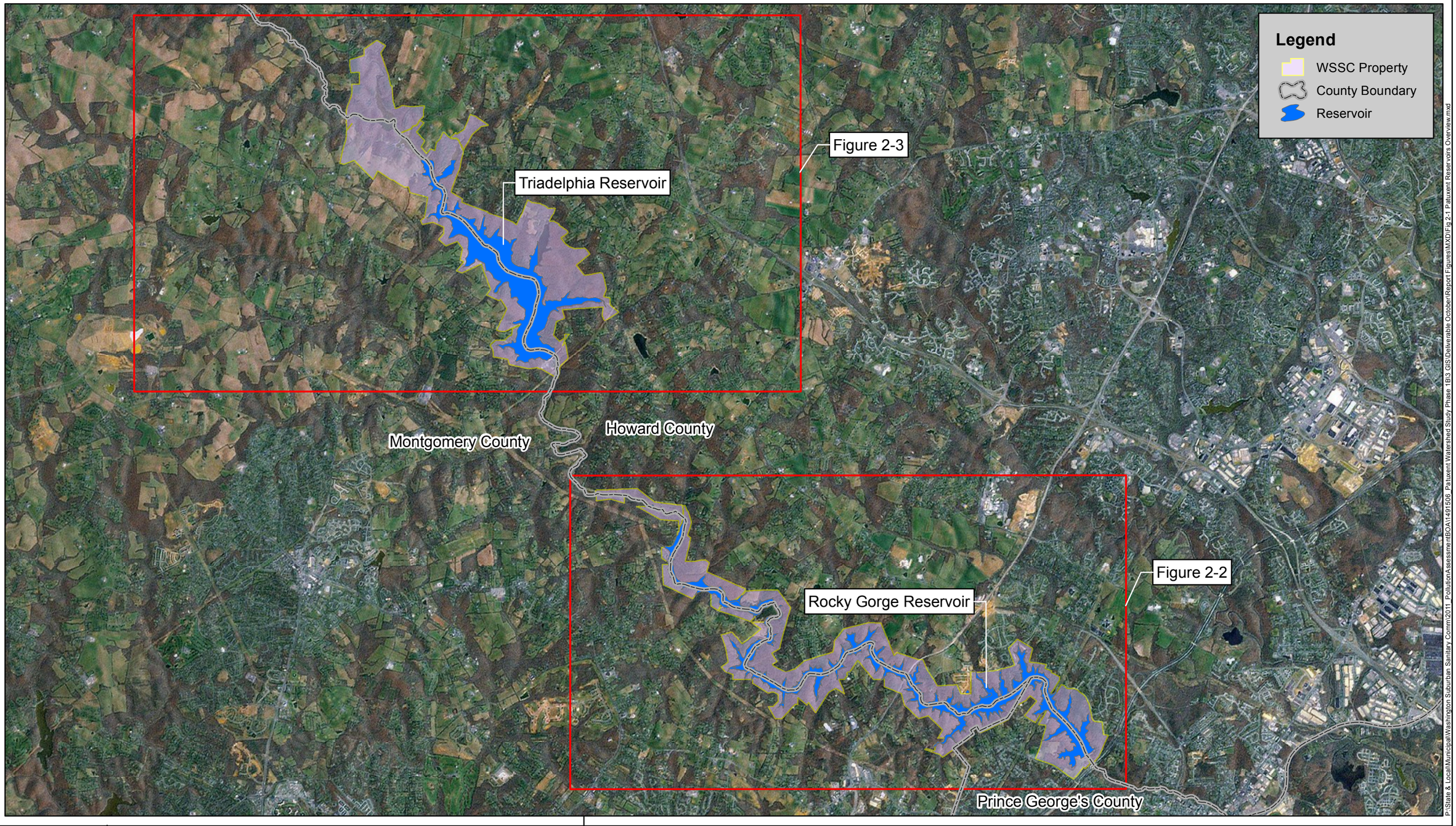
These annual reports present not only water quality measurements, but also address the broad range of environmental studies and actions within the larger Patuxent watershed. Discussion topics typically include: water quality monitoring, habitat and biological studies, stream corridor management, agricultural issues, forestry management, new regulatory issues, public outreach activities, and any other watershed related issues addressed during the calendar year.

WSSC has conducted water quality monitoring of the reservoir for almost 20 years to provide data for technical analyses and long-term trend evaluations to support protection of the reservoirs and drinking water supplies. Typically, three sites on each reservoir are monitored monthly, except during winter months. The reservoirs are monitored for phosphorus, nitrogen, total organic carbon, specific metals, turbidity, and chlorophyll. In addition, in-situ transparency and depth profile measurements of pH, conductivity, temperature, reduction-oxidation potential and dissolved oxygen are performed.

For the 2009 annual report, WSSC's Environmental Group conducted an evaluation of historic water quality data (1993-2008). That evaluation focused on eleven indicators to assess the condition of the Patuxent Reservoirs including: chlorophyll-*a*, dissolved oxygen, total and orthophosphate phosphorous, total nitrogen (Total Kjeldahl, nitrate-nitrite and ammonia), total organic carbon, water transparency (using Secchi depth), chloride, and total algal counts. The eleven indicators were chosen for inclusion in the 2009 report because of their relevance to address required nutrient reductions associated with the TMDLs issued by MDE, and their usefulness to operators at the Patuxent Water Filtration Plant.

2.5 WSSC's Current Watershed Regulations

The watershed user regulations governing the public use of WSSC's Triadelphia and Rocky Gorge Reservoirs are presented on the Commission's website: http://www.wsscwater.com/home/jsp/content/watershed.faces; and in a WSSC produced brochure (dated 2011) which is available at the Brighton Dam Information Center. These two documents detail the permitted activities, prohibited activities, required permits and user fees, and penalties for violating these regulations. They also provide detailed activity-specific requirements for boating and boat mooring, fishing, hunting, picnicking, and horseback riding.



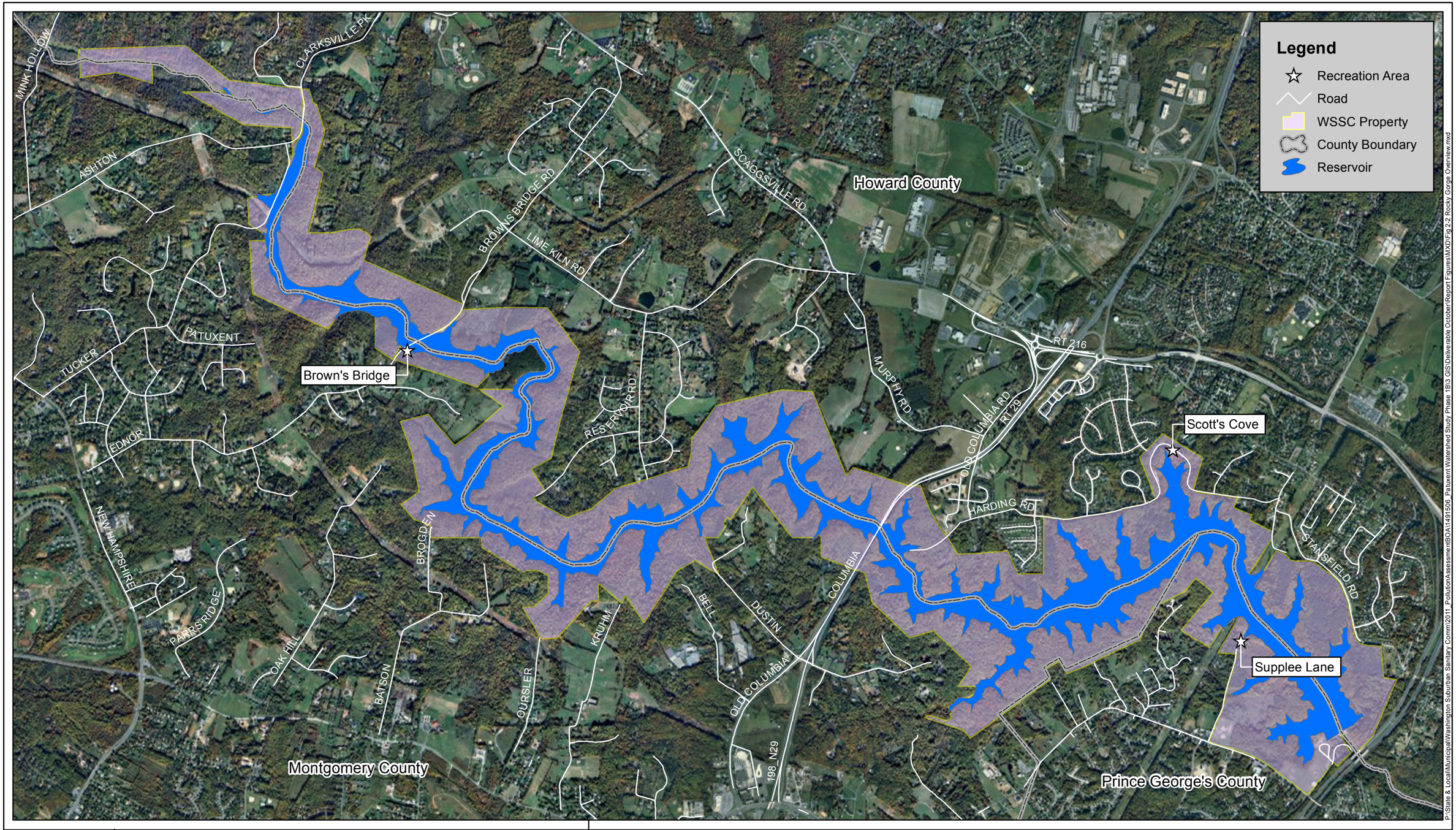
EA Engineering, Science, and Technology, Inc.

Figure 2-1. Patuxent Reservoirs Overview

0 0.5 1 Miles

N W E S

Data Sources:
NRCS SSURGO
WSSC
ESRI Imagery



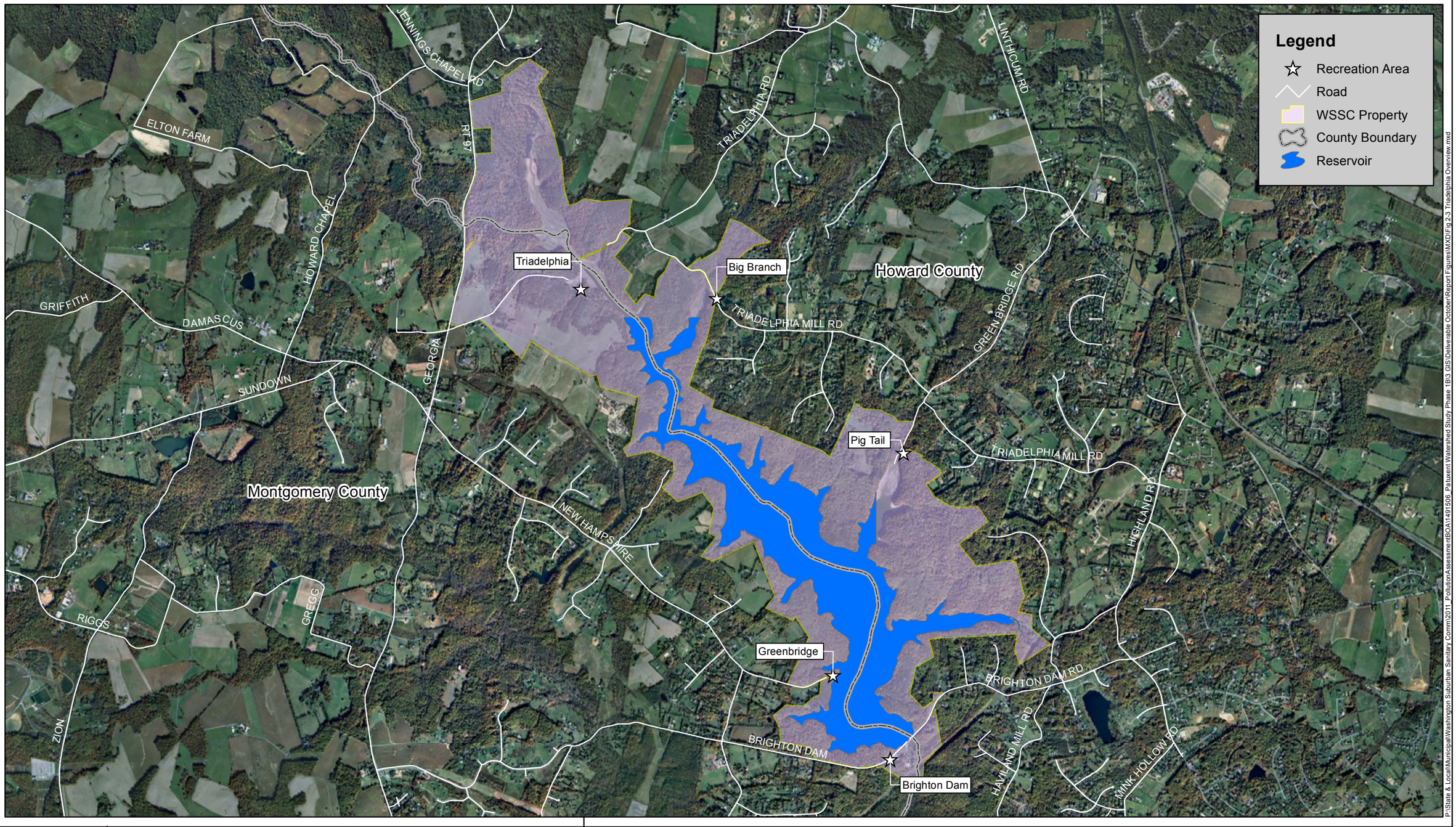
EA Engineering, Science, and Technology, Inc.

Figure 2-2. Rocky Gorge Reservoir Overview

0 0.5 1 Miles

N W E S

Data Sources:
NRCS SSURGO
WSSC
ESRI Imagery



EA Engineering, Science, and Technology, Inc.

Figure 2-3. Triadelphia Reservoir Overview

0 0.5 1 Miles

N W E S

Data Sources:
NRCS SSURGO
WSSC
ESRI Imagery

3 Study Methods and Approach

In March 2012, EA developed a work plan for the study efforts to be conducted as part of this watershed evaluation. The elements of that work plan are briefly described below, and the results of this study are presented in Section 6.

3.1 Review of Existing WSSC Reports and Recreational User Program

EA and Chesapeake Environmental Management (CEM), referred to as the Study Team, reviewed and assessed the following existing information from WSSC.

- Forest Conservation Plan for Washington Suburban Sanitary Commission Reservoir Properties (MDNR 2007)
- Patuxent Reservoirs Interim Watershed Management Report (Versar 2009)
- The Patuxent Reservoirs Watershed Protection Group's (2011) Annual Report
- WSSC's Watershed Recreational User Program (http://www.wsscwater.com/home/jsp/content/wrup.faces)

3.2 Stakeholder Meetings

In cooperation with WSSC, EA conducted two public stakeholder meetings. Separate meetings were conducted for stakeholders of the Rocky Gorge Reservoir (18 June at the Laurel Boys and Girls Club) and the Triadelphia Reservoir (19 June at the Izaak Walton League Wildlife Achievement Center). Stakeholders could attend and speak at either or both of these venues. The purpose of the stakeholder meetings was to:

- present an overview of the study work plan,
- answer questions about the study, and
- listen to and record stakeholder comments and suggestions regarding recreational use of the WSSC-owned lands adjacent to Rocky Gorge and Triadelphia reservoirs and potential impacts to reservoir water quality.

Approximately three weeks prior to the public stakeholder meetings, WSSC placed advertisements in 3 local newspapers and posted news releases on WSSC's website and in community calendars. In addition, WSSC provided EA with several community mailing lists, and email addresses of permit holders that obtained their permits online (https://secure.wsscwater.com/home/jsp/content/wrup.faces). EA sent over 3,500 mailed and 350 e-mail meeting notices to all stakeholders identified in the sources provided by WSSC.

Stakeholders were invited to submit written comments within a 30-day comment period that ended on July 19, 2012.

3.3 Desktop Analysis of Erosion Potential

The Study Team conducted a desktop mapping study of highly erodible soils (HES) surrounding the Patuxent Reservoirs using a Geographic Information System (GIS). The objective of the GIS assessment was to perform a "desktop analysis" to identify soils within the reservoir buffer

property that may be susceptible to erosion. GIS soil type data were obtained from the Soil Survey Geographic Database (SSURGO) for Howard, Montgomery, and Prince George's Counties, Maryland, available from the USDA's Natural Resources Conservation Service (NRCS) Soil Data Mart (Soil Survey Staff 2012). It is important to the note that HES does not represent actual erosion, but merely soils that have a higher potential for erosion. It is possible to have a well-designed trail on HES soil that will not erode, and likewise it is possible for a poorly designed trail on non-HES soil to erode.

The NRCS has developed HES lists separately for each county but they all use a consistent definition of HES based on the COMAR 27.01.01.01 criteria defined as soils with an erodibility factor (Kw) greater than 0.35 and with a slope greater than 5%, or soils with slope greater than 15% (COMAR 2012). The soil erodibility factor Kw represents a soil's inherent susceptibility to erosion, and is experimentally measured as the rate of soil detachment by runoff and raindrop impact (USDA 2012). Factors that affect Kw include soil texture, organic matter content, structure size class, and the saturated hydraulic conductivity of the subsoil (USDA 2012). The Kw does not include other factors that contribute to erosion of roads and trails, such as alignment and types of use (vehicle, horseback riding, etc.).

The HES soil types for Prince George's County were obtained online from the Prince George's County Soil Conservation District (Prince George's County Soil Conservation District 2009). The HES lists for Howard County and Montgomery County were obtained from NRCS. The lists of the HES for each county are presented in Appendix A. Soils marked as UaF (Udorthents, Highway, 0 to 65% slopes) were removed from the mapping, because they correspond to major highways (e.g., Route 29). The HES soils layer was clipped by the trails layer to determine the portion of the buffer property trails that cross HES areas.

High-resolution digital elevation data (1/9 arc-second or approximately 3 meter grid cells) were downloaded from the U.S. Geological Survey's (USGS) National Map Viewer (USGS 2012) in order to examine slope and trail alignment.

3.4 Field Survey of Public Access Areas, Accessible Interior Trails, and WSSC Access Roads

The Study Team conducted a reconnaissance-level survey of the public access areas, authorized recreation trails, and unauthorized trails within the WSSC-owned buffer property of the Triadelphia and Rocky Gorge reservoirs. The objectives of the survey were to:

1. document the condition and suitability of public access points,
2. record global position system (GPS) coordinates of existing public access trails, accessible interior trails, and the WSSC Access Roads,
3. determine the proximity of the trails to the reservoir, and
4. photo-document sections of the recreation trails and WSSC Access Roads with existing erosion, high erosion potential, or water quality impacts (e.g., trash, animal waste, etc.).

The recreation area survey documented features of the recreation areas, including types of permitted recreational uses, available parking, restroom facilities, drainage stabilization criteria,

and potential water quality impacts. The objectives of the public access point survey were to record features related to types of use (picnicking, boating, fishing, and equestrian) and level of use.

The procedure used to evaluate the erosion conditions of the recreation trails and WSSC Access Roads was based on recommendations presented in *Research for the Development of Best Management Practices to Minimized Horse Trail Impacts on the Hoosier National Forest* by U.S. Forest Service and Virginia Tech (March 2005), but adapted for a reconnaissance-level survey due to the time and budget constraints of this study. Trails were mapped on foot or where possible from a 4WD truck. GPS coordinates were recorded using a Garmin® GPSMap 62stc handheld GPS receiver. Locations of the trail with visually obvious signs of erosion, features contributing to a high erosion potential (i.e., steep slope, steep alignment, bare soil or gravel), or water quality impacts were photo-documented. During the trail survey, observations of conditions or practices of neighboring properties that have the potential to adversely impact erosion or water quality were also photo-documented.

Areas of observed trail erosion were characterized as follows:

- High: Area of impact exceeding approximately 50 square feet,
- Medium: Areas of impact of approximately 20 to 50 square feet, and
- Low: Areas of impact of less than 20 square feet.

For all sections of trail designated as impacted, a GPS waypoint and geotagged photograph was recorded for reference.

3.5 Reconnaissance-Level Survey of the WSSC Equestrian Trail

A reconnaissance-level survey was conducted by the EA Team on 4 June 2012 to evaluate the suitability for horseback riding on the 10.1 mile section of the Rocky Gorge Access Road (Montgomery and Prince George's Counties) that is designated by WSSC as the equestrian trail (Appendix B). The survey was conducted by an EA environmental scientist with over 40 years of horse riding experience. The survey was conducted in 4-wheel drive vehicle (where access allowed) and on foot. All sections of the Rocky Gorge Access Road equestrian trail surveyed were evaluated for their suitability for horseback riding, with consideration given to slope, footing, trail clearance, stream crossings, and other potential obstacles or hazards. Observations of trail condition were also made, and areas of extreme erosion or other notable trail conditions were photo-documented. The equestrian trail was evaluated for slope and footing. Reasonable footing for a horse is a natural surface consisting of hard packed earth. A trail road base with crumbling subsoil, loose gravel or cobble-size rocks was considered poor footing for horses. Trail slopes were classified as

- Gentle (<5 degree slope)
- Moderate (5 – 15 degree slope)
- Steep (15 to 25% slope)
- Very Steep (> 25 degree slope).

The survey used a rating scale of 0-5 to generally describe the condition of each trail section. The rating scale (Table 3-1) was developed by EA specifically for the purpose of assessing WSSC trail suitability for horse riding.

TABLE 3-1 RATING SCALE TO ASSESS SUITABILITY OF TRAILS FOR HORSEBACK RIDING

Rating	Description of Prevailing Conditions
5	Excellent horseback riding trail. Terrain flat or moderately rolling. Footing conditions firm and free from loose rocks, deep footing or other impediments. Stream crossings easy with gentle slopes, good footing and no obstacles.
4	Very good horseback riding trail. Terrain moderately rolling with some steeper areas. Footing mostly good, with some areas of loose rock or "deep" footing. Stream crossings moderately easy, with steeper banks, or some obstacles such as rocks, roots or ledges to navigate.
3	Moderate horseback riding trail. Terrain hilly, with several steeper areas to be negotiated. Footing variable, with a mix of good footing interspersed with areas of moderate to poor footing due to rocks, ledges, roots, or bogs. Stream crossings ranging from moderate to difficult with steep ascents, and rocky or deep footing. Some obstacles such as rocks, roots, ledges.
2	Poor horseback riding trial. Significant stretches of steep terrain. Footing poor with an abundance of loose rock, steps, downed trees or logs. Stream crossing difficult with very steep ascents, ledges or drops and rocky or deep footing. Serious obstacles at crossing such as large rocks/boulders, trees or logs, deep gullies or areas of erosion, concrete railroad ties.
1	Unsuitable or potentially unsafe riding trail. Significant stretches of very steep terrain. Very poor footing with significant amounts of loose rock, erosion, gullies, loose soil, deep bogs, downed trees. Stream crossings washed out or impassable.
0	Impassable riding trail. Potentially dangerous conditions over which a horse could not safely travel. Impassable conditions could be caused by extremely steep terrain, extremely poor footing, or impassable stream crossings or obstacles. Risk of injury to horse or rider is high.

4 National and Regional Perspectives and Experience for Water Supply Protection and Recreational Uses of Drinking Water Reservoirs

The AWWA states in its policy on Recreational Use of Domestic Water Supply Reservoirs that the "*protection of public health and drinking water quality should be the highest priority in operational decisions for reservoirs used for both water supply and recreation*" (AWWA 2012). Thus, decisions regarding recreational use of domestic water supply reservoirs should be fully consistent with the intent of the source water protection.

AWWA further recommends that when considering recreational uses of domestic water supply reservoirs, the water utility should develop an integrated reservoir management plan and associated implementation actions to mitigate water quality impacts and to minimize increased risks to accommodate recreational uses of the reservoir. Reservoir management plans should include appropriate water quality monitoring to evaluate and, if necessary, mitigate water quality impacts and to minimize increased risks.

AWWA also recommends several protection and enhancement measures to protect drinking water supply sources including: land purchases, land use planning, zoning, and management practices, security measures and patrols, and identification, investigation and cooperative resolution of pollution issues (AWWA 2010). Additional measures that can be implemented to protect source water include participation in the development of point and nonpoint source pollution regulatory strategies such as permits and source assessments, pollutant source tracking (e.g., microbial source tracking) and public awareness and education.

EA conducted a limited survey of the following national water supply utilities in order to review the range of policy actions that other water supply utilities are taking in different regions of the country to protect reservoir water quality.

- Massachusetts Department of Conservation and Recreation
- Spartanburg Water System, South Carolina
- City of Seattle, Washington

The policies and procedures established by these national water supply utilities to manage reservoir properties and recreational activities are briefly summarized below.

4.1 Massachusetts Department of Conservation and Recreation

The Massachusetts Department of Conservation and Recreation (MDCR) operates a drinking water supply system consisting of four watershed areas, two drinking water supply reservoirs, and a series of intakes and aqueducts. To protect these public water supplies, Massachusetts MDCR implemented a Watershed Protection Act (WsPA). The intent in developing the WsPA was to regulate land use and activities within critical areas of the three main watersheds for the purpose of protecting the quality of drinking water. The Department's WsPA recognizes that it is important to preserve buffer zones around open water, and to limit impervious surfaces over an aquifer.

The WsPA established protective buffers to keep contaminants out of drinking water supplies by developing and enforcing a buffer zone protection policy. This policy recognizes two distinct zones around water supplies and their tributaries.

- The first zone consists of the area within 400 feet of a reservoir, and within 200 feet of tributaries and surface waters. Within this zone, any alteration including construction, excavation, grading, paving, and dumping is strictly prohibited. Additionally, the generation, storage, disposal or discharge of pollutants is also prohibited.
- The second protection zone is between 200 and 400 feet of tributaries and surface waters, and on land within flood plains, over some aquifers, and within bordering vegetated wetlands. Within this zone the alteration of bordering vegetated wetlands, more dense development and other activities are prohibited. Additionally, certain activities are prohibited including outdoor uncovered storage of manure.

In addition to the buffer zone areas noted above, the MDCR also enforces recreational use restrictions, including access for animal companions. The Massachusetts Drinking Water Regulations (310 CMR 22.00) cite strict prohibitions on animals within 100 feet of a public drinking water reservoir and its tributaries. Additionally, State drinking water regulations [310 CMR 22.20B(4)] require that "*No stabling, hitching, standing, feeding or grazing of livestock or other domestic animals shall be located, constructed, or maintained within 100 feet of the bank of a surface water source or tributary thereto*."

Horses are restricted to MDCR's designated roads and trails. The designated roads and trails "*limit access to appropriate locations by prohibiting horses on trails with unbridged stream crossings and within 200 feet of a tributary or source water*", in accordance with MDCR's Master Policy (MDCR, 2009, p.55). The rationale for these buffer distance restrictions is that domestic animal wastes contain fecal bacteria and pathogens, such as *Giardia* and *Cryptosporidium* that can be passed to both human and wildlife populations, and ultimately into public water supplies. In addition to bacterial contamination and potential parasites, domestic animal waste also contains nitrogen and phosphorus which can alter water chemistry and quality. "*Horses also have the potential to alter the runoff characteristics of the landscape, increasing the ability of pollutants to enter the drinking water supply. The WsPA established protective buffers to help keep these contaminants out of the metropolitan Boston drinking water supply*" (MDCR, 2012).

The WsPA regulates land use and acceptable recreational activities within the reservoir watersheds for the purpose of protecting drinking water quality. The Ware River Watershed's Public Management Plan (MDCR, 2011a) lays out strict regulations that address recreational access and rules for many recreational groups including, but not limited to: motorized vehicle use, bicycles, hiking and walking, boating and fishing, camping and access for dogs and horseback riding.

Animal regulations for the Ware River Watershed require that all animal waste be removed or buried more than 100 feet from water. Dogs, horses and other domestic animals are restricted from water access at all times. Some effects of horseback riding include fecal wastes from

horses and their riders and the resulting threat of microbiological contamination and an increase in the sediment/nutrient inputs caused by large numbers or riders on trails, riding off trails, or riding on closed trails (MDCR, 2009). For these reasons horseback riding has been limited to MDCR Designated Horseback Riding Routes which are roads, not trails. Additionally there have been specific restrictions enacted, such as "*no riding during mud season, permit required for group rides of 15 or more, no watering of horses in tributaries*" (MDCR, 2011a, p.15).

In the Wachusett Reservoir Watershed, another Massachusetts water supply, similar restrictions are implemented. However, there is a section of the watershed that is sufficiently hydrologically distant from the reservoir and horseback riding is allowed on an extensive trail system on this property (MDCR 2011b).

MDCR's horseback riding policy takes into account Federal and State regulations for drinking water protection, as well as the local increasing popularity of recreational horseback riding and scientific research on waterborne diseases. The "*Division's policy allows opportunities, given past practices and public input, for horseback riding on designated roads and trails in the Ware River watershed, yet is adequate to restrict microbiological contamination to the drinking water supply source waters*" (MDCR, 2009, p. 54).

The regulations and limitations summarized above have allowed the Massachusetts Water Resource Authority (MWRA) to limit its water treatment and thus save significant capital and operational costs. MWRA's 2005-2010 Report states that its water supply system is one of the few in the nation that is so well protected and of such high quality that USEPA regulations do not require the added treatment step of filtration (MWRA 2010).

4.2 Spartanburg Water System, South Carolina

The Spartanburg Water System (SWS) developed a Buffer Management Plan to implement water protection measures within its watershed and surrounding buffer areas (SWS, 2009). The management plan is in effect for Lake Blalock, its surrounding property owners, and other recreational users. SWS acknowledges that its main purpose is to provide high quality drinking water, but also to provide recreational opportunities such as boating and fishing, and educational opportunities for users of the lake. The Plan sets standards to be applied to all users to help maintain a balance of source water protection and recreational uses.

Lake Blalock's normal surface water elevation is 710 feet above mean sea level (MSL) and as part of the Plan, SWS owns the property up to an elevation of 720 feet MSL around the lake, and in some areas above the 720 foot elevation mark. The amount of buffer land SWS owns laterally extends long distances on gently sloping land and shorter distances on the more steeply sloping lands. Protection of the SWS buffer property is essential for reducing contaminants that may adversely affect water quality. Vegetation is a vital component in SWS's buffer management program, as it provides soil stabilization, reduces surface runoff including sediment and pollutants, and provides wildlife habitat.

Adjoining landowners' access to the lake and SWS buffer property is secondary to protecting the lake as a source of drinking water. Adjoining landowners' access Lake Blalock and the SWS buffer property is strictly by permission from SWS, and access to the reservoir and SWS buffer

property is granted with the understanding that SWS can terminate that access if it is determined necessary to effectively manage the water supply and buffer lands.

Most of the buffer owned by SWS is wooded and there are many restrictions implemented to protect the vegetation. The vegetation management plan addresses the protection of trees, canopy, shrubs and understory, lawns, and the use of herbicides, fertilizer and pesticides. Invasive species and threatened species are also part of SWS's management plan.

Recreational use in the buffer zone is limited and allowed by permit access only. Any and all pathways used for access, walking or other uses must be pre-approved and compliant with SWS Policies (see Lake Blalock Buffer Management Plan 2009). Modifications to vegetation, grading and the addition of impervious structures are not permitted. All boats must be launched from permitted docks or at the public landing. The use of motorized vehicles is not permitted except for use in buffer restoration. The use of best management practices (BMPs) is encouraged for erosion and sediment control as well as for land development. Having a garden or livestock (including cows, horses, goats, and chickens) is not allowed within the buffer. Additionally, pet kennels, fences, pens, dog houses and enclosures are also not allowed within the buffer.

There are general land use maintenance regulations in place for adjacent land owners and buffer zone recreational users. These regulations include no camping and no fires, as well as banning the use of fish attractors. For adjacent land owners, SWS's buffer plan prohibits the use of herbicides, pesticides or other chemicals (including fertilizers) within the buffer. Residents are encouraged to maintain their septic systems and have properly managed stormwater systems that do not drain onto the buffer land.

To assure adjoining landowner compliance with the Plan, landowners must obtain a Landowner Access Permit. The Landowner Access Permit allows the landowner and their family (as well as guests) to passively use and enjoy the buffer land, access to the lake, and grants other rights specifically authorized in the Plan. Owning a valid Landowner Access Permit is required for all other permits and authorizations granted to the landowners. By maintaining the Landowner Access Permit, the landowner agrees that they will abide by the terms of the Buffer Management Plan, and will adhere to the SWS Policies and Procedures for Use of Water Supply Reservoirs for any activities that involve the buffer property. It also requires landowners to be responsible for any costs, damages, or penalties that result from violations of the Plan, or any permits granted under it. Similarly, all other users who wish to gain access to the SWS buffer property are required to obtain a permit before conducting activities within the buffer.

Any individual who does not obtain appropriate permits and prior authorization from SWS, or who violates the conditions of the permit, are subject to enforcement procedures which include fines, required restoration, permit revocation/denial, or other enforcement means as required and provided for by law. Enforcement of the buffer lands is handled by Lake Wardens who have State authority to issue citations.

4.3 City of Seattle, Washington

As stated above, the MWRA's five year report for 2005-2010 stated that its water supply system is one of the few in the nation that is so well protected and of such high quality that USEPA

regulations do not require the additional treatment steps of coagulation and filtration, and thus providing for substantial capital and operational cost savings.. The same can be said for the City of Seattle, Washington's water supply. The City has taken perhaps the strongest measure to ensure its source water protection by prohibition of agricultural, industrial, and recreational activities in (and residential use of) its entire 90,000-acre watersheds that supply its drinking water (NRDC, 2003, p. 39). "*This vigorous protection program means there is little opportunity for contaminants to enter the water*" (SPU, 2009).

Seattle's water comes primarily from two watersheds in the Cascade Mountains which are publicly owned by the Seattle Public Utilities (SPU). The main source of water comes from the Cedar River Watershed, an unfiltered surface water supply located about 35 miles east of downtown Seattle near North Bend. "*To protect the quality of the water from this unfiltered source, Seattle Public Utilities actively enforces the "closed status" of the 91,000-acre Cedar River Municipal Watershed. Guided tours and in-depth programs led by experienced Watershed educators and guest presenters provide a rare and exciting glimpse into this hidden gem*" (SPU, 2012, p. 5).

SPU has also begun replacing its open reservoirs with underground structures. The so-called "underground reservoirs" are intended to improve the quality and security of the water supply system. These covered areas provide new public spaces on the reservoir "lids" throughout Seattle which can be used for open recreation. The City plans to bury or decommission all remaining uncovered reservoirs by 2013. [http://www.seattle.gov/util/MyServices/Water/WaterSytemProjects/ReservoirCovering/index.htm]

Personal communication with a SPU scientist indicated that horses are allowed to use a small part of SPU land which is not in the watershed, and does not drain to the drinking water reservoirs. However, horses are not allowed on SPU property that is within the reservoir's watershed.

4.4 Additional Reservoir Policies and Best Management Practices

Review of the current literature has identified other watershed protection programs that provide insight into what municipalities and utilities are doing to protect drinking water quality. These are briefly summarized below.

Baltimore County, MD has established detailed regulations for the protection of water quality, streams, wetlands and floodplains (Baltimore County Code, Article 33, Title 3). Key provisions related to the protection of surface waters using forest buffers include:

- For a Designated Use I or I-P stream (i.e., water used for public water supply), the forest buffer shall be the greater of the following:
    - Seventy-five (75) feet,
    - Twenty-five (25) feet from the outer wetland boundary, or
    - Twenty-five (25) feet from the one hundred-year floodplain reservation or easement boundary.

- For Designated Use III, III-P, IV or IV-P streams (natural and recreational trout waters), the forest buffer shall be the greater of the following:
    - One hundred (100) feet,
    - Twenty-five (25) feet from the outer wetland boundary, or
    - Twenty-five (25) feet from the one hundred-year floodplain reservation or easement boundary
- There are additional County forest buffer standards and requirements for steep slopes (>10%) and highly erodible soils (K values >0.24) [§33-3-111(c)]
- Other County management requirements for forest buffers:
    - The existing vegetation within the forest buffer shall not be disturbed
    - Soil disturbance shall not take place within the forest buffer by grading, stripping of topsoil, plowing, cultivating, or other practices
    - Filling or dumping shall not occur within the forest buffer
    - Except as permitted by the Department, the forest buffer shall not be drained by ditching, underdrains, or other drainage systems
    - Pesticides shall not be stored, used, or applied within the forest buffer, except for the spot spraying of noxious weeds consistent with the recommendations of the University of Maryland Cooperative Extension Service
    - Animals may not be housed, grazed, or otherwise maintained within the forest buffer
    - Motorized vehicles shall not be stored or operated within the forest buffer, except for maintenance and emergency use approved by the Department
    - Materials shall not be stored within the forest buffer

Source: Baltimore County - Baltimore County Code, Article 33, Title 3 Protection of Water Quality, Streams, Wetlands and Floodplains.
[http://resources.baltimorecountymd.gov/Documents/Environment/eir/forestbufferregs.pdf]

City of Baltimore, Maryland – for Loch Raven, Prettyboy, and Liberty Reservoirs

The City of Baltimore owns the three reservoirs located in Baltimore County (a portion of one is also in Carroll County) and operates the central regional water system that supplies finished water to approximately 1.8 million people in the City and five surrounding counties. The "Reservoir Watershed Management Agreement of 2005" was signed to ensure that the three reservoirs and supporting watersheds will continue to provide high quality raw water for the Baltimore metropolitan area. Buffer requirements for these three reservoirs are not clear from the literature consulted by EA. For the Baltimore County properties, the buffer distances (noted above) apply. Loch Raven and Prettyboy Reservoirs are designated by MDE as Use III-P waters therefore the >100 foot buffer would apply (see above). Liberty Reservoir is designated as Use I-P, therefore the >75 foot buffer guidance (described above) would apply. For Carroll County bordering lands, a 100 foot buffer applies. [Source: Baltimore Metropolitan Council, 2000.]

The City of Baltimore allows certain types of recreational activities with some use restrictions for its three reservoirs. Fishing, boating, picnicking, hiking, mountain biking, and horseback riding are allowed at Loch Raven Reservoir. Birding, hiking, boating and horseback riding are allowed at Liberty Reservoir. Seasonal managed hunting with many associated enforced regulations is also allowed at Prettyboy and Loch Raven reservoirs. In addition to hunting, hiking, horseback riding, nature photography, and bird watching are allowed at Prettyboy Reservoir.

The City of Baltimore watershed regulations governing the three reservoirs are presented in: http://publicworks.baltimorecity.gov/Portals/publicworks/documents/Watershed%20Regulations.pdf. The regulations concerning horseback riding are quoted below:

> "*Horseback riding is permitted on the unpaved fire roads ONLY. There are over 200 miles of such roads on the three Water Quality Management Areas. Horseback riding is not permitted in areas where the public normally congregates. More specifically, riding is banned in the following areas: picnic areas; along paved roads (except where necessary to reach fire roads); parking lots; police pistol ranges; Pine Ridge Golf Course property; The Loch Raven Skeet and Trap Center; maintenance facility areas; boat dock areas; below the high water line or in the reservoirs and tributary streams; shortcutting between fire roads is prohibited; when the roads are wet or muddy; within the reservoir lakes; and through wetlands or other environmentally sensitive areas.*"

Note that the City is currently working to resolve issues with mountain bikers using unauthorized trails at Loch Raven Reservoir that were developed within sensitive areas of the City-owned forest buffer around the reservoir.

Maryland Department of Agriculture – Changes to Nutrient Management Regulations

In May 2012, Maryland's Department of Agriculture (MDA) issued proposed changes to the State's nutrient management regulations, based on "*recommendations of a University of Maryland scientific panel as well as concerns raised by environmental, agricultural and municipal stakeholders*." The revised nutrient management regulations are effective as of October 15, 2012, and are designed to achieve consistency in the way all sources of nutrients are managed and help Maryland meet nitrogen and phosphorus reduction goals. Although these proposed changes do not directly address reservoir shoreline or buffer land protection as applied to the Patuxent (or Baltimore) reservoirs, there is useful and current information contained in the document. For the latest supplement of the Nutrient Management Manual see: http://www.mda.maryland.gov/pdf/finalnmregs.pdf

When discussing nutrient application setbacks from surface water resources, the proposed regulations offer the following requirements assuming a vegetated buffer or riparian forested buffer is present (which is not typically the case around the Patuxent reservoirs):

- Application of crop nutrients using a broadcast spreader (e.g., spinners or slashers) requires a 35-foot setback from the edge of surface water.
- Pastures and hayfields are subject to a 10-foot nutrient application setback.

- Livestock shall be excluded from the setback to prevent direct deposition of nutrients within the setback.
- Operators are responsible for sediment and erosion control of livestock stream crossing areas.

Regarding “temporary field stockpiling (staging) for stackable organic nutrient sources” (e.g., horse manure and poultry litter piles), MDA’s proposed regulations offer the following requirements:

- If a vegetated buffer is not in place, at least 100 feet from any surface water and any irrigation or treatment ditch.
- At least 100 feet from wells, springs and wetlands.
- At least 200 feet from any residence outside the operator’s property.
- Material shall be field stockpiled temporarily in a manner that prevents nutrient runoff.

Although this proposed regulatory guidance is focused solely on nutrient management to protect water quality (not microbial contamination), and does not address recreational activities such as horse trails or dog walking, it does provide additional useful guidance on the protection of water quality from nutrient applications adjacent to surface waters.

US EPA's Model Surface Water Ordinance

USEPA produced a guidance document with general information on stream and shoreline buffers to serve as general guidance for communities. The language in the model came from enforced ordinances which were in place at the time. According to the USEPA Ordinance website (http://www.epa.gov/owow/NPS/ordinance/osm7.htm), there were five (5) surface water ordinances in effect for areas within Nevada, Minnesota, North Carolina, Virginia and New York. Language from the Model Ordinance includes:

- "Stream and shore buffer widths vary from twenty feet to up to 200 feet in ordinances throughout the United States. Since this ordinance is for reservoirs that supply public drinking water, the larger buffer width of 200 feet would be more appropriate."
- "The buffer strip shall be maintained in its natural state to the maximum extent possible, and shall be planted with an erosion resistant vegetative cover in those areas that have been disturbed."
- A “buffer strip shall be maintained along the edge of all public water supply reservoirs and any tributary stream discharging into these reservoirs.”
- “The following uses shall not be permitted within the buffer strip or within [blank] feet of the required buffer strip:
    - septic tanks and drainfields;
    - feed lots or other livestock impoundments;
    - trash containers and dumpsters which are not under roof or which are located so that leachate from the receptacle could escape unfiltered and untreated;

    - fuel storage in excess of fifty (50) gallons [200L];
    - sanitary landfills;
    - activities involving the manufacture, bulk storage or any type of distribution of petroleum, chemical or asphalt products or any materials hazardous to a water supply (as defined in the Hazardous Materials Spills Emergency Handbook, American Water Works Association, 1975, as revised)"
- "A reduction in the required buffer width down to an absolute minimum of seventy-five feet (75') may be granted by the [local governmental authority] upon presentation of an impact study that provides sufficient documentation and justification that even with the reduction, the same or a greater degree of water quality protection would be afforded as would be with the full-width buffer."

Source: USEPA Model Surface Water Ordinance:
http://water.epa.gov/polwaste/nps/upload/Model_Surface_Water_Ordinance.pdf

Other Buffer Information
In addition to source and drinking water protection, we also looked into protection of streams for general environmental protection. We looked into other source water protection measures to get an understanding of distances mandated for protection of source waters in several areas. Examples include:

Lane County, Oregon has implemented the following BMPs to protect water quality:
- Riparian setback of 50 feet along streams
- Non-impact forest lands, impacted forest lands and exclusive farm use zones will have 100 foot setback
- Restrict development in riparian areas

Source: EWEB Source Water Protection Project: Best Management Practices and Model Ordinance Review. June 2009. p. 7
http://www.lanecounty.org/departments/pw/lmd/landuse/documents/flood_dwp/cpw%20bmp%20report_final.pdf

County of York, Virginia – Watershed Management and Protection Area Overlay Zone:
- "A two hundred foot (200') [60m] wide buffer strip shall be maintained along the edge of any tributary stream or reservoir. The required setback distance shall be measured from the centerline of such tributary stream and from the mean high water level of such reservoir. Such buffer strip shall be maintained in its natural state or shall be planted with an erosion resistant vegetative cover."
- "The following uses shall not be permitted within the buffer strip required above or within five hundred feet (500') [150m] of the required buffer strip:
    - septic tanks and drainfields;
    - feed lots or other livestock impoundments;

- trash containers and dumpsters which are not under roof or which are located so that leachate from the receptacle could escape unfiltered and untreated;
- fuel storage in excess of fifty (50) gallons [200L];
- sanitary landfills;
- activities involving the manufacture, bulk storage or any type of distribution of petroleum, chemical or asphalt products or any materials hazardous to a water supply"

Source: County of York, VA Article III. Districts Division 7. Overlay Districts Sec. 24.1-376. WMP-Watershed Management and Protection area overlay district.
http://www.epa.gov/owow/NPS/ordinance/documents/york_va.pdf

Marquette County, Michigan – Model Riparian Buffer Implementation Plan:

- "Buffer of 50 feet in total width recommended for both sides of a stream
  - Zone 1 - The Streamside Zone: 25' from the stream's edge. The first 25' are responsible for protecting the physical and ecological integrity of the stream system. This zone has critical importance in protecting water quality.
  - Permitted Activities in Zone 1:
    - Footpaths
    - Road crossings
    - Utility right-of-ways
    - Flood control structures
    - Restricted Activities in Zone 1:
    - Removal of existing vegetation (except where necessary to accommodate permitted uses)
    - Soil disturbance (grading or filling)
    - Use of pesticides or fertilizer
    - Presence of livestock
    - Use of motorized vehicles
    - Construction of permanent structures"
- "Zone 2 - The Outer Zone: Begins at the edge of Zone 1 and extends out another 25 feet. Its primary purpose is to protect the streamside zone and to provide distance between the streamside zone and any upland development. While the retention of the natural vegetation is encouraged, some management is allowed.
  - Permitted Activities in Zone 2:
    - Removal of mature tree cover (retention of shrub layer and herbaceous groundcover is required to allow for infiltration of run-off)
    - Bike paths
    - Stormwater management facilities
    - Approved recreational uses
    - Restricted Activities in Zone 2:

        - Soil disturbance (grading or filling)
        - Use of pesticides or fertilizer
        - Presence of livestock
        - Construction of permanent structures"
- "Increase the size of vegetative riparian buffers on lands with steep slopes. Increase buffers an additional 10 feet on 15% - 17% slopes, and up to an additional 70 feet on slopes > 25%"
- "Regulate certain land uses designated as potential water pollution hazards, and must be set back from any stream or waterbody by the distances indicated below:
    1. Storage of hazardous substances - (150 feet)
    2. Above ground or underground petroleum storage facilities - (150 feet)
    3. Drainfields from onsite sewage disposal and treatment systems (i.e., septic systems) - (100 feet)
    4. Raised septic systems - (250 feet)
    5. Solid waste landfills or junkyards - (300 feet)
    6. Confined animal feedlot operations - (250 feet)
    7. Subsurface discharges from a wastewater treatment plant - (100 feet)
    8. Land application of biosolids - (100 feet)"

Source: A Model Riparian Buffer Implementation Plan. Developed for local units of government in the Upper Peninsula of Michigan with an emphasis on protecting water quality and quality of life. A Simple, Low-cost Great Lakes Protection Tool. July 2003. http://www.superiorwatersheds.org/images/riparianbufferreportnew.pdf

New Jersey Department of Environmental Protection – Riparian Zone Model Ordinance:

- "Riparian zones shall be 50 - 300 feet wide along both sides of water
- Where steep slopes (> 15 percent) are located within the designated widths, the riparian zone shall be extended to include the entire distance of this sloped area to a maximum of 300 feet
- Extend the riparian zone to cover the entire floodway in areas where the floodway has been delineated per the Flood Hazard Area Control Act or the State's adopted floodway delineations
- Riparian zone areas shall remain in a natural condition or, be restored to a natural condition.
- Restricted activities within these zones include:
    - clearing or cutting of trees and brush, except for removal of dead vegetation and pruning for reasons of public safety or for the replacement of invasive species with indigenous species.
    - altering of watercourses
    - dumping of trash, soil, dirt, fill, vegetative or other debris
    - regrading or construction

    - no new construction, development, use, activity, encroachment, or structure shall take place in a riparian zone, except as specifically authorized
- Permitted activities include:
    - passive recreation areas of public and private parkland
    - hiking, bicycle and bridle trails, provided that said trail have been stabilized with pervious materials"

Source: NJDEP's Riparian Zone Model Ordinance. July 2008.
http://www.nj.gov/dep/wqmp/docs/riparian_model_ordinance.pdf

4.5 Summary and Findings

Numerous municipalities and states have implemented legislation, regulations, policies and practices defining land uses, recreational restrictions, and riparian buffers as a means of source water protection. These range from Seattle where there is no recreational or commercial use allowed within the entire reservoir's watershed area, to watersheds where shoreline buffers may range from 50-100 feet with minimal restrictions. It is clear, however, that there are no consistent recommendations or guidance for what restrictions are required to reasonably achieve source water protection. Nevertheless, the existence of such restrictions acknowledges the special protection that is afforded to drinking water supply sources.

Distance restrictions (buffer setbacks) for recreational horseback riding, dog walking and other animal activities have not been identified that could be directly applied to the Rocky Gorge and Triadelphia Reservoirs. AWWA recommends (see Section 1) that shoreline access for such animal activities "should be discouraged" but does not indicate what form of discouragement or separation from the shoreline could be determined. Appropriate criteria for setbacks would be expected to vary nationally for each region based upon surficial soil characteristics, slopes, runoff characteristics for storm types, amount and type of activity, and seasonal wet weather concerns.

The information reviewed would obviously suggest that a larger buffer would be more protective than a smaller buffer, and that properly designed and maintained roads and trails which minimize erosion and runoff are necessary to protect proximate water resources. Although they do not currently exist, shoreline buffer requirements could be developed for the WSSC buffer properties based upon the overall guidance presented above, which might dictate minimal distances for all fishing and horse trails, as well as specifying required characteristics (BMPs) for the design of all future buffer area improvements.

5 Descriptions of Trails and Access Points

5.1 Results of GPS Trail Mapping

In cooperation with WSSC, naming conventions were adopted to summarize the GIS mapping data and subsequent text discussions. The trail naming conventions are presented in Table 5-1.

5.1.1 Summary of Rocky Gorge Reservoir Trail Mapping

Figure 5-1 presents an overview of the GPS trail mapping for the Rocky Gorge Reservoir. Approximately 21.2 miles of WSSC Access Road were mapped around the Rocky Gorge Reservoir, of which a portion has been designated by WSSC for equestrian use (designated equestrian trail). The designated Access Road equestrian trail extends from Supplee Lane to Tucker Lane, and is approximately 10.1 miles in length.

In addition to the WSSC Access Road, approximately 28.2 miles of shoreline and interior trails were mapped in the Rocky Gorge Reservoir buffer property. Of these 28.2 miles of actively used trails mapped, only 1.7 miles of shoreline trail is currently authorized by WSSC for shoreline fishing, and 0.3 miles serves as public access at Scott's Cove Recreation Area. The remaining 26.2 miles of shoreline and interior trails are not authorized by WSSC for any recreational use. A summary of the mapping data collected by EA for the Rocky Gorge Reservoir buffer property is presented in Table 5-2. Individual trail segments are discussed below.

5.1.1.1 Rocky Gorge Shoreline Trails

Tucker Lane
The shoreline fishing trail (Figure 5-2) is accessed at Tucker Lane and runs south along the west bank for approximately 0.4 miles. The trail width was between 2 to 3 feet. Motorcycle and ATV tracks were observed on the trail. Localized bank erosion caused by accessing the edge of water was also observed. The following safety issues were identified:

- fallen trees 2 to 3 feet off the ground creating tripping hazard (Photo 5-1), and
- a hole in the trail due to slope failure that created a trail width of less than a foot (Photo 5-2).

Brown's Bridge at Ednor Lane
The Brown's Bridge Recreation Area at Ednor Lane has access to shoreline fishing trails that run both east and west of the access area.

The trailhead for the shoreline fishing trail running west is located at the west side parking area about 500 feet from the shoreline. The designated shoreline fishing trail runs northwest toward the shoreline for approximately 0.3 miles, but an unauthorized trail continues for another 0.2 miles (Figure 5-2). The trail is generally 2 to 3 feet wide. Horse tracks and manure were observed on the trail, indicating an unauthorized recent recreational use. In several areas on this trail, horseback riding has ripped out vegetation at the roots and displaced soil material causing slope and channelized erosion (Photo 5-3 and Photo 5-4).

The trailhead for the shoreline fishing trail running east is located on the east side parking area leading to the boat ramp. The designated shoreline fishing trail runs east along the shoreline for approximately 0.1 miles, but an unauthorized trail continues for another 0.5 miles (Figure 5-2).

Supplee Lane Recreation Area
A shoreline trails run both east and west from the Supplee Lane Recreation Area (Figure 5-3). The shoreline fishing trail on the west trail segment runs for about 0.1 miles, but an unauthorized trail continues for another 0.6 miles. Fishing equipment packaging and beer cans/bottles were found along the trail (Photo 5-5). Localized bank erosion caused by accessing the edge of the water was observed. The shoreline trail connects to an old horseback riding trail (Terry Ledley Equestrian Trail) after 0.5 miles from the public access point, but then continues as an unauthorized trail. East of the public access area, the shoreline fishing trail runs for about 0.1 miles. An unauthorized shoreline trail continues for about 1.5 miles, and has substantial bank erosion (Photo 5-6).

Brown's Bridge Recreation Area - North Bank
This trail originates from the closed Brown's Bridge Recreation Area on the north bank of Rocky Gorge Reservoir (Howard County) on Brown's Bridge Road (Figure 5-2). The unauthorized shoreline trail is approximately 2 to 3 feet wide, and runs west along the shoreline for approximately 0.3 miles. There was fishing-related and other assorted trash on the trail. There is some localized bank erosion in areas that appear to be used for fishing. Motorcycle tracks at the beginning of the trail have caused rutting on the fairly steep slope (Photo 5-7) indicating unauthorized recreational access to WSSC buffer property.

The eastern shoreline fishing trail segment runs for approximately 1 mile on flat to moderate slopes, and is 2 to 3 feet wide. There is moderate erosion near the beginning of the trail where exposed roots were observed (Photo 5-8), and about half-way along the trail where the shoreline has a collapsed area of red soil (approximately 20×7×3 feet in size) (Photo 5-9). An overflowing trashcan was also observed in an unauthorized trail segment near the shoreline (Photo 5-10).

Scott's Cove Recreation Area
A shoreline trail runs both east and west from the Scott's Cove Recreation Area (Figure 5-3). This trail segment provides shore access for fishing and canoe launching, and contains a canoe storage area along the shore.

The west trail segment runs for about 1.2 miles, but only 0.2 miles are authorized for use. Fishing and other assorted trash was occasionally found along the trail (Photo 5-11). Horse manure was also found on the trail, indicating recent unauthorized recreational use (Photo 5-12). Localized bank erosion, caused by accessing canoe parking/storage and edge of water for fishing, was observed. The trail is currently stable, and in good condition, with the exception of several areas of erosion near the petroleum pipeline utility access (Photo 5-13). The east trail segment runs for about 0.8 miles, with only 0.2 miles being authorized for use.

5.1.1.2 Rocky Gorge Interior Trails

Terry Ledley Equestrian Trail
A supplemental reconnaissance-level survey was conducted by EA on 4 June 2012 to evaluate a 3.5 mile section of the Terry Ledley Equestrian Trail (Appendix B; and Photo 5-14) for horseback riding. This trail is no longer authorized by WSSC for public use, including horseback riding. The 3.5 mile section of the Terry Ledley Equestrian Trail is well aligned with the natural topography, has gentle slopes, and was determined to be in excellent condition for use by horses. The footing was observed to be firm and generally free from rocks, loose footing or deep footing. Two stream crossings were encountered consisting of gradual bank descents into a shallow stream. The footing was good at both crossings, comprised primarily of sand, gravel and some cobble, and there was little evidence of erosion at either of the stream crossings (Photo 5-15). In EA's observation, this 3.5 mile section of the Terry Ledley trail is an excellent horseback riding trail and was given a rating of 5. The trail typically runs between 75 feet to 100 feet from the shoreline, but gets as close as 50 feet from the shoreline in certain segments (Photo 5-16).

The entire Terry Ledley Equestrian Trail was subsequently mapped and is shown in Figure 5-3, which also shows the locations of observed localized erosion on the trail as defined in Section 3.4. The entire Terry Ledley trail is approximately 5.8 miles in length, and extends from Supplee Lane to Route 29, where it joins the Pat Oliva trail discussed below.

Pat Oliva Equestrian Trail
The Pat Oliva trail is another old horse trail located on the Montgomery County portion of the WSSC's Rocky Gorge buffer property. This trail is located on the southwest side of the reservoir extending from the south side of the Route 29 Bridge to the WSSC Access Road north of Brogden Road just before the end of Link Road (Figure 5-2). The trail runs parallel the shoreline for approximately 6.1 miles, typically running within 50 feet of the shoreline (Photo 5-17). There are trail spurs that link to the Rocky Gorge Access Road, and spurs that link to the reservoir shoreline. The trail width ranges from about 1 to 6 feet, with a typical width of 3 feet. Most of the trail surface consists of exposed soil, rock, and leaf litter. The trail slope is typically low to flat slope (<10 percent trail grade) (Photo 5-18), but has short segments with trail slopes as steep as 19 percent. Sections of the Pat Oliva trail are unstable and eroded due to poor alignment (e.g., Photo 5-19), or due to channelized erosion (Photo 5-20 and Photo 5-21). Soil erosion is also evident at muddy stream crossings (e.g., Photo 5-22). Horse tracks were found throughout the trail, and in some areas have resulted in small areas of disturbed soil (Photo 5-23). Horse manure and trash were found throughout the trail. Location of observed erosion on the Pat Oliva Trail and spurs are shown in Figure 5-2.

5.1.1.3 Rocky Gorge WSSC Access Road

Maps of the Rocky Gorge WSSC Access Road are shown in Figure 5-4 and Figure 5-5. In May 2011, WSSC designated the portion of the Access Road extending from Supplee Lane (Prince George's County) to Tucker Lane (Montgomery County), approximately 10.1 miles, for recreational use as an equestrian trail. As described in Section 3.5, EA conducted a reconnaissance-level survey to evaluate the suitability of the designated equestrian trail for

horseback riding. The location of the designated equestrian trail is presented in Map 1 of Appendix B. The Field Visit Report for the equestrian trail survey is included as Appendix B.

The sections of the WSSC Access Road that have been designated for recreational use are summarized below in six sections. The equestrian trail was evaluated for slope and footing as described in Section 3.5.

Section 1 – Tucker Lane Access to Ednor Road Access
This Access Road section is characterized by steep terrain, with several significant stretches of very steep terrain where the Access Road goes up and down steep hillsides, and stormwater runoff has created substantial areas of serious erosion, gullies and washouts. The footing in these areas is poor, primarily consisting of loose boulder to cobble-size rock, interspersed with areas of crumbling subsoil and bedrock. This section was given a rating of 1 defined as an unsuitable or potentially unsafe riding trail. Most of this segment of Access Road could not be traveled by EA's 4 wheel drive vehicle.

Section 2 – Ednor Road Access to Brogden Road Access
The Access Road section near Ednor Road climbs a very steep hill, where steep terrain, combined with erosion and poor footing conditions make the trail very difficult to travel on horseback or 4 wheel drive vehicle. The footing in these areas is primarily loose cobble-size rock, interspersed with areas of crumbling subsoil and bedrock. This section was given a rating of 2 defined as a poor horseback riding trial.

Section 3 – Brogden Road Access to Batson Road Access
The terrain along this short section of the Access Road has moderate slope with a few areas of steep terrain, with reasonable footing. There were a few areas of rocky footing, but nothing that would be an impediment to horses. This section was given a rating of 3 defined as a moderate horseback riding trail.

Section 4 – Batson Road Access to Kruhm Road Access
The terrain along this section of the Access Road is moderate, with a few areas of moderately steep terrain, with reasonable footing. This section was given an overall trail rating of 3 defined as a moderate horseback riding trail.

Section 5 – Kruhm Road Access to Burtons Lane Access
Section 5 was not surveyed in its entirety due to limitations of access and time. The terrain along this section of the trail appears to be mostly moderate, with a few areas of moderately steep terrain, with reasonable footing. There were a few areas of rocky footing encountered, but nothing that would be an impediment to horses. This section was given an overall trail rating of 3 defined as a moderate horseback riding trail. However, there is a section of road that has been washed out due to a failed culvert (Photo 5-24, Photo 5-25, and Photo 5-26), which makes that portion of the road impassable.

Section 6 – Burtons Lane Access to Supplee Lane Access
The terrain along this section of the trail is mostly moderate, with a few areas of moderately steep terrain, but with reasonable footing. There were a few areas of rocky footing encountered,

but with one exception, nothing that would be an impediment to horses. Overall, this section was given a rating of 3. One particularly steep section of the trail was given a rating of 1 and deemed unsuitable for horseback riding in its current condition due to the steep terrain, rocky and unstable footing, serious erosion and deep gullies that needs repair (Photo 5-27). There are no stream crossings on this section of the Access Road, as all streams are directed through culverts under the Access Road.

5.1.1.4 Rocky Gorge WSSC Access Road - North

The northern sections of the WSSC Access Road in Howard County (Figure 5-4 and 5-5) are not designated for recreational use of any kind. These segments of the WSSC Access Road were mapped with handheld GPS, and their general condition documented. Individual segments of the northern WSSC Access Road are summarized below.

Harding Road Section
This Access Road section is located on the north side of the reservoir and is primarily used as a utility corridor. The road begins east of the intersection of Bishops Gate Lane and Harding Road. It continues southwest until the end of Old Columbia Road and then continues westward to the reservoir. The Access Road is heavily vegetated at the beginning, and tall grass and weeds that obscure the path (Photo 5-28). A few areas have exposed soil and rock. Conditions along the trail exhibited very little erosion or potential for further erosion due to heavily vegetated slopes with little exposed soil.

Route 29 to Brown's Bridge North Section
This Access Road section is located on the north side of the reservoir. This road is comprised of exposed soil, fist sized rubble, and roots. Areas of significant erosion were observed throughout the trail (e.g., Photo 5-29) and were characterized by rutting along the trail.

Brown's Bridge North to Fox Haven Section
This Access Road section is located on the northeast side of the reservoir and its southernmost point begins on the north side of Brown's Bridge. The trail is primarily Access Road with some utility use. The Access Road exhibits a high level of use. Exposed soils dominate the road base with intermittent areas of vegetation, rocks, and roots (Photo 5-30). Severe erosion occurs in areas of unauthorized motor bike use in the form of deep rutting (Photo 5-31).

5.1.2 Summary of Triadelphia Reservoir Trail Mapping

Figure 5-6 presents an overview of the GPS trail mapping for the Triadelphia Reservoir. Approximately 20.4 miles of WSSC Access Roads were mapped around the Triadelphia Reservoir. None of the WSSC Access Road located within the buffer property for the Triadelphia Reservoir is authorized for recreational use of any kind.

In addition to the Triadelphia portion of the WSSC Access Road, approximately 11.8 miles of shoreline and interior trails were mapped in the Triadelphia Reservoir buffer property. Of the 11.8 miles of actively used trails that were mapped, only 1.9 miles of shoreline trail are currently authorized by WSSC for shoreline fishing. The remaining 9.9 miles of active trails are not

authorized by WSSC for any recreational use. A summary of the mapping data collected by EA for the Triadelphia Reservoir buffer property is presented in Table 5-3.

5.1.2.1 Triadelphia Shoreline Trails and Interior Trails

Triadelphia Recreation Area Shoreline and Interior Trails
The shoreline trail is about 2 feet wide with steep slopes, and protruding rock formations. The main use for the shoreline trail was observed to be shoreline fishing. Trash (packaging from fishing gear and beer cans and bottles) was found along the trail (Photo 5-32). There were instances of bank erosion due to foot traffic along the shoreline (Photo 5-33). The shoreline trail ended at the edge of WSSC property boundary adjacent to MD 97 (Figure 5-7).

There are also upland trails originating from the overflow parking area at the service road. The unauthorized trails appeared to be created recently with vegetative clearing and no definitive trail pattern.

Greenbridge Recreation Area
The Greenbridge Recreation Area has access to shoreline fishing trails north and south from the access point (Figure 5-8). The northern section of the shoreline fishing trail is approximately 0.1 miles long, but then continues as an unauthorized trail for about 0.6 miles. The southern portion runs approximately 0.25 miles. The average trail width is about 2 feet. The main use for the shoreline trail consists of accessing a canoe storage area, and shoreline fishing. The segment of the shoreline trail that runs north of the Greenbridge Recreation Area has areas of bank erosion due to foot traffic and canoe storage (Photo 5-34). The trail exhibited assorted trash.

Brighton Dam Recreation Area
This short section (<0.1 miles) of shoreline fishing trail can be accessed from the Brighton Dam recreation Area (Figure 5-8). There is localized bank erosion due to fishing at the edge of water (Photo 5-35). There are no trash receptacles available near the shoreline fishing trail.

Big Branch Recreation Area
The surveyed shoreline trails consisted of segments that extend south of the Big Branch Recreation Area for about 0.7 miles (Figure 5-7). The trail has an average width of about 2 feet, and has steep slopes and protruding rock formations. There is localized bank erosion due to fishing access at the edge of water. An unauthorized trail spur connects the shoreline fishing trail to a playground adjacent to Triadelphia Mill Road. There is a high potential for trail erosion south from the playground due to a steep trail slope and very high bank slope (Photo 5-36). Minor rutting 4 inches deep over a length of 10 feet was observed along a moderately sloped area of 11 degrees.

Pig Tail Recreation Area
A shoreline fishing trail begins at the Pig Tail Recreation Area, and runs south along the eastern bank (Figure 5-8). The trail is approximately 9 feet wide for about 0.5 miles, and then it narrows to about 2 feet wide. There are several areas with existing trail erosion (Photo 5-37). Horse manure was observed on the trail, indicating unauthorized recreational use.

5.1.2.2 Triadelphia WSSC Access Road

WSSC Access Road: Triadelphia Lake Road
This section of WSSC Access Road extends to the north and south of Triadelphia Lake Road (Figure 5-9). This section of the WSSC Access Road is approximately 1.7 miles in length. The road has an average width of approximately 10 feet, and maximum width of 15 feet (Photo 5-38). Slopes in this section are between 6 and 10 degrees. The Access Road has minor rutting from vehicles (Photo 5-39). Trees along one section of the trail were numbered with red spray paint, and it appeared as if the trail had recently been cleared by a small dozer based on the appearance of the surface. (Photo 5-40).

Greenbridge West
This section of WSSC Access Road is approximately 5.0 miles in length (Figure 5-10). Road width varies between 6 and 13 feet (Photo 5-41), but is about 10 feet on average. The slopes along the road are relatively flat and typically range between 6 and 10 degrees. The midsection of this trail can be accessed from Denit Estates Drive. Rutting and slight erosion are noted throughout most of this trail. However, one area in particular had more significant rutting of 10 inches deep, over a length of about 150 feet and 2.5 feet in width (Photo 5-42).

Greenbridge East
This section of WSSC Access Road is approximately 1.3 miles in length (Figure 5-10). The width of this trail varies between 8 and 13 feet, but is about 10 feet on average. Slopes vary along the trail between 8 and 15 degrees with most recorded slopes measuring roughly 10 degrees. No erosive conditions were noted on the road, although there are areas with erosion potential due to road alignment and slope conditions. The road crosses areas of open grassland that drain directly into the reservoir (Photo 5-43). There is an unauthorized trail spur from the Access Road leading to the shoreline.

West Big Branch
The Access Road is approximately 5.99 miles in length (Figure 5-10). The width of the road ranges from 8 and 11 feet. Moderate slopes are present with a maximum of 15 degrees (Photo 5-44) but average about 10 degrees. Most of the areas west of the Big Branch Access Road were overgrown with thick vegetation (Photo 5-45). The road shows signs of slight rutting caused from vehicle traffic (Photo 5-46).

Pigtail
The Access Road is approximately 5.05 miles in length (Figure 5-10). The majority of the road had a width of roughly 10 feet, bur ranged from 6 feet to 16 feet. The slope of the road varied significantly with a typical slope of 10 degrees and a maximum slope of 24 degrees. Most of the road is in good condition, though there were areas with rutting. The most significant rutting was 10 inches deep, over a length of 200 feet and about 1 foot width (Photo 5-47).

5.2 Access Points

5.2.1 Rocky Gorge Reservoir Public Access Areas

There are eight (8) public access entrances to the Rocky Gorge property. Each is described below.

Tucker Lane
Tucker Lane is located on west bank of Rocky Gorge Reservoir (Montgomery County), and consists of paved road shoulder parking off of Tucker Lane (Photo 5-48). The parking area dimensions are 4 x 100 feet, which will accommodate approximately 5 cars. Tucker Lane is used for access to an authorized shoreline fishing trail, and to access the equestrian trail on the WSSC Access Road (Photo 5-49). Level of use was observed by EA to be low. The area drains toward Rocky Gorge Reservoir. The access point did not have any obvious signs of erosion or erosion potential.

Brown's Bridge at Ednor Road
Brown's Bridge is located on both north (Brown's Bridge Road) and south banks (Ednor Road) of Rocky Gorge Reservoir (Howard and Montgomery County sides, respectively); however, only the north Howard County side access area has been closed by WSSC.

The Ednor Road access area consists of a portable toilet, boat launch ramp, gravel parking lot, and trash receptacles. The parking areas are 100 x 35 feet (Montgomery County side and east of Ednor Road.), and 100 x 100 feet (Montgomery County side and west of Ednor Road). The parking areas do not have ground striping, but the size of the parking lot is sufficient to accommodate many vehicles (Photo 5-50). The access point is used to gain access to the equestrian trail west of Ednor Road, and provides access for boat launching and shoreline fishing. Due to availability of multiple parking areas, the level of use is assumed to be relatively high. The area drains toward Rocky Gorge Reservoir. There is a large rut in the parking area on Montgomery County side and east of Ednor Road (Photo 5-51 and Photo 5-52). The rut measures approximately 2.5 inches deep, and is 2 feet wide and 300 feet long. Otherwise, the access point has low erosion potential.

Brogden Road
The Brogden Road access area provides public access to the equestrian trail on the WSSC Access Road. The only parking area available consists of a gravel turnabout at the cul-de-sac on Brogden Road that is also used by school busses as a turnaround (Photo 5-53). A posted WSSC sign indicates that the access point is restricted to "Bridle Trail Entrance Only" (Photo 5-54). Level of use appears to be relatively low, with only off-road parking available. The area drains toward Rocky Gorge Reservoir. The access point was stable with no current indication of erosion.

Batson Road
The Batson Road access area provides public access to the equestrian trail on the WSSC Access Road. There is no designated parking area. A gravel turnabout (Photo 5-55) has off-road parking that can accommodate several vehicles; however, there is no suitable parking for horse

trailers. Level of use was observed to be low. The area drains toward Rocky Gorge Reservoir. The access point was observed to have considerable uncollected trash.

Kruhm Road
The Kruhm Road access area provides public access to the equestrian trail on the WSSC Access Road. The only parking available is roadside parking along Kruhm Road, just outside a gated private property at the terminal end of Kruhm Road (Photo 5-56). Roadside parking in this area is flat and safe from traffic, but there is no place to turn around a trailer rig, and therefore is not suitable for horse trailers.

Burtons Lane
The Burtons Lane access area provides public access to the equestrian trail on the WSSC Access Road. There are no designated parking spaces along Burtons Lane, and the roadside parking that is available is not suitable for horse trailers (Photo 5-57). Adjacent property owners at this location complained about public parking on their property.

Supplee Lane Recreational Area
Supplee Lane is located on south bank of Rocky Gorge Reservoir (Prince George's County), and consists of a picnic area (Photo 5-58), portable restroom facility, boat launch ramp (Photo 5-59), and paved parking lot (cars and boat trailers), and trash receptacles. The parking areas are 75 x 315 feet (Photo 5-60). There are 17 car spaces, 4 handicap spaces, and 32 boat trailer spaces marked. The main uses for the Supplee Lane Recreational Area are boat launching, fishing, picnicking, and for access to the equestrian trail on the WSSC Access Road. Due to availability of different types of parking spaces, this is a high use area. The area drains toward the Rocky Gorge Reservoir. The access point has no signs of obvious erosion. Dog owners were observed allowing their dogs to swim in the reservoir, which is an unauthorized practice and violates WSSC's watershed regulation. There is slope erosion at the beginning of the trail on the east side shoreline fishing trail.

Scott's Gove Recreational Area
The Scott's Cove Recreational Area (Photo 5-61) is located on the north bank of Rocky Gorge Reservoir (Howard County), and consists of picnic area, playground, portable restroom facility, boat launch ramp, canoe storage/parking, gravel parking lots (at two locations off of Harding Road), and trash receptacles. The parking areas were measured to be 462 x 64 feet (north lot) and 362 x 55 feet (south lot). There is no ground striping in the parking area to delineate parking spaces. The main uses for are picnicking, canoe storage, boat launching, and shoreline fishing. This is a high use area, due to availability of multiple designated parking areas. The area drains toward Rocky Gorge Reservoir. The access point does not have any obvious signs for high erosion potential. Dog owners were observed allowing their dogs to swim in the reservoir, which is an unauthorized practice and violates WSSC's Watershed Regulation. The use of canoe storage/parking has created some bank erosion along the shoreline trail leading from this access area.

5.2.2 Triadelphia Reservoir Public Access Areas

There are five (5) public access points to WSSC's Triadelphia watershed. Each is described below.

Brighton Dam Recreational Area
Parking at Brighton Dam Recreational Area consists of a paved primary parking lot (Photo 5-62), and paved overflow parking lot (Photo 5-63). The site contains a Welcome Center, a fenced in picnic area (Photo 5-64) portable restroom facilities, open space (Photo 5-65), and WSSC maintenance facility. There are fifty-four (54) parking spaces and three (3) handicapped parking spaces in the primary parking lot. An overflow parking lot has an additional thirty-two (32) parking spaces and a gravel road within the picnic areas. The area drains toward the Patuxent River below Brighton Dam. There was no major deterioration observed that would adversely affect water quality such as erosion or uncollected trash. There is some localized river bank erosion areas due to fishing access to the edge of water (Photo 5-66). There were numerous trash receptacles available.

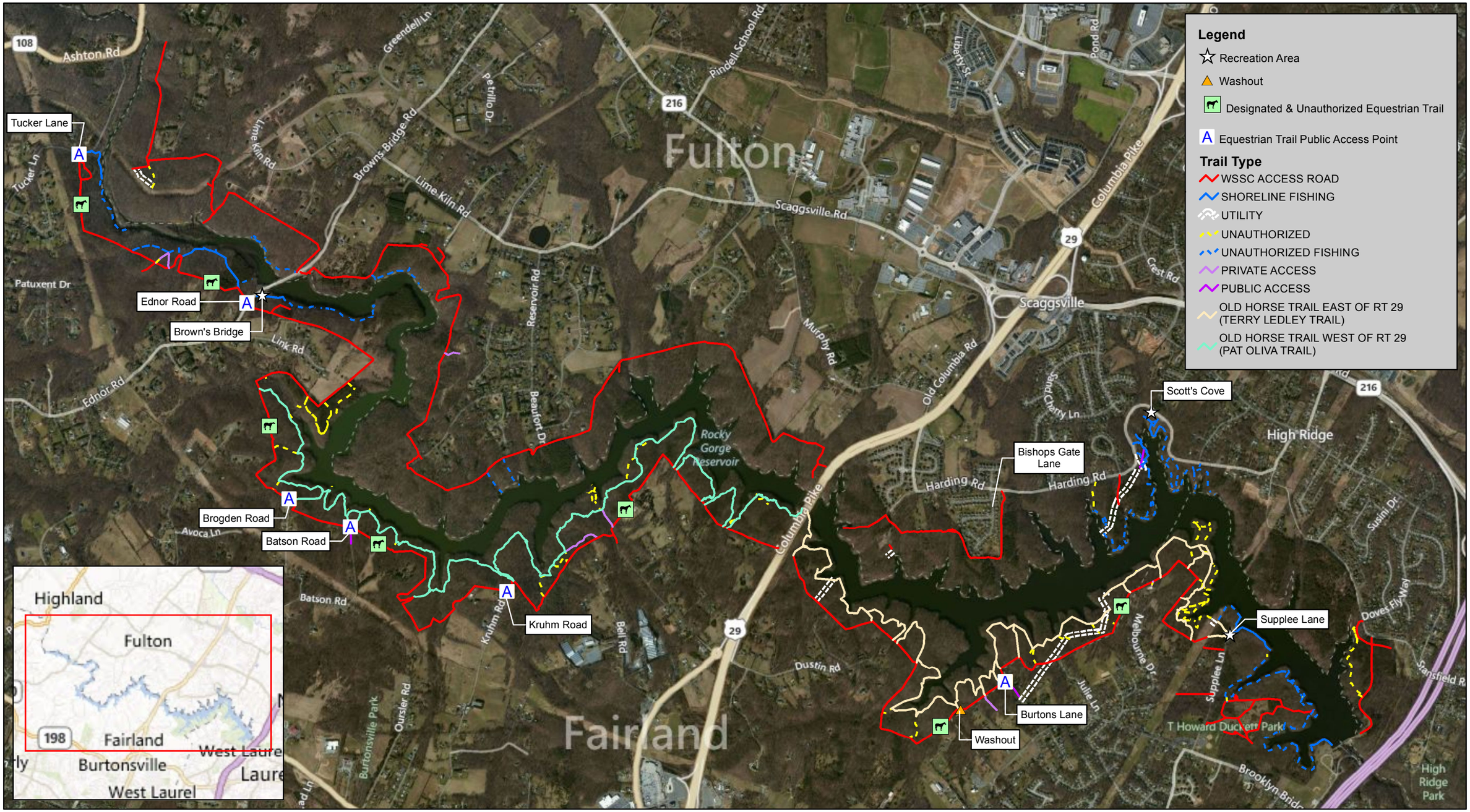
Pig Tail Recreational Area
Pig Tail Recreational Area (Photo 5-67) is located on the east bank of Triadelphia Reservoir (Howard County), and consists of paved parking (primary parking lot), portable restroom facility, boat launch ramp, parking, and trash receptacles. The parking area was measured 142 x 45 feet with thirteen (13) spaces and one (1) handicapped space. The main uses are boat launching and fishing, but horse manure was observed at this site indicating recent unauthorized recreational use. Level of use was considered to be medium, due to available parking. The area drains toward Triadelphia Reservoir. There were no indications of substantial impacts to water quality from erosion, trash, or animal wastes.

Big Branch Recreational Area
Big Branch Recreational Area is located on the north bank of Triadelphia Reservoir (Howard County) and includes paved parking (parking lot off of Triadelphia Mill Road), a portable restroom facility (Photo 5-68), playground, boat launch ramp (Photo 5-69), parking, and trash receptacles. The parking area is 48 x 107 feet with twelve (12) spaces and one (1) handicapped space. The main uses of the site are picnicking, boat launching, and fishing. Level of use is considered to be medium, because of the number of designated parking spaces. The area drains toward Triadelphia Reservoir (Photo 5-70). There were no indications of potential erosion, or impacts to water quality at this access area.

Triadelphia Recreational Area
Triadelphia Recreational Area is located on the south bank of Triadelphia Reservoir (Montgomery County) and includes canoe parking/storage, picnic area, outdoor restroom facility (Photo 5-71), playground, boat launch ramp (Photo 5-72), fishing dock (Photo 5-73), paved and grass/gravel parking lots (primary and overflow lots) (Photo 5-74), and trash receptacles (Photo 5-75). The parking areas were measured 120 x 145 feet (primary) and 80 x 75 feet (overflow) with twenty-three (23) spaces, two (2) handicapped spaces, and five (5) boat trailer parking spaces for the primary parking lot. The overflow parking lot was un-striped, therefore the number of spaces was not determined. The main uses of the site are picnicking, boat launching, hunting (due to newly established trails), and fishing. Level of use was considered to be relatively high, due to availability of overflow parking. The area drains toward Triadelphia Reservoir. There are areas of localized bank erosion on the shoreline trail due to fishing access and canoe parking/storage.

Greenbridge Recreational Area

This access area is located on the west bank of Triadelphia Reservoir (Montgomery County), and consists of paved parking (primary parking lot), portable restroom facility (Photo 5-76), boat launch ramp (Photo 5-77), boat trailer parking, trash receptacles, and shoreline canoe parking/storage. The parking area was measured as 85 x 225 feet with twenty-three (23) spaces, two (2) handicapped spaces and ten (10) boat trailer spaces. The main uses of this site are boating and fishing. Level of use was considered to be medium, due to available parking. The area drains toward Triadelphia Reservoir. There are bank erosion areas with un-stabilized slopes due to canoe parking/storage at the shoreline and foot traffic to the canoe storage space (Photo 5-78).



P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-1 RG Overview.mxd

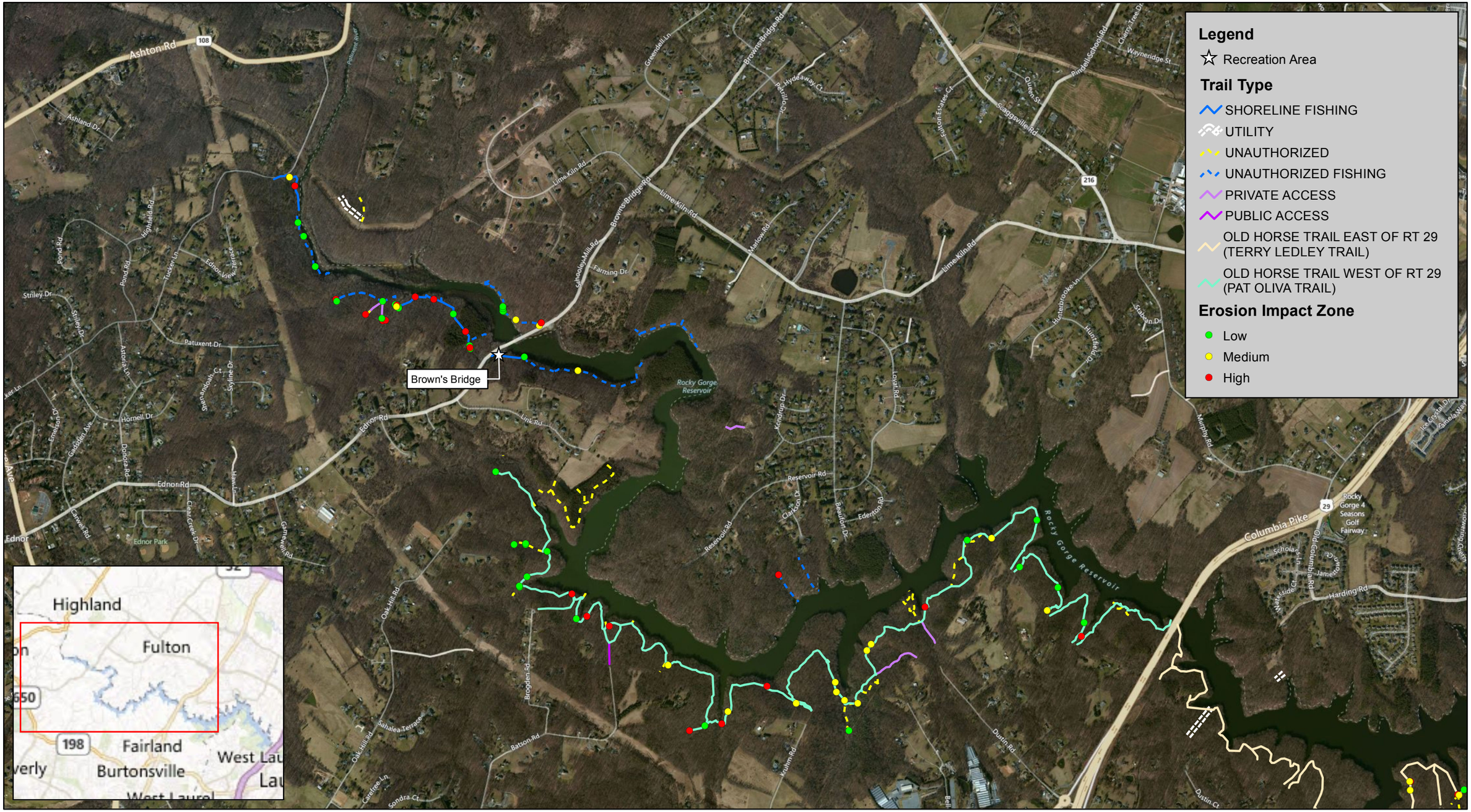
EA Engineering, Science, and Technology, Inc.

Figure 5-1. Overview Map Rocky Gorge Reservoir

N W E S

Miles
0 0.25 0.5

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation



P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-2 RG Western Trails Shoreline & Interior.mxd

EA Engineering, Science, and Technology, Inc.

Figure 5-2. Western Trails, Shoreline & Interior
Rocky Gorge Reservoir

N
W E
S

Miles
0 0.25 0.5

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

Scott's Cove

Bishops Gate Lane

Supplee Lane

T Howard Duckett Park

Columbia Pike

Harding Rd

Old Columbia Rd

Rocky Gorge 4 Seasons Golf Fairway

Brooklyn Bridge Rd

Patuxent

Legend

☆ Recreation Area

Trail Type

- SHORELINE FISHING
- UTILITY
- UNAUTHORIZED
- UNAUTHORIZED FISHING
- PRIVATE ACCESS
- PUBLIC ACCESS
- OLD HORSE TRAIL EAST OF RT 29 (TERRY LEDLEY TRAIL)
- OLD HORSE TRAIL WEST OF RT 29 (PAT OLIVA TRAIL)

Erosion Impact Zone

- Low
- Medium
- High

Highland
Fulton
Fairland
Burtonsville
West Laurel
198

Figure 5-3. Eastern Trails, Shoreline & Interior Rocky Gorge Reservoir

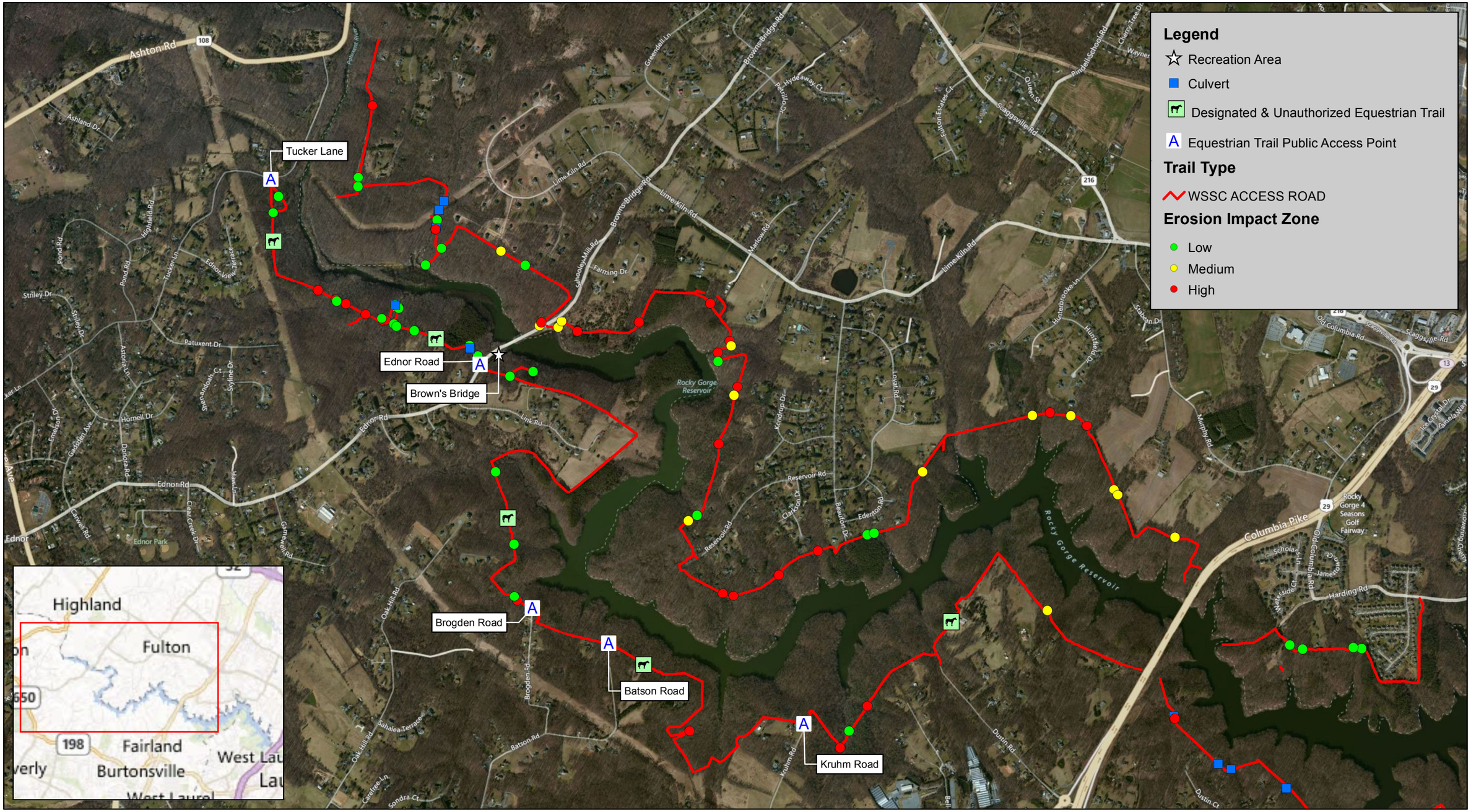
EA Engineering, Science, and Technology, Inc.

N W E S

Miles
0 0.125 0.25

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491508_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-3 RG Eastern Trails Shoreline & Interior.mxd



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EA Engineering, Science, and Technology, Inc.

Figure 5-4. Western Trails, WSSC Access Road
Rocky Gorge Reservoir

N
W E
S

Miles
0 0.25 0.5

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-5 RG Eastern Trails WSSC Access Rd.mxd

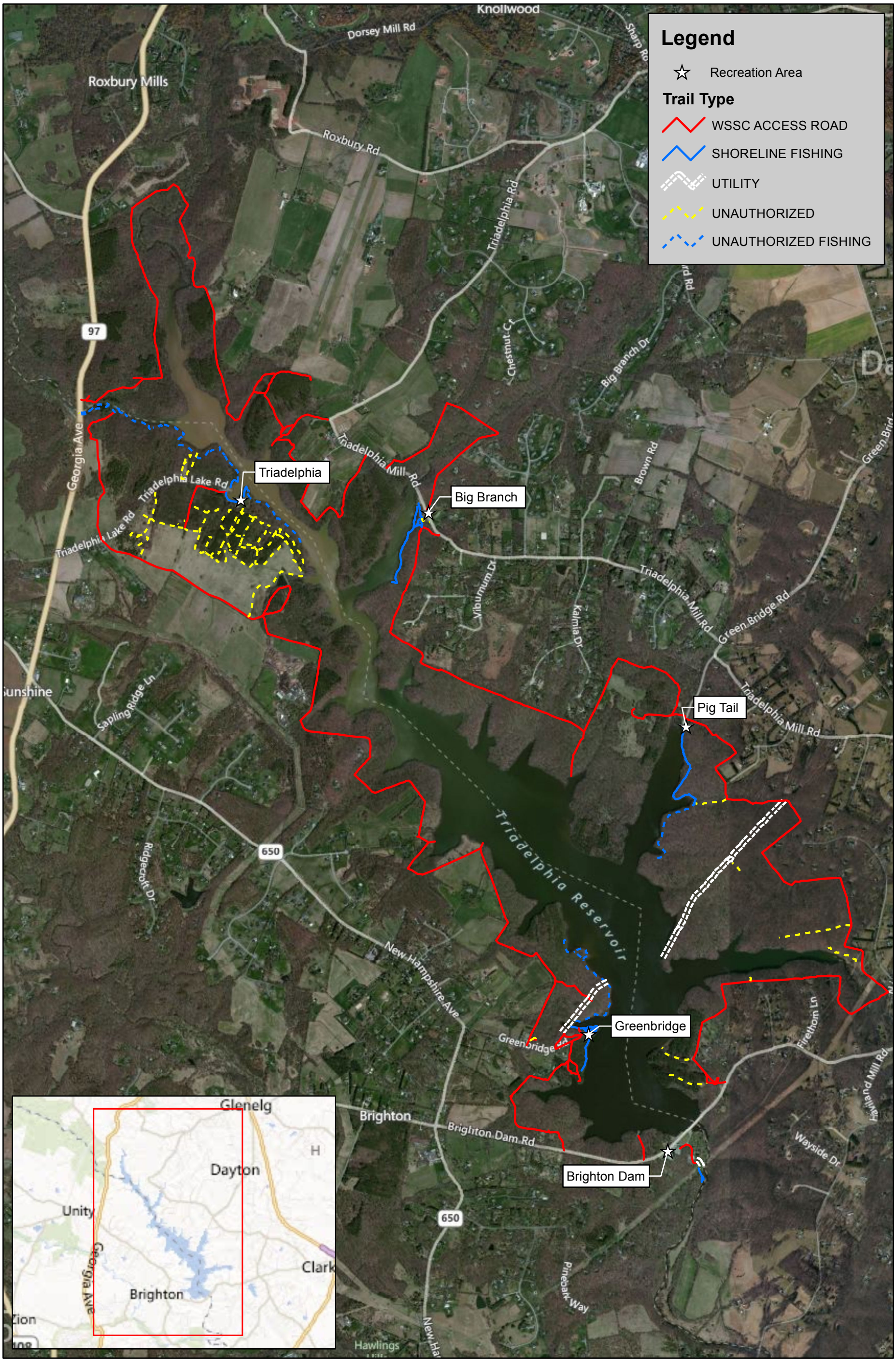
EA Engineering, Science, and Technology, Inc.

Figure 5-5. Eastern Trails, WSSC Access Road
Rocky Gorge Reservoir

N
W E
S

Miles
0 0.125 0.25

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation



P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-6 Tri Overview.mxd

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Figure 5-6. Overview Map
Triadelphia Reservoir

N
W E
S

Miles
0 0.25 0.5

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

Legend

☆ Recreation Area

Trail Type

- SHORELINE FISHING
- UTILITY
- UNAUTHORIZED
- UNAUTHORIZED FISHING

Erosion Impact Zone

- Low
- Medium
- High

Triadelphia

Big Branch

Glenelg
Dayton
Unity
Brighton
Clarksville

Figure 5-7. Northern Trails, Shoreline & Interior
Triadelphia Reservoir

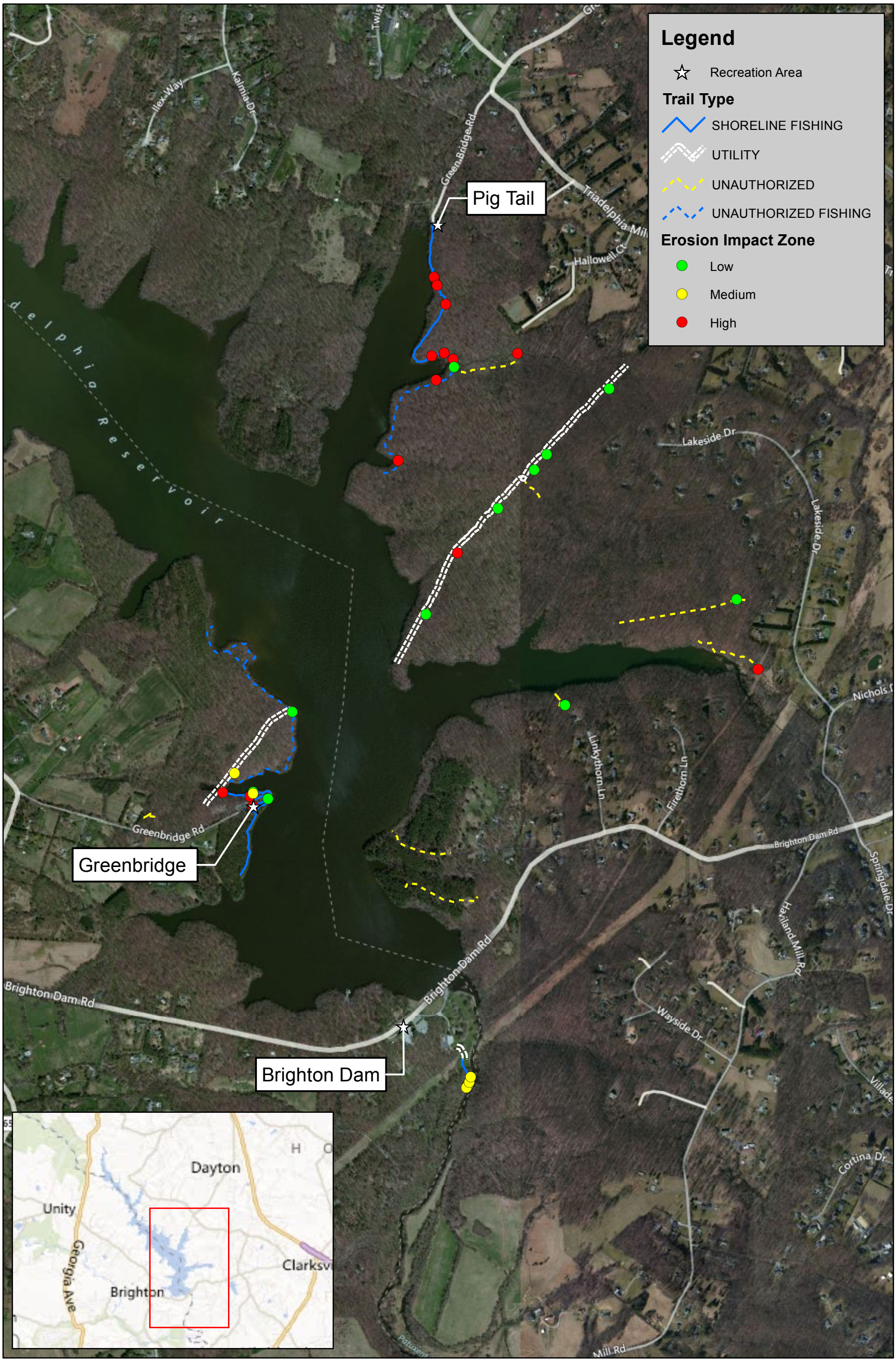
EA Engineering, Science, and Technology, Inc.

N W E S

Miles
0 0.125 0.25

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-7 Tri Northern Trails Shoreline & Interior.mxd



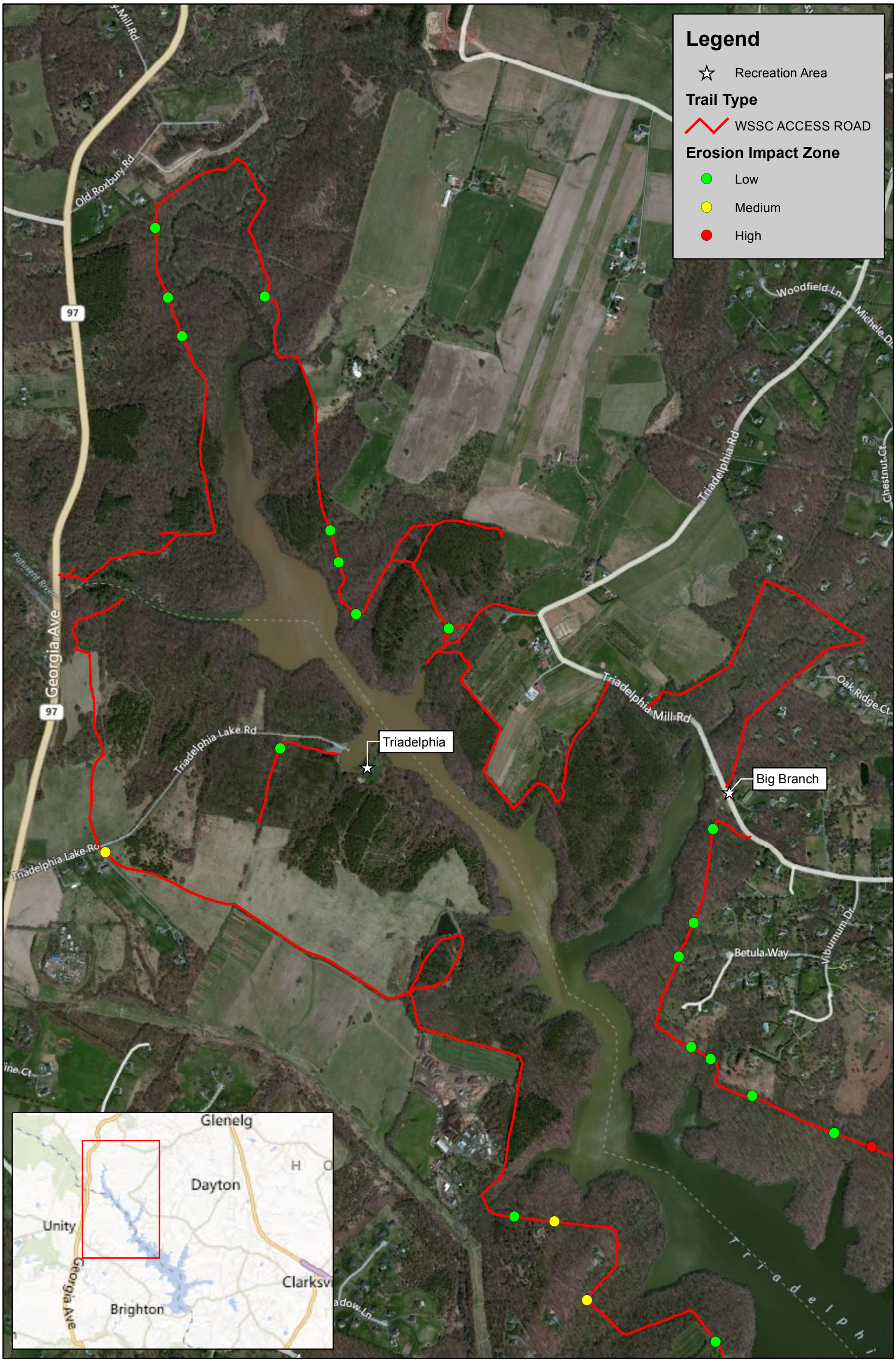
EA Engineering, Science, and Technology, Inc.

Figure 5-8. Southern Trails, Shoreline & Interior
Triadelphia Reservoir

N W E S

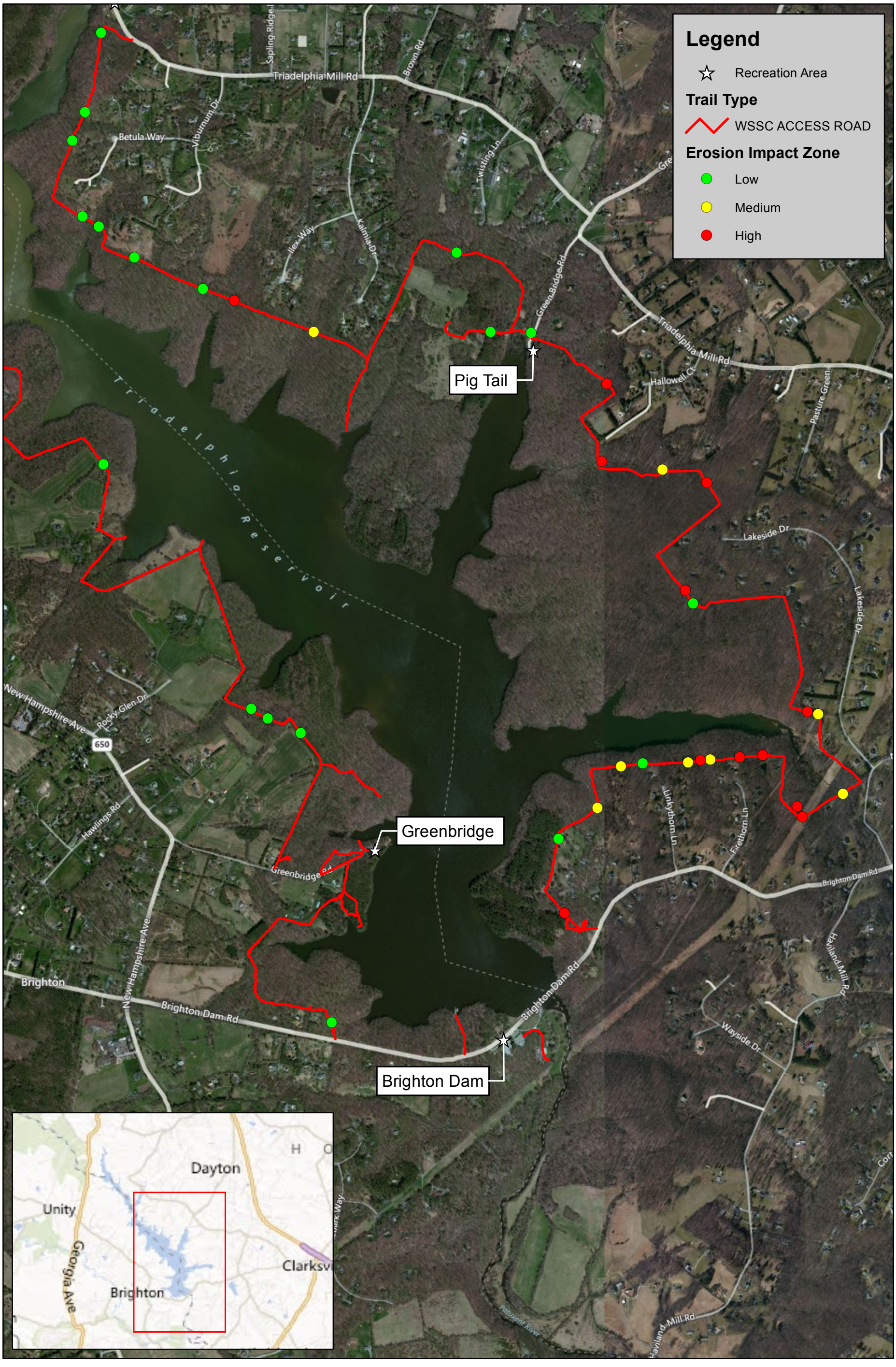
Miles
0 0.125 0.25

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation



EA Engineering, Science, and Technology, Inc.

Figure 5-9. Northern Trails, WSSC Access Road
Triadelphia Reservoir



P:\State & Local\Municipal\Washington Suburban Sanitary Comm\2011_PollutionAssessmentBOA\1491506_Patuxent Watershed Study Phase 1B\3 GIS\Deliverable October\Report Figures\MXD\Fig 5-10 Tri Southern Trails WSSC Access Rd.mxd

EA Engineering, Science, and Technology, Inc.

Figure 5-10. Southern Trails, WSSC Access Road
Triadelphia Reservoir

N W E S

Miles
0 0.125 0.25

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

TABLE 5-1 NAMING CONVENTIONS USED TO SUMMARIZE TRAIL MAPPING DATA

Trail Designation	Description
Designated Equestrian Trail	Section of the WSSC Access Road located within buffer property of the Rocky Gorge Reservoir that is currently designated for equestrian use. The Designated Equestrian Trail extends from Supplee Lane (Prince George's County) to Tucker Lane (Montgomery County).
Interior Trails	Trails located on reservoir buffer property between the WSSC Access Road and the shoreline.
Old Horse Trails	Interior trails previously permitted by WSSC for horseback riding, but currently not authorized for recreational use. (i.e. Terry Ledley Trail and Pat Oliva Trail, see below)
Pat Oliva Trail	Old Horse Trail used by equestrians that is located on the Rocky Gorge reservoir, and extends from Route 29 to the WSSC Access Road near Link Road (Montgomery County only).
Private Access	Unauthorized trails from private residences used to gain access to WSSC-owned reservoir buffer property.
Public Access	Trails used to gain access to WSSC-owned reservoir buffer property.
Shoreline Fishing	Shoreline trail designated by WSSC for fishing.
Terry Ledley Trail	Old Horse Trail used previously by equestrians that is located on the Rocky Gorge Reservoir, and extends from Route 29 to Supplee Lane (Prince George's and Montgomery Counties).
Unauthorized	Unauthorized trails used to gain access to WSSC-owned reservoir buffer property.
Unauthorized Fishing	Unauthorized shoreline trails used for fishing.
Utility	Trail following a public utility, such as gas pipeline or electric transmission line; may also be a cleared pathway in an otherwise forested area, allowing access for utility company maintenance, but not authorized for public recreation.
WSSC Access Road	Perimeter access road used by WSSC.

TABLE 5-2 SUMMARY OF TRAILS AND WSSC ACCESS ROAD MAPPED WITHIN THE WSSC-OWNED BUFFER OF THE ROCKY GORGE RESERVOIR

Trail Designation	Miles of Trails Mapped	Total Miles of Trail with Highly Erodible Soils (HES)	Percent with Highly Erodible Soils (HES) [1]
WSSC Access Road	21.2	13.7	65%
Designated Equestrian Trail	10.1	9.1	90%
Old Horse Trail:	11.9	10.7	90%
Pat Oliva Trail	6.1	5.5	90%
Terry Ledley Trail	5.8	5.2	90%
Private Access	0.6	0.5	83%
Public Access	0.3	0.20	67%
Shoreline Fishing	1.7	1.1	65%
Unauthorized	5.0	4.4	88%
Unauthorized Fishing	7.3	5.7	78%
Utility	1.4	0.8	57%
Total	**49.4**	**37.1**	**75%**

1. The Highly Erodible Soils (HES) designation does not represent actual erosion, but merely a classification of soil type with an inherent susceptibility to erosion as discussed in Section 3.3 and Section 6.2.

TABLE 5-3 SUMMARY OF TRAILS AND WSSC ACCESS ROAD MAPPED WITHIN THE WSSC-OWNED BUFFER OF THE TRIADELPHIA RESERVOIR

Trail Designation	Miles of Trails Mapped	Total Miles of Trail with Highly Erodible Soils (HES)	Percent with Highly Erodible Soils (HES) [1]
WSSC Access Road	20.3	11.7	58%
Shoreline Fishing	1.9	1.6	84%
Unauthorized	5.9	4.7	80%
Unauthorized Fishing	2.8	2.2	79%
Utility	1.2	0.5	42%
Total	**32.1**	**20.7**	**64%**

1. The Highly Erodible Soils (HES) designation does not represent actual erosion, but merely a classification of soil type with an inherent susceptibility to erosion as discussed in Section 3.3 and Section 6.2.

6 Results, Observations and Recommendations

The technical components of this study are presented in Section 3 which includes literature reviews as well as a substantial field effort. In Section 6 we present the results from this investigation and make recommendations to better manage the Commission's buffer property to maintain and improve reservoir water quality. Topics include observations and results from the stakeholder meetings, the erosion analysis and relative sediment loadings, forest and reservoir management issues and a variety of specific property management issues. Section 6.6 briefly summarizes what we believe are the key recommendations from this study.

6.1 Public Stakeholder Meetings

EA conducted two public meetings as part of this study (18 June and 19 June 2012). It was clear based on the large stakeholder turnout, over 85 individuals on 18 June and over 50 individuals on 19 June, that the Patuxent River Reservoirs are a treasured recreational resource by this community. Many individuals publicly shared their interest in the reservoirs and their continued enjoyment of the recreational opportunities provided. The EA presentation and summaries of the meetings, including summaries of the stakeholder comments are provided in Appendix C. Many individuals representing adjacent and nearby land-owners and recreational users such as horseback riders, boaters and fishermen and deer hunters presented their observations on the health of the watershed, and preserving recreational opportunities. Several stakeholders shared their volunteer efforts in maintaining the health of the watershed by organized clean-ups, culvert cleanings, reporting suspicious uses and public policing efforts. Additional Stakeholder Meeting information including meeting transcripts, meeting summaries, and information submitted to EA by stakeholders during the public meeting as well as within the 30-day comment period, can be found on WSSC's website: http://www.wsscwater.com/home/jsp/content/2012-watershedstudy.faces

6.2 Results of the Potential for Erosion Analysis

Using the methods described in Section 3.3, maps of highly erodible soils (HES) were developed for the buffer property of the Rocky Gorge Reservoir (Figures 6-1), and the Triadelphia Reservoir (Figure 6-2). The WSSC Access Road and interior trails in Rocky Gorge were also examined for their trail alignment in order to characterize relative erosion potential. Special consideration should be given to trails located on HES in order to avoid poor alignments (i.e., running straight up and down hills), and instead follow elevation contours in order to minimize trail slopes and potential flow paths.

6.2.1 Potential for Erosion within Buffer of Rocky Gorge Reservoir

The total buffer property surrounding the Rocky Gorge Reservoir is approximately 2,880 acres, with approximately 64% of this buffer property characterized as having HES. Approximately 83% of the buffer within Montgomery and Prince George's Counties was characterized as having HES, whereas only 47% of the buffer property within Howard County was characterized as having HES. Existing trails were overlaid onto the HES maps in order to identify trails located on HES (Figure 6-1), and the percent HES for each trail is summarized in Table 5-2.

This analysis shows that the designated equestrian trail, and the old horse trails (the Terry Ledley and Pat Oliva Equestrian Trails) consist of approximately 90% HES.

Figure 6-1 shows that the WSSC Access Road has very poor alignment, because in many segments it tends to cross substantial elevation contours at an angles approaching 90 degrees. The poor alignment of the Access Road, which includes the designated equestrian trail, means that it has a high erosion potential. Further, since parts the Access Road are occasionally bulldozed, the erosion potential is considered very high.

In contrast to the Access Road, the Terry Ledley Equestrian Trail is contoured with the topography resulting in good trail alignment, and a substantially lower erosion potential, even though it is located on an area with HES. Much of the Pat Oliva Equestrian Trail also has good alignment, although in order to achieve this good alignment the trail has been routed close to the reservoir shoreline.

6.2.2 Potential for Erosion within Buffer of Triadelphia Reservoir

The results of the potential for erosion analysis within the WSSC-owned buffer of the Triadelphia Reservoir are summarized in Figures 6-2. The GPS data for the trails was used to create a GIS layer of mapped trails that was then overlaid onto the HES layer in order to identify sections of trail that have a high potential for erosion.

The total buffer property surrounding the Triadelphia Reservoir is approximately 2,063 acres, with approximately 57% of this buffer property characterized as having HES. Approximately 79% of the buffer within Montgomery County was characterized as having HES, whereas only 44% of the buffer property within Howard County was characterized as having HES. Existing trails were overlaid onto the HES maps in order to identify trails located on HES (Figure 6-2), and the percent HES for each trail is summarized in Table 5-3. This analysis shows that almost all of the WSSC Triadelphia Reservoir Access Road located within Montgomery County has HES, whereas only about 50% of the Access Road in Howard County has HES. Overall, about 58% of the Access Road is characterized as having HES.

Figure 6-2 shows that the Triadelphia Reservoir Access Road is generally well aligned with the elevation contours, especially compared to the Access Road located in the Rocky Gorge buffer property. Even in those areas where the Access Road has poor alignment, the road slopes are still moderate (<15%).

6.3 Field Survey Observations and Recommendations

6.3.1 Rocky Gorge Reservoir Trails and Access Points

The primary issue we noted with the recreational shoreline trails is stream crossings. At the Tucker Lane shoreline trail there is a stream crossing in the authorized trail section that needs a bridge to prevent trail erosion caused by foot traffic. Additionally, the designated portion of the shoreline fishing trail at Brown's Bridge at Ednor Lane contains 3 stream crossings that require bridges in order to prevent trail erosion caused by foot traffic.

The Rocky Gorge Access Road is in poor condition and many sections are not recommended for horseback riding. There is a large washout in section 5 that cuts the trail making it impassable (see Photo 5-26). The Access Road is also difficult to travel with vehicles. If the Access Road is to be used for emergency vehicles or recreational use, the Road should be maintained to accommodate those uses.

Public access areas in Rocky Gorge should have adequate parking for the intended uses. In several cases (such as Batson Road and Kruhm Road) there are designated horse trail entrances but they do not have adequate parking for horse trailers. Other access points such as Burtons Lane are adjacent to private property and do not have clear boundaries or parking areas.

6.3.2 Triadelphia Reservoir Trails and Access Points

Triadelphia Reservoir shoreline and interior trails have large quantities of trash littered around (Greenbridge Recreational Area, Brighton Damn Recreational Area). To minimize litter there should be accessible trash receptacles available along authorized shoreline fishing areas.

The Triadelphia Reservoir Access Road has areas with rutting due to vehicle use in all areas surveyed as part of this study. Areas of rutting can cause erosion and dangerous conditions for vehicle traffic. The Access Road should be maintained for vehicle use.

The public access areas to the Triadelphia Reservoir buffer property have designated parking lots. The primary issue noted at these access points is unauthorized recreational activities, such as shoreline fishing in unauthorized areas and horseback riding. Adequate enforcement at these points would reduce the level of unauthorized uses and potentially improve water quality.

6.3.3 Relative Sediment Loading

The Study Team has surveyed and mapped more than 80 miles of trails within WSSC's watershed property including: the WSSC Access Roads, authorized shoreline fishing trails, and unauthorized trails, as well as the old interior horse trails (e.g., the Terry Ledley and Pat Oliva Equestrian Trails). The Study Team observed numerous culverts and stream crossings on the property which transport water and associated water quality pollutants from adjoining watershed lands and drainage features onto WSSC's buffer property. As detailed in Section 6.2, these WSSC property trails have been evaluated for their erosion potential with the goal of determining *relative* sediment and other runoff contaminant loading to the reservoirs. The data do not exist to allow for a quantitative loading estimate from the various sources, but we believe that the current study provides sufficient information to support *qualitative* sediment loading observations.

Based upon the field work completed, it is clear that the dominant source of displaced sediment within the buffer property is from the WSSC Access Roads, where significant erosion is evident in many areas of the 50 miles of roads. Loadings from outside WSSC's buffer property are conveyed to the reservoir via the Patuxent River, tributaries, and stormwater culverts. An assessment of loadings from outside the buffer property was not part of this study. However, it was observed that many of the culverts are partially blocked, and some exhibit some level of erosion of the surrounding fill material. A failed culvert was found on the Montgomery County

side of the Rocky Gorge WSSC Access Road that has resulted in a section of the road approximately 40 feet wide by 8-10 feet deep being completely eroded. It is recommended that all culverts be assessed to determine if they have the necessary hydraulic capacity to handle current and projected peak flows. The approximately 30 miles of other trails surveyed (shoreline fishing trails, unauthorized trails and the existing interior horse trails), are smaller, less eroded and typically within areas of lower erosion potential.

In summary, the information collected in this study indicates that the WSSC Access Roads are the dominant source of sediments and associated runoff contaminants (sediment and associated nutrients) originating within the WSSC buffer property, and that the apparent loadings of these contaminants from smaller interior trails are substantially smaller in comparison. Quantitative loading estimates were beyond the scope of this study, as were any observations or estimates of sediment or nutrient loadings coming from upstream neighboring lands (outside of the WSSC property).

6.3.4 Rocky Gorge Access Roads

As discussed in Section 6.2.1, most of the Rocky Gorge Access Roads are aligned straight up and down hill sides making the road surface highly susceptible to erosion. Although some of the Access Road segments are easily accessible and in very good condition, it was observed that substantial portions of the Rocky Gorge Access Road are significantly eroded, and many areas would not be suitable for use by emergency vehicles (fire or police), WSSC police, or horseback riding. Many of these segments appear to be unmaintained and have extremely steep slopes with substantial gullies and washed out areas where our Study Team's 4-wheel drive trucks could not navigate. This prevents continuous travel, and effectively divides the Rocky Gorge Access Road into discrete segments. Further, the rocky and slippery footing on many of these steep slope areas would be potentially dangerous for horses and riders, and vehicles other than small all-terrain vehicles (ATVs) that may be used by WSSC for maintenance. The significant erosion documented on many segments of the Rocky Gorge Access Road further suggests that they represent a substantial contribution of sediment runoff to the reservoir from within the WSSC managed property.

6.3.5 Triadelphia Access Roads

Compared to the Rocky Gorge Access Roads, the Triadelphia Access Roads are better aligned and have gentler slopes (Section 6.2). The potential for erosion analysis discussed in Section 6.2 also shows that the section of Triadelphia Access Road between Brighton Dam Road and the Big Branch Recreation Area has relatively little highly erodible soil (HES) compared to the Rocky Gorge Access Roads. Furthermore, there were fewer observed erosion impacts on the Triadelphia Access Road than on the Rocky Gorge Access Road (Section 5.1.1.3 and Section 5.1.2.2). For these reasons, EA recommends that WSSC consider allowing recreational activity, such as horseback riding, on sections of the Triadelphia Access Road. Special consideration should be given to allowing recreational activity on the section of the Triadelphia Access Road located between Brighton Dam Road and the Pig Tail Recreation Area, which was observed to be located on stable soils, generally well aligned, and have reasonable slopes.

6.3.6 WSSC Property Boundary and Fences

WSSC property boundary fences were observed to be in poor condition or absent in many of the areas that were walked as part of this study, making it easier for adjacent homeowners to encroach on Commission property for unauthorized activities. EA recommends that WSSC reestablish fencing or clear boundary markers in selected areas to better control unauthorized access across WSSC property boundaries.

6.4 Additional Observations and Recommendations

6.4.1 Purchase Additional Properties within Watershed

To further protect water quality of the Patuxent reservoirs, WSSC should consider purchasing additional lands and/or conservation easements within the broader watershed (when properties become available), to better control future development and land use changes which contribute to sediment, nutrient loadings, and other run-off contaminants. The Supplemental Environmental Project, completed by the Commission in 2010, appears to be an example of a successful land acquisition program to enhance the watershed buffer. By controlling development, access to watershed lands, limiting increases in impervious surface within the watershed, and making environmental improvements to the purchased properties, reservoir water quality will be further enhanced. This would also allow WSSC to protect or establish more forested land in proximity to the reservoirs, and possibly allow better control of invasive species which would otherwise be introduced. In lieu of acquiring additional watershed property, another approach to consider would be the construction (and long-term maintenance) of appropriate BMPs within the watershed to control the introduction of sediments and contaminants to the reservoirs.

6.4.2 Animal Management (e.g., Culling of the Deer Herds)

Based upon evidence observed during EA's numerous trips through the watershed property, information presented on WSSC's website regarding overpopulation and damage to forest resources, and information presented at the two public meetings, we support the continued use of carefully controlled MDNR-assisted deer management on the reservoir properties.

As noted in WSSC literature, the purpose of the current deer management program is to manage populations in areas where deer have exceeded the carrying capacity of the available habitat, and have damaged the watershed forests, the native canopy and caused habitat changes to other forest communities (e.g., birds and understory vegetation). There is also concern for damage to nearby residential landscaping and agricultural crops, as well as for the health and safety of nearby residents (e.g., automobile collisions and Lyme disease) (WSSC, 2012).

Several stakeholders spoke at the two public meetings in support of WSSC's deer management program and the need to have better deer management in the watershed. They noted that vegetation plays an important role in preservation of water quality; and deer were directly impacting the vegetation which results in invasive species, altered habitats, and the loss of a natural protection against sedimentation. Deer droppings were also noted during the meetings as having the potential to adversely affect water quality. The importance of deer management was

emphasized and several stakeholders suggested that there be more WSSC managed deer hunts as a management strategy.

Further, the Forest Conservation Plan (MDNR- Forest Service 2007) addressed the issue in its recommendations to WSSC for the next 15 years. In this report, MDNR-FS stated: "*Managing Wildlife: Continue and expand the WSSC's preferred deer control strategy to support natural regeneration of forests and improved habitat conditions over time, essential to the long-term sustainability of the forestlands*." (p. 64).

For more information on WSSC's deer management program see: http://www.naturalresources.umd.edu/Documents/Workshops/20110526/WSSCDeerMgmtRpt.pdf.

6.4.3 Fire Prevention

Fire represents a significant (and potentially increasing) risk to the forested WSSC water supply buffer property and resulting adverse impacts to water quality and quantity. MDNR reports that each year more than 6,000 natural cover fires occur in Maryland, and the three main causes are arson, debris burning, and children playing with fire. The State experiences both spring and fall fire seasons when climate and fuel conditions result is a greater chance for an outdoor fire to occur (http://www.dnr.state.md.us/forests/forester/mdfacts.asp).

Forest fires are dramatic events that alter the landscape, and make watersheds vulnerable to large scale erosion and transport of sediments, nutrients, and other contaminants into feeder streams and then into the reservoirs themselves. Additionally, the impacts of a substantial forest fire are long lasting and would have substantial impacts on reservoir-based water utility infrastructure and operations. The Water Research Foundation (http://waterrf.org) is working to address this issue. It has also been reported that the frequency and length of the fire season has increased substantially in parts of the country as a result of climate change, land use and current forest practices (Moritz et al, 2012).

A "Forest Fire Policy" for the Patuxent Reservoirs area is included in the Forest Conservation Plan (MDNR-Forest Service 2007- Appendix D) which provides general guidance to follow for wildfire suppression and how to respond when a fire is identified. EA recommends that WSSC develops, implements, and enforces a detailed Fire Protection Plan that identifies all responsible emergency response groups, and their roles and responsibilities under specific conditions. Rapid access to WSSC property areas is a key aspect of this program, which involves the ability to move equipment into certain reservoir areas (e.g., via the Access Roads and other trails), as well as access via public roads and private properties.

6.4.4 Homeless Activity

As part of the field investigation, there was some evidence of what appeared to be homeless activity on the WSSC-owned property (e.g., fire-pits, sleeping bag) which represents unauthorized activity, a security breach, and potential fire hazard. This also represents a potential threat to water quality (forest fire, pollution, sedimentation and human wastes) (Photo 6-1).

6.4.5 Signage is Poor, Inconsistent and Misleading to Users

Signs intended to identify authorized access entrance areas, allowable public uses in specific areas, and prohibited activities are often in poor condition and misleading (Photo 6-2) and/or outdated as to the information they convey. Replacement signs should be clearly visible from access points, and should use consistent and clear language to indicate the allowed activities and prohibitions in each specific area (e.g., fishing, hunting, boating, horses, and dogs). A good example is Photo 6-3 from the Ware River Watershed in Massachusetts. Signs also need to clearly demarcate approved trails and points where access is and is not allowed. For example, new signage should be placed such that it is clear to horse trail riders that they can continue to ride on the main WSSC-approved Access Road that is well marked, but that they cannot take side paths which are not approved, or which would take them closer to the reservoir shoreline. The Terry Ledley Equestrian Trail, for example, has several newer signs located at trail junctures that clearly indicate that riders should not stray from the main trail.

Another observation is that WSSC has public access areas immediately adjacent to private residential property. These access points need clear marking to avoid the potential for watershed users to accidentally trespass onto an adjacent homeowner's property.

6.4.6 Public Access Areas Near Private Property

The field study conducted under this study identified a network of unauthorized trails (e.g., Photo 6-4 and Photo 6-5), many of which lead to private properties with direct access to WSSC's property. While most of these access areas appear to be in reasonable condition (not contributing substantively to watershed degradation), these are not WSSC-authorized trails according to the Watershed User Regulations. WSSC needs to make a determination of how to manage these private access points moving forward, and then amend the watershed regulations to clearly present the decision. Points for WSSC to consider are: should these private access trails be allowed as long as they are properly maintained in a manner that is consistent with WSSC policy, should they be allowed only to the extent that they are direct paths to the authorized "Access Roads", should these private access points be separately permitted with additional user fees or licenses and stipulations regarding their use, or should they be removed (with appropriate enforcement).

Another issue that needs to be addressed by the Commission is the official "permission" or "permit" that some adjacent property owners have received for direct access onto WSSC's reservoir buffer property. It was learned during the public stakeholder meetings that there are a number of adjacent landowners who were granted access rights to the reservoir buffer properties by a former WSSC employee. That document includes access to the reservoir property, as well as permission to clear a "*spur horseback trail from your proposed entrance to our main horseback trail*" with the least damage to trees and shrubs on the WSSC property. We suggest that WSSC's General Counsel's Office investigate how many of these letters might exist, determine whether they are valid as ongoing permissions to access Commission-owned property from adjacent private areas, and understand what (if any) rights these letters convey. If these permissions are not valid, affected parties should be notified regarding the decision, and the effect on their private access.

Another issue we noted with adjacent property owners is the presence of large quantities of animal manure near the WSSC property line (Photo 6-6 and Photo 6-7). These large piles are likely contributors to nutrient pollution and runoff as well as other affiliated concerns with animal waste (see Section 2.3 on pathogens). It would be in the best interest of WSSC to promptly work with these landowners to implement BMPs that would protect the watershed from the potentially adverse impacts of these manure piles.

6.4.7 Human Modifications to WSSC Property

WSSC should develop guidance to control human modifications to trails, adjacent private property access points, and any future construction within the interior property. Regular recreational users and adjacent property owners are making modifications to WSSC lands, potentially without WSSC's knowledge or consent. Examples of human modifications we have seen as part of this project include spurs for new trails, access trails to adjacent private properties, and moving and cutting logs to form entrances and trail edges. Additionally, during field visits we noticed many logs that were placed on the Terry Ledley Equestrian Trail set up as a 'horse jump' (Photo 6-8 and Photo 6-9). If WSSC decides to allow access to the Commission's water supply buffer property, it would be useful to have written guidance on what constitutes an allowable modification as well as pre-construction approval processes by the Commission. This language should also be added as an amendment to WSSC's watershed regulations.

In addition to guidance on "trail" modifications, this guidance should also address the proper design of stream crossings to avoid erosion, and for redesigning portions of approved paths on steeper slopes and sensitive areas. Staff from the Howard, Montgomery or Prince George's Soil Conservation Districts could assist WSSC in defining these minimal practices. In keeping with the AWWA policy for recreational uses of drinking water supply reservoirs (see Section 1.2), the cost for necessary improvements to authorized trails could be paid for by those who benefit by implementing special horse trail user fees, or by requiring the equestrian community to make (and maintain) necessary improvements as a condition for continued use of specific trail segments.

6.4.8 Shoreline Fishing Trails/Use Regulation Recommendations

The current WSSC regulations regarding fishing stipulate that:

- Fishing is allowed from April 1through November 15, daily, between sunrise and sunset.
- Fishing is permitted from boats and from the shores of the reservoirs at places designated by WSSC.
- Fishing from the shores of the Triadelphia Reservoir is allowed at the following designated locations.
    - Where Greenbridge Road terminates at the reservoir in Montgomery County, going both east and west along the shore line until coming upon the "no trespassing" signs.
    - Where Triadelphia Lake Road terminates at the reservoir in Montgomery County, going east along the shoreline within the signs indicating the designated fishing boundary.

    - The fishing dock, pier.
- Fishing from the shores of the Rocky Gorge Reservoir is allowed at the following designated locations:
    - Along the west bank only, parallel to Tucker Lane, south from Maryland State Route 108 approximately 650 yards to the "no trespassing" signs.
    - Scott's Cove adjacent to all parking lots, along the perimeter, both east and west, to the "no trespassing" signs.
    - Along the south bank from the end of Supplee Lane, west to the sign, and east to the "no trespassing signs.

Although the current WSSC regulations establish designated areas for shoreline fishing, it was observed during EA's survey of the shoreline fishing trails that there are 7.3 miles of unauthorized shoreline fishing trails in the Rocky Gorge Reservoir, and 2.8 miles of unauthorized shoreline fishing trails in the Triadelphia Reservoir. The amount of shoreline observed to be used for unauthorized shoreline fishing greatly exceeds the authorized shoreline fishing area for both reservoirs. EA recommends that WSSC close all unauthorized shoreline fishing trails, and restore those portions that are eroded or unstable.

EA recommends that WSSC maintain the seasonal restrictions to shoreline fishing in order to prevent foot traffic on the shoreline trails during seasonally muddy conditions, and during the winter months when the diurnal freeze-thaw cycle increases the trails vulnerability to near-shore erosion. The time of day restrictions have a negligible impact on erosion or water quality impacts, but EA recognizes that such restrictions are warranted for logistical reasons and for reservoir security.

6.4.9 Horse Trails/Use Regulation Recommendations

The current WSSC regulations regarding horseback riding stipulate that:

- Horseback riding is only allowed on the Access Roads between sunrise and sunset.
- The Access Roads are closed in wet weather to protect the watershed from erosion.
- The Access Roads shall not be used if they are wet and muddy.
- A Watershed Use Permit is required and riding is only allowed between 1 April and 15 November.
- The Watershed Use Permit may be revoked by WSSC whenever the holder violates these regulations. Furthermore WSSC may refuse that person future privileges of riding on the Access Road.
- The current regulation also specifies the eight Rocky Gorge Reservoir access points to gain access to the Access Roads where riding is allowed.

Although these regulations are quite clear as to their intent, evidence indicates that they are not adhered to by all of the riders. There is abundant evidence of recent horse activity on a network of unauthorized trails throughout the property, evidence of regular access onto Commission property directly from adjacent private properties, and use of established but currently unauthorized horse trails closer to the reservoir edge (e.g., Terry Ledley Equestrian Trail, Pat Oliva Equestrian Trail). We also note that the authorized trails (on the WSSC Access Road) are

not clearly marked, there appears to be confusion as to whether the older trails can still be used, and the signage is sometimes confusing (Photo 6-10).

The potential impacts of horse activities on water quality are largely related to: the number and frequency of horses using the property, areas where they frequent (proximity to the reservoir, tributaries and eroded areas), and the design and long-term maintenance of the trails they use to minimize erosion and runoff of sediments, nutrients, and fecal material to surface waters. To address these issues, we provide the following observations:

- Better policing would improve the public's adherence to the regulations that are in effect (see Section 6.4.9 on enforcement/policing).
- WSSC could choose to limit the number of permits granted each year for horseback riding. Combined with better enforcement, this method could limit excessive use of trails in vulnerable areas and thereby reduce potential impacts to water quality.
- WSSC could restrict the use of authorized trails to group rides (e.g., 5 or more riders) which would require prior approval of WSSC watershed staff and perhaps an additional "group ride" type of permit. This type of restriction is currently in effect for the Ware Watershed in Massachusetts (see Section 4 for more detail). For larger group rides (over 15 riders) the Ware Watershed regulations also require that a Group Access Permit be submitted at least two weeks prior to the planned access date.
- The design and maintenance of authorized trails could be improved by using the services of Soil Conservation District staff with special expertise in equine issues. Based on a conversation with Mr. Steve Darcey (Prince George's Soil Conservation District), District staff could evaluate the quality of existing trails, make recommendations on improving trails to minimize erosion potential, recommend relocation of trail segments vulnerable to erosion, recommend relocation of trails that are judged to be too close to shorelines to more sustainable areas, suggest redesigns of stream crossing areas, and note trail segments where redesign, relocation and/or armoring would be beneficial to improving water quality.
- Soil Conservation District staff could also help adjacent property owners better manage equine operations with the potential to runoff onto WSSC property and impact the watershed (e.g., manure pile management and implementation of appropriate BMPs).
- WSSC needs to amend regulations that can be reasonably enforced regarding the use of the numerous interior trails, and the WSSC-authorized Access Roads currently used by horses. At present, the horse trail regulations are not rigorously followed, the authorized trails are not clearly marked, and the signage is sometimes confusing (e.g., Photo 6-10).
- Regarding the regulation that prohibits the use of the Access Roads (and presumably any other authorized horse riding trail) if they are "wet and muddy", this erosion prevention provision needs to be better defined with a consistent means of allowing horse trail users to know whether the trails are closed on any particular day within the riding season. Approaches could include: no riding within 24 to 72-hours of a precipitation event that exceeds a set threshold; or WSSC could post on their website when the horse trails are closed following a significant precipitation event; or the horse community could assign a qualified (and WSSC-approved) person to visit susceptible areas to more directly judge soil and erosion potential conditions and then advise WSSC on the status to post on the Commission's website.

If WSSC chooses to limit horse trail riding to only the authorized Access Roads, we suggest that better maps be produced to show the allowable access and trailer parking points, clearly show Access Road areas where riding is unsafe or otherwise unacceptable due to extreme slopes and unstable surfaces, and a definitive statement of the current regulations and penalties. Soil Conservation Service staff could also be asked to help determine alternate trail alignments or structural improvements which bypass these dangerous areas so that a continuous trail is retained. If other specific horse trail areas are deemed to be acceptable by the Commission (e.g., Terry Ledley Equestrian Trail, Pat Oliva Equestrian Trail, Triadelphia Access Road), those areas should also be mapped carefully to show access points to the trails, the trails themselves, and make it absolutely clear where riding is not allowed (supported with clear signage and enforcement).

EA recommends that WSSC maintain the seasonal restrictions to horseback riding in order to prevent trail damage during seasonally muddy conditions, and during the winter months when the diurnal freeze-thaw cycle increases the trails vulnerability to damage and erosion. The time of day restrictions to horseback riding have a negligible impact on erosion or water quality impacts, but EA recognizes that such restrictions are warranted for logistical reasons and for reservoir security.

6.4.10 Enforcement / Policing Activities on WSSC Property

WSSC should increase policing activities on Commission property to enforce existing watershed rules and regulations, and to make it clear to the general public that these properties are managed on a regular basis, and there are repercussions for misuse. Based on our observations during this project, there is minimal presence of WSSC police officers to observe and enforce current watershed regulations. In the two months that EA was actively evaluating the trail system, we never saw any policing activity beyond the staff in the visitor center. Additionally, during the two stakeholder meetings and open comment period it was brought to our attention that many boaters and fishermen use WSSC's property without permits, with little concern for being caught or resulting penalties. Also brought to our attention at the stakeholder meetings were individuals who used the WSSC property trails for hiking and running, uses which are clearly prohibited according to the website.

During our field efforts we witnessed horseback riding on currently banned trails as well as evidence of recent horse wastes and horseshoe prints on a larger portion of unauthorized trails. With limited or minimal policing, WSSC is not able to catch violators and properly enforce penalties. We believe there needs to be a larger policing effort to uphold the policies and regulations, better signage as to acceptable and prohibited activities, and clear penalties for violators of the Commission's watershed regulations. Spartanburg SC reservoirs, for example, are policed by "Lake Wardens" who have delegated authority as South Carolina Constables to issue citations. Violators are subject to enforcement procedures which include fines, required restoration, permit revocation/denial, or other enforcement means as required and provided for by law.

6.4.11 Boating Restrictions / Access Ramps

The Commission's regulations allow the use of certain types of boats on the reservoirs, subject to restrictions which are detailed in the Watershed User Regulations booklet and on the website. An issue affecting freshwater resources nationwide is the introduction and establishment of zebra mussels (*Dreissena polymorpha) and other* invasive freshwater species which can cause significant damage to intakes and pipes at water treatment plants.

Baltimore City has established boating regulations designed to help protect its reservoirs against the introduction of zebra mussels and other invasive species. The current regulation states:

> "*Persons desiring to use their watercraft on Liberty, Loch Raven and/or Prettyboy Reservoirs must sign an affidavit stating that their watercraft will be used ONLY on Liberty, Loch Raven and/or Prettyboy Reservoirs*" (City of Baltimore Watershed Regulations §A-5.1).

The regulation further states that the use of live bait for fishing is prohibited unless it has been purchased from a Maryland State-certified zebra mussel-free bait store within 48-hours of use (§A-5.5).

Although a regulation like this does not preclude zebra mussels (and other invasive aquatic species such as *Hydrilla* and Eurasian watermilfoil) from entering the reservoirs, it is a prudent measure to educate the public of the concerns, and take a cost-effective step to protect the waters from the significant damage these invasive species can cause. We believe that amending the watershed use regulations to include a similar permit-based requirement for boaters on Rocky Gorge and Triadelphia Reservoirs would be beneficial.

6.4.12 Public Amenities

It was noted during our site visits and by stakeholders during the public meetings, that there could be improvements made in the public access areas of the watershed property. Most notable were the following:

- There was a noticeable amount of litter and trash around many of these access areas (see Photos 5- 32, 5-55), and the shoreline (Photos 5-5, 5-10 and 5-11).
- The portable toilets should be better maintained.
- The garbage dumpster at the head of the Supplee Lane boat ramp parking area was often observed to be overloaded and contain items that should not be brought onto the property (e.g., a mattress, household waste). Upon a recent (August 2012) visit we noted this dumpster has been removed. However, we recommend proper and adequate trash receptacles be in place and properly maintained for the expected public use of the Supplee Lane access area.

Each of these conditions contributes to degradation of the property, and some small but unacceptable degradation or potential degradation of water quality within the reservoir system.

We recognize that these are difficult if not impossible issues to eliminate on a large watershed property that the public uses, but conditions might improve somewhat with more (better) policing, more and better maintained garbage and trash bins, and better signage in the picnicking, playground, boat launching and public fishing areas.

6.5 Other Management and Stewardship Issues

6.5.1 Public Stewards

We generally support the idea that responsible recreational users can be a valuable resource, and working with WSSC professionals can play an important role identifying potential watershed issues (e.g., property misuse and damage), and reporting restricted, illegal or damaging activities. As presented by several speakers during the public meetings, responsible users can be "the eyes and ears" which supplement WSSC staff to identify issues and report violations of WSSC's watershed regulations. By implementing a simple and functional reporting system, watershed "stewards" could easily and effectively relay information to watershed managers for specific follow-up actions. At the public meetings there were comments by stakeholders who did not know how, or were unable to report an issue to the proper authorities. A simple and effective system should be in place for recreational users to report potentially dangerous events to WSSC police. There could also be a program established to educate and then certify active users of the watershed to ensure that only responsible members of the public would be recognized.

6.5.2 Patuxent Reservoir Management Plan

The WSSC Patuxent Reservoirs are a critical regional water supply source and the long-term quality and quantity of those resources must be fully protected. AWWA (2010) has published an updated and revised "Operational Guide to AWWA Standard G300, Source Water Protection" which is consistent with USEPA's Multiple Barrier Approach. Standard G300 presents a framework for water utilities to better understand and ensure the completeness and effectiveness of their source water protection program. The AWWA framework is applicable to water systems of any size, and results in a reservoir management program that is specific to site-specific circumstances. The standard also provides a series of worksheets and examples to help guide utilities through the process. The six primary elements of the AWWA's Standard G300 for source water protection are:

1. A written SWP Vision or official policy
2. Source Water Characterization
3. Program Goals
4. Action Plan
5. Implementation of SWP Practices
6. Program Evaluation and Revision

Although several of these components have been developed and are in place within the Commission, we recommend that WSSC develops an updated reservoir management plan for the Rocky Gorge and Triadelphia Reservoirs that is consistent with the guidance presented in

AWWA Standard G300 (AWWA 2010). The process of working through this updated AWWA G300 standard would help WSSC objectively evaluate the completeness and effectiveness of its source water protection program using the most recent guidance available.

6.5.3 Re-examine Forest Conservation Plans and Address Key Recommendations

In 2007, MDNR's Forest Service developed a Forest Conservation Plan for the reservoir properties, and Versar's (2009) Interim Watershed Management Report presented additional recommendations related to water supply buffer property management.

MDNR's Forest Conservation Plan

The purpose of WSSC's (2007) Forest Conservation Plan was to guide conservation and sustainable management of forests surrounding their two reservoirs. The recommendations in the Plan were designed to maintain the forest lands in a healthy and actively regenerating condition and to make the forests resistant to disturbance, and quick to recover when a disturbance does occur. The specific Forest Conservation Goals in the Plan were developed through collaboration of WSSC and MDNR's Forest Service. The primary goal of the Plan was protecting and enhancing water quality.

EA recommends that the 2007 Forest Conservation Plan for WSSC reservoir properties be re-examined, compared to current operating practices, and appropriate management recommendations from the Plan be implemented to better protect the watershed. Some relevant management objectives from the Forest Conservation Plan's recommendations are:

- Minimizing Risk to Water Quality: The goal of conserving reservoir forest buffer for water quality involves avoiding disturbances that generate sediment, like erosion, fires, flooding, and invasive plants and insects.
- Silviculture: re-establishment of adequate levels of seedling regeneration, reduction of the high risk of disturbance to pine plantations from large storms or insect infestations, and enhancing structural complexity and overall species diversity in the forest.

EA generally agrees with the Forest Conservation Plan's recommendations of several management actions that are warranted and encourages the implementation of these management objectives including:

- Managing Wildlife: Continue and expand the WSSC's deer control strategy to support natural regeneration of forests and improved habitat conditions over time.
- Reducing Weeds: Manage invasive species, particularly before any silvicultural operation.
- Thinning Woods: Reduce density of overstocked stands to increase resilience in the event of pest infestations and encourage structural diversity and advanced regeneration, an average of 1.6% of forest area per year for 15 years.
- Managing People: Reduce the immediate human impacts to soil, vegetation, and wildlife habitat and water quality through:
    - Active (programs) and passive (signs) public education
    - Treatments of high-use recreation areas

    - Law and regulation enforcement
    - Controlling access and maintaining roads
- Maintaining Roads: Maintain roads and boundaries for protection, management, and emergency access. Reduce sediment moving off the internal road system.
- Responding to Storms and Fires: Survey stand damage after major storms. Identify damage and the need for invasive species control. Further train WSSC staff in wildfire suppression and coordinate with local fire departments to improve wildfire response capacity.
- Protecting Rare Species:
    - Protect ¼ mile radius around active bald eagle nests on the Northern shore of the Triadelphia Reservoir near Kalmia Farms (stand 22) and the Howard County side of Rocky Gorge Reservoir near the end of Reservoir Road (stand 46).
    - Use 100 feet or greater buffer to protect endangered plant small-flowered hemicarpha (*Lipocarpha micrantha*) near Browns Bridge Road shoreline, and the Nontidal Wetland of Special State Concern north of the bridge.
    - Monitor the status of gray birch population near the end of Greenbridge Road.
- Managing for Wildlife Habitat: Manage areas of more than 25-acre interior patches for forest interior habitat by selective or small group selection cutting as needed to assure healthy and regenerating stands.

<u>Patuxent Reservoirs Interim Watershed Management Report</u>
The Interim Watershed Management Report (Versar 2009) was a compilation of several reports on the Patuxent Reservoirs watershed over a 30-year period with additional GIS analysis to characterize current land uses. The report was to address long-term management uses for the watersheds.

The Interim Management Report presents relevant key findings and suggested recommendations. We believe that the Report's recommendations should be re-examined, compared to current Commission practices, and decisions made for additional relevant improvements to implement within WSSC's buffer property. It is acknowledged that many recommendations in the Versar Report are aimed at improvements within the broader 80,000 acres of the Patuxent River drainage basin outside of WSSC's control. However, certain key recommendations from the Interim Management Report included:

- Planting of riparian buffers (if applicable in unforested portions of WSSC property) to address potential phosphorus and sediment sources from agriculture, and for reduction in stream scour/channel erosion.
- Explore zoning and other development regulations, codes and ordinances as tools with which to create and better protect stream buffers, contiguous forests tracts, and other key natural resources. The Patuxent Reservoirs Watershed Protection Group's Technical Advisory Committee (2011) is already doing these and note expected environmental benefits.
- Opportunities for stream restoration within WSSC-owned land should be assessed and coordinated with ongoing restoration efforts in the upstream (off-site) lands to help minimize stream scour/channel erosion.

- Stream scour could be addressed through strategic retrofit of new volume control BMPs or enhancement of existing flood control ponds to better protect from channel erosion and scour, particularly in small tributaries and headwater streams.
- Develop strategies for invasive plants and insects and for deer management, in light of the known deleterious impact of invasive species and deer on forest regenerative capacity and stream buffer/floodplain stability.
- Education and outreach be targeted strategically in subwatersheds with strong potential for improving water quality conditions.

6.6 Summary of Recommendations

In December 2011 EA was contracted by the Commission to conduct an independent evaluation of the buffer property surrounding the two reservoirs, and provide recommendations on current and future uses and management of the property that might affect or improve water quality, and reduce storage capacity losses. The discussions and recommendations presented in this report are based upon EA's field observations of the WSSC-owned buffer property, reviews of policies and practices enacted in other national and regional drinking water reservoir watersheds, and the information obtained during two stakeholder meetings conducted for this study. The Study Team mapped and conducted a reconnaissance-level survey of more than 80 miles of trails within WSSC's watershed property including: the WSSC Access Roads, authorized shoreline fishing trails, and unauthorized trails, as well as the old interior horse trails (e.g., the Terry Ledley and Pat Oliva Equestrian Trails). Based upon these efforts, key findings and recommendations include:

6.6.1 Prevention and Restoration of Erosion

- Although some of the WSSC Access Road segments at Rocky Gorge are easily accessible and in very good condition, it was observed that substantial portions of the Rocky Gorge Access Road are significantly eroded, and many areas would not be suitable for use by emergency vehicles (fire or police), WSSC police, or horseback riding. Most of the Rocky Gorge Access Roads are routed straight up and down hills, and many segments appear to be unmaintained and have steep slopes with substantial gullies and washed out areas where the Study Team's 4-wheel drive trucks could not navigate. This prevents continuous travel, and effectively divides the Access Road into discrete segments. Further, the rocky and slippery footing on many of these steep slope areas would be potentially dangerous for horses and riders, and small all-terrain vehicles (ATVs) that may be used by WSSC for maintenance. If the Rocky Gorge Access Road is to be used for emergency vehicles or recreational use, the Road should be maintained to accommodate those uses. (Sections 6.3.1 and 6.3.4)
- The Access Road for the Triadelphia reservoir buffer property is generally well aligned with the topography and located on stable soils (Section 6.2.2). EA recommends that WSSC consider amending its watershed regulations to designate sections of the Triadelphia Reservoir Access Road, especially in Howard County, for recreation use such as horseback riding.
- EA recommends that all unauthorized shoreline fishing trails be closed and impacted sections be restored.

- Our study indicates that the WSSC Access Roads are the dominant source of sediments and associated runoff contaminants (sediment and associated nutrients) originating from trails within the WSSC buffer property, and that the apparent loadings of these contaminants from smaller interior trails are substantially smaller in comparison. Quantitative loading estimates were beyond the scope of this study, as were observations or estimates of sediment or nutrient loadings coming from upstream neighboring lands (outside of the WSSC property). EA recommends that a more quantitative study of relative loadings of sediments and associated contaminants be conducted in the future so that if specific load reductions are required, they can be cost-effectively evaluated. (Section 6.3.3)

6.6.2 Fire Protection

- Fire represents a significant risk to the forested WSSC water supply buffer property and resulting adverse impacts to water quality and quantity. EA recommends that WSSC develop, implement, and enforce a detailed Fire Protection Plan that identifies all responsible emergency response groups, and their roles and responsibilities under specific conditions. Rapid access to WSSC property areas is a key aspect of this emergency response plan, which involves the ability to move equipment into certain reservoir property areas (e.g., via the Access Roads and other trails), as well as access via public roads and private properties.

6.6.3 Security and Enforcement

- WSSC should increase policing activities on Commission property to enforce existing watershed rules and regulations, to make it clear to the general public that these properties are managed on a regular basis, and there are repercussions for misuse. Based on our observations during this project, there is insufficient presence of WSSC police staff to observe and enforce current watershed regulations. (Section 6.4.9)

6.6.4 Forest Management

- WSSC's (2007) Forest Conservation Plan was to guide conservation and sustainable management of forests surrounding their two reservoirs. EA recommends that the 2007 Forest Conservation Plan for WSSC reservoir properties be re-examined, compared to current operating practices, and appropriate management recommendations from the Plan be implemented to better protect the watershed. (Section 6.5.3)

6.6.5 Wildlife and Invasive Species Control

- EA supports the continued use of controlled MDNR-assisted deer management on the reservoir properties. Our support for continued deer management is based upon EA's observations during the trail surveys, information presented on WSSC's website regarding deer overpopulation and damage to forest resources, and statements at the two public meetings, (Section 6.4.2)

6.6.6 Public Access

- Public access areas in Rocky Gorge should provide adequate and appropriate parking for their intended uses. In several cases, there are designated horse trail entrances but they do not have adequate parking for horse trailers. Other access points are adjacent to private property and do not have clear boundaries or parking areas. (Section 6.3.1)
- WSSC property boundary fences were observed to be in poor condition or absent in many of the areas, making it easier for adjacent homeowners to encroach on Commission property for unauthorized activities. EA recommends that WSSC reestablish fencing or clear boundary markers in selected areas to better control unauthorized access onto WSSC property. (Section 6.3.6)
- Posted signs intended to identify authorized access entrance areas, allowable public uses in specific areas, and prohibited activities are often found to be in poor condition and misleading and/or outdated as to the information they convey. Replacement signs should be clearly visible from access points, should convey that the properties are actively managed, and should use consistent and clear language to indicate the allowed activities and prohibitions in each specific area. (Section 6.4.5)

6.6.7 Recreational Uses

- Although WSSC's horse trail regulations are quite clear as to their intent, evidence indicates that they are not adhered to by all of the riders. There is abundant evidence of recent horse activity on a network of unauthorized trails throughout the property, access directly from adjacent private properties, and use of established but currently unauthorized horse trails closer to the reservoir edge (i.e., Terry Ledley and Pat Oliva Equestrian Trails). Recommendations for WSSC to consider include:
    - better policing of the buffer property to improve the public's adherence to the regulations that are in effect;
    - involving the Soil Conservation District staff with special expertise in equine issues to evaluate the quality of existing trails, make recommendations on improving trails to minimize erosion potential, recommend relocation of trail segments vulnerable to erosion or deemed too close to the shoreline, and suggest redesigns of stream crossing areas.
    - Soil Conservation District staff could help adjacent property owners better manage equine operations with the potential to runoff onto WSSC property and impact the watershed; e.g., manure pile management and implementation of appropriate BMPs. (Section 6.4.9)
- If WSSC chooses to restrict horse trail riding to <u>only</u> the currently authorized Access Roads in Rocky Gorge, we recommend that better maps be produced that show the allowable access and trailer parking points, clearly show Access Road areas where riding is unsafe or otherwise unacceptable due to steep slopes and unstable surfaces, and a definitive statement of the current regulations and penalties. (Section 6.4.9)
- If <u>other</u> specific horse trail areas are deemed to be acceptable by the Commission (e.g., Terry Ledley Equestrian Trail, Pat Oliva Equestrian Trail, Triadelphia Access Road), we recommend that those areas be mapped carefully to show access points to the trails, the trails themselves, and provide clear signage where riding is not allowed. (Section 6.4.9)

- The Commission's regulations allow the use of certain types of boats on the reservoirs, subject to restrictions which are detailed in the Watershed User Regulations. To reduce the potential for the introduction and establishment of invasive aquatic species (e.g., zebra mussels (*Dreissena polymorpha), Hydrilla*, watermilfoil), we recommend that the Commission implement a permit-based requirement that boaters using the Rocky Gorge and Triadelphia Reservoirs can use their watercraft only on the two Patuxent reservoirs. Although a regulation like this cannot preclude zebra mussels (and other invasive aquatic species) from entering the reservoirs, it is a prudent and cost-effective measure to educate the public of this important water quality issue. (Section 6.4.10)

6.6.8 Neighboring Land Impacts

- The field study identified a network of trails, many of which lead to private properties with direct but unauthorized access to WSSC's property. WSSC needs to make a determination of how to manage these private access points. Options to consider include: allow private access trails to authorized areas as long as they are properly maintained in a manner consistent with WSSC policy; establish a fee-based permit process that grants private access privilege with stipulations regarding their use; or remove all private access and enforce compliance with regular patrols by watershed security professionals. (Section 6.4.6)
- The Commission needs to address the official "permissions" or "permits" that some adjacent property owners received in the past from a former WSSC employee allowing direct access to WSSC's reservoir property. We recommend that WSSC's General Counsel's Office investigate how many of these letters might exist, whether they are valid as ongoing permissions to access Commission-owned property, and understand what (if any) rights these letters might currently convey. (Section 6.4.6)
- Another adjacent property owner issue is the presence of large quantities of animal manure near the WSSC property line. These large piles contribute to nutrient pollution and runoff as well as other affiliated concerns with animal waste. It is in the best interest of WSSC to promptly work with these landowners to implement BMPs that would protect the watershed from the potentially adverse impacts of these manure piles. (Section 6.4.6)

6.6.9 Programmatic Issues

- AWWA (2010) published an updated and revised "Operational Guide to AWWA Standard G300, Source Water Protection" that is consistent with USEPA's Multiple Barrier Approach. Although several of these components have been developed and are in place within the Commission, we recommend that WSSC develop an updated reservoir management plan for the Rocky Gorge and Triadelphia Reservoirs that is consistent with the guidance presented in AWWA Standard G300. The process of working through this updated AWWA G300 standard would help WSSC objectively evaluate the completeness and effectiveness of its source water protection program using the most recent guidance available. (Section 6.5.2)
- To further protect water quality of the Patuxent reservoirs, WSSC should consider the purchase of additional lands and/or conservation easements within the broader watershed,

when properties become available. By controlling development, access to watershed lands, limiting increases in impervious surface within the watershed, and making environmental improvements to the purchased properties, reservoir water quality will be further enhanced. In lieu of acquiring additional watershed property, another approach to consider would be the construction (and long-term maintenance) of appropriate BMPs within the watershed to control the introduction of sediments and contaminants to the reservoirs. (Section 6.4.1)

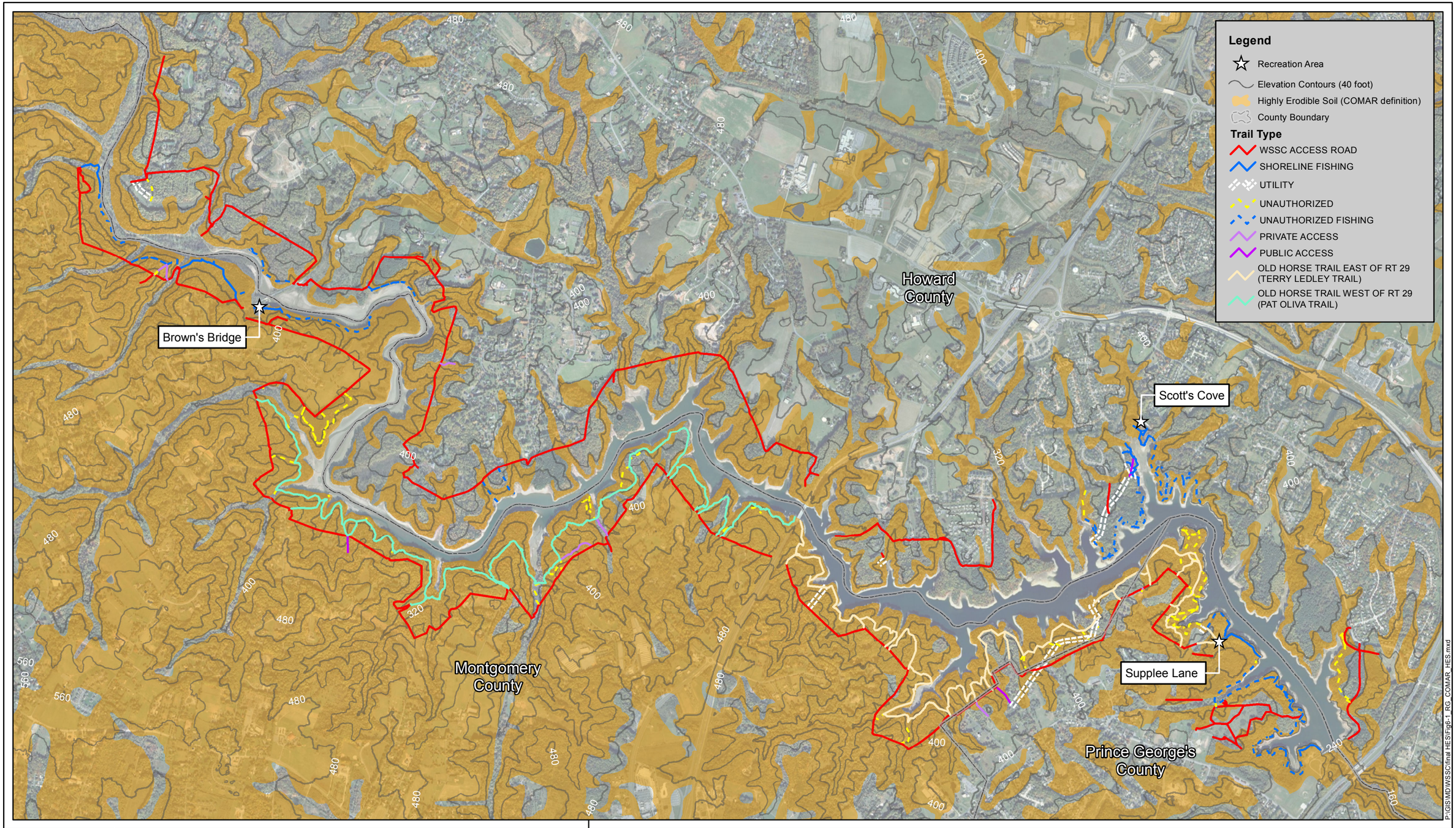


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Figure 6-1. Rocky Gorge Reservoir
Highly Erodible Soils

0 0.5 1 Miles

N W E S

Data Sources:
USGS National Elevation Dataset
NRCS SSURGO soil data
WSSC
ESRI Imagery

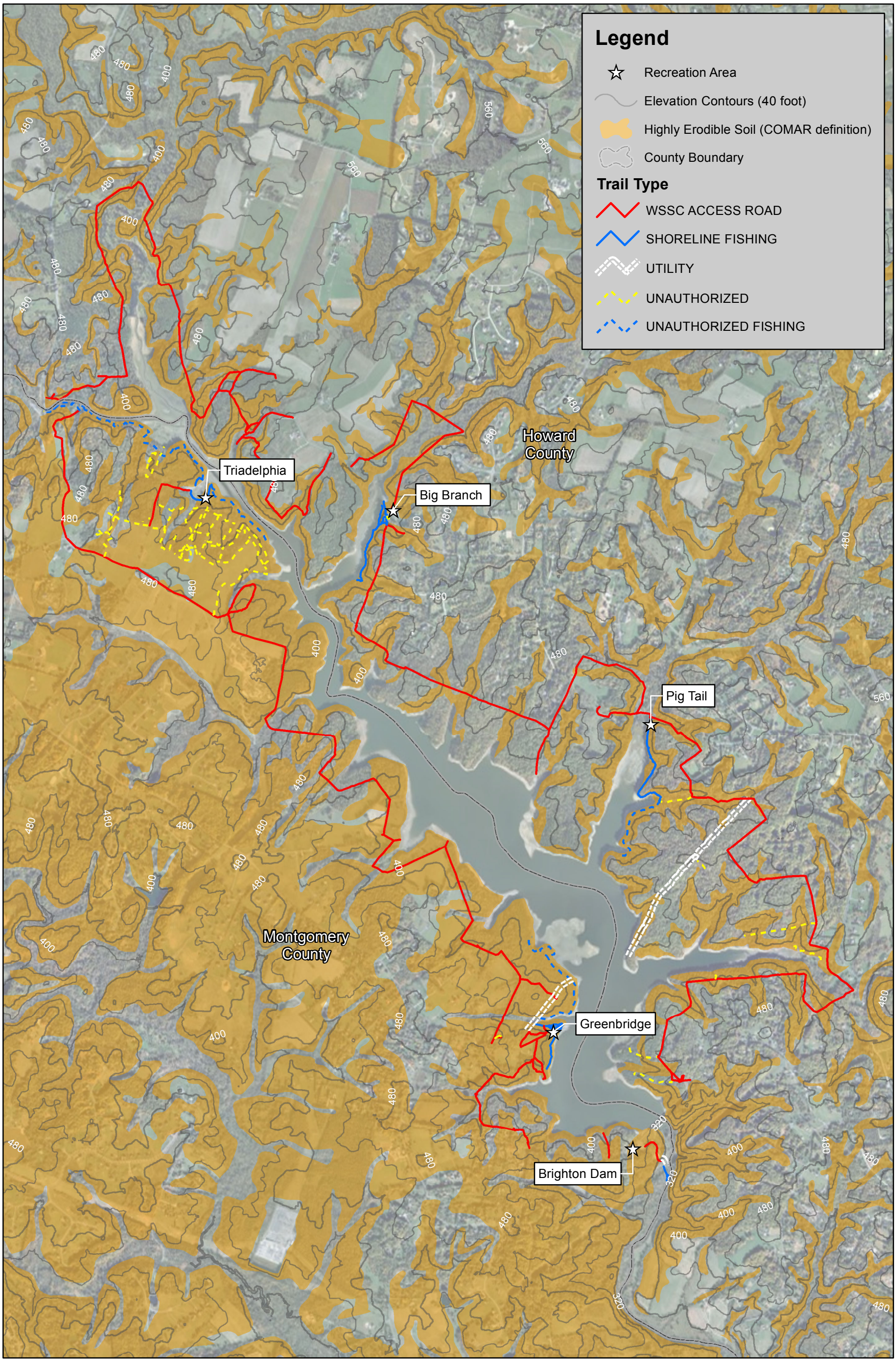

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Figure 6-2. Triadelphia Reservoir
Highly Erodible Soils

N
W E
S

Miles
0 0.25 0.5

Data Sources:
USGS National Elevation Dataset
NRCS SSURGO soil data
WSSC
ESRI Imagery

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Study Results, Observations, and Recommendations

Photo 5-1: Tucker Lane fallen trees

Photo 5-2: Tucker Lane hole in trail

Study Results, Observations, and Recommendations

Photo 5-3: Ednor Lane slope and channelized erosion

Study Results, Observations, and Recommendations

Photo 5-4: Ednor Lane slope and channelized erosion

Study Results, Observations, and Recommendations

Photo 5-5: Supplee Lane Recreation Area fishing equipment packaging found along the trail

Photo 5-6: Supplee Lane Recreation Area unauthorized shoreline trail with substantial bank erosion

Photo 5-7: Brown's Bridge Recreation Area - North Bank motorcycle tracks caused rutting on the fairly steep slope

Photo 5-8: Brown's Bridge Recreation Area - North Bank exposed roots

Photo 5-9: Brown's Bridge Recreation Area - North Bank shoreline collapsed area of red soil

Study Results, Observations, and Recommendations

Photo 5-10: Brown's Bridge Recreation Area - North Bank overflowing trashcan

Study Results, Observations, and Recommendations

Photo 5-11: Scotts Cove West Shoreline Trail trash on trail

Photo 5-12: Scotts Cove West Shoreline Trail manure on trail

Photo 5-13: Scotts Cove West Utility Trail erosion

Photo 5-14: Terry Ledley Equestrian Trail sign.

Study Results, Observations, and Recommendations

Photo 5-15: Terry Ledley Equestrian Trail stream crossing.

Photo 5-16: Terry Ledley Equestrian Trail reservoir from closest trail point.

Photo 5-17: Pat Oliva Trail close to water at the Olivia Pass

Photo 5-18: Pat Oliva Trail

Photo 5-19: Pat Oliva Trail section eroded due to poor trail alignment

Photo 5-20: Pat Oliva Trail channelized erosion

Photo 5-21: Pat Oliva Trail channelized erosion

Photo 5-22: Pat Oliva Trail stream crossing

Photo 5-23: Pat Oliva Trail horse tracks and disturbed soil

Photo 5-24: Washout area within Section 5 of the Access Road

Photo 5-25: Washout area within Section 5 of the Access Road

Photo 5-26: Washout area within Section 5 of the Access Road

Photo 5-27: Section 6 steep hill with deep erosion/gully.

Study Results, Observations, and Recommendations

Photo 5-28: Harding Road Section with heavy vegetation

Photo 5-29: Route 29 to Brown's Bridge North Section erosion

Photo 5-30: Brown's Bridge North to Fox Haven Section trail

Photo 5-31: Brown's Bridge North to Fox Haven Section rutting

Photo 5-32: Triadelphia Recreational Area Shoreline and Interior Trails trash found along trail

Photo 5-33: Triadelphia Recreational Area Shoreline and Interior Trails bank erosion

Photo 5-34: Greenbridge Recreation Area bank erosion

Photo 5-35: Brighton Dam Recreational Area bank erosion

Photo 5-36: Big Branch shoreline trail high slope alignment

Photo 5-37: Pig Tail Recreational Area trail erosion

Photo 5-38: Triadelphia Lake Road

Photo 5-39: Triadelphia Lake Road rutting from vehicles

Photo 5-40: Triadelphia Lake Road area cleared by a small dozer

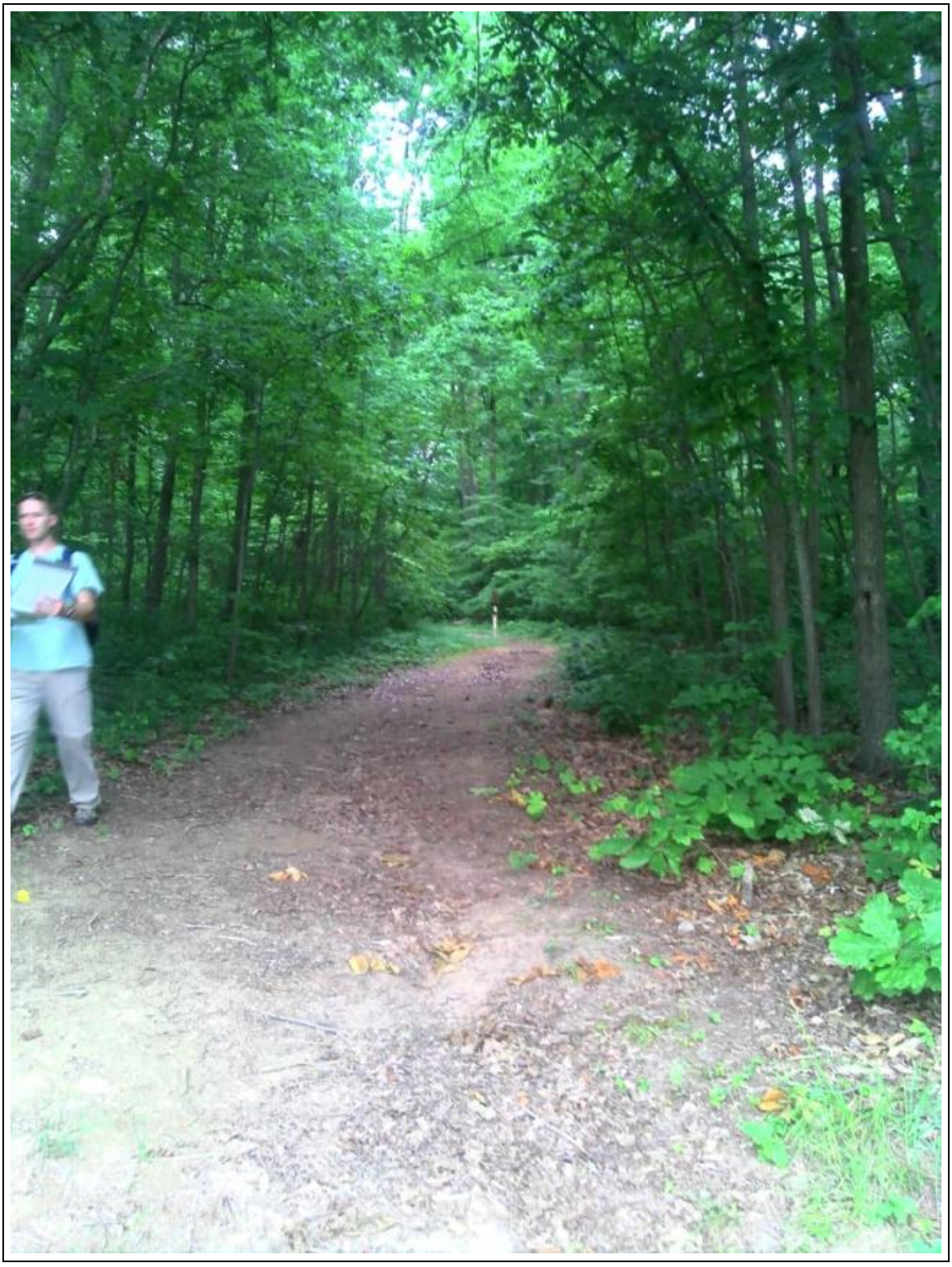


Photo 5-41: Greenbridge West Access Rd

Photo 5-42: Greenbridge West Access Rd significant rutting and erosion

Photo 5-43: Greenbridge East unauthorized trail spur to shoreline

Photo 5-44: West Big Branch moderate slope

Photo 5-45: West Big Branch Access Road covered with overgrown vegetation

Photo 5-46: West Big Branch Access Road vehicle induced rutting

Photo 5-47: Pig Tail vehicle rutting

Photo 5-48: Tucker Lane paved road shoulder parking

Photo 5-49: Tucker Lane access trail

Photo 5-50: Brown's Bridge at Ednor Road parking Montgomery County side and west of Ednor Road

Photo 5-51: Brown's Bridge at Ednor Road parking Montgomery County side and east of Ednor Road

Photo 5-52: Brown's Bridge at Ednor Road parking Montgomery County side and east of Ednor Road

Photo 5-53: Brogden Road parking area at cul-de-sac used by school buses are turn around

Photo 5-54: Brogden Road access sign

Photo 5-55: Batson Road gravel turnabout off-road parking

Photo 5-56: Kruhm Road parking

Photo 5-57: Burtons Lane parking

Photo 5-58: Supplee Lane picnic area

Photo 5-59: Supplee Lane Recreation Area boat launch ramp

Photo 5-60: Supplee Lane Recreation Area parking

Photo 5-61: Scott's Gove Recreational Area

Photo 5-62: Brighton Dam paved primary parking lot and welcome center

Photo 5-63: Brighton Dam paved overflow parking lot

Photo 5-64: Brighton Dam fenced in picnic area

Photo 5-65: Brighton Dam outdoor open space

Photo 5-66: Brighton Dam localized bank erosion due to fishing access to edge of water

Photo 5-67: Pig Trail Recreational Area

Photo 5-68: Big Branch Recreational Area outdoor restroom facility

Photo 5-69: Big Branch Recreational Area boat launch ramp

Photo 5-70: Big Branch Recreational Area drains toward Triadelphia Reservoir

Photo 5-71: Triadelphia Recreational Area outdoor restroom facility

Photo 5-72: Triadelphia Recreational Area boat launch ramp

Photo 5-73: Triadelphia Recreational Area fishing dock

Photo 5-74: Triadelphia Recreational Area parking lot

Photo 5-75: Triadelphia Recreational Area trash receptacles

Photo 5-76: Greenbridge Recreational Area paved parking and outdoor restroom facility

Photo 5-77: Greenbridge Recreational Area boat launch ramp

Photo 5-78: Greenbridge Recreational Area bank erosion with un-stabilized slopes

Study Results, Observations, and Recommendations

Photo 6-1: Apparent Homeless Activity

Photo 6-2: Example of confusing signage

Figure 14. Ware River Public Access Signage

Ware River Watershed Public Access Management Plan Update – 2010

Photo6-3: Ware River, Massachusetts, recreational sign

Photo 6-4: Example of unauthorized private access to WSSC property

Photo 6-5: Example of unauthorized private access to WSSC property

Photo 6-6: Horse farm with manure pile.

Photo 6-7: Horse farm with manure pile.

Photo 6-8: Example of human modification to WSSC property – horse jump

Photo 6-9: Example of human modification to WSSC property – horse jump

Photo 6-10: Example of confusing signage

Appendix A
Maryland COMAR - Highly Erodible Soils (HES)
Howard, Montgomery, Prince George's Counties

MARYLAND COMAR - HIGHLY ERODIBLE SOILS - HOWARD COUNTY, MD

JEB 10/12

NOTES: Table is based on data from NRCS SSURGO data (9/21/2006) exported from the Soil Data Mart.
This table lists soils meeting the Maryland COMAR and local SCD definition of Highly Erodible Soils (HES).

Map Unit Sym	Map Unit Name	HES Criteria
BrD	Brinklow channery loam, 15 to 25 percent slopes	slope >= 15%
BtF	Brinklow-Blocktown channery loams, 25 to 65 percent slopes	slope >= 15%
CeC	Chillum loam, 5 to 10 percent slopes	k >= .35 and slopes >5%
ChC	Chillum-Russett loams, 5 to 10 percent slopes	k >= .35 and slopes >5%
GaD	Gaila loam, 15 to 25 percent slopes	slope >= 15%
GdD	Gladstone-Legore complex, 15 to 25 percent slopes, stony	slope >= 15%
GmB	Glenville silt loam, 3 to 8 percent slopes	k >= .35 and slopes >5%
GmC	Glenville silt loam, 8 to 15 percent slopes	k >= .35 and slopes >5%
GnB	Glenville-Baile silt loams, 0 to 8 percent slopes	k >= .35 and slopes >5%
GoB	Glenville-Codorus silt loams, 0 to 8 percent slopes	k >= .35 and slopes >5%
GuB	Glenville-Urban land-Udorthents complex, 0 to 8 percent slopes	k >= .35 and slopes >5%
JaB	Jackland silt loam, 3 to 8 percent slopes	k >= .35 and slopes >5%
LrD	Legore-Relay gravelly loams, 15 to 25 percent slopes, very stony	slope >= 15%
LrF	Legore-Relay gravelly loams, 25 to 65 percent slopes, very stony	slope >= 15%
MaD	Manor loam, 15 to 25 percent slopes	slope >= 15%
McD	Manor loam, 15 to 25 percent slopes, very rocky	slope >= 15%
MgD	Manor-Bannertown sandy loams, 15 to 25 percent slopes, rocky	slope >= 15%
MgF	Manor-Bannertown sandy loams, 25 to 65 percent slopes, rocky	slope >= 15%
MkF	Manor-Brinklow complex, 25 to 65 percent slopes, very rocky	slope >= 15%
RtC	Russett-Alloway-Hambrook complex, 5 to 10 percent slopes	k >= .35 and slopes >5%
RtD	Russett-Alloway-Hambrook complex, 10 to 15 percent slopes	k >= .35 and slopes >5%
RuC	Russett and Beltsville soils, 5 to 10 percent slopes	k >= .35 and slopes >5%
SrC	Sassafras and Croom soils, 5 to 10 percent slopes	k >= .35 and slopes >5%
SrD	Sassafras and Croom soils, 10 to 15 percent slopes	k >= .35 and slopes >5%
SrE	Sassafras and Croom soils, 15 to 25 percent slopes	slope >= 15%
UaF	Udorthents, Highway, 0 to 65 percent slopes	slope >= 15%
UbF	Udorthents, Refuse, 0 to 65 percent slopes	slope >= 15%
UcD	Urban land-Chillum-Beltsville complex, 5 to 15 percent slopes	k >= .35 and slopes >5%
UoE	Udorthents, 0 to 45 percent slopes, Gravel Pits	slope >= 15%
UsD	Urban land-Sassafras-Beltsville complex, 5 to 15 percent slopes	k >= .35 and slopes >5%
UuD	Urban land-Udorthents complex, 8 to 25 percent slopes	slope >= 15%
UwC	Urban land-Woodstown-Sassafras complex, 5 to 10 percent slopes	k >= .35 and slopes >5%
WgD	Wheaton-Glenelg complex, 8 to 25 percent slopes	slope >= 15%
WhB	Wiltshire silt loam, 3 to 8 percent slopes	k >= .35 and slopes >5%

MARYLAND COMAR - HIGHLY ERODIBLE SOILS (HES)
MONTGOMERY COUNTY, MARYLAND
SLOPES GREATER THAN 5 PERCENT WITH A Kw-FACTOR GREATER THAN 0.35

NOTES: Table is based on data from NRCS SSURGO data (2/02/2007) exported from the Soil Data Mart. This table lists soils meeting the Maryland COMAR and local SCD definition of Highly Erodible Soils (HES) based on the Kw-Factor. RV infers representative value (mid range). Percent Compostion is only given for major components, not minor components. Kw-Factor is from surface layer and includes adjustments for rock fragments. Not Rated = n/r. Highly Erodible Soils (HES) criteria elements are: K Factor=Kw-Factor > 0.35 with slopes > 5% or Slope=slopes > 15%. Slopes with RV's of 4% were included to capture thoses soils that have slope ranges up to 8%. The Glenelg soils have been added to this table because of incorrect Kw values in the database. The Croom soils have been removed from this list because of incorrect Kw values in the database.

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV	Kw-Factor
1B:	Gaila silt loam, 3 to 8 percent slopes	9,469			
	Gaila		95	6	0.37
1C:	Gaila silt loam, 8 to 15 percent slopes	17,070			
	Gaila		95	12	0.37
2B:	Glenelg silt loam, 3 to 8 percent slopes	52,024			
	Glenelg		95	6	0.43
2C:	Glenelg silt loam, 8 to 15 percent slopes	12,732			
	Glenelg		95	12	0.43
2UB:	Glenelg-Urban land complex, 0 to 8 percent slopes	10,232			
	Glenelg		50	4	0.43
2UC:	Glenelg-Urban land complex, 8 to 15 percent slopes	7,445			
	Glenelg		50	12	0.43
7UB:	Gaila-Urban land complex, 0 to 8 percent slopes	608			
	Gaila		50	4	0.37
7UC:	Gaila-Urban land complex, 8 to 15 percent slopes	639			
	Gaila		50	12	0.37
17B:	Occoquan loam, 3 to 8 percent slopes	11,998			
	Occoquan		80	6	0.37
17C:	Occoquan loam, 8 to 15 percent slopes	5,647			
	Occoquan		80	12	0.37
19B:	Bucks silt loam, 3 to 8 percent slopes	1,866			
	Bucks		85	6	0.37
22B:	Readington silt loam, 3 to 8 percent slopes	2,862			
	Readington		80	6	0.43
35B:	Chrome and Conowingo soils, 3 to 8 percent slopes	2,085			
	Conowingo		30	6	0.43
37B:	Travilah silt loam, 3 to 8 percent slopes	973			
	Travilah		95	6	0.43
41B:	Elsinboro silt loam, 3 to 8 percent slopes	430			
	Elsinboro		85	6	0.49

Maryland COMAR - (HES) Montgomery County, MD (cont)
Slopes > 5% with Kw-Factor > 0.35

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV	Kw-Factor
57B:	Chillum silt loam, 3 to 8 percent slopes	1,295			
	Chillum		100	6	0.43
57C:	Chillum silt loam, 8 to 15 percent slopes	624			
	Chillum		100	12	0.43
57D:	Chillum silt loam, 15 to 25 percent slopes	144			
	Chillum		100	20	0.43
57UB:	Chillum-Urban land complex, 0 to 8 percent slopes	428			
	Chillum		50	4	0.43
59B:	Beltsville silt loam, 3 to 8 percent slopes	595			
	Beltsville		100	6	0.43
64B:	Croom and Bucks soils, 3 to 8 percent slopes	1,261			
	Bucks		30	6	0.37
64C:	Croom and Bucks soils, 8 to 15 percent slopes	469			
	Bucks		30	12	0.37
65B:	Wheaton silt loam, 0 to 8 percent slopes	3,457			
	Wheaton		100	4	0.49
66UB:	Wheaton-Urban land complex, 0 to 8 percent slopes	8,054			
	Wheaton		50	4	0.49
66UC:	Wheaton-Urban land complex, 8 to 15 percent slopes	2,302			
	Wheaton		50	12	0.49
67UB:	Urban land-Wheaton complex, 0 to 8 percent slopes	1,499			
	Wheaton		25	4	0.49

MARYLAND COMAR - HIGHLY ERODIBLE SOILS (HES)
MONTGOMERY COUNTY, MARYLAND

SLOPES GREATER THAN 15 PERCENT

NOTES: Table is based on data from NRCS SSURGO data (2/02/2007) exported from the Soil Data Mart. This table lists soils meeting the Maryland COMAR and local SCD definition of Highly Erodible Soils (HES) based on the slope percent. RV infers representative value (mid range). Percent Compostion is only given for major components, not minor components. Not Rated = n/r. Highly Erodible Soils (HES) criteria elements are: K Factor=Kw-Factor > 0.35 with slopes > 5% or Slope=slopes > 15%.

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
16D:	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	17,026		
	Brinklow		50	20
	Blocktown		30	20
18E:	Penn silt loam, 15 to 45 percent slopes, very stony	93		
	Penn		95	30
21D:	Penn silt loam, 15 to 25 percent slopes	1,691		
	Penn		95	20
21E:	Penn silt loam, 25 to 45 percent slopes	698		
	Penn		95	35
21F:	Nestoria-Rock outcrop complex, 25 to 50 percent slopes	243		
	Nestoria		65	38
24D:	Montalto silt loam 15 to 25 percent slopes, very stony	149		
	Montalto		100	20
57D:	Chillum silt loam, 15 to 25 percent slopes	144		
	Chillum		100	20
61D:	Croom gravelly loam, 15 to 25 percent slopes	142		
	Croom		100	20
61E:	Croom gravelly loam, 25 to 40 percent slopes	216		
	Croom		100	33
109D:	Hyattstown channery silt loam, 15 to 25 percent slopes, very rocky	2,748		
	Hyattstown		90	20
109E:	Hyattstown channery silt loam, 25 to 45 percent slopes, very rocky	207		
	Hyattstown		90	35
116D:	Blocktown channery silt loam, 15 to 25 percent slopes, very rocky	9,470		
	Blocktown		85	20
116E:	Blocktown channery silt loam, 25 to 45 percent slopes, very rocky	6,556		
	Blocktown		85	35
200	Pits, gravel	326	100	?
201	Pits, quarry	235	100	?

MARYLAND COMAR - HIGHLY ERODIBLE SOILS
PRINCE GEORGE'S COUNTY, MARYLAND

SLOPES GREATER THAN 15 PERCENT

NOTES: Table is based on data from NRCS SSURGO data (7/31/2009) exported from the Soil Data Mart. This table lists soils meeting the Maryland COMAR and local SCD definition of Highly Erodible Soils (HES). Percent Compostion is only given for major components, not minor components. Slope percentage is representative value (mid range). Highly Erodible Soils (HES) Criteria element: Slopes greater than 15 percent.

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
AfE	Annapolis fine sandy loam, 15 to 25 percent slopes	220		
	Annapolis		80	20
AfF	Annapolis fine sandy loam, 25 to 40 percent slopes	114		
	Annapolis		75	33
BwD	Brinklow channery loam, 15 to 25 percent slopes	8		
	Brinklow		85	20
ByD	Brinklow-Blocktown channery loams, 15 to 25 percent slopes	6		
	Brinklow		50	20
	Blocktown		35	20
ByF	Brinklow-Blocktown channery loams, 25 to 65 percent slopes	64		
	Brinklow		50	45
	Blocktown		40	45
CbE	Chillum-Urban land complex, 15 to 25 percent slopes	62		
	Chillum		50	20
CcE	Christiana-Downer complex, 15 to 25 percent slopes	851		
	Christiana		45	20
	Downer		35	20
CcF	Christiana-Downer complex, 25 to 40 percent slopes	220		
	Christiana		45	35
	Downer		35	35

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
CdE	Christiana-Downer-Urban land complex, 15 to 25 percent slopes	523		
	Christiana		35	20
	Downer		30	20
CnE	Collington-Wist complex, 15 to 25 percent slopes	3140		
	Collington		60	20
	Wist		25	20
CnF	Collington-Wist complex, 25 to 40 percent slopes	921		
	Collington		60	35
	Wist		25	35
CoE	Collington-Wist-Urban land complex, 15 to 25 percent slopes	472		
	Collington		40	20
	Wist		30	20
CrE	Croom gravelly sandy loam, 15 to 25 percent slopes	295		
	Croom		75	20
CsE	Croom-Howell-Collington complex, 15 to 25 percent slopes	869		
	Croom		50	18
	Howell		25	20
	Collington		25	20
CsF	Croom-Howell-Collington complex, 25 to 40 percent slopes	980		
	Croom		50	35
	Collington		25	35
	Howell		25	35
CwE	Croom-Marr complex, 15 to 25 percent slopes	8309		
	Croom		50	20
	Marr		30	18
CwG	Croom-Marr complex, 25 to 60 percent slopes	2381		

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
	Croom		50	35
	Marr		30	35
CxE	Croom-Marr-Urban land complex, 15 to 25 percent slopes	810		
	Croom		45	20
	Marr		30	20
CzE	Croom-Urban land complex, 15 to 25 percent slopes	499		
	Croom		70	20
EwE	Evesboro-Downer complex, 15 to 25 percent slopes	191		
	Evesboro		40	20
	Downer		30	20
GmF	Grosstown-Marr-Hoghole complex, 15 to 40 percent slopes	3		
	Marr		30	28
	Grosstown		30	28
	Hoghole		15	28
	Dodon		10	28
HOE	Howell and Annapolis soils, 15 to 25 percent slopes	36		
	Howell		50	20
	Annapolis		40	20
HZE	Howell and Dodon soils, 15 to 25 percent slopes	94		
	Howell		50	20
	Dodon		30	20
HZF	Howell and Dodon soils, 25 to 40 percent slopes	40		
	Howell		50	30
	Dodon		30	30
McD	Manor loam, 15 to 25 percent slopes	187		
	Manor		90	20

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
MfF	Manor-Brinklow complex, 25 to 65 percent slopes, very rocky	417		
	Manor		55	43
	Brinklow		30	45
MnE	Marr-Dodon complex, 15 to 25 percent slopes	11947		
	Marr		50	20
	Dodon		35	20
PT	Pits, gravel	1097		
	Pits, gravel		100	40
SnE	Sassafras-Urban land complex, 15 to 25 percent slopes	281		
	Sassafras		55	20
SOE	Sassafras and Croom soils, 15 to 25 percent slopes	1238		
	Sassafras		40	20
	Croom		35	20
SOF	Sassafras and Croom soils, 25 to 40 percent slopes	610		
	Sassafras		40	35
	Croom		35	35
UdbE	Udorthents, loamy, 15 to 25 percent slopes	114		
	Udorthents		100	20
UdgE	Udorthents, reclaimed gravel pits, 15 to 25 percent slopes	747		
	Udorthents		100	20
UdrF	Udorthents, refuse substratum, 0 to 50 percent slopes	1198		
	Udorthents		100	25
WDF	Westphalia and Dodon soils, 25 to 40 percent slopes	6272		
	Westphalia		45	35
	Dodon		40	35

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV
WDG	Westphalia and Dodon soils, 40 to 80 percent slopes	1128		
	Westphalia		45	60
	Dodon		40	60

MARYLAND COMAR - HIGHLY ERODIBLE SOILS
PRINCE GEORGE'S COUNTY, MARYLAND

SLOPES GREATER THAN 5 PERCENT WITH A K-FACTOR GREATER THAN 0.35

NOTES: Table is based on data from NRCS SSURGO data (7/31/2009) exported from the Soil Data Mart. This table lists soils meeting the Maryland COMAR and local SCD definition of Highly Erodible Soils (HES). Percent Compostion is only given for major components, not minor components. Slope percentage is representative value (mid range). K-Factor is from surface layer. Highly Erodible Soils (HES) Criteria element: K Factor=K Factor > 0.35 and slopes > 5%

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV	K-Factor
AdC	Adelphia-Holmdel complex, 5 to 10 percent slopes	519			
	Adelphia		55	8	.37
BaC	Beltsville silt loam, 5 to 10 percent slopes	3302			
	Beltsville		70	7	.37
CaC	Chillum silt loam, 5 to 10 percent slopes	82			
	Chillum		75	8	.37
CaD	Chillum silt loam, 10 to 15 percent slopes	63			
	Chillum		75	14	.37
CbD	Chillum-Urban land complex, 5 to 15 percent slopes	222			
	Chillum		50	10	.37
CbE	Chillum-Urban land complex, 15 to 25 percent slopes	62			
	Chillum		50	20	.37
CcC	Christiana-Downer complex, 5 to 10 percent slopes	4543			
	Christiana		45	8	.49
CcD	Christiana-Downer complex, 10 to 15 percent slopes	1715			
	Christiana		50	12	.49
CcE	Christiana-Downer complex, 15 to 25 percent slopes	851			
	Christiana		45	20	.49
CcF	Christiana-Downer complex, 25 to 40 percent slopes	220			
	Christiana		45	35	.49

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV	K-Factor
CdD	Christiana-Downer-Urban land complex, 5 to 15 percent slopes	6980			
	Christiana		30	10	.49
CdE	Christiana-Downer-Urban land complex, 15 to 25 percent slopes	523			
	Christiana		35	20	.49
GfB	Glenelg-Wheaton-Urban land complex, 0 to 8 percent slopes	336			
	Wheaton		30	5	.43
GfC	Glenelg-Wheaton-Urban land complex, 8 to 15 percent slopes	5			
	Wheaton		30	11	.43
GwD	Grosstown-Woodstown-Beltsville complex, 5 to 15 percent slopes	311			
	Beltsville		20	10	.37
HwC	Howell-Dodon complex, 5 to 10 percent slopes	23			
	Dodon		40	8	.37
HZD	Howell and Dodon soils, 10 to 15 percent slopes	74			
	Dodon		40	13	.37
HZE	Howell and Dodon soils, 15 to 25 percent slopes	94			
	Dodon		30	20	.37
HZF	Howell and Dodon soils, 25 to 40 percent slopes	40			
	Dodon		30	30	.37
LxD	Liverpool-Piccowaxen complex, 5 to 15 percent slopes	296			
	Liverpool		45	10	.37
MnD	Marr-Dodon complex, 10 to 15 percent slopes	10473			
	Dodon		40	13	.37
UrcD	Urban land-Christiana-Downer complex, 5 to 15 percent slopes	3655			
	Christiana		15	8	.49
WDF	Westphalia and Dodon soils, 25 to 40 percent slopes	6272			

Mapunit Sym	Mapunit Name/Component Name(s)	Total Acres	Comp % RV	Slope % RV	K-Factor
	Dodon		40	35	.37
WDG	Westphalia and Dodon soils, 40 to 80 percent slopes	1128			
	Dodon		40	60	.37

Appendix B
WSSC T. Howard Duckett (Rocky Gorge) Reservoir
Horse Trail Reconnaissance Report

WSSC T. Howard Duckett (Rocky Gorge) Reservoir
Horse Trail Reconnaissance Report

Background

On June 4, 2012, staff from EA Engineering, Science and Technology, Inc. (EA), along with Chesapeake Environmental Management, Inc. (CEM), conducted a one-day reconnaissance level survey of the designated equestrian trails along the southern shore (Montgomery and Prince George's Counties) of the T. Howard Duckett (Rocky Gorge) Reservoir. Currently WSSC allows equestrian use of a portion of the WSSC access road that runs along the southern perimeter of the WSSC-owned buffer of the Rocky Gorge reservoir. The designated equestrian trail extends from Tucker Lane (approximately 3.9 miles downstream of Brighton Dam) to the Supplee Lane Access Area (approximately 0.9 miles upstream of Duckett Dam). The entire length of WSSC access road that is currently designated for equestrian use is approximately 10.1 miles long. Prior to enacting new Watershed Regulations in May 2011, WSSC allowed equestrian use of several different trails closer to the shoreline. Except as noted below, these previous equestrian trails were not surveyed on June 4, 2012; however, they were mapped by EA and CEM during the related work for evaluating other "interior trails" and their conditions.

The survey was conducted by vehicle and on foot. The survey area extended from the Tucker Lane access point eastward to the Supplee Lane Recreational Area located off Supplee Lane. The survey was conducted by 4-wheel drive vehicle in a few areas, but most areas were inaccessible by vehicle, and those areas were surveyed on foot, by hiking the trails. The reconnaissance-level survey utilized observation and personal experience to make a determination of the suitability of the designated equestrian trail for horseback riding. The survey was conducted in support of a broader effort being undertaken by WSSC to inventory existing trails and recreational use around both reservoirs, and to evaluate the potential for reducing water quality impacts to the reservoirs associated with trail use.

Methods

The reconnaissance level assessment of designated equestrian trail was conducted on June 4, 2012. The survey was conducted by a professional environmental scientist with over 40 years of horse riding experience. The survey was conducted by vehicle (where access allowed) and by foot. All trail sections surveyed were evaluated for their suitability for horseback riding, with consideration given to slope, footing, trail clearance, stream crossings, and other potential obstacles or hazards. Observations of trail condition were also made, and areas of extreme erosion or other notable trail conditions were photo-documented.

The survey used a rating scale of 0-5 to generally describe the condition of each trail section. The rating scale was developed by EA specifically for the purpose of assessing WSSC trail suitability for horse riding.

Rating	Description of Prevailing Conditions
5	Excellent horseback riding trail. Terrain flat or moderately rolling. Footing conditions firm and free from loose rocks, deep footing or other impediments. Stream crossings easy with gentle slopes, good footing and no obstacles.
4	Very good horseback riding trail. Terrain moderately rolling with some steeper areas. Footing mostly good, with some areas of loose rock or "deep" footing. Stream crossings moderately easy, with steeper banks, or some obstacles such as rocks, roots or ledges to navigate.
3	Moderate horseback riding trail. Terrain hilly, with several steeper areas to be negotiated. Footing variable, with a mix of good footing interspersed with areas of moderate to poor footing due to rocks, ledges, roots, or bogs. Moderate to difficult stream crossings with steep ascents, and rocky or deep footing. Some obstacles such as rocks, roots, ledges.
2	Poor horseback riding trial. Significant stretches of steep terrain. Footing poor with an abundance of loose rock, steps, downed trees or logs. Stream crossing difficult with very steep ascents, ledges or drops and rocky or deep footing. Serious obstacles at crossing such as large rocks/boulders, trees or logs, deep gullies or areas of erosion, concrete railroad ties.
1	Unsuitable or potentially unsafe riding trail. Significant stretches of very steep terrain. Very poor footing with significant amounts of loose rock, erosion, gullies, loose soil, deep bogs, downed trees. Stream crossings washed out or impassable.
0	Impassable riding trail. Potentially dangerous conditions over which a horse could not safely travel. Impassable conditions could be caused by extremely steep terrain, extremely poor footing, or impassable stream crossings or obstacles. Risk of injury to horse or rider is high.

The trail was assessment was conducted by vehicle in some areas, and in other areas by foot. Two sections of the trail were not evaluated during the initial reconnaissance due to limits on time and access. The designated equestrian trail was evaluated in sections corresponding to the existing designated equestrian access points as shown below.

Trail Section	Description	Approximate Length (miles)
Section 1	Tucker Lane Access to Ednor Road Access	1.2
Section 2	Ednor Road Access to Brogden Road Access	2.0
Section 3	Brogden Road Access to Batson Road Access	0.3
Section 4	Batson Road Access to Kruhm Road Access	1.3
Section 5	Kruhm Road Access to Burtons Lane Access	3.7
Section 6	Burtons Lane Access to Supplee Lane Recreation Area	1.6
Total		10.1

The reconnaissance-level survey also considered the suitability of the equestrian designated access points, including an assessment of parking for typical horse trailer rigs. For purposes of this assessment a standard trailer rig was considered to be a full-size pickup truck or SUV and standard, bumper-pull, 2-horse trailer.

Observations

Section 1 – Tucker Lane Access to Ednor Road Access (approximately 1.2 miles)

Section 1 of the trail can be accessed via either Tucker Lane or Ednor Road (Map 1). Designated recreational access parking along Tucker Lane is unmarked roadside parking along a curve in a narrow road with a guardrail on one side (Photo 1). This roadside parking area is not suitable for horse trailers due to the narrowness of the road, and would be unsafe for loading and unloading horses. Designated recreational access parking along Ednor Road is a marked gravel parking area (Photo 2). The area is large enough to accommodate two (2) trailer rigs. The parking lot is level and graveled which provide safe loading and unloading conditions for horses. The parking area is large enough to turn a trailer rig around to safely re-enter Ednor Road.

Section 1 was given an overall trail rating of 1. This trail section is characterized by steep terrain, with several significant stretches of very steep terrain where the access road goes straight up and down the hillsides, and stormwater runoff has created substantial areas of serious erosion, gullies and washouts. The footing in these areas is primarily loose boulder to cobble-size rock, interspersed with areas of crumbling subsoil and bedrock. One particularly steep section of the trail was given a rating of 0 and deemed impassable on horseback in its current condition, due to the extremely steep terrain (maximum slope >45 degrees), and rocky, eroding footing (Photo 3).

There are two stream crossings along this trail section, one of the stream crossings was rated 2, and was deemed passable, but difficult due to stream erosion, steep banks and rocky footing. The other stream crossing was rated 1 and was observed to be difficult to cross on horseback due to stream bank erosion, a partial wash-out of concrete railroad ties, steep banks, and several large boulders (Photo 4).

There appeared to be private equestrian access to this section of the trail from one or two side trails leading in from an area of private residences off Patuxent Drive. However, private access points along this section were not confirmed, and there was no direct evidence of horse use along these private access trails. There was no direct evidence of horse use observed anywhere along Section 1.

Section 2 - Ednor Road Access to Brogden Road Access (approximately 2.0 miles)

Section 2 of the trail can be accessed by either Ednor Road or Brogden Road (Map 1). Parking for this section is available at the Ednor Road access point and the Brogden Road access point. Parking along Ednor Road is as described above, on the west side of Ednor Road. Thus, equestrians wishing to access Section 2 from Ednor Road would be required to cross the road to gain access to the trail. Ednor Road is a moderately used road, and the road crossing at this location is suitable for horses. However, there are no road signs indicating an equestrian crossing at this location. Parking on the east side of Ednor Road is also available, but is not suitable for horse trailers, due to the small size of the parking area. Parking at the Brogden Road access point is available in the form of a small, circular, gravel parking lot in a residential area at the end of Brogden Road (Photo 5). The parking area is large enough to accommodate 2 trailer rigs. The parking lot is level and graveled which provides safe loading/unloading conditions. The parking area is large enough to turn a trailer rig around to safely re-enter Brogden Road.

Section 2 was given an overall trail rating of 2. This rating was based on limited access to this stretch of trail from both the Ednor Road and Brogden Road access points. From the Ednor Road side, the trail quickly climbs a very steep hill, where steep terrain, combined with erosion and poor footing conditions make the trail very difficult to travel on horseback (Photo 6). From the Brogden Road access, the trail section is characterized by moderately steep terrain, with several significant stretches of very steep terrain where runoff has created significant areas of erosion, gullies and washouts. The footing in these areas is primarily loose cobble-size rock, interspersed with areas of crumbling subsoil and bedrock (Photo 7). No stream crossings were encountered in the stretch of Section 2 that was assessed on June 4, 2012.

There appeared to be evidence of private equestrian access to the Ednor Road end of this section of the trail from a farm located off Link Road. This same farm has an active horse barn on private property immediately adjacent to the WSSC buffer along this section of the trail (Photo 8). There was no direct evidence of horse use observed along Section 2.

Section 3 - Brogden Road Access to Batson Road Access (approximately 0.3 miles)

Section 3 of the trail can be accessed via either Brogden Road or Batson Road (Map 1). Parking for this section is available at either the Brogden Road access point or at Batson Road. Parking

along Brogden Road is as described above. Parking at the Batson Road access point is available in a residential area at the end of Batson Road, and is not suitable for horse trailers (Photo 9). There is no designated parking lot at this location, and it would be difficult to get a trailer rig turned around. Also, there is no suitable area for loading or unloading horses and a large amount of litter was observed (Photo 9).

Section 3 was given an overall trail rating of 3. The terrain along this short section of the trail is moderate, with a few areas of moderately steep terrain, with reasonable footing (Photo 10). There were a few areas of rocky footing, but nothing that would be an impediment to horses. No serious obstacles or stream crossings were encountered along this trail section.

There was no evidence of private equestrian access to this section of the trail. There was no direct evidence of horse use along Section 3 observed on June 4, 2012.

Section 4 - Batson Road Access to Kruhm Road Access (approximately 1.3 miles)

Access to this section is available at both the Batson Road and Kruhm Road access points (Map 1). As described above, there is no suitable parking for horse trailers at the Batson Road access, but there is suitable parking at the nearby Brogden Road access. Parking at the Kruhm Road access is roadside parking along Kruhm Road, just outside a gated private property at the terminal end of Kruhm Road (Photo 11). Roadside parking in this area is flat and safe from a traffic perspective, but there is no place to turn around a trailer rig, and therefore is not suitable for horse trailers.

Section 4 was given an overall trail rating of 3. The terrain along this section of the trail is moderate, with a few areas of moderately steep terrain, with reasonable footing. There was one steep section encountered where access road erosion has created some gullies, making footing on relatively steep terrain difficult (Photo 12). This section was rated 2. There was also a stream crossing comprised of concrete railroad ties. The ties had algae growing on them creating slippery conditions for horses, and one of the ties was damaged and had exposed iron rebar that could catch a horses shoe causing loss of shoe or possible hoof damage or leg injury (Photo 13). This stream crossing was rated 2. No other serious obstacles or stream crossings were encountered along this trail section. Evidence of recent horse use was observed along this section.

There was no evidence of private equestrian access to this section of the trail from side trails, however not all side trails could be investigated during the one-day survey. There was evidence of access to this trail section by horses from the designated Kruhm Road access area that is located in an area of horse farms adjoining Kruhm Road. There was also considerable evidence of recent equestrian use of this section of the designated trail, as well as along one unauthorized side trail that was investigated for a short distance.

Section 5 – Kruhm Road Access to Burtons Lane Access (approximately 3.7 miles)

Access for this section is available at both the Kruhm Road and Burton Lane Access points (Map 1). Parking along Kruhm Road is as described above and is not suitable for horse trailers. There

is no designated parking area at the Burton Lane access. Burtons Lane ends at a private residence, and roadside parking is very limited due to the narrow residential road. In addition, property on both sides of the road is marked "no trespassing" (Photo 14). Even if roadside parking was available at this location, the location is not suitable for horse trailers as there is nowhere to turn around a trailer rig.

Section 5 was not surveyed in its entirety due to limitations of access and time. A portion of the trail was walked from both the Kruhm Road access and the Burtons Lane access. Based on limited observation, this trail section was given an overall rating of 3. The terrain along this section of the trail appears to be mostly moderate, with a few areas of moderately steep terrain, with reasonable footing. There were a few areas of rocky footing encountered, but nothing that would be an impediment to horses. No serious obstacles or stream crossings were encountered along the portion of this trail section that was observed on June 4, 2012.

There was no evidence of equestrian accessing this trail section from the Burtons Lane access area. However, as noted above, there is evidence of significant horse use of the Kruhm Road access area.

Section 6 – Burtons Lane Access to Supplee Lane Access (approximately 1.6 miles)

Access for this section is available at both the Burtons Lane access and Supplee Lane access points (Map 1). As noted above, there is no designated parking along Burtons Lane, and the roadside parking that is available is not suitable for horse trailers. There is a large recreational parking lot at the Supplee Lane access area (Photo 15). The parking lot is paved and is designed to accommodate cars. No area of the parking lot is designated for horse trailer rigs or equestrian use, but the parking lot is large enough to accommodate an estimated 4-6 trailer rigs. Paved parking is not the most suitable for loading and unloading horses, as pavement can be slippery. However, the Supplee Lane parking area is relatively flat and could be used for horse trailers.

Section 6 was surveyed in its entirety by foot and was given an overall rating of 3. The terrain along this section of the trail is mostly moderate, with a few areas of moderately steep terrain, but with reasonable footing. There were a few areas of rocky footing encountered, but with one exception, nothing that would be an impediment to horses. One particularly steep section of the trail was given a rating of 1 and deemed unsuitable for horseback riding in its current condition due to the steep terrain, rocky and unstable footing, serious erosion and deep gullies (Photo 16). There are no stream crossings on this section of the access road, as all streams are directed through culverts under the access road.

There are several horse farms that abut this section of the WSSC buffer and access road, and there appeared to be private equestrian access to this section of the trail at several locations. There was also considerable evidence of recent equestrian use of this section of the designated trail that can be accessed directly near the Supplee Lane Recreation Area, or indirectly via a number of unauthorized side trails that connect to an old horse trail called "Terry Ledley's Equestrian Trail". There was no direct evidence of horse use along these side trails observed on June 4, 2012.

One active horse barn on private property immediately adjacent to the WSSC buffer was observed along this section of the trail with a substantial manure pile almost directly adjoining the WSSC property boundary (Photo 17).

Supplemental: Section of Terry Ledley Equestrian Trail between Supplee Lane and Burtons Lane *(approximately 3.5 miles)*

Although not included in the scope of work from WSSC, a section of the old interior horse trail that local equestrians call the Terry Ledley Equestrian Trail, located between the Supplee Lane and Burtons Lane (Map 1) access area, was also evaluated. This trail is no longer authorized by WSSC for public use, including horseback riding.

Access to the Terry Ledley Equestrian Trail is provided at the Supplee Lane Recreation Area. The suitability for horse trailer parking available at this area is described above. This trail is also accessible from the designated access road equestrian trail, which could also be accessed from the Burtons Lane access point. The trail begins off of the designated access road equestrian trail on the west side of the transmission line crossing near the Supplee Lane access point. The trailhead is marked with a sign designating it as "Terry Ledley's Equestrian Trail" (Photo 18).

A significant portion of the marked (orange blaze marks) trail was walked on foot on June 4, 2012, and this trail section was given an overall rating of 5. The trail was found to be in excellent condition for use by horses. The terrain was mostly flat to gently undulating. The footing was firm and generally free from rocks, loose footing or deep footing. Two stream crossings were encountered. Both stream crossings were gradual bank descents into a shallow stream (Photo 19). The footing was good at both crossing, comprised primarily of sand, gravel and some cobble. There was little evidence of erosion at either of the stream crossings. The trail travels generally westward between the designated access road equestrian trail and the reservoir. The reservoir was visible in some locations, and in three locations the trail approached to within 100 feet of the reservoir (Photo 20). Side trails off the orange blaze marked trail led to the reservoir shoreline in several locations, but no evidence of equestrian use of the side trails was observed. There was little or no erosion observed along any portion of the trail. Considerable evidence of recent equestrian use of the trail was observed on June 4, 2012.

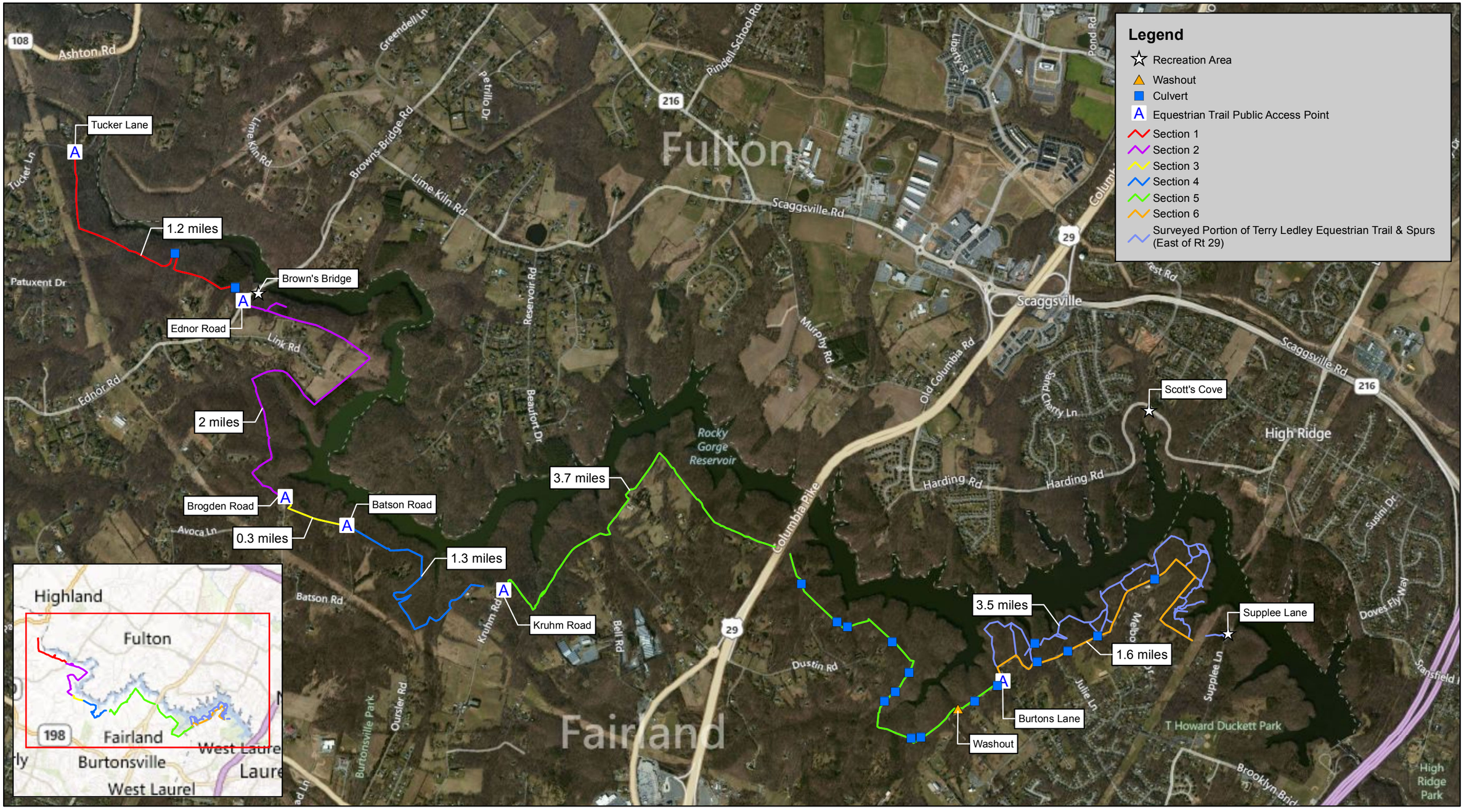
The Terry Ledley Equestrian Trail is accessed by the designated equestrian trail directly, or via unauthorized side trails that connect to the designated equestrian trail in several locations shown in Map 1.

Maps

Map 1 – Designated and unauthorized equestrian trails located within the WSSC-owned Rocky Gorge Reservoir that were surveyed on 4 June 2012.

Photos

Photo 1 – Tucker Lane roadside parking.
Photo 2 – Ednor Road west side parking.
Photo 3 – Section 1 extremely steep hill (maximum slope >45 degrees) that is impassable on horseback
Photo 4 – Section 1 stream crossing with washed out railroad ties
Photo 5 – Brogden Road parking
Photo 6 – Section 2 steep hill near Ednor Road
Photo 7 - Section 2 typical steep hill with erosion and rock footing
Photo 8 – Section 2 horse farm – near Ednor Road
Photo 9 – Batson Road parking
Photo 10 – Section 3 moderate hill trail with some erosion
Photo 11 – Kruhm Road parking
Photo 12 – Section 4 steep hill with some erosion and gullies
Photo 13 – Section 4 stream crossing with railroad ties/rebar
Photo 14 – Burtons Lane parking
Photo 15 – Supplee Lane Recreation Area parking
Photo 16 – Section 6 steep hill with deep erosion/gully
Photo 17 – Section 6 horse farm with manure pile
Photo 18 – Terry Ledley Equestrian Trail sign
Photo 19 – Terry Ledley Equestrian Trail stream crossing
Photo 20 – Terry Ledley Equestrian Trail reservoir from closest trail point



EA Engineering, Science, and Technology, Inc.

Map 1. Designated and unauthorized equestrian trails located within the WSSC-owned Rocky Gorge Reservoir that were surveyed on 4 June 2012

N W E S

Miles
0 0.25 0.5

Data Sources:
WSSC
Aerial Imagery (c) 2010 Microsoft Corporation

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Horse Trail Reconnaissance Report Photographs

Photo 1: Tucker Lane roadside parking.

Horse Trail Reconnaissance Report Photographs

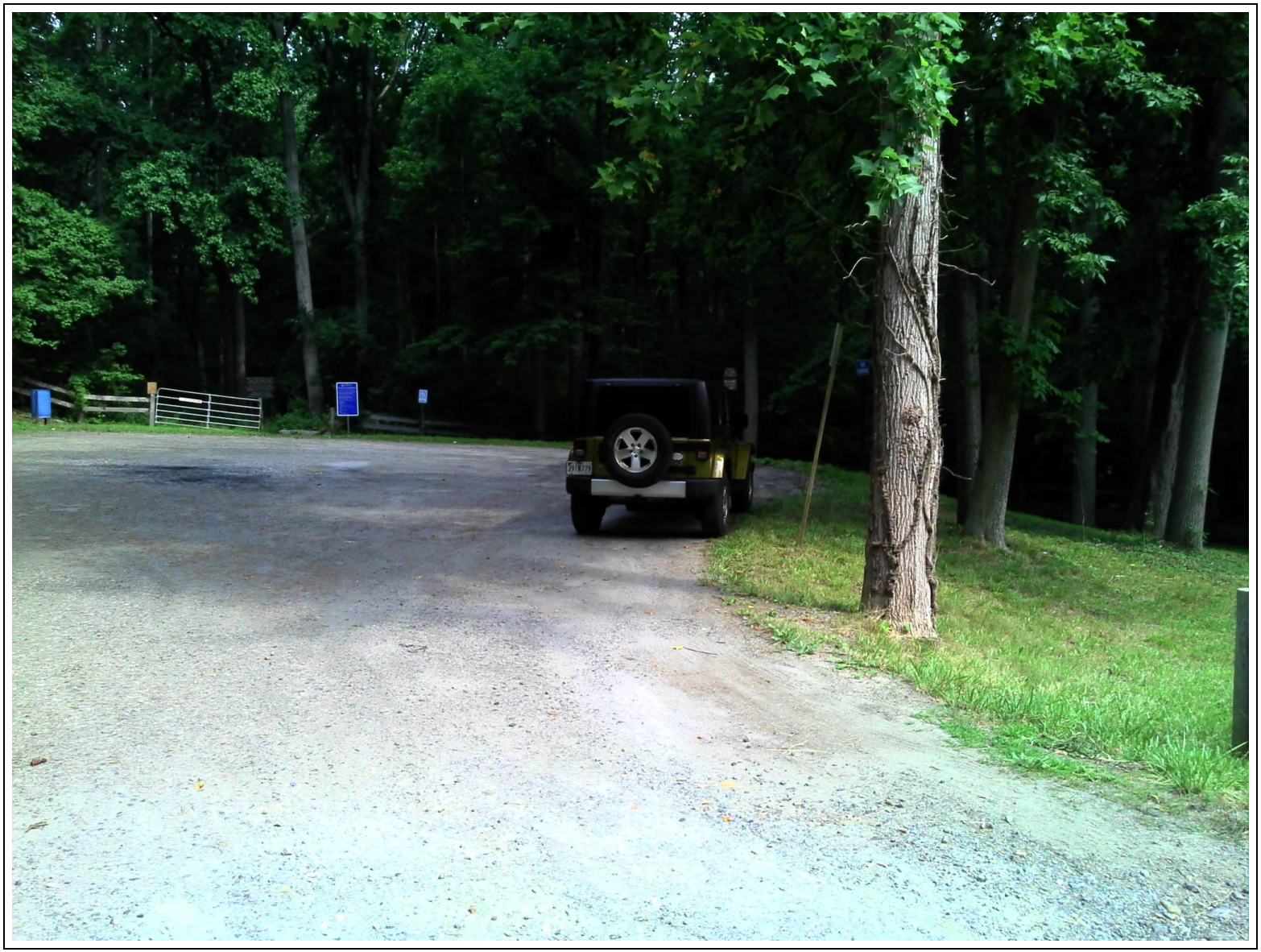

Photo 2: Ednor Road west side parking.

Horse Trail Reconnaissance Report Photographs

Photo 3: Section 1 extremely steep hill (maximum slope >45 degrees) that is impassable on horseback

Horse Trail Reconnaissance Report Photographs

Photo 4: Section 1 stream crossing with washed out railroad ties

Horse Trail Reconnaissance Report Photographs

Photo 5: Brogden Road parking.

Horse Trail Reconnaissance Report Photographs

Photo 6: Section 2 steep hill near Ednor Road.

Horse Trail Reconnaissance Report Photographs

Photo 7: Section 2 typical steep hill with erosion and rock footing.

Horse Trail Reconnaissance Report Photographs

Photo 8: Section 2 horse farm – near Ednor Road.

Horse Trail Reconnaissance Report Photographs

Photo 9: Batson Road parking.

Horse Trail Reconnaissance Report Photographs

Photo 10: Section 3 moderate hill trail with some erosion.

Horse Trail Reconnaissance Report Photographs

Photo 11: Kruhm Road parking.

Horse Trail Reconnaissance Report Photographs

Photo 12: Section 4 steep hill with some erosion and gullies.

Horse Trail Reconnaissance Report Photographs

Photo 13: Section 4 stream crossing with railroad ties/rebar.

Horse Trail Reconnaissance Report Photographs

Photo 14: Burtons Lane parking.

Horse Trail Reconnaissance Report Photographs

Photo 15: Supplee Lane Recreation Area parking.

Horse Trail Reconnaissance Report Photographs

Photo 16: Section 6 steep hill with deep erosion/gully.

Horse Trail Reconnaissance Report Photographs

Photo 17: Section 6 horse farm with manure pile.

Horse Trail Reconnaissance Report Photographs

Photo 18: Terry Ledley Equestrian Trail sign.

Horse Trail Reconnaissance Report Photographs

Photo 19: Terry Ledley Equestrian Trail stream crossing.

Horse Trail Reconnaissance Report Photographs

Photo 20: Terry Ledley Equestrian Trail reservoir from closest trail point.

Appendix C
Stakeholder Meetings – Presentation and Summaries

Patuxent Reservoirs Watershed Protection Study

Stakeholder Input Sessions

EA Engineering, Science, and Technology, Inc.
&
Chesapeake Environmental Management, Inc.

18 & 19 June 2012

EA Engineering, Science, and Technology, Inc.

- Maryland-based environmental consulting firm founded in 1973
- Headquartered in Hunt Valley, MD
- 21 offices in 13 states with >400 employees
- Subcontractor
  - Chesapeake Environmental Management, Inc. (CEM)
- EA is conducting an independent watershed protection study which will make recommendations to WSSC

Meeting Agenda and Format

- EA to describe our workplan
- Stakeholders provide input on watershed uses
- 2+ hour meeting time (7 – 9+ p.m.)
- Speaking time limited to 3 minutes; speakers given notice when 30 seconds remain
- Meeting will be audio-recorded and transcribed, comments will be summarized on flip charts, and a meeting summary will be prepared
- Written comments accepted through July 19, 2012

Meeting Purpose

- Solicit Public Input:
  - 3,500 meeting invitations to a WSSC mailing list plus 350 e-mail invitations
  - Ads placed in 3 newspapers, plus news releases and community calendars
- Listen: Stakeholder comments and suggestions
  - How the watershed is being used
  - How it should be used
  - Ensure compatibility with its primary function as a public water supply
- Seek a Variety of Opinions: Hear from a broad group of users

Meeting Goals

- Full participation and equal representation
- Expression and understanding of public interests

Ground Rules

- One speaker at a time
- Be concise
- Honor time limits
- Keep to task and topic
- Listen
- Be respectful

Key Project Staff

- Mike Powell, MS, MSE – Water quality and modeling
- Bill Rue, MS – Water quality scientist
- Wendy Bley, MS – Water quality & 40+ year equestrian
- Jody Smet, MS – Recreation, Land Use, and Shoreline Management
- Nick Walls, MS – Urban Affairs and Public Policy, and digital mapping

Overview

- Patuxent Reservoirs
  - WSSC owns and operates 2 water supply reservoirs within the 85,000 acre Patuxent River watershed
    - Triadelphia Reservoir (1943); Rocky Gorge Reservoir (1952)
  - Provide 1/3 of WSSC's drinking water supply
  - WSSC responsible for protecting long-term water quality and storage capacity
- EA's tasks
  - Objectively evaluate activities within the WSSC buffer with the potential to impact reservoir water quality and storage capacity
  - Make reservoir buffer management recommendations to WSSC.

Patuxent Reservoirs Watershed Protection Study Overview

Purpose: Objectively evaluate potential for water quality impacts from stakeholder activities within the WSSC–owned buffers

Major Study Tasks:

1. Develop Study Work Plan
2. Review existing data
3. Conduct public outreach
4. Conduct a survey of existing access and recreation trails, prepare an updated trail map, identify potential sources of water quality impacts
5. Prepare report and make recommendations

Development of Work Plan

- Review existing relevant information from WSSC, public agencies, industry, and other sources
  - WSSC water quality reports
  - WSSC regulations
  - WSSC Forest Conservation Plan
  - Source Water Assessment
  - Maps and recreational user materials (brochures, websites, etc.)
- Description of deliverables
- Schedule for completion

Mapping and Analysis of Erosion Potential

- Use existing data to develop digital maps of Rocky Gorge and Triadelphia Reservoirs
  - Watershed boundaries, WSSC's ownership , full pool elevation
  - Topography, land cover, soil data, canopy cover
  - Access roads and recreation access points
  - Natural/sensitive areas
  - Reservoir and culverts

Field Reconnaissance of Public Access Areas

- Conduct field reconnaissance of the reservoir buffer areas to
  - Verify the maps
  - Document condition of shoreline recreational trails
  - Further assess existing erosion and erosion potential
  - Determine proximity of the trails to the reservoirs
- Assess potential for erosion and contamination arising from public access and use
  - Nutrient pollution, sediments, shoreline trash dumping
- Public safety

Field Reconnaissance of WSSC Access Roads and Interior Trails

- Evaluate the condition and suitability of the WSSC access roads for designated uses
- Evaluate public access points for traffic safety, signage, off-road parking, and suitability for horse trailers and other users
- Document uses of the WSSC buffer land and adjacent properties with the potential to impact reservoir water quality

Reservoir Buffer Assessment and Recommendations

- Identify and discuss potential water quality impacts
- Make recommendations to reduce water quality impacts
  - Buffer management
  - Policies for managing public access
  - Designated access points
  - Suitable trail locations
- Describe reasonable measures WSSC could implement to improve water quality

Written Comments

Please send written comments by July 19, 2012 to:

Ms. Tracy Eberhard
teberhard@eaest.com
or
Patuxent Watershed Study
c/o EA Engineering, Science
and Technology, Inc.
15 Loveton Circle
Sparks, MD 21152

Summary of Stakeholder Outreach Meeting for Patuxent Reservoirs Watershed Protection Study – Rocky Gorge Reservoir 18 June 2012

EA Engineering, Science, and Technology (EA) held stakeholder outreach meetings on the Patuxent Reservoirs Watershed Protection Study (Study) on June 18 and 19, 2012.. EA is authorized by the Washington Suburban Sanitary Commission (WSSC) to conduct the Study. This summary describes stakeholder comments at the 18 June 2012 meeting.

Meeting Date: June 18, 2012 (7 pm to 10 pm)

Location: Laurel Boys and Girls Club
701 Montgomery Street 26430
Laurel, Maryland 20707

Speakers: See below

Agenda Items:

- EA presented an overview of the Study work plan
- EA answered questions about the Study
- EA listened to and recorded stakeholder comments and suggestions regarding recreational use of the WSSC-owned lands adjacent to Rocky Gorge and Triadelphia reservoirs and potential impacts to water quality

Meeting Format:

- Stakeholder speaking time limited to 3 minutes
- Meeting was audio-recorded and transcribed
- Written comments will be accepted through July 19, 2012

Meeting Summary

Jody Smet, EA, gave a PowerPoint slide presentation (available separately) that provided:

- background information on EA ;
- meeting agenda and format;
- meeting purpose and goals;
- meeting ground rules; and
- key project staff

Mike Powell, EA, gave a PowerPoint slide presentation (available separately) that provided a brief overview of the Study, which will include:

- a review of existing data and information relating to water quality, forest conservation, watershed boundaries, and various physical characteristics;

- field reconnaissance of WSSC access roads and interior trails for the verification of maps, documentation of erosion potential or contamination, and threats to public safety; and
- recommendations regarding buffer management, public access points, and trail locations in order to improve water quality.

Questions and Answers about Study

Mike Powell answered questions about EA's contract with WSSC, availability of information and data, field methodologies including an assessment of erosion, water quality, the extent to which recreational activities could be limited or eliminated, and whether additional factors like sedimentation, vegetation, water depth profiles or damage to culverts would be included in the scope of the Study.

Stakeholder Comments

A diverse group of stakeholders provided comments. The following briefly summarizes key stakeholder comments and concerns by recreational use/activity.

Equestrians

Many speakers stated that the vast majority of the horse trails along the reservoir show no traces of erosion and that issues related to sediment and erosion are caused by culverts and steep access roads instead of properly constructed switchback trails previously used for horseback riding. They said that issues related to fecal matter are more pertinent to deer and other wildlife, not horses. Rather than contributing to litter and excessive waste, many riders explained that they are active in cleaning up trash along the trails. Additionally, the equestrian community feels that they are important stewards of the watershed and have played a pivotal role as WSSC's eyes and ears for many years. Several stakeholders questioned reports of erosion along the trails and want WSSC to present the scientific rationale that horseback riding in these areas has negative impacts on the reservoir and its water quality.

Another concern frequently expressed was the overall dissatisfaction of and negative impact on the commercial horse stables due to:

- prohibiting use of the old bridle trails (e.g., Terry Ledley trail and Pat Oliva trail);
- the winter closure of all designated equestrian trails; and
- closing private horse entrances to the trails.

According to one speaker, the horse economy represents $5.6 billion, and a reduction in riding could negatively affect both local businesses associated with the horse industry, as well as property values near the reservoir. One speaker cited real estate experts who have said that closing the horse trails has hurt property values in West Laurel.

Many stakeholders shared their frustration with the closure of trails due to a lack of other existing areas for horse riding. Not only does the closing of trails affect local residents, but it discourages outsiders from traveling to such areas and spending money to support local businesses dependent upon horse related retail and services.

Further evidence of the value of the horse riding trails was articulated by those who stated that such activities provided valuable outdoor interactive learning experiences for young children. Additionally, one person referenced the value of trained riders in the case of potential search and rescue operations.

Overall, the stakeholders commented that the study is not focusing on the right issues related to erosion and sedimentation and water quality. Instead of focusing on recreational activities within the WSSC-owned buffer, they suggest that a more effective approach would include more analysis of tributary inputs, and land uses such as deforestation and overdevelopment in the larger, surrounding watershed.

Anglers and Boaters

Anglers and boaters alike said that they specifically bought their houses because of the close proximity to the reservoir and its associated benefits. Some stakeholders expressed their gratitude for the fishing opportunities that are permitted in the area. Others commented on the currently imposed restrictions on use and asked that the boating season be extended once again. Stakeholders also commented on lack of WSSC policy enforcement at the reservoirs.

Hunters/Deer Management

A few stakeholders commended WSSC's active deer management program and discussed the need to have better deer control in the watershed.

Pollution Sources from Outside WSSC Reservoir Buffer

Several stakeholders recognized the importance of protecting the reservoir's water quality as it is a major source of drinking water for many citizens. One speaker insisted that pollutants in the reservoir, and erosion and sediment from housing developments are more responsible for contamination within the watershed than are permit holders (i.e., recreational users).

Many stakeholders commented that the study was using bad data and focusing on the wrong issues. They would like to see a greater emphasis on other relevant issues such as surrounding development, tributary health, wetland preservation, and biodiversity. Stakeholders commented that WSSC should make the results of the study available to the public.

Stakeholder Speaker List: 18 June 2012

1. James Robinson
2. Chuck Seldon
3. Barbara Sollner-Webb
4. Brian Eyler
5. Donald Chamberlin
6. Stan Hopkins
7. Clara Gouin
8. Annette Ashby Knox
9. David Armstrong
10. Debby Poole
11. Virginia Henriksen
12. Patty Sobel
13. Lucy Errter
14. Denise Raynor
15. Peter Shumacher
16. Fran Koch
17. James Putman
18. Denis Webb
19. Dana Grabiner
20. Priscilla Huffman
21. Maria Schwartz
22. Laurel Santamarina
23. Alyce Ortuzar
24. Thomas Porter
25. Ravi Khanna
26. Jane Van Molton
27. Pat Oliva
28. Elizabeth Yuster

Summary of Stakeholder Outreach Meeting for Patuxent Reservoirs Watershed Protection Study – Triadelphia Reservoir 19 June 2012

EA Engineering, Science, and Technology (EA) held stakeholder outreach meetings on the Patuxent Reservoirs Watershed Protection Study (Study) on June 18 and 19, 2012.. EA is authorized by the Washington Suburban Sanitary Commission (WSSC) to conduct the Study. This summary describes stakeholder comments at the 19 June 2012 meeting.

Meeting Date: June 19, 2012 (7 pm to 9 pm)

Location: Izaac Walton League Wildlife Achievement Chapter
26430 Mullinex Mill Road
Mt. Airy, Maryland 21771

Speakers: See below

Agenda Items:

- EA presented overview of study work plan
- EA answered questions about the study
- Listen to stakeholder comments and suggestions for how the reservoir buffer is being used, and how it should be used in the future

Meeting Format:

- Stakeholder Speaking time limited to 3-5 minutes
- Meeting was audio-recorded and transcribed
- Written comments accepted through July 19, 2012

Meeting Summary

Jody Smet, EA, gave a PowerPoint slide presentation that provided:

- a brief background on the EA firm;
- meeting agenda and format;
- meeting purpose and goals;
- meeting ground rules; and
- key project staff

Mike Powell, EA, gave a PowerPoint slide presentation that provided a brief overview of the Patuxent Reservoirs Watershed Impact Study, which includes:

- a review of existing data and information relating to water quality, forest conservation, watershed boundaries, and various physical characteristics;
- field reconnaissance of WSSC access roads and interior trails for the verification of maps, documentation of erosion potential or contamination, and threats to public safety; and

- recommendations regarding buffer management, public access points, and trail locations in order to improve water quality.

Questions and Answers about Study

Mike Powell answered questions regarding the study. Questions related to the project included details of the contract with WSSC, details of and the potential for a Phase 2 of the watershed project, communication with stakeholders to increase outreach to all bill payers and permit holders, erosion measurement techniques, and whether additional factors like sedimentation, vegetation, water depth profiles or damage to culverts would be included in the scope of the study.

Stakeholder Comments

A diverse group of stakeholders provided comments. The following briefly summarizes key stakeholder comments and concerns by recreational use/activity.

Equestrians

Many speakers stated that the vast majority of the horse trails along the reservoir have no significant erosion and that issues related to sediment and erosion are caused by culverts, steep access roads and nearby development instead of properly constructed switchback trails previously used for horseback riding. Rather than contributing to litter and excessive waste, many riders explained that they are active in cleaning up trash along the trails. Additionally, the equestrian community feels they are important stewards of the watershed and have played a pivotal role as WSSC's eyes and ears for many years. Several stakeholders questioned reports of erosion along the trails and want WSSC to present the scientific rationale that horseback riding in these areas has negative impacts on the reservoir and its water quality.

Another concern frequently expressed was the overall dissatisfaction of and negative impact on the commercial horse stables due to:

- prohibiting use of the old bridle trails (e.g., Terry Ledley trail and Pat Oliva trail);
- the winter closure of all designated equestrian trails; and
- closing private horse entrances to the trails.

Reduced access to equestrian trails was stated to have negatively affected both local businesses associated with the horse industry, and property values near the reservoir because many people chose to live in the area specifically for access to the trails. Many stakeholders shared their frustration with the closure of trails due to a lack of alternative local horseback riding trails.

Further evidence of the value of the horse riding trails was articulated by those who stated that such activities provided valuable outdoor interactive learning experiences for children and other outreach groups.

Overall, the stakeholders commented that the study is not focusing on the right issues related to erosion and sedimentation and water quality. Instead of focusing on recreational activities within the WSSC-owned buffer, they suggest that a more effective approach would include more analysis of tributary inputs, and land uses such as deforestation and overdevelopment in the larger, surrounding watershed.

Anglers and Boaters

Anglers and boaters alike said that they specifically bought their houses because of the close proximity to the reservoir and its associated benefits. Others commented on the currently imposed restrictions on use and asked that the boating season be extended once again. Boaters stressed that they feel their use on the water has had no impact to water quality and the imposed restrictions should be removed. Stakeholders also commented on lack of WSSC policy enforcement at the reservoirs. A stakeholder expressed concern over sedimentation from the Patuxent River. Many of the anglers/boaters stated that WSSC has mishandled the equestrian issue, and are concerned that WSSC will use the Watershed Impact Study to justify closing the reservoir completely.

Hunters/Deer Management

Several stakeholders spoke in support of WSSC's active deer management program and the need to have better deer control in the watershed. Vegetation was stressed as providing a major role in preservation of water quality; and deer were directly impacting the vegetation which results in invasive species and the loss of a natural protection against sedimentation. The importance of deer management was emphasized and it was suggested that there be more WSSC managed deer hunts.

Pollution Sources from Outside WSSC Reservoir Buffer

Additionally, several speakers said that they recognize the importance of maintaining and cleaning the area since the reservoir is a major source of drinking water for many citizens. One speaker insisted that pollutants in the reservoir, erosion and sediment from housing developments are more responsible for contamination within the watershed than are permit holders.

Similar to those interested in preserving horse trails, many of these stakeholders commented that the study was using bad data and focusing on the wrong issues. They would like to see a greater emphasis on other relevant issues such as surrounding development, tributary health, and biodiversity. Many stakeholders shared their desire to have greater public outreach from WSSC to the stakeholders and bill payers. They would like WSSC to provide more information about the study, and release results of the study when it is completed.

Stakeholder Speaker List: 19 June 2012

1. Barbara Miller
2. Rob Gibbs
3. Robert Gunderman
4. John Love
5. Philip Norman
6. Melissa Daston
7. Barbara Sollner-Webb
8. Jane von Maltzhan
9. Nathan Tennies
10. Mike Caruso
11. Denis Webb
12. Maria Schwartz
13. Pat Oliva
14. Chuck McMillian
15. Debby Poole
16. Ann Coles
17. Ron Polniaszek
18. Kim Eubanks
19. Barbara Boyds