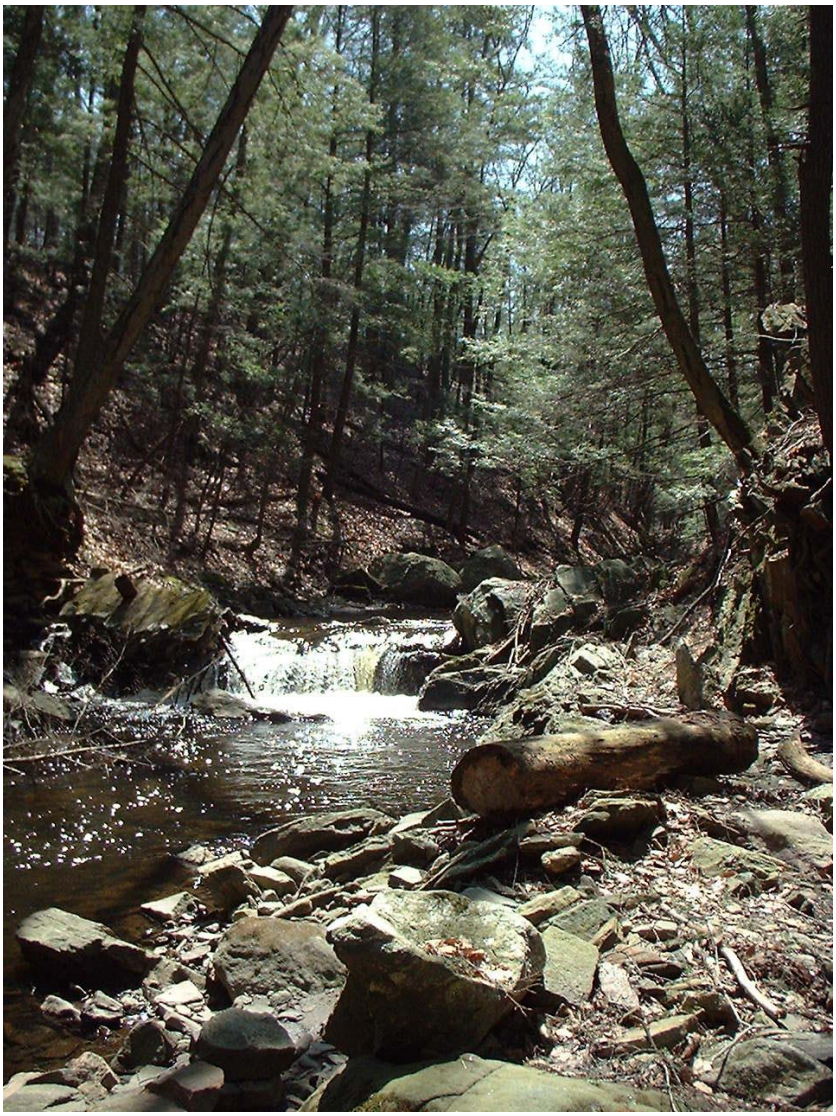
BUXTON GORGE
NATURAL RESOURCE INVENTORY AND ASSESSMENT



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I. Introduction

The environmental consulting team of Stephen W. Coleman, Roderick G. Christie and Michael W. Klemens have been retained by The Town of Bedford to conduct a Natural Resource Inventory and Assessment for Buxton Gorge, a 90-acre parcel of land off of Buxton Road, identified by the Town's open space advisory committee as the number one priority for preservation in Bedford. The Westchester Land Trust has been retained by the Town of Bedford to oversee the completion of this natural resource inventory and assessment of the property.

As outlined in the project's scope, a comprehensive natural resource inventory and assessment has been completed for the Buxton Gorge property. Target biological groups surveyed included mammals, breeding birds, amphibians, reptiles and plant groups including trees, shrubs, wildflowers, grasses and grass-like plants. Special emphasis was placed on the identification of endangered, threatened, and special concern species. Broad Brook was surveyed according to NYSDEC standards and included a species inventory, establishment of a biotic index, including water quality parameters. Existing vegetative communities were described, mapped, and analyzed to determine the habitat values, functions, restoration opportunities, and overall attractiveness to support environmentally sensitive species. The site's potential to be used as a outdoor classroom for local schools was also evaluated. The primary analysis, and report preparation, was carried out by Stephen W. Coleman, and Roderick G. Christie, with assistance provided by Michael W. Klemens. Survey work was completed during the months of May through August 2003.

II. Study Area

The study site is located along Buxton Road and consists of 90 acres that extends to Interstate 684 to the south and property owned by Bedford Park of Westchester LLC, to the north and east. The property consists of second growth woodlands, small isolated transitional fields, riparian wetlands, and "Buxton Gorge" a deep Hemlock ravine through which flows Broad Brook, a tributary of the Croton Reservoir.

III. Historical Features of the Property

Up until the early 1950's much of the Buxton Gorge property was open pastureland (see 1926 aerial of area – Appendix A). The only areas that were not cut were the steep slopes of the Gorge on both sides of the river. Individual fields were delineated by stonewalls that are present today. Most of these walls are still in good condition. Like much of the land in this area, it was cleared to provide grazing land for livestock. As early as 1947, many of the fields on the property were abandoned and reverted back to forest. Today all of the fields are forest again ranging in age from approximately 30 to 60 years old.

The old-growth forest on the property consists primarily of hemlocks with some oaks and sugar maples of significant age on the east side of the river. The construction of interstate 684 from 1964-1974 more than likely diminished this forest further and effectively cut off the property from open land to the east. With development on the west and 684 on the east, the property has become an "island" amidst suburban development.

House sites on Buxton Road bordering the property date back to the 1800's or earlier. There is one old barn site on the property to the east of the bridge over Broad Brook on Buxton Road, but field studies indicated that this site appears to have been destroyed during the construction of 684. There is also a small dam site just above the Gorge area. Construction materials indicate this dam was most likely constructed to pond water for livestock and was abandoned at the same time as the nearby pastureland.

IV. Plant Communities

The predominant plant communities present on the subject parcel consist of a deciduous forest with an "Old Growth" Hemlock dominated Gorge, and a forested riparian wetland system (see Appendix C: Natural Resources which provides a breakdown of vegetative cover types present on property).

Mature Mesophytic Lowland Forest:

The overall forested community present on the property, in general, would be classified as a "Mature Mesophytic Lowland Forest" habitat that has been extensively studied and characterized by Kiviat and Stevens "Biodiversity Assessment Manual for the Hudson River Estuary Corridor", 2001, and further described in the publication " Ecological Communities of New York State (Reschke, 1990). Reschke further describes this as a forest community that is dominated by oak and tulip trees and classified as a mesophytic hardwood forest that occurs on moist, well-drained soils. Dominant tree species observed include red oak (Quercus rubra), black oak (Quercus velutina), sugar maple (Acer saccharum), American beech (Fagus Americana), tulip tree (Liriodendron tulipifera), white ash (Fraxinus americana), shagbark hickory (Carya ovata), pignut hickory (Carya glabra), hemlock (Tsuga Canadensis), black birch (Betula lenta), and sassafras (Sassafras alibidum). Understory trees that were present consisted of smaller individuals of the same species as the dominant trees. The shrub layer was represented by spicebush (Lindera benzoin), witch-hazel (Hamamelis virginiana), and maple-leaf viburnum (Viburnum acerifolium). Common ground layer species observed include Christmas fern (Polystichum acrostichoides), garlic mustard (Aliaria petiola), Virginia creeper (Parthenocissus quinquefolia), wood ferns (Dryopteris spp.), and white wood aster (Aster divaricatus).

The canopy coverage is fairly complete, although there are several areas where dead or fallen trees have created openings in the canopy. A thicker assemblage of understory trees, shrubs, and vines of species previously highlighted dominate the vegetation within these areas. In general, the understory is relatively sparse and open representative of typical forested conditions in this type of vegetative community. The forest floor consists of a good level of leaf litter, and numerous fallen logs and tree limbs. Boulders and rock outcrops, and a series of well defined stonewalls are readily apparent throughout the property.

Approximately two-thirds of the subject parcel consists of a mature mixed hardwood forest in which many trees exceed 12 inches diameter at breast height. In several areas of the property, trees in excess of 30+ inches were observed consisting mostly of large sugar maples, white and red oaks and tulip trees.

Hemlock Gorge

Of particular interest and regional importance, is the Gorge section of the parcel that is bordered on both sides by Mature Hemlock Trees. The majority of the hemlocks within the Gorge were estimated over 100 years old. Two hemlock trees were bored to determine exact age. The smaller of the two hemlocks had an estimated age of 118 years and was representative of the majority of the hemlocks within the Gorge area. The larger of the hemlocks was aged at 185 years old. This tree along with several other hemlocks, oaks and maples were common along the edges of the brook and on the eastern slope of the property. Old growth Hemlock forests have become relatively rare habitats in our region due principally to the destruction caused by the woolly adelgid. The hemlock stand within the Gorge area of the property appears to be healthy and thriving despite evidence of the woolly adelgid.

Stands of tall white pine (Pinus strobus) and Norway Spruce (Picea abies) were also observed on the property and reminiscent of prior land use activities on the parcel. In the middle section of the property a transitional area dominated by oaks and scattered Juniper (Juniperus virginiana) is present that exhibits some of the typical characteristics of an Oak Savanna plant community. The forest canopy is more open which has allowed the establishment of Juniper and ground covers more common in old fields and forest openings.

Forested Riparian Wetland Complex:

Broad Brook principally defines the wetlands system located on the property. Riparian forested wetlands were observed to be present immediately adjacent to Broad Brook and hydrologically connected to the Brook. The wetland would be classified as a riverine forested wetlands complex with some representation of scrub-shrub habitat. The wetland receives hydrological support from its juxtaposition in the landscape, receiving surface water runoff from adjacent slopes, Broad Brook, and some groundwater discharge from the adjoining slope interface.

The forested wetland is similar to the red maple–hardwood swamp community as described by Reschke (1990). Red maple is the dominant tree and sapling species within the wetland on the subject parcel. Other tree species observed included Black gum (Nyssa sylvatica), American elm (Ulmus Americana), and green ash (Fraxinus pennsylvanica). Several upland tree species were also observed along the outer edges of the wetlands. The shrub layer consisted predominately of spicebush, silky dogwood (Cornus amomum), and winterberry (Ilex verticillata). Ground layer species observed included skunk cabbage (Symplocarpus foetidus), sensitive fern (Onoclea sensibilis), sphagnum moss (Sphagnum spp.), cinnamon fern (Osmunda cinnemomea), garlic mustard, and a variety of sedges (Carex spp.). The canopy coverage for this wetland is fairly uniform and closed with some scattered pockets that allow for successful establishment of shrubs and herbaceous vegetation. A small vernal pool/scrub shrub type wetland habitat was located in the eastern most section of wetlands.

V. Natural Resource Inventory

A. Breeding Bird Survey – Methods and Results

The principle survey method involved time-constrained, systematic physical ground searches along random transects throughout each of the habitat types. Unless noted, all species listed were documented through direct observation. Direct observation included visual as well as auditory observation, and evidence of avian activity such as feathers, droppings, tracks, scrapings, and bones. Surveys were conducted between sunrise and two hours after sunrise, mid-day, and/or one hour before and after sunset. All birds observed were identified and recorded to genus and species name. No birds or bird evidence observed during the investigation, were collected as voucher specimens. The breeding bird survey was conducted from 05-20-03 through 06-13-03, for a total of 18.5 hours. The analysis of the data from several site visits help provide a picture of the number of breeding pairs throughout the study site. An individual singing male needed to be recorded a minimum of 3 times to be counted as a probable breeding pair.

Of particular interest is the number of forest interior species that were observed to be present within the study area. The majority of the forest interior species were observed within the older aged forested sections of the property. The older aged second growth forest, and the total size of the property appears to serve as important nesting habitat for several forest interior species. The forest provides a large block of forest canopy that is not only attractive to nesting species but important for migration as well. None of the species identified are listed as threatened or endangered in New York State. Several of these species have however, been placed on watch status and/or listed as high conservation priority species. Twelve (12) forest interior species were observed within the project area and include the following species:

- Scarlet Tanager
- Rose-breasted Grosbeak
- Wood Thrush
- Red-eyed Vireo
- Ovenbird
- Eastern Wood-Pewee
- Hairy Woodpecker
- Sharp-shinned hawk
- Veery
- Worm-eating Warbler (Westchester County – special concern status)
- Black-capped Chickadee
- Great-horned Owl

The younger second growth forested areas parallel to the linear wetlands complex, the wetlands complex of forested and riparian habitats, and the edges closest to existing buildings and structures, provides a combination of essential habitats for several more common and adaptable transition and edge type bird species. Forest interior species noted above, were also observed to utilize these other habitat areas of the property.

A total of 73 different bird species were observed within the general study area during the spring season. As noted above, approximately 44 of these species represent summer resident breeding bird species. The regional complex of relatively intact, forested lands and the corridor created as a result of road networks likely has limited some of the resources normally attractive to spring migrants. Seventy-three different bird species would be considered a little below average number for spring migration throughout the Westchester area.

Based upon the results of the breeding bird survey and spring migration data, the study site's most important attribute for bird populations is the older growth forest community that is capable of supporting populations of sensitive forest interior species. The table below provides information on avian species that were observed as a result of the spring 2003 census.

Common Name	**Scientific Name**	**Probable Breeding Species**
Great Blue Heron	*Ardea herodias*	
Green Heron	*Butorides striatus*	
Canada Goose	*Branta canadensis*	
Wood Duck	*Aix sponsa*	
Mallard	*Anas platyrhynchos*	
Turkey Vulture	*Cathartes aura*	
Sharp-shinned Hawk	*Accipiter striatus*	*x*
Red-tailed Hawk	*Buteo jamaicensis*	
Wild Turkey	*Meleagris gallopavo*	*x*
Killdeer	*Charadrius vociferus*	
Rock Dove	*Columbia livia*	*x*
Mourning Dove	*Zenaida macroura*	*x*
Black-billed Cuckoo	*Coccyzus erythropthalmus*	
Eastern Screeh-Owl	*Otus asio*	
Great Horned Owl	*Bubo virginianus*	*x*
Chimney Swift	*Chaetura pelagica*	
Belted Kingfisher	*Megaceryle alcyon*	*x*
Red-bellied Woodpecker	*Centurus carolinus*	*x*
Downy Woodpecker	*Picoides pubescens*	*x*
Hairy Woodpecker	*Picoides villosus*	*x*
Northern Flicker	*Colaptes auratus*	*x*
Pileated Woodpecker	*Dryocopus pileatus*	*x*
Eastern Wood-Pewee	*Contopus virens*	*x*
Eastern Phoebe	*Sayornis phoebe*	*x*
Eastern Kingbird	*Tyrannus tyrannus*	
Barn Swallow	*Hirundo rustica*	
Blue Jay	*Cyanocitta cristata*	*x*
American Crow	*Corvus brachyrhynchos*	*x*
Black-capped Chickadee	*Parus atricapillus*	*x*
Tufted Titmouse	*Parus bicolor*	*x*
White-breasted Nuthatch	*Sitta carolinensis*	*x*
Carolina Wren	*Thyothorus Ludovicianus*	*x*

Common Name	**Scientific Name**	**Probable Breeding Species**
House Wren	*Troglodytes aedon*	
Ruby-crowned Kinglet	*Regulus calendula*	
Veery	*Catharus fuscescens*	
Gray-cheeked Thrush	*Catharus minimus*	
Swainson's Thrush	*Catharus ustulatus*	
Hermit Thrush	*Catharus guttatus*	
Wood Thrush	*Hylocichla mustelina*	*x*
American Robin	*Turdus migratorius*	*x*
Gray Catbird	*Dumetella carolinensis*	*x*
Northern Mockingbird	*Mimus polyglottos*	*x*
Cedar Waxwing	*Bombycilla cedrorum*	*x*
European Starling	*Sturnus vulgaris*	
Yellow-throated Vireo	*Vireo flavifrons*	
Red-eyed Vireo	*Vireo olivaceus*	*x*
Blue-winged Warbler	*Vermivora pinus*	*x*
Yellow Warbler	*Dendroica petechia*	*x*
Chestnut-sided Warbler	*Dendroica pensylvanica*	
Black-throated Green Warbler	*Dendroica virens*	
Pine Warbler	*Dendroica pinus*	
Black-and-White Warbler	*Mniotilta varia*	*x*
American Redstart	*Setophaga ruticilla*	
Worm-eating Warbler	*Helmitheros vermivorus*	*x*
Ovenbird	*Seiurus aurocapillus*	*x*
Louisiana Waterthrush	*Seurus motacilla*	*x*
Common Yellowthroat	*Geothlypis trichas*	*x*
Scarlet Tanager	*Piranga olivacea*	*x*
Northern Cardinal	*Cardinalis cardinalis*	*x*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	*x*
Indigo Bunting	*Passerina cyanea*	
Rufous-sided Towhee	*Pipilo erythrophthalmus*	*x*
Chipping Sparrow	*Spizella passerina*	*x*
Song Sparrow	*Milospiza melodia*	*x*
White-throated Sparrow	*Zonatrichia albicollis*	
Dark-eyed Junco	*Junco hyemalis*	
Red-winged Blackbird	*Agelaius phoeniceus*	*x*
Common Grackle	*Quiscalus quiscula*	*x*
Brown-headed Cowbird	*Molothrus ater*	*x*
Northern Oriole	*Icterus galbula*	*x*
House Finch	*Carpodacus mexicanus*	*x*
American Goldfinch	*Carduelis tristis*	
House Sparrow	*Passer domesticus*	*x*

B. Amphibians and Reptiles Survey – Methods and Results

Surveys for amphibians and reptiles took place on May 20-21, 2003. A total of 12 hours were spent in the field. Field inventory techniques included visual searches of downed logs, stumps, leaf litter, and rock piles to determine the presence or absence of individual species, examination of cover types, frog sounds and calls, larval sampling, and identification of egg masses. A detailed description of amphibian and reptile survey techniques can be found in Klemens (1993). A total of 11 species of amphibians and reptiles were documented at the site. None of the species identified are listed as endangered, threatened or special concern species. Wood frogs and gray tree frogs were indicative of suitable wetland habitat on the parcel.

Common Name	**Scientific Name**
Northern Two-lined Salamander	*Eurycea bislineata*
Red-backed Salamander	*Plethodon cinereus cinereus*
Red-Spotted Newt	*Notophthalmus viridescens viridescens*
American Toad	*Bufo americanus*
Gray Tree frog	*Hyla versicolor*
Spring Peeper	*Pseudacris crucifer*
Green Frog	*Ranas clamitans*
Bullfrog	*Rana catesbeiana*
Wood frog	*Rana sylvatica*
Eastern Box Turtle	*Terrapene carolina carolina*
Eastern Garter Snake	*Thamnophis sirtalis*

Note: the eastern box turtle is listed as a NYS special concern status species

C. Mammal Survey – Methods and Results

Mammals were surveyed by active ground searches looking for evidence of any animal activity. The primary survey method involved time-constrained, systematic physical ground searches along random transects throughout each of the habitat types. Unless noted, all species listed were documented through direct observation. Direct observation included visual as well as auditory observation, and evidence of animal signs such as fur, tracks, droppings, scrapings, and bones. Surveys were conducted either between sunrise and two hours after sunrise, mid-day, and/or one hour before and after sunset. All animals observed were identified and recorded to genus and species name. No animals or animal evidence observed during the investigation, were collected as voucher specimens. The mammal survey was conducted from May 21 through July 31, 2003. A total of 9.0 hours were spent in the field. Weather conditions were conducted during optimal field conditions, sunny, warm conditions with average temperature in the mid 70's F.

Field investigation confirmed the presence of 16 different mammal species on the project site. Gray squirrels, eastern chipmunks, white-tailed deer, raccoons and deer mice were the most commonly observed mammals. Deer were especially abundant as evidenced by numerous well-worn trails, bedding areas and abundant droppings. Chipmunks and gray squirrels were most

common along stonewalls and rock outcrops, throughout the forested sections, and along wetland corridors. Raccoons sign was observed primarily along the stream corridor and within the wetland. Coyote droppings were observed along the higher slope areas of the property. Existing mammal populations are well represented by species that would be considered common and readily observed within northern Westchester County. Mink (*Mustela vison*) was the only species considered that represents a sensitive focal species of large tracts of land. River Otter were not observed during the survey, but according to local sources, they have been observed using the hemlock ravine area. The mammal species that currently utilize the property are:

Common Name	**Scientific Name**
Virginia Opossum	*Didelphis virginiana*
Short-tail Shrew	*Blarina brevicauda*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Chipmunk	*Tamias striatus*
Woodchuck	*Marmota monax*
Gray Squirrel	*Sciurus carolinensis*
Southern Flying Squirrel	*Glaucomys volans*
Red Squirrel	*Tamiasciurus hudsonicus*
White-footed Mouse	*Peromyscus leucopus*
Meadow Vole	*Microtus pennsylvanicus*
Mink	*Mustela vison*
Red Fox	*Vulpes vulpes*
Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephitis mephitis*
White-tailed Deer	*Odocoileus virginianus*

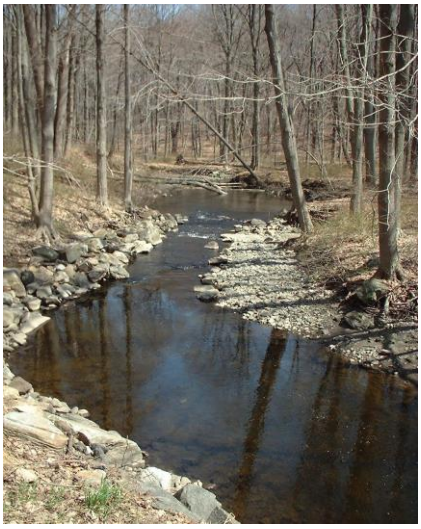
D. Stream Survey - Methods and Results

A Benthic Macroinvertebrate Analysis for the Broad Brook was conducted on July 7, 2003, by Rod Christie, Mianus River Gorge Preserve, Inc. Three sites on the Broad Brook were tested to determine the overall water quality. Site # 1 was at the bridge on Buxton Road. Site # 2 was just downstream from the "Gorge" area, and site # 3 was on the bridge on Bedford Center Road. All sites were tested for nitrate nitrogen, total phosphorus, total coliform, fecal coliform and E coli. Sites 1 and 2 were also sampled for macroinvertebrates and specimens collected were used to determine total group biotic index, family biotic index, EPT richness, and % composition for each site. A physical survey was also taken for sites 1 and 2.

The Broad Brook originates somewhere in the vicinity of Arthur W. Butler Sanctuary on Chestnut Ridge Road. It flows northerly paralleling interstate 684 and crossing South Bedford Road, Guard Hill road, Broad Brook Road, Bedford Center Road and finally Buxton Road before entering the Gorge. From the Gorge it flows northerly through the Bedford and Taconic Correctional Facilities and under interstate 684 before emptying into the Beaverdam Brook in Beaverdam Sanctuary. Beaverdam brook then empties into the Croton Reservoir. Protection of Buxton Gorge and Broad Brook is important to protecting this tributary to the drinking water supply for NYC.

Results

Overall, the water quality of the Broad Brook in the Buxton Gorge area is fair to good despite some apparent stormwater runoff problems upstream of the site. EPT Richness, Major Group Biotic Index and Family Biotic Index all indicated a slightly impacted stream at site #1 and even less impacted at site # 2 (the 4.6 family biotic index for site # 2 is just above the range of 0-4.5 for non-impacted streams). The presence of large numbers of juvenile crayfish at site #2 may also have skewed the results to look worse than they actually were. EPT richness was greater at site # 2 indicating a better diversity of species. EPT for site # 2 was 7, which is just shy of the value for a non-impacted stream (>7 indicates non-impacted). Percent composition shows that quantity of sensitive species like mayflies, stoneflies and some caddisflies was greater for site #2 than for site # 1, but both sites were below the percentages for a typical NY stream. It is worth noting that this NYS typical stream is more reflective of streams in upstate New York, which are less affected by thermal pollution (warming of water).



Sampling Site # 1

Physical survey data indicated that Broad brook is typical of so many streams in this area where water temperature and flow are the most limiting factors. Broad brook is a secondary stream that typically has large flows in the spring, but is reduced to a very small flow in summer. Fortunately, there are some deeper pools and undercut banks where trout and other temperature sensitive species can escape the water temperatures associated with low flow. Air and water temperatures for site # 1 were 21 degrees C and 20 degrees C respectively indicating conditions that are suitable for brown

trout but not brook trout. Site # 2 had a similar air temperature but slightly lower water temperature at 18 degrees C. Water temperature decreases as you move downstream. The hemlocks of the Gorge area are effectively shading the stream, thus reducing stream temperatures and benefiting aquatic wildlife.

Mountain bikes and all-terrain vehicles from the 684 rest stop have caused some erosion problems in the areas just south of Buxton Road. Runoff from Buxton road, other roads upstream and possibly other sources is destroying habitat in the upper area of the brook. There are also many areas in the Brook that are directly impacted by garbage dumping from the 684 rest stop. Habitat for macroinvertebrates has been somewhat compromised at site # 1 where rocks are sometimes more than 25% embedded in the bottom. This condition improves as one moves downstream with little or no embeddedness at sample site # 2.

Chemical analysis indicated no fecal coliform or E-Coli bacteria although there were elevated levels for total phosphorus and nitrate nitrogen. Sample site # 3 had the highest levels, followed by site # 1 and then site #2. Again, as the water traveled downstream through the Gorge area it became cleaner. Further examination of the upper watershed might provide more clarification as to the sources of these elevated levels.

Like many similar streams in this area, the health of Broad Brook is greatly influenced by water temperatures, flow and silt from runoff. Broad brook has most of the macroinvertebrates typical of this size stream and the quantity of these creatures is directly proportional to the amount of habitat present and the water quality. Nearest to Buxton road, silt from runoff has destroyed some habitat (covered the rocks with sand and silt) although water quality still seems to be adequate for most species. Elevated levels of nitrogen and phosphorus from upstream may cause some problems in summer when the water is warm and low.

The stretch of the stream from Bedford Center Road to Buxton Road has areas that are less wooded and so water temperature at Buxton Road are higher than downstream. Further down in the Gorge area, the brook is more shaded and so the water temperature has fallen, benefiting aquatic life. As the brook flows downstream much of the sand and silt settles out so that by site # 2 there were fewer rocks embedded in the bottom (the more embedded the rocks, the less habitat there is for macroinvertebrates). Diversity in this lower area is greater as is quantity of sensitive species of mayflies. There also is a greater abundance of two-lined salamanders, both under the rocks and larval salamanders in the water. This greater diversity and quantity of aquatic species in the lower Gorge indicates that habitat conditions are better than at site # 1. The large number of net-spinning caddis flies at both sites, although significantly larger at site # 1, indicates the brook is stressed, but is not uncommon in streams of this size in Westchester where thermal pollution is a factor. It appears that the farther downstream of Buxton Road one samples, the better are the stream conditions. It also appears that the shade and undisturbed forest provided by the hemlock Gorge and surrounding land are very important to the long-term health of this brook. The protection of the Buxton Gorge parcel is crucial so that the brook can clean itself before emptying into Beaverdam and then the Croton drinking water system.

Broad Brook has great potential for use as a recreational trout fishery in the Buxton Gorge area. There is already a reproducing brown trout population as indicated by DEC sampling in 1995 that yielded four small brown trout (under stocking size) at the Buxton Road Bridge (site # 1). Conversations with DEC personnel indicate they have never stocked Broad Brook so all trout must be either coming upstream from fish stocked in the Beaverdam or naturally reproducing. Brown trout were also spotted by this observer on numerous occasions during visits to the site. This native population could be augmented by spring stocking for a put and take fishery (which is typical of most of the streams in this area). With some filtering of stormwater runoff and elimination of mountain bike and all-terrain vehicle traffic from the 684 rest stop, Broad brook could provide a successful spring trout fishery. Some stream restoration projects by groups like Trout Unlimited or local friends groups could further improve habitat and one full day of garbage cleanup could greatly improve the aesthetics of the brook for fishermen. Working with the State of New York to move back the fence for the rest stop would also be a distinct improvement and would prevent dumping from impacting the property. Listed in table format are the results for the Benthic Macroinvertebrate Study and Water Quality Analysis for the sampling sites.

Flows and water quality in the Broad Brook are sufficient to support a Spring trout fishery.

Benthic Macroinvertebrate Data Reporting Sheet			
July 2, 2003			
	Site # 1 – Bridge	Site # 2 – Lower	NYS standard
% Composition			
Mayfly	1%	3%	40%
Stonefly	1%	4%	5%
Caddisfly	45%	22%	10%
Midge	17%	28%	20%
Beetle	11%	5%	10%
Worms	.9%	3%	5%
Others	24%	35%	10%
EPT Richness	5	7	
Major Group Biotic Index	4.98	5.39	
Family Biotic Index	5.24	4.60	

Chemical Parameter Data Reporting Sheet			
July 2, 2003			
	Site # 1 – Bridge	Site # 2 – Lower	Site # 3 – Center Road
Nitrates	2.31 mg/L	2.13 mg/L	2.72 mg/L
Total phosphorus	.17 mg/L	.12 mg/L	.31 mg/L
Total coliform	Present	Present	Present
Fecal Coliform	Absent	Absent	Absent
E. Coli	Absent	Absent	Absent
Nitrate nitrogen			
DEC Standards			
Typical natural levels for freshwater: < 1 mg/L			
Recommended level for trout: .06 mg/L			
Sewage treatment plant effluent: ~ 30 mg/L			
Total Phosphate			
No DEC standards			
Guidelines:			
Above .05 mg/L impact likely			
Above .1 mg/L impact certain			
Wastewater: 5-30 mg/L			

E. Botanical Survey - Methods and Results

Vegetative survey methods involved direct field identification of plants observed within the project study area. Inventory included random linear searches throughout the project impact area. All plants that could be visually observed and identified were recorded. The entire project impact area was surveyed to observe all plants present. Plants were identified by flower type and floral structure, by plant type, and leaf shape and arrangement. Plants were identified in both flowering and non-flowering conditions. When necessary, individual plants were collected if they required laboratory verification to specific species. Plants within the genus Carex and some of the grass genera were collected and later verified to species. Individual plants were identified by common name and scientific name (genus and species), and recorded for each impact area. The New York State Department of Environmental Conservation's publication "New York State Endangered, Threatened and Special Concern Species 1998, was used as the definitive list for determining whether any plants observed on the study area would be considered Endangered, Threatened or Special Concern status. The vegetative survey was conducted from May 20 through August 25, 2003. A total of 26.0 hours were spent in the field, plus an additional 2.0 hours of laboratory work keying out individual plant species.

Results

One of the primary objectives of the field survey was to determine whether any endangered, threatened or special concern status species were located within the study area. The results of the field survey found no endangered, threatened or special concern status plant species within the proposed study area. Several environmentally sensitive plant species were observed during the inventory but none that were on the published list. A total of 193 plant species were observed to be present throughout the study area. This represented 34 species of trees, 34 species of shrubs and vines, and 125 species of forbs (wildflowers, ferns, grasses and grass-like plants). Despite evidence of current and past land use practices within the study area, the forest composition, species diversity and plant community is fairly well intact and representative of a majority of sites throughout Westchester County. Several invasive plant species have become established within the study area. A list of observed plant species by target group follows:

Trees:

Common Name	**Scientific Name**
Norway Maple	*Acer platanoides*
Red Maple	*Acer rubrum*
Sugar Maple	*Acer saccharum*
Tree of Heaven	*Ailanthus altissima*
Black Birch	*Betula lenta*
Yellow Birch	*Betula lutea*
Ironwood	*Carpinus caroliniana*
Shagbark Hickory	*Carya ovata*
Pignut Hickory	*Carya glabra*
Flowering Dogwood	*Cornus florida*

Common Name	Scientific Name
American Beech	*Fagus grandifolia*
White Ash	*Fraxinus Americana*
Green Ash	*Fraxinus pennsylvanica*
Black Walnut	*Juglans nigra*
Eastern Red Cedar	*Juniperus virginiana*
Sweet Gum	*Liquidambar styraciflua*
Tulip Poplar	*Liriodendron tulipifera*
Crab-apple	*Malthus spp.*
Black gum	*Nyssa sylvatica*
Norway Spruce	*Picea abies*
White Pine	*Pinus strobus*
Red Pine	*Pinus resinosa*
American Sycamore	*Platanus occidentalis*
Cottonwood	*Populus deltoides*
Black Cherry	*Prunus serotina*
White Oak	*Quercus alba*
Chestnut Oak	*Quercus prinus*
Red Oak	*Quercus rubra*
Black Oak	*Quercus velutina*
Black Locust	*Robinia pseudocacia*
Black Willow	*Salix nigra*
Sassafras	*Sassafras albidum*
Eastern Hemlock	*Tsuga Canadensis*
American Elm	*Ulmus Americana*

Shrubs & Vines

Common Name	Scientific Name
Shadblow	*Amelanchier canadensis*
Porcelain berry	*Ampelopsis brevipedunculata*
Japanese Barberry	*Berberis thunbergii*
Oriental bittersweet	*Celastrus orbiculatus*
Summersweet	*Clethra alnifolia*
Silky dogwood	*Cornus amomum*
Autumn olive	*Elaeagnus umbellata*
Winged Euonymus	*Euonymus atropurpurea*
Forsythia	*Forsythia spp.*
Huckleberry	*Gaylussacia baccata*
Witch hazel	*Hamamelis virginiana*
Winterberry	*Ilex verticillata*
Mountain Laurel	*Kalmia latifolia*
Spicebush	*Lindera benzoin*
Privet	*Ligustrum vulgare*

Common Name	Scientific Name
Tartarian Honeysuckle	*Lonicera tatarica*
Japanese Honeysuckle	*Lonicera japonica*
Morrows Honeysuckle	*Lonicera morrowii*
Virginia Creeper	*Parthenocissus quinquefolia*
Swamp Azalea	*Rhododendron viscosum*
Brambles	*Rhubus spp.*
Poison Ivy	*Rhus glabra*
Staghorn sumac	*Rhus typhina*
Blackberry	*Ribes allegheniensis*
Multiflora Rose	*Rosa multiflora*
Pink flowering raspberry	*Rubus odoratus*
Wineberry	*Rubus phoenicolasias*
Greenbrier	*Smilax spp.*
Steeplebush	*Spirea tomentosa*
Highbush Blueberry	*Vaccinium corymbosum*
Lowbush Blueberry	*Vaccinium spp*
Maple-leaved Viburnum	*Viburnum acerifolium*
Arrowood Viburnum	*Viburnum dentatum*
Grape	*Vitis spp.*

Forbs (wildflowers, ferns, grasses and grass-like plants)

Common Name	Scientific Name
Yarrow	*Achillea millefolium*
White Baneberry	*Actaea pachypoda*
Maidenhair Fern	*Adiantum pedatum*
Garlic mustard	*Alliaria petiolata*
Wild Leek	*Allium tricoccum*
Pigweed	*Amaranthus spp.*
Ragweed	*Ambrosia spp.*
Broom sedge	*Andropogon virginicus*
Wood anemone	*Anemone quinquefolia*
Spreading dogbane	*Apocynum androsaemifolium*
Wild columbine	*Aquilegia Canadensis*
Jack-in-the-pulpit	*Arisaema atrorubens*
White wood aster	*Aster divaricatus*
New England Aster	*Aster novae-angliae*
Wood Aster	*Aster spp.*
Lady Fern	*Athyrium filix-femina*
Bluejoint	*Calamagrostis Canadensis*
Marsh Marigold	*Caltha palustris*
Yellow sedge	*Carex flava*
Laxiflora sedge	*Carex laxiflora*

Common Name	Scientific Name
Lurid Sedge	*Carex lurida*
Pennsylvania sedge	*Carex pensylvanica*
Tussock Sedge	*Carex stricta*
Fox sedge	*Carex vulpinoides*
Spotted Knapweed	*Centaurea maculosa*
Celandine	*Chelidonium majus*
Lamb's quarters	*Chenopodium album*
Spotted Pipsissewa	*Chimaphila manulata*
Oxeye daisy	*Chrysanthemum leucanthemum*
Chickory	*Cichorium intybus*
Enchanter' nightshade	*Circaea quadrisulcata*
Virgin's Bowers	*Clematis virginiana*
Yellow clintonia	*Clintonia borealis*
Virginia dayflower	*Commelina virginica*
Crown vetch	*Coronilla varia*
Umbrella sedge	*Cyperus strigosus*
Yellow Lady's Slipper	*Cypripedium calceolus*
Queen Anne's lace	*Daucus carota*
Hay-scented fern	*Dennstaedtia punctilobula*
Naked Tick Trefoil	*Desmodium nudiflorum*
Deptford pink	*Dianthus armeria*
Dutchman's breeches	*Dicentra cucullaria*
Crabgrass	*Digitaria spp.*
Marginal Wood Fern	*Dryopteris marginalis*
New York Fern	*Dryopteris noveboracensis*
Wood Fern	*Dryopteris spp.*
Barnyard grass	*Echinochloa crusgalli*
Wild rye	*Elymus virginicus*
Purple-leaf willow herb	*Epilobium coloratum*
Horsetail	*Equisetum arvense*
Daisy fleabane	*Erigeron annuus*
Trout lily	*Erythronium americanum*
Boneset	*Eupatorium perfoliatum*
White snakeroot	*Eupatorium rugosum*
Meadow fescue	*Fescue elatior*
Wild strawberry	*Fragaria virginiana*
Marsh bedstraw	*Galium palustre*
Wild geranium	*Geranium maculatum*
Yellow avens	*Geum aleppicum*
Gill-over-the ground	*Glechoma hederacea*
Manna grass	*Glyceria obtusa*
Rattlesnake Plantain	*Goodyera pubescens*
Dame's Rocket	*Hesperis matronalis*

Common Name	Scientific Name
Jewelweed	*Impatiens capensis*
Wild morning glory	*Ipomoea spp.*
Blueflag	*Iris versicolor*
Soft rush	*Juncus effusus*
Path rush	*Juncus tenuis*
Rice cut grass	*Leersia oryzoides*
Duckweed	*Lemna spp.*
Butter-and-eggs	*Linaria vulgaris*
Cardinal flower	*Lobelia cardinalis*
Ground Cedar Clubmoss	*Lycopodium complanatum*
Purple loosestrife	*Lythrum salicaria*
Canada Mayflower	*Maianthemum canadense*
Yellow sweet clover	*Melilotus officinalis*
Wild mint	*Mentha arvensis*
False Solomon's Seal	*Mianthemum racemosum*
Japanese stilt grass	*Microstegium vimeneum*
Patridgeberry	*Mitchella repens*
Indian Pipe	*Monotropa uniflora*
Forget-me-not	*Myosotis verna*
Cinnamon Fern	*Osmunda cinnamomea*
Interrupted Fern	*Osmunda claytoniana*
Royal Fern	*Osmunda regalis*
Deer-tongue grass	*Panicum clandestinum*
Paspalum	*Paspalum spp.*
Reed-canary grass	*Phalaris arundinacea*
Timothy	*Phleum pratense*
Wild blue phlox	*Phlox divaricata*
Common reed	*Phragmites communis*
Pokeweed	*Phytolacca Americana*
Clearweed	*Pilea pumila*
Common plantain	*Plantago major*
Kentucky bluegrass	*Poa pratensis*
Pinkweed	*Polyganum pennsylvanicum*
Solomon's seal	*Polygonatum pubescens*
Common smartweed	*Polygonum hydropiper*
Arrow-leaved tearthumb	*Polygonum sagittatum*
Christmas fern	*Polystichum acrostichoides*
Selfheal	*Prunella vulgaris*
Tall buttercup	*Ranunculus acris*
Field sorrel	*Rumex acetosella*
Curled dock	*Rumex crispus*
Bloodroot	*Sanguinaria Canadensis*
Soft-stem bulrush	*Scirpus validus*
Blue-eyed grass	*Sisyrinchium montanum*

Common Name	**Scientific Name**
Deadly nightshade	*Solanum dulcamara*
Canada goldenrod	*Solidago Canadensis*
Early goldenrod	*Solidago juncea*
Swamp goldenrod	*Solidago uliginosa*
Spagnum moss	*Spagnum spp.*
Chickweed	*Stellaria alsine*
Skunk cabbage	*Symplocarpus foetidus*
Common dandelion	*Taraxacum officinale*
Tall meadow rue	*Thalictrum polyganum*
Marsh fern	*Thelypteris thelypteroides*
Field pennycress	*Thlaspi arvense*
Red clover	*Trifolium pratense*
White clover	*Trifolium repens*
Cattail	*Typha latifolia*
Blue vervain	*Verbena hastata*
False hellebore	*Veratrum viride*
Smooth Yellow violet	*Viola pensylvanica*

VI. Potential Uses of Buxton Gorge for Recreation and Outdoor Education (See Appendix B – Recreation Potential Map)

Presently, the Buxton Gorge property is principally being used for hiking and mountain biking/all-terrain vehicles by local neighbors (especially the apartment complex to the west) and people from the 684 rest area. There is little or no use by schools or by hikers from other areas.

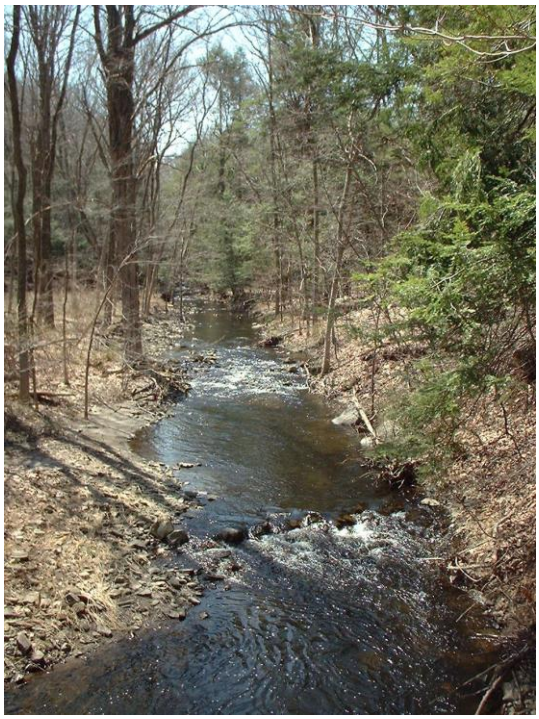
Recommendations:

1. Spring fishery as discussed in water quality report

2. Hiking trails

A. The proximity of Buxton Gorge to Bedford Hills Elementary School and the many residents living in Bedford Hills, Katonah and Bedford makes it an ideal location for use by school groups and the general public. Since this site has substantial diversity of habitats, it provides a lot of things to see in a relatively small area.

B. A trail network exists and can be further delineated and expanded upon. Creation of a new group of trails on the east side of the brook would allow visitors scenic views of the Gorge while preventing erosion created by trails on steep slopes. This eastern portion is distinctly different from other portions of the property. Although it is possible to create a trail on this side of the brook that is exclusively on Buxton property, it is recommended that the trail be constructed partially on State property so that it is farther up the slope. This would require moving back the fence from the 684 rest area to accommodate the new trail. This would open up the other side of the Gorge for a trail so that a loop trial with two bridges could give walkers fantastic views of the Gorge. Standing on the bridge and watching the spring torrent of water through the Gorge would be an impressive sight.



Potential site of new footbridge below Gorge

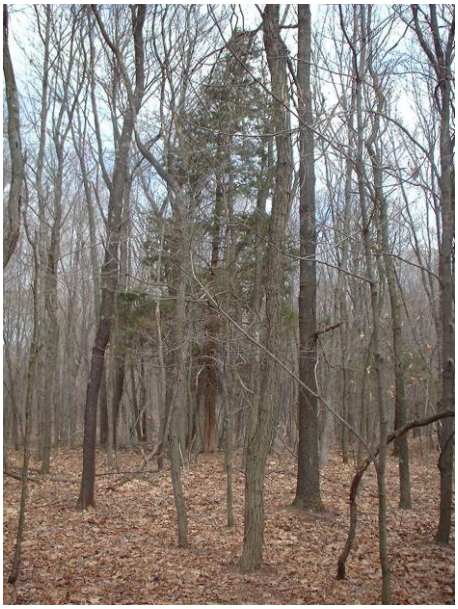
There are some existing trails that we would recommend removing. The trail from the southern end of the 684 rest area is a conduit for mountain bikes and other undesirable activity. It also continues across the brook and into the wetland area. Removal of this trail and its connecting trail to Buxton (just south of the bridge) would help curtail this type of activity. It also would keep trails away from the fragile vernal pond. Repair of the holes in the 684 fence would also help stop some of these activities.

C. The upland parts of the site lend themselves to many different types of programs including: observation of wildlife, wildlife habitats, animal architecture, trees and shrubs, colonial history, geology, and many, many more. Local teachers could develop programs that would supplement their lessons and enrich their curricula. The reclaiming of old field areas, as mentioned below, would also increase diversity and opportunities for outdoor education.

D. Broad Brook provides many opportunities to study aquatic life with school classes. Sites just below the Buxton Road Bridge would be easy for children to access and are less sensitive to impact. There are also other sites in the Gorge or below it that lend themselves to aquatic studies, but they should be chosen carefully to prevent impacting the sizable two-lined salamander population and the vernal pond.

E. The aesthetics of the trails could be improved by working with the State to move back the fence for the 684 rest area to the top of the hill. Possibly, the State would be interested in donating this sloped portion of land to make it part of the Preserve. Relocating the fence would put it out of sight and would prevent garbage from 684 from being dumped on the property. The addition of some sort of sound barrier along the 684 rest area, although expensive, would further decrease the traffic noise and increase the experience for hikers and school groups.

F. Some adjustments are also necessary to prevent hikers from traversing the steep slopes and causing severe erosion and habitat destruction. This has recently become a problem and further marking of the trail and placement of edging could prevent further damage.



3. Eliminate use of area for paint ball. Presently the area to the east of Buxton Farm is being used for paint ball. Plywood blinds and other structures have been constructed that detract from the aesthetics and enjoyment of the area for other visitors.

4. There are also opportunities to further diversify the habitats of the area by reclaiming one or more of the old fields. A field habitat juxtaposed with the surrounding forest would increase wildlife diversity and provide more opportunities for viewing wildlife. Two possible locations have been marked on the

recreation potential map. These sites were chosen because they are limited in tree and shrub diversity and species composition is typical of a forest that was recently open field. They also are easy to access for mowing and for environmental education programs. In addition, they are delineated by stonewalls.

5. The most logical place for a parking area is off Buxton road adjacent to the present Buxton Farm property. This area would take minimum improvement to make a small parking area for visitors. Presently the area is dominated by Norway maple and other non-native species and the periphery of the parking area could be easily improved to provide a welcoming entrance planted with flowering shrubs and other wildlife attractants. A small map kiosk would provide trail maps and rules for the Preserve.

VII. Potential Restoration Projects

Buxton Gorge has many opportunities for restoration work.

1. Control of silt from road runoff in the upper watershed will improve aquatic habitat and improve water quality. During rains the Broad Brook is heavily laden with silt from sources in the upper watershed .

Pool just below Buxton road after rain storm

2. Control of all-terrain vehicle access and repair of stream crossing area – All-terrain vehicle/mountain bike access from interstate 684 crosses the stream and enters the southern wetland area of Buxton property. Blocking of this access and repair of the banks of the stream would help restore trout habitat and prevent silt from washing into the stream.

Stream crossing area

Bike trail from 684 rest area through stream to wetland on other side

3. The Buxton property has a wonderful assemblage of stone walls. When this area is opened to the public there is a greater chance of stones being stolen and walls disappearing. If stones that have fallen off walls were put back there would be less chance they would be stolen. This minor repair could also keep the walls standing for another hundred years.

4. Although the site has many non-native invasive species, it is not recommended that these be removed. Not only would it be an extremely large job, but it would destroy much of the existing habitat in the wetland areas.

Non-natives leaf out earlier than natives and so are easily visible in springtime.

5. Restoration of areas where walkers have made trails down the steep slopes is important to prevent erosion and runoff.

6. Several areas of the stream below the 684 rest area need extensive garbage cleanup. A crew of volunteers could make a huge difference in the aesthetics of the property. Pulling back of the fence for the rest area would help keep this happening again in the future, especially on the steep slope behind the comfort station.

VIII. Summary

The Buxton Gorge property represents a unique assemblage of habitats and is good example of the type of natural areas found throughout the Town of Bedford. The deep Hemlock-lined Gorge section of the property is a unique natural resource that is worthy of permanent protection for all of the residents of Bedford to enjoy and appreciate. The Gorge really has to be experienced to realize its uniqueness and timeless natural beauty. The Gorge represents a declining and increasingly rare natural community that should be preserved as a vital example of the region's rich natural heritage.

The property and the surrounding area have undergone extensive land use changes that have resulted in a corresponding loss of species diversity. The habitats present throughout the property and the wildlife species that depend upon these habitats have been compromised in their ability to sustain environmentally sensitive species. The results of the Natural Resource Inventory and Assessment revealed lower overall species diversity values and limited numbers of individuals within populations observed. Despite low diversity and species abundance, ample restoration opportunities and initiatives exist that could potentially enhance species abundance and diversity. The location of the Buxton Gorge property is ideally suited to function as a local recreational and educational resource for the residents of the Town of Bedford and surrounding region.

IX. Technical References

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X. Appendices

- Appendix A: 1926 Aerial Photograph of Buxton Gorge Area
- Appendix B: Recreation Potential
- Appendix C: Natural Resources