# 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)

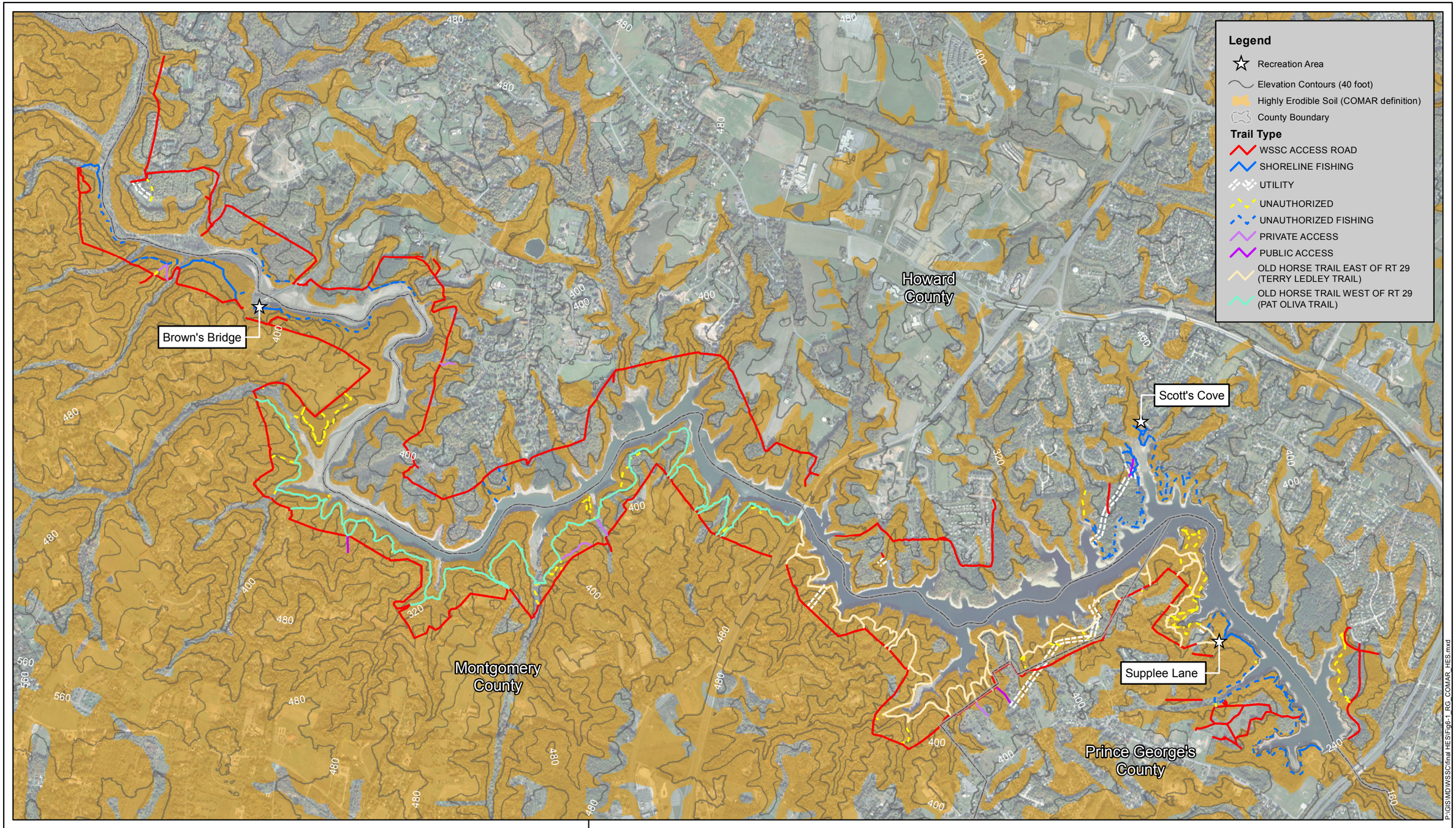


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Figure 6-1. Rocky Gorge Reservoir
Highly Erodible Soils

0 0.5 1 Miles

N W E S

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

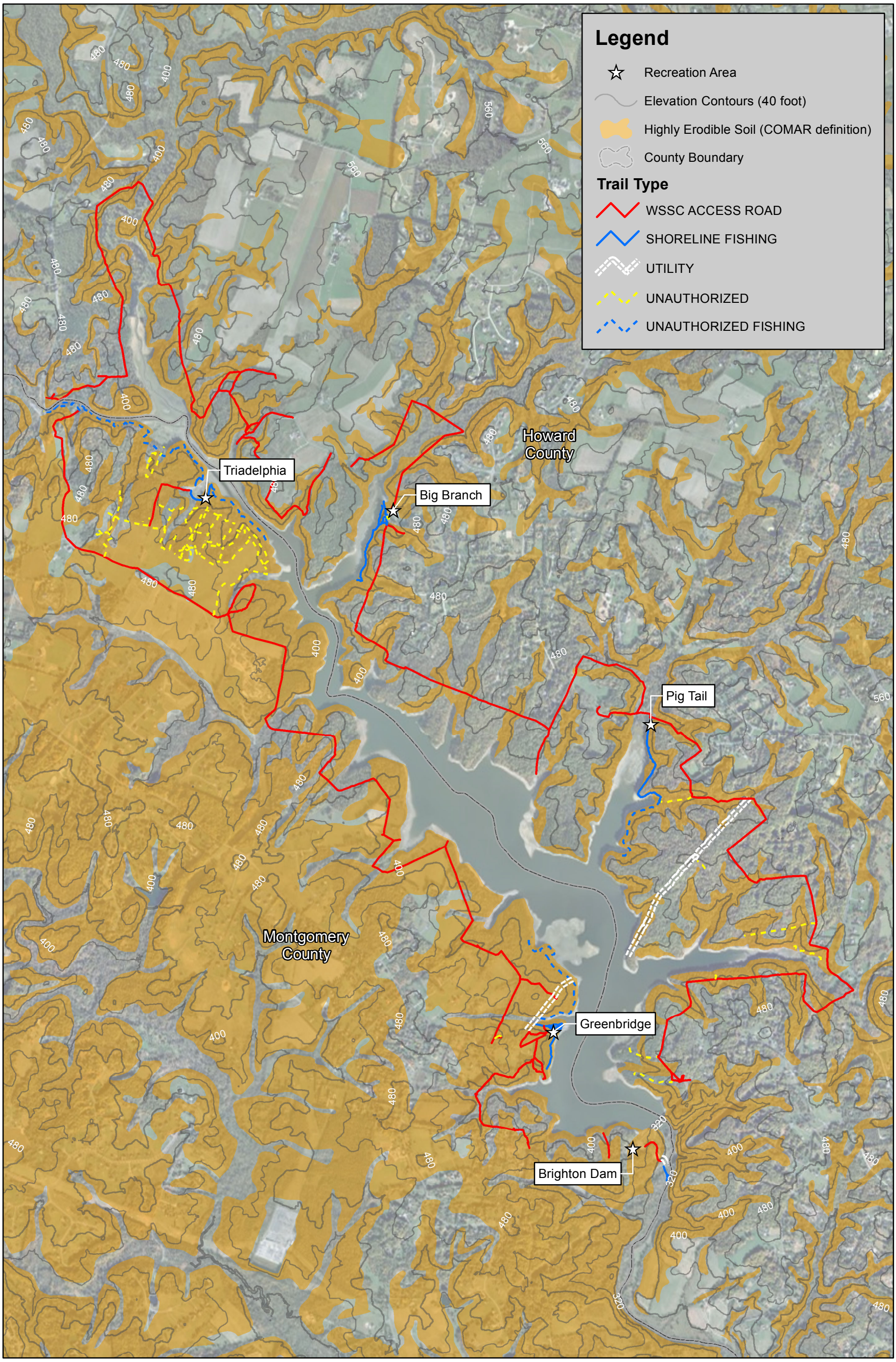


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Figure 6-2. Triadelphia Reservoir
Highly Erodible Soils

N
W E
S

Miles
0 0.25 0.5

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