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## FINAL REPORT

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### Nottoway River Survey for Threatened and Endangered Mussels and Fish of

#### **Abstract**

The Nottoway River, where it passes through Fort Pickett, Virginia was surveyed for threatened and endangered mussels and fish during 1997 and 1998. The surrounding hillsides which form the drainage basin for this river also were surveyed for unique flora and fauna. No federally listed species were identified during the surveys, however, several state listed rare species of mussels were found. The hillsides adjacent to the Nottoway River and its tributaries clearly represent a unique community on Fort Pickett. Because of this and because federally listed mussels and fish have been located in the Nottoway River downstream of Fort Pickett by other researchers, I recommend that this area be maintained as a low use area. Excessive military training in the area surrounding the Nottoway River could cause unnecessary sedimentation and degradation of the river, resulting in irreversible damage to the ecosystem.

#### **Introduction**

The Nottoway River basin, where it passes through Fort Pickett, Virginia, is relatively undisturbed and hosts some of Fort Pickett's most interesting natural communities. Because of its uniqueness, it also may harbor rare or endangered species. Several species of rare or endangered mussels (*Fusconaia masoni*, *Elliptio lanceolata*, *Alasmidonta heterodon*, and *Villosa constricta*) and an endangered fish (*Percina rex*) have been found, or are suspected to occur, in the Nottoway River upstream or downstream of Fort Pickett (Jenkins et al. 1994, Terwilliger and Tate 1995). This study attempted to determine if these species occurred in the Nottoway River within the bounds of Fort Pickett. The uplands and lowlands surrounding the river also were surveyed in an attempt to determine if the area possessed unique properties. I thank the fish and wildlife personnel of Fort Pickett for their assistance with field and office work and Richard Neves of Virginia Polytechnic Institute and State University for his assistance with mussel identification and survey techniques.

#### **Study Area**

This work was conducted on Fort Pickett, near Blackstone, Virginia (Nottoway, Dinwiddie, and Brunswick Counties). The Nottoway River parallels the southern boundary of Fort Pickett, 2 to 3 km north of the boundary line. It originates from swamps and small streams west of Fort Pickett and is dammed at the Route 46 bridge, creating the Fort Pickett Reservoir. The study area was that portion of the Nottoway River and its drainage basin, extending from the Route 46 dam to the east edge of Fort Pickett at Gills Bridge on Route 613 (Figure 1). Limited work was conducted upstream of the Fort Pickett Reservoir for comparative purposes. The Virginia Department of Conservation and Recreation, Division of Natural Heritage designated this area as the Nottoway Basin Macrosite (Fleming and Van Alstine 1994) and recommended that it be protected from exploitation.

Military training in this area is limited and appears to be largely non-destructive, except at bridge crossings and ford sites. However, significant military training and timber harvesting have taken place around the perimeter of the area.

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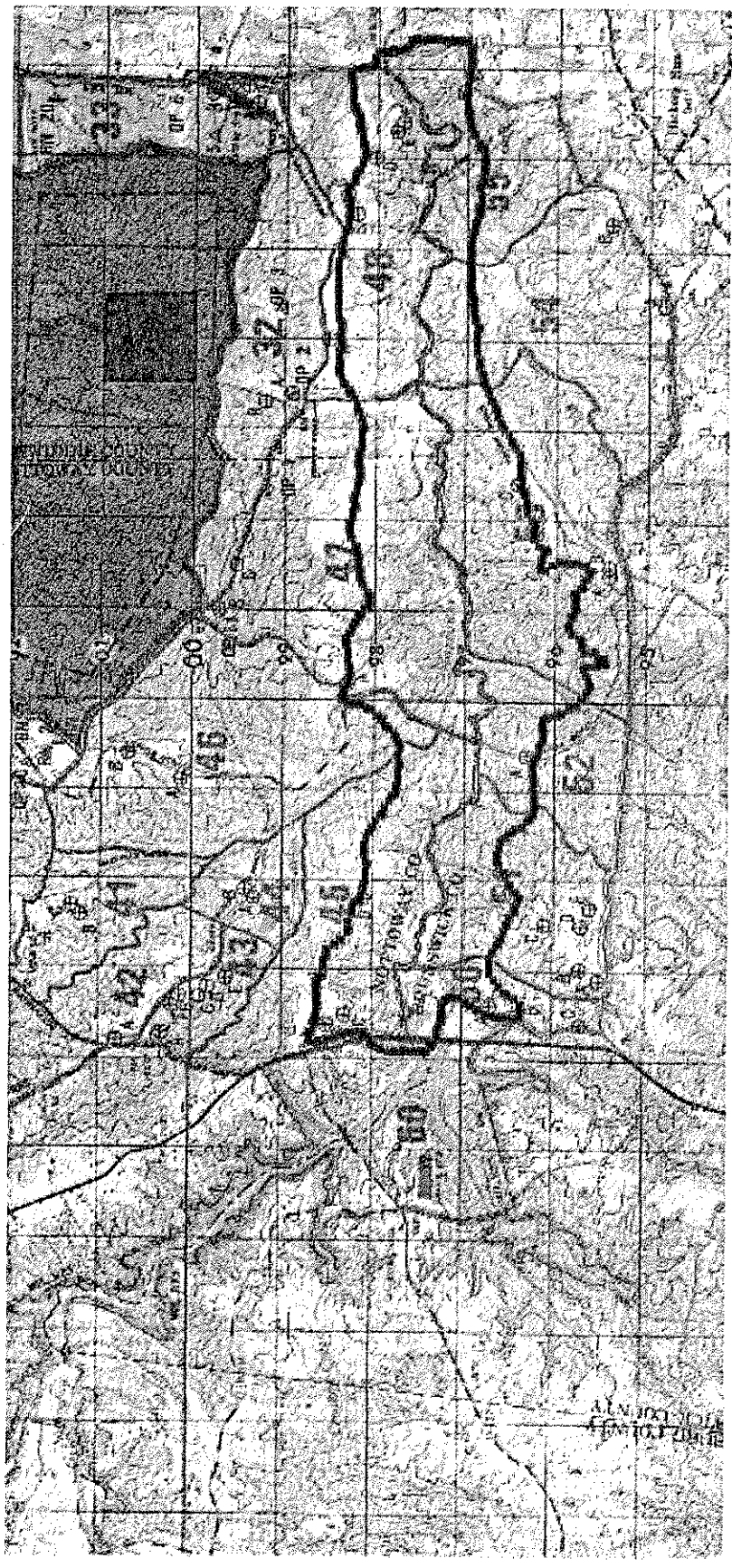


Figure 1. Study area and approximate boundary (heavy black line) of the Nottoway Basin Macroosite (Fleming and Van Alstine 1994) on Fort Pickett, Virginia.

## Methods

Terrestrial Habitats -- Subjective surveys of the land surrounding the Nottoway River were conducted to identify unique habitats and species. The area was searched on foot and both floral and faunal characteristics, as well as evidence of historic features, were noted.

Mussels -- The Nottoway River was sampled from the Route 46 bridge downstream to Gills Bridge on Route 613 for the presence of mussels. Species of interest that were sought included the Atlantic pigtoe (*Fusconaia masoni*), yellow lance (*Elliptio lanceolata*), dwarf wedgemussel (*Alasmidonta heterodon*), triangle floater (*A. undulata*), eastern floater (*Pyganodon cataracta*), squawfoot (*Strophitus undulatus*), and notched rainbow (*Villosa constricta*). Beds of *Elliptio* spp. (other than *E. lanceolata*) were noted, but individuals were not counted. Both aquascopes and snorkeling gear were used to identify mussel beds and to gather specimens. However, aquascopes were quickly abandoned due to their inadequacy in water over 45 cm deep. Whenever possible, both living and dead (shells only) individuals were identified. Sampling points were noted and the number of individuals found at each site was recorded. Live mussels were returned to their beds after identification. The shells of dead individuals were retained for reference purposes. Surveys were conducted with aquascopes in June 1997 and via snorkeling gear in July 1998, during periods of low water. Still, some areas were not accessible due to excessive current or depth.

During 1997, 2 Nottoway River tributaries were surveyed with aquascopes. Crooked Creek, near the Route 615 bridge, and Hurricane Branch, near Range Road, were searched for approximately 100 m upstream and 100 m downstream of the bridges that cross them. The Crooked Creek survey was the only work that was conducted above the Fort Pickett Reservoir.

In 1998, a short length of Tommeheton Creek (approximately 70 m) on Range 15 was surveyed with snorkeling gear. Unfortunately, very cloudy (i.e., milk-colored) water prevented visual location of beds, so all searching was done by probing the creek substrate with ungloved hands. Additionally, the entire stream bottom was overlaid by 30-60 cm of soft silt and organic matter, indicating that the habitat was unsuitable for mussels (Pennak 1989, Terwilliger and Tate 1995).

Fish -- Although suitable logperch habitat in the Nottoway River was abundant (Page and Burr 1991, Jenkins et al. 1994, Terwilliger and Tate 1995), only 2 sites were sampled for the Roanoke logperch (*Percina rex*). These were the Range Road crossing and the southeast ford site, just upstream from Gills Bridge. Seines and backpack-mounted electrofishing equipment were used to capture individuals. However, electroshocking proved ineffective for sampling *Percina* spp. without the risk of harming other species and it was nearly impossible to seine effectively due to the abundance of underwater snags. Therefore, fish monitoring efforts were terminated before a full survey could be conducted.

## Results

Terrestrial Habitats -- The terrestrial habitats of the Nottoway Basin Macrosite are mostly forested. The hillsides are moderately sloped and a narrow floodplain exists on either side of the river. In some low areas, old oxbows from previous paths of the river are abundant. Obvious surface erosion in the area is limited to specific locations along the river (usually near bridges and ford sites) and appears to be the result of vehicle and personnel movements during military training activities.

The canopy in forested portions of the area is comprised predominantly of mature timber. Loblolly pine (*Pinus taeda*), tulip poplar (*Liriodendron tulipifera*), Florida maple (*Acer barbatum*), and green ash (*Fraxinus pennsylvanica*) trees over 90 cm in diameter, at breast height (dbh), were observed, and 1 stand of sycamores (*Platanus occidentalis*) contained several trees in excess of 120 cm dbh. Other mature trees in the area included sweet gum (*Liquidambar styraciflua*), elm (*Ulmus* sp.), American beech (*Fagus grandifolia*), several species of oaks (*Quercus* spp.), and various maples (*Acer* spp.). Common shrubs and vines in the area included pawpaw (*Asimina triloba*), holly (*Ilex* sp.), greenbrier (*Smilax* spp.), spicebush (*Lindera benzoin*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Rhus radicans*). Herbaceous species were rarely noted, but they were abundant in lowland areas and where openings in the canopy allowed light to penetrate to the forest floor.

The Nottoway Basin Macrosite supports a variety of wildlife species, providing habitat for both aquatic and terrestrial species. In addition to mussels and fish (see below), other aquatic species observed included several musk turtles (*Sternotherus odoratus*), an eastern river cooter (*Pseudemys concinna concinna*), and a snapping turtle (*Chelydra serpentina*). Evidence of beaver (*Castor canadensis*) and raccoon (*Procyon lotor*) activity was common along the river. However, very little beaver evidence was fresh, suggesting that beaver populations in the area were limited. White-tailed deer (*Odocoileus virginianus*), eastern wild turkeys (*Meleagris gallopavo*), great blue herons (*Ardea herodias*), northern bobwhites (*Colinus virginianus*), red-tailed hawks (*Buteo jamaicensis*), and turkey vultures (*Cathartes aura*) were frequently observed in and immediately surrounding the area. Other species seen or heard in the Macrosite included an eastern box turtle (*Terrapene carolina carolina*), a green-backed heron (*Butorides striatus*), 2 red-shouldered hawks (*Buteo lineatus*), and countless woodpeckers and songbirds. Additionally, several large stick nests, which may have been used by hawks, great-horned owls (*Bubo virginianus*), or crows (*Corvus* spp.) were observed within the Macrosite.

Because of the size and physiography of the Nottoway Basin Macrosite and the surrounding area, it is a likely spot to locate historic or prehistoric cultural sites and artifacts. Of particular note, were a number of large, cobble-sized rock piles scattered throughout the woods east of Tower Road and south of the river. This suggests some sort of historic or prehistoric human activity, however, the actual significance of the piles is unknown and they may be from more modern times.

*Mussels* -- Forty individuals of 6 species of interest were counted during the mussel surveys (Table 1). The only species of interest not encountered during the surveys was the federally endangered dwarf wedgemussel. Countless *Elliptio* spp. individuals, other than *E. lanceolata*, were encountered, but no effort was made to estimate total numbers.

Good populations of mussels (all species combined) were found at all sampling locations on the Nottoway River below the Fort Pickett Reservoir, except directly below the dam at Route 46. However, deep water and excessive current precluded effective sampling at that location. Although total counts were not made, mussel abundance appeared to be higher in that portion of the river below Shacks Hole Road than above it. Mussel populations in Nottoway River tributaries appeared to be limited, but sampling in those areas was done only with aquascopes, preventing thorough surveys.

Although the mussels of interest were found at all locations, as expected their numbers were significantly lower than other *Elliptio* species. Additionally, more mussels of interest were found in the vicinity of the Range Road bridge than at any other site (Table 1).

No attempt was made to quantify the number of Asian clams (*Corbicula orbiculata*) found. However, they were abundant throughout the Nottoway River and were present in extremely high numbers at most sampling sites.

*Fish* -- Although only 2 sites were actually sampled, excellent logperch habitat existed at various places along the Nottoway River (Page and Burr 1991, Jenkins et al. 1994, Terwilliger and Tate 1995). Limited electroshocking and seining yielded a number of individuals in the genus *Percina*, however, no *Percina* ~~rex~~ were identified. Other species of fish present included largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), American eel (*Anguilla rostrata*), and various daces, chubs, and shiners.

Table 1. Mussels identified during surveys of the Nottoway River and tributaries at Fort Pickett, Virginia, 1997-1998.

Species	Location	No. Live Individuals	No. Dead Individuals
<i>Alasmidonta undulata</i>	Nottoway River near Tower Road	1	
	Nottoway River near Range Road	2	3
	Hurricane Branch near Range Road		1
	Nottoway River near SE Ford Site	1	
	Nottoway River near Shacks Hole Road	1	
<i>Pyganodon cataracta</i>	Nottoway River near Tower Road	1	
	Nottoway River near Range Road		1
	Nottoway River near Shacks Hole Road	1	
	Nottoway River near First Bridge Below Dam		1
<i>Elliptio lanceolata</i>	Crooked Creek near Route 615		2
<i>Fusconaia masoni</i>	Nottoway River near Tower Road	1	
	Nottoway River near Range Road	2	5
	Hurricane Branch near Range Road		1
	Nottoway River near SE Ford Site	1	1
	Nottoway River near Shacks Hole Road	2	1
<i>Strophitus undulatus</i>	Nottoway River near Range Road		3
<i>Villosa constricta</i>	Nottoway River near Range Road		6
	Nottoway River near SE Ford Site	1	
	Nottoway River near Shacks Hole Road	1	

## Discussion

Many of the features of the Nottoway Basin Macrosite are difficult to quantify. Their "value" is largely intrinsic so only subjective measures are possible. However, the lowlands and uplands of the Nottoway River basin are extremely diverse and possess many interesting characteristics. The survey conducted by the Virginia Natural Heritage Division (Fleming and Van Alstine 1994) identified several unique vegetative communities in the area. The river, itself, provides habitat for several species of rare mussels and has the potential to support populations of the dwarf wedgemussel and the Roanoke logperch, both federally endangered species.

Terrestrial Habitats -- The uplands and lowlands of the Nottoway Basin Macrosite are unique in that they have been left largely undisturbed for many years. This has allowed vegetational succession to proceed uninterrupted, resulting in some old growth tree specimens over 120 cm dbh. The mature hardwoods probably are extremely important to the ecology of the area. In addition to protecting the Nottoway River from excessive erosion, they may provide nesting and feeding cover for many wildlife species (e.g., woodpeckers) and act as escape cover for other species. This tract also probably is an important travel corridor, allowing wildlife to disperse along the length of the river without exposing themselves.

Although deer, turkeys, bobwhites, red-tailed hawks, and turkey vultures may prefer hunting and foraging in the peripheries of the area more than the interior, the mature timber stands in the Macrosite also provide excellent nesting habitat for turkeys, red-tailed hawks, and other large birds. On 2 separate occasions, hen turkeys with poults were noted just outside the boundaries of the Macrosite and the stick nests of other species were observed in large trees throughout the area.

Although I did not observe any federally listed species in the area, Fleming and Van Alstine (1994) identified several rare plants and animals in the area. Additionally, the area (particularly near the Fort Pickett reservoir) has been used by federally threatened bald eagles (*Haliaeetus leucocephalus*). Use of the area by a threatened species may not mandate protection, but this portion of Virginia is within the bald eagle's nesting range, therefore, protection may be warranted if evidence of nesting is documented.

Neotropical migrant songbird populations are declining all across North America and much of this is attributed to habitat loss and fragmentation (Freemark and Collins 1992, Robinson 1992, Faaborg et al. 1995, Peterjohn et al. 1995). A number of songbird species may use the Nottoway Basin Macrosite for nesting and feeding. The Macrosite may be one of a few large tracts of mature hardwoods in the area and extremely important to some declining songbird species [e.g., cerulean warblers (*Dendroica cerulea*)] (Shugart et al. 1978, Ehrlich et al. 1988, Sauer and Droege 1992, Smith et al. 1993).

Although most military training within the Macrosite appears to be limited to foot traffic, there is evidence of excessive erosion in certain places near the river margins and at bridge/ford sites,



where large numbers of soldiers and vehicles have moved through the area. Likewise, timber harvesting on the slopes above the Nottoway River could cause siltation of the waterway. Either activity may be detrimental to sensitive species within and surrounding the river.

Characteristics of the Macrosite and surrounding land suggest that Native Americans and early Europeans may have established camps or settlements in the area. The rock piles on the south side of the river suggest some sort of human activity, although it is unclear what the ramifications of the piles may be. Investigation of the site by a qualified historian or archeologist may provide some answers.

Mussels -- Mussel surveys on Fort Pickett yielded no surprises. Species which are typically rare elsewhere in the Nottoway River watershed (Terwilliger and Tate 1995) were extant, but uncommon, on Fort Pickett, as well. All species of interest except the dwarf wedgemussel and the yellow lance were found in the study area (Table 1). The Range Road, Tower Road, and Shacks Hole Road bridge sites had the widest diversity of species.

Yellow lances were present just upstream of the study area, in Crooked Creek, but dwarf wedgemussels were not encountered anywhere on Fort Pickett. However, absence of these species in my surveys does not eliminate the possibility that they do occur within the Macrosite. Dwarf wedgemussels and yellow lances have been found elsewhere in the Nottoway River and its tributaries by other researchers (Neves 1991). Additionally, my surveys rarely included areas > 500 m from bridge/ford sites and there probably were some rare individuals that were overlooked, even in areas that were surveyed. Furthermore, many of the Atlantic Slope mussels are difficult to identify by untrained observers (Johnson 1970, Fuller 1973, Neves 1991). A malacologist, experienced with these species, is required for positive identification.

Low abundances of the mussel species of interest may be caused by a variety of factors. Chief among these factors is pollution (Havlik and Marking 1987, Pennak 1989, Neves 1991, Pinkney et al. 1997). At the bridge and ford sites and in various backwaters along the river, there were iron-like (rusty red) deposits and significant evidence of petrochemicals. The source of these pollutants is unknown--some may occur naturally, but it is more likely that they are the result of military training or other activities on Fort Pickett. They very closely resemble the sludge-like material in Tommeheton Creek, flowing from the controlled access area to the Nottoway River. Military trash (e.g., shell casings, communications wire, meal bags, tarps, empty barrels, etc.) also was common near the bridge/ford sites. However, despite being unsightly, it probably had little influence on mussel populations, unless it was indicative of some other pollution.

Excessive siltation may be disruptive to the life cycles of certain mussel species (Pennak 1989, Neves 1991, Terwilliger and Tate 1995, Pinkney et al. 1997). Siltation may be caused by human activities (e.g., logging, military training, etc.) in the area and probably is exacerbated by the dam at Route 46. The dam may increase sediment loading by reducing instream flow levels (Pennak 1989, Neves 1991). Silt that is eroded into the river may not be washed downstream effectively. On Fort Pickett, mussel abundance appeared to be directly correlated with distance from the dam

(e.g., more mussels of all species were observed downstream of Shacks Hole Road than upstream of it), although total counts were not made. Similarly, copper sulphate (used in the Fort Pickett Reservoir to reduce algae levels) and other pollutants are less likely to be quickly dispersed downstream (Neves 1991, Pinkney et al. 1997), resulting in areas of high concentration of these substances. Although silt loads appear to be much lower downstream than upstream, siltation and pollution throughout the Nottoway River on Fort Pickett may be too heavy to support good mussel populations (Neves 1991, Terwilliger and Tate 1995), especially if preferred bedding sites are usurped by Asian clams. A hydrologist or stream ecologist may be able to offer more insight into the possible effects of these factors.

Competition with Asian clams also may be influencing numbers of native mussels (Neves 1991, Terwilliger and Tate 1995). Asian clams reproduce quickly and eventually overrun habitat (i.e., shallow, sandy runs) normally used by native species, particularly dwarf wedgemussels and yellow lances. Quite literally, a handful of sand from the bottom of the Nottoway River may contain 10-12 (or more) Asian clams.

*Fish* -- Populations of the Roanoke logperch have been found in the Nottoway River and its tributaries, downstream of Fort Pickett (Burkhead and Jenkins 1991, Jenkins et al. 1994, Terwilliger and Tate 1995). The Nottoway River on Fort Pickett possesses excellent logperch habitat (Page and Burr 1991, Jenkins et al. 1994, Terwilliger and Tate 1995) and supports populations of other fish in the genus *Percina*. Therefore, although actual sampling failed to yield positive results, it is possible that *Percina rex* does exist in these waters. Additional work by a qualified ichthyologist is warranted because my sampling was limited.

If *Percina rex* is not found on Fort Pickett, further research into reasons may be appropriate. *Percina rex* rarely occurs in high numbers, but pollutants (e.g., petrochemicals, copper sulphate from algae control efforts, toxins from exploded ordinances, etc.), instream flow variability due to the dam at Route 46, or excessive siltation may have precluded use of this stretch of the river (Burkhead and Jenkins 1991, Jenkins et al. 1994). One stretch of the Nottoway River where Roanoke logperch have been found, is about 50 km downstream of Fort Pickett (near the Interstate 85 bridge). Much less siltation is evident at this site than the portion of the river on Fort Pickett.

### **Management Recommendations**

My findings suggest that the Nottoway Basin Macrosite is a unique community on Fort Pickett and should be preserved as such. I believe that the boundaries established by the Virginia Natural Heritage Division (Fleming and Van Alstine 1994) are appropriate. However, I think it is important to include the Fort Pickett Reservoir and upstream portions of the Nottoway River, as well, because evidence of rare mussels was found above the reservoir and impacts in this area may directly or indirectly affect downstream areas. I concur with the recommendations of Fleming and Van Alstine (1994), that the Macrosite be managed for low-impact uses and that further research in the area is warranted.

If possible, timber should not be harvested in the Macrosite. Timber harvesting near water bodies has been linked to excessive sedimentation of adjacent watercourses (Neves 1991, Terwilliger and Tate 1995). If the area is deemed essential for military training purposes, training should be limited to foot traffic by small squads only. Military debris should not be disposed of in the river or on adjacent lands and regulations to this effect should be enforced. Bridges and ford sites across the river should be well-maintained to prevent excessive erosion and expulsion of petrochemicals into the river. Furthermore, I recommend that all military training and maneuvers be prohibited within 50 m of the river (excluding bridges and ford sites) to prevent destruction of the river banks.

I also recommend that a 200 m wide buffer zone be established surrounding the Macrosite boundaries. Military maneuvers, timber harvesting, and other activities may be conducted within the buffer zone, but every effort should be made to avoid large scale perturbations (e.g., clear-cutting, bulldozing, demolition, etc.) within this zone. This will prevent the Macrosite from becoming a biogeographic "island".

I recommend conducting further research on the mussels, fish, wildlife, vegetation, and ecological processes in the Macrosite. This information will provide specific management guidelines for individual species and the area as a whole. Qualified personnel are essential for this work because many of the species (especially mussels) are difficult to identify and specialists will know the most efficient sampling methods and be able to form cogent hypotheses regarding causes and effects of land uses and management actions.

Specifically, specialists should conduct a thorough survey of all rare mussels, fish, and insects in the river and compare those findings to populations elsewhere. Information regarding the effects of siltation, pollutants, and Asian clams should be evaluated. Attention should be given to the Fort Pickett Reservoir, Hurricane Branch, and Tommeheton Creek where they feed into the Nottoway River. Chemicals are used to control algae in the reservoir and these may have a deleterious effect on hypersensitive fish and wildlife downstream (Havlik and Marking 1987). Sewage treatment effluent is discharged into Hurricane Branch and Tommeheton Creek appears to be heavily polluted where it crosses Reservation Road so both these tributaries should be evaluated for possible negative effects (Neves 1991). A qualified hydrologist can evaluate instream flow regimes and make recommendations to reduce silt loading in the river.

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**Appendix A.** List of scientific and common names used in the text.

Mussels

<i>Alasmidonta heterodon</i>	Dwarf Wedgemussel
<i>Alasmidonta undulata</i>	Triangle Floater
<i>Pyganodon cataracta</i>	Eastern Floater
<i>Corbicula orbiculata</i>	Asian Clam
<i>Elliptio</i> spp.	
<i>Elliptio lanceolata</i>	Yellow Lance
<i>Fusconaia masoni</i>	Atlantic Pigtoe
<i>Strophitus undulatus</i>	Squawfoot
<i>Villosa constricta</i>	Notched Rainbow

Fish

<i>Anguilla rostrata</i>	American Eel
<i>Ictalurus punctatus</i>	Channel Catfish
<i>Lepomis macrochirus</i>	Bluegill
<i>Micropterus salmoides</i>	Largemouth Bass
<i>Percina</i> spp.	
<i>Percina rex</i>	Roanoke Logperch

Plants

<i>Acer</i> spp.	Maples
<i>Acer barbatum</i>	Florida Maple
<i>Asimina triloba</i>	Pawpaw
<i>Fagus grandifolia</i>	American Beech
<i>Fraxinus pennsylvanica</i>	Green Ash
<i>Ilex</i> sp.	Holly
<i>Lindera benzoin</i>	Spicebush
<i>Liquidambar styraciflua</i>	Sweet Gum
<i>Liriodendron tulipifera</i>	Tulip Poplar
<i>Parthenocissus quinquefolia</i>	Virginia Creeper
<i>Pinus taeda</i>	Loblolly Pine
<i>Platanus occidentalis</i>	Sycamore
<i>Quercus</i> spp.	Oaks
<i>Rhus radicans</i>	Poison Ivy
<i>Smilax</i> spp.	Greenbriers
<i>Ulmus</i> sp.	Elm

Birds

<i>Ardea herodias</i>	Great Blue Heron
<i>Bubo virginianus</i>	Great Horned Owl
<i>Buteo jamaicensis</i>	Red-tailed Hawk

<i>Buteo lineatus</i>	Red-shouldered Hawk
<i>Butorides striatus</i>	Green-backed Heron
<i>Cathartes aura</i>	Turkey Vulture
<i>Colinus virginianus</i>	Northern Bobwhite
<i>Corvus spp.</i>	Crows
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Meleagris gallopavo</i>	Eastern Wild Turkey

#### Mammals

<i>Castor canadensis</i>	Beaver
<i>Odocoileus virginianus</i>	White-tailed Deer
<i>Procyon lotor</i>	Raccoon

#### Reptiles

<i>Chelydra serpentina</i>	Snapping Turtle
<i>Pseudemys concinna concinna</i>	Eastern River Cooter
<i>Sternotherus odoratus</i>	Musk Turtle
<i>Terrapene carolina carolina</i>	Eastern Box Turtle