# Mount Rose Preserve Stewardship Plan

## Final Draft Plan - August 2016

**Prepared for**

New Jersey Conservation Foundation

**Prepared by Michael Van Clef, Ph.D., Stewardship Director**

Friends of Hopewell Valley Open Space

## Introductory Information

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|---|---|
| Project Area: | Mount Rose Preserve |
| Project Co-Owners and Stakeholders: | Co-Owners: Mercer County, New Jersey Conservation Foundation, Hopewell Township, Friends of Hopewell Valley Open Space<br>Acquisition Assistance: D&R Greenway Land Trust, Friends of Princeton Open Space, Hopewell Borough, Lawrence Township, Municipality of Princeton, New Jersey Green Acres Program, Pennington Borough, Stony Brook – Millstone Watershed Association |
| Total Plan Acreage: | 397 acres (includes 11 acres currently in private ownership) |
| Municipality, County: | Hopewell Township, Mercer County |
| Wildlife Action Plan Conservation Zone: | Central Piedmont Plains (14) |
| NJDEP Watershed Management Area: | Millstone River (WMA 10) |
| Waterbodies: | Honey Branch tributaries (1.2 miles), Cleveland Brook (500 feet), Small pond (0.15 acres) |
| Numbers of Rare Species Conservation Targets[1]: | Total Number of Animal Species: 9<br>Total Number of Plant Species: 2<br>Total Number of Ecological Communities: 0<br><br>*Note: Categories below are not mutually exclusive.*<br>Globally Rare Species: 0<br>Federally Endangered Species: 0<br>Federally Threatened Species: 0<br>State Endangered Species: 2<br>State Threatened Species: 5<br>State Special Concern Species: 4<br>State Game Species of Concern: 0<br>Wildlife Action Plan Priority Animal Species: 9<br><br>Globally Rare Ecological Communities: 0<br>State Rare Ecological Communities: 0 |
| Habitat Conservation Targets: | 1) Forest, 2) Shrubland, 3) Meadow |
| Landscape-Scale Conservation Areas: | *ENSP Landscape Project Importance Summary* -<br>Largest Habitat Patch - Upland Forest - < 250 contiguous acres<br>*New Jersey Natural Heritage Program Priority Sites* -<br>There are no sites that overlap the Preserve.<br>*New Jersey Audubon Society Important Bird and Birding Areas* –<br>There are no sites that overlap the Preserve. |

[1] Species include those confirmed or suspected to be present within the Preserve or its immediate vicinity based upon publicly available information from the NJ Department of Environmental Protection (Endangered and Nongame Species Program and Natural Heritage Program).

*Cover Photo: White Turtlehead located at a groundwater seep*

| | |
|---|---|
| Species Conservation Target List[1]: | **Animals (9)**<br><br>***Birds (6)***<br>Bald Eagle – foraging only (State Endangered), Barred Owl – breeding sighting (State Threatened), Bobolink – breeding sighting (State Threatened), Brown Thrasher – breeding sighting (Special Concern), Eastern Meadowlark – breeding sighting (Special Concern), Great Blue Heron – foraging only (Special Concern)<br><br>***Retiles (2)***<br>Eastern Box Turtle – occupied habitat (Special Concern), Wood Turtle – occupied habitat (State Threatened)<br><br>***Mammals (1)***<br>Bobcat – live individual sighting (State Endangered)<br><br>**Plants (2)**<br>*Wild Comfrey – *Cynoglossum virginianum var. virginianum* (S2)<br>*Leatherwood – *Dirca palustris* (S2)<br><br>E=State Endangered; S1=Critically Imperiled (< 5 known populations); S2=Imperiled (6-20 known populations), S3=Rare (21-100 populations).<br><br>*Species observed during field surveys by M. Van Clef. There were no NJ Natural Heritage Program records for rare plant species within or in the vicinity of the Preserve. |
| Invasive Plant Species List: | Each invasive plant species was assigned an 'Action Code' based upon observations of current extent of infestations on the Preserve and within New Jersey. Codes include: "1" = immediate implementation of an eradication program across the entire Preserve, "2" = selective control measures to minimize negative impacts, especially in particular habitats and "3" = no direct control measures due to low probability of causing significant harm or species is very abundant and control measures are impractical. Particular species may be controlled through specific habitat restoration projects. See report for additional information on distribution, infestation severity and control recommendations.<br><br>***Total Number of Mapped Invasive Species: 32***<br><br>**Action Code = 1 (7 species)**<br>Blue Plantain Lily, Chinese Bushclover, English Ivy, Japanese Aralia, Linden Viburnum, Oriental Photinia, Zelkova<br><br>**Action Code = 2 (11 species)**<br>Asiatic Bittersweet, Autumn Olive, Callery Pear, Canada Thistle, Catalpa, Common Reed, Mugwort, Reed Canary Grass, Toringo Crabapple, Tree-of-Heaven, Winged Burning Bush<br><br>**Action Code = 3 (14 species)**<br>Black Locust, Bush Honeysuckles, Carpgrass, Cool season hay grasses, Garlic Mustard, Japanese Barberry, Japanese Honeysuckle, Japanese Stiltgrass, Mile-a-Minute, Multiflora Rose, Norway Spruce, Privet, Wineberry |
| Overabundant Native Animal Species: | This plan will address management of invasive species in the context of an overabundant deer population, which has a profound negative impact on conservation values. The Preserve is located within the NJ Division of Fish & Wildlife's Deer Management Zone #12 (Deer Management Units 254 and 255). |

## Contributors

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We would like to especially thank the contributions of Katherine Dresdner of the Hopewell Valley Citizens Group. Her tireless volunteer efforts were critical to the ultimate success of the land acquisition of nearly 235 acres completed in 2015.

## Executive Summary

The Mount Rose Preserve represents an important example of protection of critical natural and recreational resources. This plan includes results of literature review, stakeholder interviews, a public survey, and field investigations conducted at the 397-acre Preserve. The Preserve includes lands previously owned by Hopewell Township, along with lands acquired in 2015 with funding from private citizens and many stakeholder organizations, especially Mercer County and NJ Green Acres Program. Management of the Preserve will be led by the four co-owners; Mercer County, New Jersey Conservation Foundation (NJCF), Hopewell Township and Friends of Hopewell Valley Open Space (FoHVOS) with input from other stakeholders (See Page i and iii above). Co-owners' responsibilities will be described within a Memorandum of Understanding.

There are three main purposes of this stewardship plan. The first is to clearly state the vision and goals for the Preserve including protection of biodiversity and provision of recreational opportunities. The second is to carefully define conservation values, threats to their health, and strategies/actions to mitigate identified threats. The third purpose is to provide ample sources of reference material for stakeholders and the public to effectively navigate the many aspects of the Preserve and guide its adaptive stewardship over time.

The vision for the Preserve is to provide model stewardship of biodiversity along with excellent public recreation and educational opportunities. Although the primary objective is the enhancement and recovery of natural resources, providing recreational and educational opportunities are considered high priorities that can be balanced with the requirements of biodiversity.

The primary habitat conservation targets are forest, shrubland and meadow, which form a mosaic at the Preserve. These habitats support multiple common and rare species of our flora and fauna. There are a total of 11 rare species likely to be utilizing the area including both animals (Bald Eagle, Barred Owl, Eastern Box Turtle) and plants (Wild Comfrey). All of these habitats and species are under immediate threat from overabundant deer and invasive species.

Deer are having a dramatic negative impact at the Preserve. Forest habitats fall into two categories – "Empty Forest Syndrome" or "Infested Forest Syndrome" (See page 2). Fallen trees due to Superstorm Sandy are not being replaced due to excessive deer browse. Native shrubs and wildflowers are nearly absent throughout the forest. A local reduction of the deer density to 10 per square mile is absolutely critical to allow native species, freed from excessive browse, to exert ecological control of invasive species and produce healthy native plant communities. This will require strategic deer management that involves the Preserve and nearby lands, both public and private. Stewardship plans also include extensive shrubland and meadow restoration.

The extent of invasive species infestation is significant. A total of 32 invasive species were detected. Approximately 80% of the mapped area was considered to be heavily infested with one or more species. The predominant invaders are Japanese Stiltgrass, Multiflora Rose and Autumn Olive. Importantly, seven emerging invasive species were detected and should be immediately eradicated (e.g., Japanese Aralia) to prevent future damage. A "brute force" approach that seeks direct control of all invasive species is not practical. This plan recommends a strategic approach with the ultimate goal of significantly reducing invasive species through directed active control and ultimate reliance on ecological control to both reverse current infestations and resist future infestations.

Recreational opportunities will be provided through 5 miles of trails. This will include a new portion of the Lawrence Hopewell Trail and two small loop trails (Meadow Trail and Forest Trail). Outreach efforts will include ample signage 'learning posts' and regular expert-led guided hikes. In addition, a picnic pavilion and portable toilets will be installed to attract public use of the Preserve.

This ambitious plan provides five primary stewardship and recreation & outreach recommendations with fourteen associated goals (see next page). Full implementation of these goals is estimated to require over 5,000 hours of co-owner staff and nearly 5,200 hours of volunteer time. The total plan implementation cost is estimated at approximately $875,600 over the next 10 years.

## Primary Stewardship, Recreation and Outreach Recommendations

There are five primary recommendations and fourteen associated goals. Goals are further divided into specific tasks with associated level-of-effort and cost estimates (Table 24). An annualized summary of activities for the 10-year plan implementation time period is provided in Table 24.

**Recommendation #1: Create an Integrated Trail System and Outreach Program**

**Goal #1-1:** Create an Integrated Trail System
Complete Lawrence Hopewell Trail through Preserve and create two self-guided loop trails within the Preserve.

**Goal #1-2:** Integrate Cultural, Historic and Natural Heritage Education
Utilize 'learning posts' within trail system. Trail signage and kiosks will be linked to web content.

**Goal #1-3:** Annually Provide 5 Guided Hikes
Hikes led by experts in cultural, historical and natural heritage topics

**Goal #1-4:** Perform Preserve Maintenance
Perform initial site cleanup and perform routine tasks to assure public safety and enjoyment of the Preserve.

**Goal #1-5**: Provide parking and public amenities
Resurface parking lot and provide a picnic pavilion and composting toilets for visitors.

**Recommendation #2: Perform Forest, Shrubland and Meadow Habitat Restorations**

**Goal #2-1:** Restore Canopy Gaps and Wildflowers on 5 Acres of Old Forest Habitat

**Goal #2-2:** Restore 27 acres of Shrubland and Guide Natural Development on 13 acres

**Goal #2-3:** Restore 34 acres of Native Wildflower Meadow

**Recommendation #3: Perform Strategic Invasive Species Control**

**Goal #3-1:** Eradicate 7 Emerging Invasive Species

**Goal #3-2:** Perform Selective Control of 11 Widespread Invasive Species

**Goal #3-3:** Maintain <5% Cover of Invasive Species within "Clean Areas" on 65 acres of Old Forest Habitat

**Recommendation #4: Provide Stewardship of Rare Species and Perform Ecological Monitoring**

**Goal #4-1:** Perform Complete Botanical Survey / Floristic Quality Assessment

**Goal #4-2:** Implement Ecological Health Monitoring Program for Forest, Shrubland and Meadow Habitats

**Goal #4-3**: Rare Species Monitoring and Stewardship

**Recommendation #5: Implement an Effective White-tailed Deer Management Program**

**Goal #5-1:** Reduce deer density to meet forest health goals including a dense, native understory

## Table of Contents

## List of Tables, Figures, Maps and Appendices

### List of Tables



### List of Figures



### List of Maps

**Individual Invasive Species Maps (arranged alphabetically by scientific name)**

**List of Appendices**

## Section I. Overview

### Introduction

The Mount Rose Preserve consists of nine parcels totaling nearly 400 acres in eastern Hopewell Township (See Table 1 and Map 1). The Mount Rose Preserve stakeholders include those groups maintaining ownership interest, contributed to acquisition funds and/or have ongoing interests. Groups maintaining an ownership interest include the Mercer County, New Jersey Conservation Foundation, Hopewell Township, and Friends of Hopewell Valley Open Space. Other stakeholders are provided on Page i and iii. This Stewardship Plan was created to collect and consolidate relevant information to jointly develop strategies to improve the ecological health and recreational and outreach opportunities within the Preserve.

This section provides a brief overview of vision and goals for the Preserve as well as a summary of conservation values, threats to conservation values, and the context for stewardship actions.

**Table 1. Mount Rose Preserve Parcel Ownership**

| Property Name | Block | Lot | Ownership | Acreage | Plan Inclusion |
|---|---|---|---|---|---|
| Bayberry Road | 39 | 26 | Hopewell Township | 75.3 | Yes |
| Bayberry Road | 39 | 32 | Hopewell Township | 9.7 | Yes |
| Carter Road | 39 | 14.01 | Hopewell Township | 66.9 | Yes |
| Mount Rose Preserve | 40 | 14.04 | Hopewell Township | 11.0 | Yes |
| Mount Rose Preserve | 39 | 12 | Co-Owners | 6.2 | Yes |
| Mount Rose Preserve | 39 | 14.021 | Co-Owners | 92.2 | Yes |
| Mount Rose Preserve | 39 | 15 | Co-Owners | 15.0 | Yes |
| Mount Rose Preserve | 40 | 14.01 | Co-Owners | 103.1 | Yes |
| Mount Rose Preserve | 40 | 14.05 | Co-Owners | 7.1 | Yes |
| Private | 39 | 14.031 | Private | 10.9 | Yes |
| **Total Acres** | | | | **397.4** | |
| **Private Ownership** | | | | **10.9** | |

### Conservation Values

The Mount Rose Preserve represents excellent examples of the natural heritage contained within the piedmont physiographic region. There were nearly 90 unique ecological communities identified during field surveys, including various forest communities dominated by Red Maple, Red Cedar, American Beech, White Oak, Sugar Maple or Ash. Shrubland and meadow communities, along with forest communities, create a mosaic of different habitats harboring diverse elements of our flora and fauna. The Preserve contains portions of Cleveland Brook and tributaries of Honey Brook, both of which drain into the Stony Brook. A total of eleven rare plants and animals have been documented within or adjacent to the Preserve. Species include Bald Eagle, Wood Turtle and Wild Comfrey.

## Vision and Goals

The vision for the Mount Rose Preserve is to provide a collaborative model of stewardship for biodiversity along with provision of excellent recreational and educational opportunities. The five primary recommendations include: 1) Create an integrated trail system and outreach program, 2) Perform Forest, Shrubland and Meadow Habitat Restoration, 3) Perform strategic invasive species control, 4) Provide stewardship of rare species and perform ecological monitoring and 5) Implement an effective white-tailed deer management program. Each of these recommendations includes action-oriented goals (See Sections IV and V). Public access will be provided for passive and active recreational opportunities such as hiking, nature observation & photography, cross-country skiing, hunting and fishing. Biking will be allowed on the Lawrence Hopewell Trail only. Horseback riding will be allowed on short loop trails through meadow or forest habitat (excluding the Lawrence Hopewell Trail).

Complete realization of the vision and goals for the Preserve can only be met through cooperative efforts of the co-owners and stakeholders, which must also strive to foster participation of private landowners to implement wise stewardship fueled by deep appreciation of the natural world. Because of the complexity of the task at hand, this plan is considered a living document subject to change over time as additional information becomes available and results from ongoing efforts are evaluated. At a minimum, this stewardship plan should be revised every ten years. The careful stewardship of the Mount Rose Preserve will provide concrete examples of exemplary stewardship and community support that can be broadly applied throughout New Jersey.

## Threats to Conservation Values

This section provides a brief overview of three significant factors that impact ecological health. These factors are interrelated and impact ecological health synergistically. In isolation, deer overabundance is the most severe threat, followed by invasive species and continuing impacts of altered soils from past agricultural use.

Degraded forests in New Jersey generally fall under two 'syndromes'. The first is the "Empty Forest Syndrome" where all native species have been removed from the forest understory by overabundant deer. These forests also have very low invasive species cover, except where canopy gaps provide additional light resources. This syndrome is usually associated with areas that have never received agricultural soil tillage and associated soil alterations (1930 aerial photography showing mature forest cover can act as a guide to determine the lack of past agricultural land use). The second syndrome is the "Infested Forest Syndrome", which includes dense invasive species cover and small amounts of native cover that is severely browsed by deer. This syndrome is associated with: 1) upland forests with past agricultural tillage that has dramatically altered soil characteristics, 2) many wetland forests regardless of past land use, and 3) riparian forests, especially where unnaturally high water flows create severe and repeated physical disturbances.

### White-tailed Deer

Statewide deer population size has varied significantly over the last one hundred years (Figure 1). The historical analysis of the white-tailed deer population density in North America (pre-European colonization) is approximately 10 per square mile (McCabe and McCabe 1984). Figure 1 shows the estimated statewide population size based upon the historical estimate for North America and deer population estimates reported by the New Jersey Division of Fish & Wildlife. By 1900, deer were nearly extinct in New Jersey because of unregulated market hunting for the sale of venison. The recovery of deer population, through the implementation of various game regulations, is a significant conservation success story. However, the deer population mushroomed during the 1900's and peaked in 1995 with 3X

more individuals than pre-European estimates. In 2011, there was 1.5X more individuals than pre-European estimates (See notes under Figure 2 for details). In the late 1990's, the NJ Division of Fish & Wildlife implemented changes to reduce the deer herd (e.g., "Earn-A-Buck" program that encouraged harvest of antlerless deer). It is important to note that deer population reduction has occurred when 40-50% of the population is harvested annually (green line in Figure 2) and 60-70% of the harvest is comprised of antlerless deer (orange line in Figure 2). Although there have been recent important changes to facilitate hunting success (e.g., Sunday bow hunting, use of crossbows, reduction in the bow hunting safety zone), population levels continue to exceed pre-European densities with noticeable ecological, economic and human health impacts.

**Figure 1. Historic and Current New Jersey Deer Population Estimates**

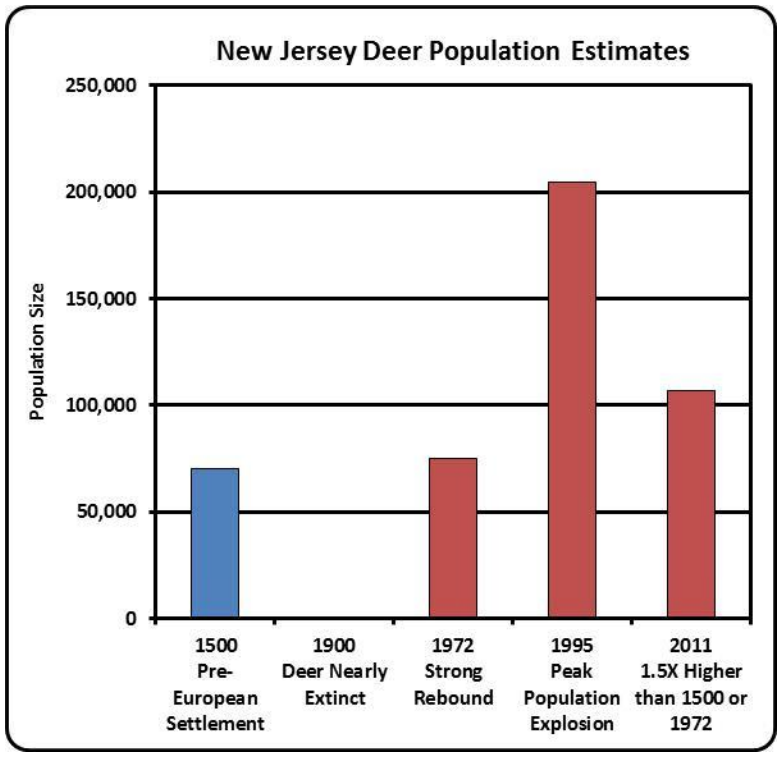
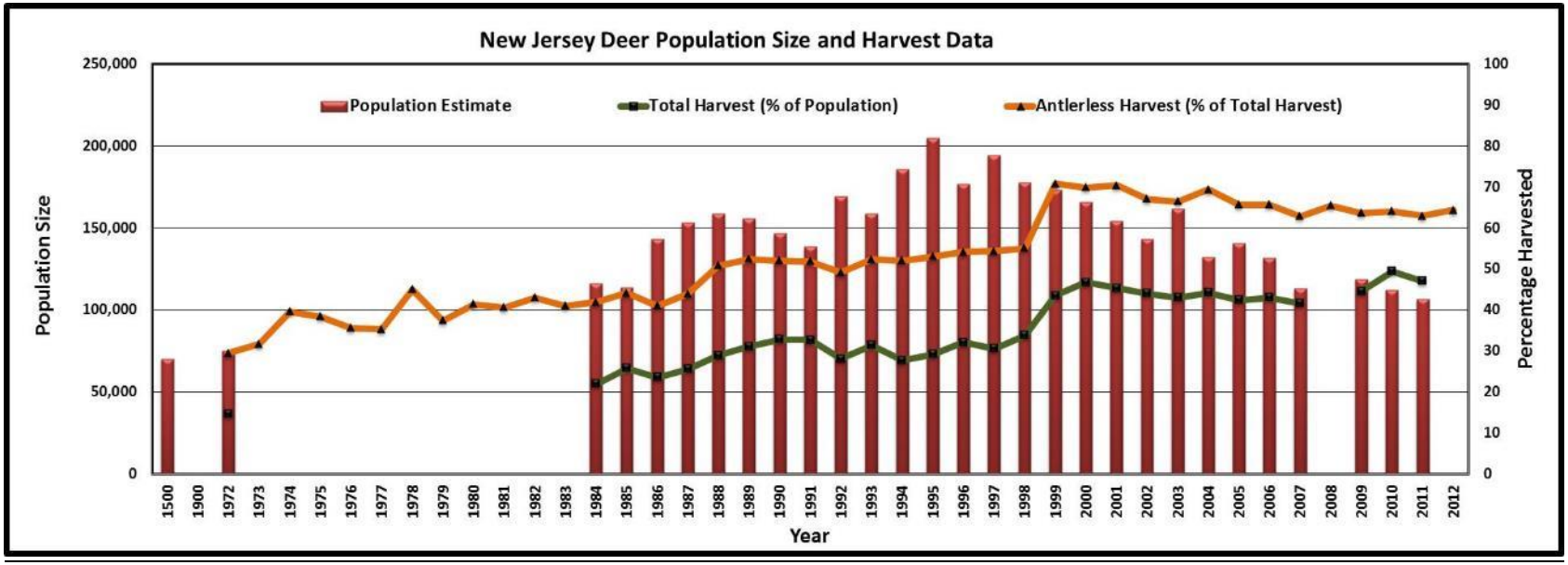


**Figure 2. New Jersey Deer Population Size and Harvest Data**




Graph prepared using NJ Division of Fish & Wildlife data sources. The estimated number of deer in 1500 is based upon the average deer density across North America (9.5/square mile) reported by McCabe and McCabe (1984) and the NJ land area reported by the US Census Bureau (7,417 square miles). Using this method, overall deer densities in particular years are: 1972 – 10.1; 1995 – 27.6 and 2011 – 14.4

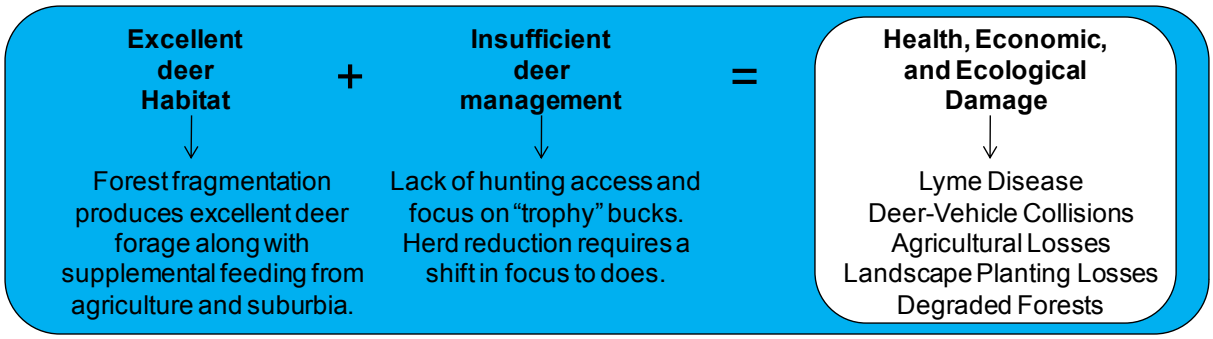
Special Note #1: Deer densities calculated by the Division of Fish & Wildlife are derived from harvest data and do not account for land inaccessible to hunting; therefore, they represent an under-estimate of actual deer population size. Species Note #2: Total population estimates are not available for 2008 or 2012.

The current effective deer densities on forested habitats are significantly greater than pre-Columbian densities because a considerable amount of land in New Jersey is developed / agricultural (ca. 50% of the total land area). In absolute numbers, the New Jersey deer population peaked in 1995 with 2.9X more individuals than pre-Columbian estimates. There is currently 1.5X more individuals than pre-Columbian estimates [but see special note #1 above].

It should be noted that the deer population size or density is less significant than their overall impacts on ecosystem health, which should be measured to inform deer management goals.

A simplified explanation of deer management issues and consequences are depicted in Figure 3. All deer management efforts must consider the current habitat conditions that serve deer population growth. Deer prefer forest edges and fields for feeding and utilize forests for cover and supplemental feeding. Deer also utilize agricultural crops as food sources and residential areas for both food and cover from hunters (state regulations prohibit firearm hunting within 450 feet of an occupied or potentially occupied structure unless written permission is provided by the owner, bow hunting is prohibited within 150 feet). Both restrictions on hunting access and insufficient hunting efficacy, plus the ability of the landscape to serve as an excellent incubator for deer population growth, combine to cause severe deer impacts.

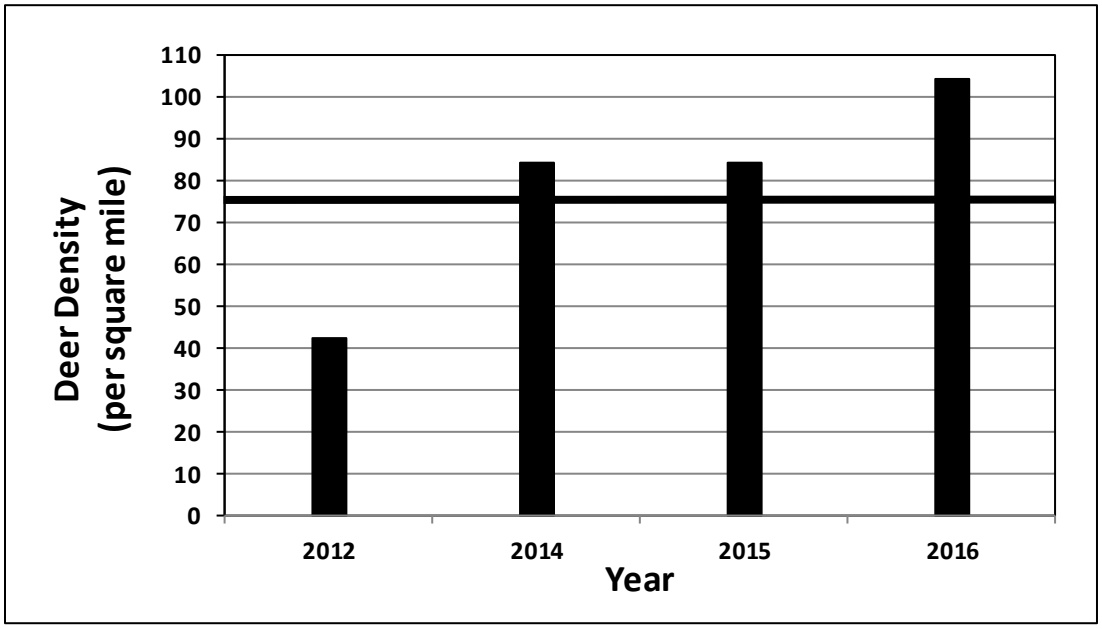
**Figure 3. Deer Population Growth Factors and Impacts**




The current statewide deer population cannot support healthy forests (and creates significant human health and economic impacts). A healthy forest consists of a canopy of tall, mature trees, a sub-canopy of smaller tree species and an understory of tree saplings & seedlings, shrubs and herbs. Deer prefer to eat native plants over non-native invasive plants leading to further degradation of our forests by allowing invasive species to proliferate. The combination of elevated deer numbers and their preference for native plants has led to degradation of New Jersey's forests by eliminating native understory growth and reducing the abundance of animals that require those plants for their survival. Although the 'correct' number of deer may vary depending upon site and regional conditions, the goal of healthy forest communities that support a diversity of plants and animals is universal.

In Hopewell, deer population estimates are quite grim (Figure 4). In 2012, following an outbreak of blue tongue disease, the population was approximately 40 deer per square mile. However, the population had doubled by 2014 and maintained over 80 deer per square mile through 2015. Due to a variety of factors, the population grew significantly in 2016 and now stands above 100 deer per square mile. The implications of this ever increasing deer population are severe. While local and partial successes are possible under effective deer management programs (e.g., Ted Stiles Preserve at Baldpate Mountain), most forests in the Hopewell Valley will continue to degrade. Deer management at the Mount Rose Preserve will have to be robust to assure local herd reduction compatible with reasonably healthy ecological communities.

**Figure 4. Hopewell Valley Deer Population Estimates**
(Horizontal line represents 4-year average)




**Invasive Species**

Humans have introduced non-native species, both intentionally and unintentionally, to parts of the world outside of their natural range. Only a small percentage of these introduced species become invasive, which is formally defined by the National Invasive Species Council as "a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (NISC 2001). The financial impacts of invasive species are enormous. Pimentel et al. (2005) estimate an annual cost of $120 billion dollars to agriculture, forestry and recreation. In addition, invasive species are considered the greatest threat to global biodiversity after outright habitat destruction (Wilcove et al. 1998).

From nature's perspective, this problem is relatively new with the first problems becoming apparent in the 1950's (Elton 1958). Accelerating infestations have only been occurring over the last 30 - 60 years in New Jersey with our most serious invasive species originating from areas with similar temperate climates (i.e., Europe and Asia).

*Plants* - In addition to being less palatable to deer, invasive plant species appear to have left behind many of their native pests and pathogens, which provide them additional benefits. In general, invasive plants are 'weedy' - maturing quickly, producing large seed crops, and having tolerance to a variety of disturbed or human-altered growing conditions. Overall, there are nearly 1,000 non-native plants in New Jersey. There are currently 34 widespread invasive plants and 137 emerging or potentially invasive plants in New Jersey (see New Jersey Invasive Species Strike Team). Unfortunately, the rate of new plant introduction continues to rise. Snyder and Kaufman (2004) estimate fifty new plant introductions to New Jersey over the last twenty-five years (these are species with individuals growing in natural or semi-natural areas outside of human cultivation). There are no estimates of the area infested by invasive plants in New Jersey, but it is likely that hundreds of thousands of acres are impacted.

Some of our most notorious invasive plants include Japanese Barberry, Japanese Stiltgrass and Garlic Mustard. Although these widespread species cause severe harm, they are likely to be significantly reduced through ecological control exerted by taller, shade tolerant native species if deer populations are reduced. Among the emerging invasive species, a new class of invasive species is more threatening to forests than our existing invasives. These new species would be resistant to ecological control by native species because they are very tall (12- 20 feet), shade tolerant (can establish under closed forest canopy), and produce large amounts of bird dispersed seed capable of quickly reaching new locations. The five most troubling species are Oriental Photinia, Common Buckthorn, Siebold's Viburnum, Linden Viburnum (now considered widespread) and Japanese Aralia.

*Animals* - Invasive animals also cause significant harm to native ecosystems. There are currently 21 widespread invasive animals and 23 emerging or potentially invasive animals in New Jersey (see New Jersey Invasive Species Strike Team). Our most widespread invaders (with impacts in parentheses) include: several earthworm species (all earthworms in New Jersey are non-native and severely alter native soils), Brown-headed Cowbird (nest parasite of many birds including forest interior birds - impacts are highest in fragmented forests), Feral Cats (kill large numbers of birds), European Starling (nest competition, primarily in human-dominated areas), Asian Tiger Mosquito (human pest and unknown ecological damage), Rusty Crayfish (alter aquatic communities), Asiatic Clam (impact aquatic systems), and Red-eared Slider (competes with native turtles, especially painted turtles).

The most troubling emerging or potentially invasive species include Feral Hog, Zebra and Quagga Mussels, Mute Swan, and Nutria, which all cause significant damage in the region. Feral Hogs have been noted in several locations across New Jersey with a significant population in Gloucester County that is being targeted for eradication by the Division of Fish & Wildlife. This species causes severe harm to forest communities in other parts of eastern North America and is a considerable new threat to New Jersey. Zebra and Quagga Mussels cause significant harm to freshwater systems (zebra mussel has been documented in eastern Pennsylvania). Large populations of Mute Swan impact native waterfowl populations and Nutria compete with native wildlife and alter wetland communities.

*Pests and Pathogens* - Invasive pest and pathogens have the potential to radically alter plant and animal communities. There are currently 12 widespread invasive pests & pathogens and 20 emerging or potentially invasive pests & pathogens in New Jersey (see New Jersey Invasive Species Strike Team). Some of the most notorious invaders include Chestnut Blight, Hemlock Wooly Adelgid and Gypsy Moth. Chestnut Blight has reduced the once dominant American Chestnut to a transient understory tree that rarely produces fruit, Hemlock Wooly Adelgid has killed over half of the state's Eastern hemlocks (ca. 13,000 acres destroyed) with many remaining trees in poor health, and Gypsy Moth periodically ravages oaks leading to localized death of mature trees (including many 300+ year old trees at Hutchinson Memorial Forest). The Gypsy Moth is the subject of an intensive treatment program that utilizes a bacterium called *Bacillus thuringiensis* to mitigate their impacts and they are also partially controlled by a naturally occurring fungus. The Gypsy Moth Suppression Program consists of a voluntary cooperative between the NJ Department of Agriculture, US Department of Agriculture, NJ Department of Environmental Protection, county agencies and municipalities. Treatments are performed via aerial spraying. While control of pests and pathogens are uncommon, the intensive work on Asian Long Horned Beetle has led to its eradication in New Jersey.

Other important widespread invasive pathogens include Dutch Elm Disease (continuing to cause damage, but mature American Elm and Slippery Elm are still common), Beech Bark Disease (caused tree death throughout the state, remaining trees appear to be mostly immune) and Dogwood Anthracnose (many plants are not severely impacted and ultimate impacts are unknown).

There are a number of emerging and potential pests and pathogens that may impact the Preserve. Emerging species already present in New Jersey include Viburnum Leaf Beetle (discovered in 2009, has potential to severely impact species such as maple-leaved viburnum, arrowwood, and other viburnums as evidenced in New York state over the past 10 years) and Bacterial Leaf Scorch (BLS). BLS may infest species within the red oak group (e.g., red oak, scarlet oak, black oak, pin oak). Currently, BLS is associated with street trees and other ornamental plantings (40% of recently tested trees were infested across the state), but spread into more natural settings appears to be occurring (J. Arsenault, personal communication). Ultimate impacts of BLS in natural areas are unknown, but the risk should be considered moderate at this time. Sudden Oak Death (SOD) is also a significant potential threat. The NJ Department of Agriculture was quick to respond to the unintentional introduction of SOD in Cape May in 2004 (introduced via contaminated nursery stock from California). Surveys were conducted for SOD and no infections have been found in wild plants, but there is continued threat of additional introductions to New Jersey. Other potential threats include Pine Flat Bug, Asian Gypsy Moth, Eurasian Nun Moth, Dutch Elm Disease 2, Phytophthera Root Rot, European Oak Bark Beetle, and two species of Ambrosia Beetle.

Unfortunately, Emerald Ash Borer has become established in New Jersey and has been documented as close as Ewing Township. While a biological control agent (parasitic wasp) is being released currently, it is likely that New Jersey will lose over 90% of its ash trees even if the control agent eventually becomes effective.

Asian longhorn beetle
ERADICATED from New Jersey!


Emerald ash borer
Spreading rapidly in New Jersey

Photo Source: Forestry Images / The Bugwood Network, http://www.forestryimages.org/

***Overview of Invasive Species Management*** - The underlying philosophical context for invasive species management is the obligation to counteract negative human impacts on natural systems, which is often referred to as "stewardship". The guiding principle of stewardship is fostering health of native plant communities that support our flora and fauna, which is indirectly accomplished through the management of invasive species. Management of invasive species is generally achieved through targeted control measures that minimize, but do not eradicate, particular invasive species. Eradication within pre-defined boundaries should only be considered a valid goal when populations are relatively small and the threat of continued spread is significant. Eradication should also be considered at 'showcase' lands. In all cases, invasive species management should aim to stimulate native plant communities to resist infestation and minimize the use of pesticides and any other intervention. However, human impacts on natural systems are diverse and perpetual, which will necessitate continuing stewardship of natural lands within the context of a human-dominated environment in order to support healthy native plant and animal communities (See Figure 7, Page 48 for further discussion).

There are two general approaches related to invasive species management. These involve a species-led approach or a habitat-led approach. A species-led approach should be employed when an invasive or potentially invasive species can either be eradicated or contained to reduce impacts across the entire Preserve or to minimize spread onto surrounding areas. This approach is warranted for invasive species that are emerging locally or regionally and for widespread invasive species with limited distribution at a particular property.

A habitat-led approach should be employed when conservation values within a defined area are threatened by invasive species that are widespread throughout the region and the Preserve. This approach involves holistic strategies to promote native plant species assemblages that reduce overall invasive species cover through direct competition for light and soil nutrients. The ultimate goal is to foster native plant communities that resist future infestations.

The management of invasive species can be classified into five broad methods referred to as mechanical, chemical, biological, cultural and ecological control (Table 2). Each control method utilizes multiple techniques and control methods may be used alone or in combination depending upon the resource to be protected and practical constraints (Table 3 and Appendix A).

Mechanical control involves physical removal or cutting of invasive species. In the past, many groups performing invasive species control relied entirely on mechanical methods. Although mechanical methods can be the most appropriate choice in limited situations, many groups have abandoned this option because progress is exceedingly slow and methods are often ineffective.

Chemical control is the most commonly used method. It can be used in concert with mechanical control (e.g., cutting plants and applying herbicide to the stump) or alone (e.g., basal bark applications). However, herbicide use to control invasive species should be judicious to avoid impacts to non-target plants and animals. In all cases, herbicide use should involve the most benign formulations and application methods that effectively control the invasive species being treated. Appendix B - Summary of Herbicide Characteristics provides a summary of eleven herbicides that includes target species classes, persistence in the environment, toxicity to humans and wildlife and estimated material cost. Each herbicide was placed into a recommended use grouping that considers all of the above mentioned factors.

The application of pesticides is regulated by the NJ Department of Environmental Protection - Pesticide Control Program (PCP). Lead staff members within the co-owners involved with the application of herbicides within the Preserve must become 'commercial pesticide applicators', which requires attendance in a one-day course on pesticide safety, passing PCP's core exam and at least one PCP category exam and completing 40 hours of on-the-job training for each category of pesticide application.

There are two categories that cover any potential applications in natural areas and stewards of the Preserve would be required to pass both category exams along with the core exam. These categories include Category 2: Forest Pest Control and Category 5: Aquatic Pest Control (required for wetland applications).

Additional staff or seasonal interns may opt to become 'certified pesticide operators', which requires attendance in a one-day training course on pesticide safety and receipt of 40 hours of on-the-job training for each category of pesticide application. Operators are not required to pass any examinations and must be directly supervised by a certified pesticide applicator. According to current regulations, direct supervision beyond the 40-hour on-the-job training consists of operators being within "very timely voice contact" and within "three travel hours by land". Staff members, interns or volunteers that are not certified applicators or operators may still apply herbicides if a certified applicator is always physically present and in the line-of-sight of the non-certified staff member. While volunteers can legally apply herbicide, this should be avoided on the Preserve.

The PCP also requires a permit for any wetland applications of pesticides. Currently, this involves a simple reporting form and an associated $75 fee. In some cases, the PCP may require an additional permit from the NJ Department of Environmental Protection - Division of Land Use when control work is deemed to significantly alter the vegetative structure of a wetland (e.g., removal of significant invasive shrub cover to promote an herbaceous wetland).

Ash decline documented at the Mount Rose Preserve.

## Table 2. Description of Invasive Plant Control Methods

| Control Method | Description | Pros | Cons | Notes |
|---|---|---|---|---|
| Biological | Introduction of a biocontrol agent (e.g., insect, pathogen) from the invasive species' native range | Dramatic reduction in abundance with minimal costs; minimal accessibility issues | Limited number of invasive species have agents | Requires extensive resources to provide effective host-specific agents; Numerous federal regulations provide significantly reduced risk of impacts to non-targets species |
| Mechanical | Physical removal of all or portions of an invasive species | No requirement for specialized training; can be performed by volunteers | Very labor intensive; may require specialized equipment; site accessibility issues, impractical for large infestations; re-sprouting or further invasive species dissemination may occur | Common techniques include mowing, cutting, pulling and girdling |
| Chemical | Application of herbicide to all or portions of a plant | Most effective and efficient method in most cases; trained staff can be assisted by volunteers | Labor intensive; site accessibility issues; requires specialized training/license and equipment; may require repeated applications for more difficult species | Common applications include foliar, cut stump, basal bark and injection; Mechanical and chemical controls may be combined for cut stump and hack-and-squirt methods |
| Cultural | Removal of invasive species through broad land use activities | Very cost effective | Does not apply well to forest habitats | Primarily applies to agricultural or horticultural systems, but may apply to the maintenance of early successional natural systems including grasslands; Techniques include prescribed fire and prescribed grazing |
| Ecological | Allowing natural ecological processes (e.g., competition for light and soil resources, predator-prey relationships, etc.) to reduce invasive species over time | Very cost effective; utilizes natural processes | May not occur in many systems due to persistent or continuing human impacts (e.g., overabundant deer, continual physical disturbance, habitat fragmentation, etc.) | Primarily applies to forest systems; As an example, very strong anecdotal evidence suggests that overabundant deer facilitate infestations by Japanese Stiltgrass and other invasive species in forests by removing the native shrub layer |

**Table 3. Specific Control Techniques by Invasive Plant Class**

| Invasive Species Class | Suggested Treatment Techniques [1] | Notes |
|---|---|---|
| Large tree | Basal Bark, Girdling or Harvesting | May be combined with herbicide application to girdled area |
| Large shrub / small tree | Basal bark, Hack-and-Squirt, Cut Stump, Girdling | Mowing may be used as a pre-treatment to reduce plant size prior to chemical treatments |
| Small shrub / tree sapling | Basal Bark, Foliar Spray, Cut Stump, Pulling | Mowing may be used as a pre-treatment to reduce plant size prior to chemical treatments; Prescribed Fire or Prescribed Grazing may be used in grassland habitat |
| Large vines | Basal Bark, Cut Stump, Hack-and-Squirt | Many vine species have extensive root systems that require herbicide treatment |
| Forest herbs, woody seedlings and small vines | Foliar Spray, Pulling | Mulching may be utilized in garden beds or other human-modified areas |

[1]For details on control methodologies see Appendix A – Overview of Control Methods and Appendix C – Invasive Species Phenology. Cultural and ecological control may apply to all invasive species classes.

Biological control involves the purposeful introduction of an insect or pathogen (biocontrol agent) that attacks an invasive species. The biocontrol agent is usually native to the same point of origin as the invasive species. Biological control is the most effective treatment technology for the limited number of invasive species where biocontrol agents have been developed. Biological control has had notable success stories and notorious failures. For example, the non-native Indian mongoose was released to control non-native rats (European and Asian) in sugarcane plantations in the West Indies. The mongoose was only partially effective (only controlled the Asiatic rat), but proceeded to consume native birds, amphibians and reptiles and ten species were driven to extinction. They also preyed upon domesticated poultry. Finally, the mongoose became a vector of infectious diseases such as rabies. The total economic cost of the biocontrol agent approaches $50 million dollars per year (Pimentel et al. 2005). Notable success stories include the control of alligator weed (New Zealand, Australia, US), mist flower (Hawaii), nodding thistle (New Zealand), prickly pear (Australia), ragwort (New Zealand) and St. John's wort (New Zealand, Canada). In New Jersey, biological control of purple loosestrife has been very effective toward eliminating persistent infestations, making loosestrife a small component of plant communities with only transient outbreaks that are quickly tamped down. Modern biological control involves thorough testing for 'host specificity' (making sure that the newly released biocontrol agent doesn't harm anything but the invasive species being targeted). This does not guarantee unintended consequences, but provides a reasonable reduction of risk that is assumed to be lower than the risk of damage known to occur through the unchecked spread of the targeted invasive species.

Biological control agents for mile-a-minute have naturally dispersed within the Preserve and are having impacts on both of these invasive species. Researchers are developing a biocontrol agent for garlic mustard, which is one of New Jersey's worst invasive species (Van Driesche et al. 2002). Research to determine natural enemies of garlic mustard began in 1998. Five weevil species and one flea beetle species were selected as potential biocontrol agents based upon field observations of host specificity and extent of damage created on garlic mustard in its native range. Researchers are currently in the process of performing laboratory tests of host specificity that includes related native species and agricultural crops in the mustard family (Brassicaceae). In addition, studies will be conducted to determine which biocontrol agents or combination of agents may lead to the greatest impacts on garlic mustard. Some of this research will be conducted during field trials in garlic mustard's native range, while others will occur under

laboratory conditions. All testing will be done using widely standardized techniques and following guidelines established in the literature and by the U.S. Department of Agriculture.

Cultural control is similar to the concept of agricultural best management practices but can be applied to early successional natural systems (e.g., grasslands, meadows). There are numerous practices that could have the effect of reducing invasive species as well as native woody species. These practices could involve planting native warm season grasses, prescribed fire, prescribed grazing and elimination of hedgerows to promote grassland or meadow plant communities that sustain themselves with minimal use of mowing and herbicide application. Prescribed fire can be an effective technique to maintain grasslands and the use of fire for ecological purposes has received attention across the world (Myers 2006 and references therein). The primary benefit of prescribed fire is its combination of cost efficiency and efficacy, especially where native warm season grasses have been established.

Prescribed grazing is defined as the application of a specific kind of livestock at a determined season, duration and intensity to accomplish defined vegetation or landscape goals (Launchbaugh 2006). The benefits of using livestock to control invasive species have been demonstrated for New Jersey's bog turtles (Tesauro 2001). This work primarily involved the use of cows to consume and destroy root mats of invasive species such as Phragmites and purple loosestrife. Another potential application may be the use of goats or other livestock to consume dense thickets of multiflora rose or autumn olive. There are a number of practical considerations to consider (e.g., cost associated with fencing materials), but targeted grazing may be the best option for land managers under certain conditions.

Ecological control of invasive species refers to the reduction of invasive species through competitive interactions with native species. Strong anecdotal evidence of other sites in New Jersey (e.g., portions of Cushetunk Mountain, Stephens State Park, Wawayanda State Park and Ted Stiles Preserve at Baldpate Mountain) indicate that a healthy native forest can ***resist and reverse*** infestations even when invasive species are located nearby or within the forest (invasive species may be restricted to highly disturbed trail edges without proliferating in the forest interior).

Although the removal of invasive species by any method has the implicit goal of fostering native species that will resist future infestations, there are a variety of factors that limit native species ability to exert ecological control. The single largest factor that can be locally remedied is overabundance of white-tailed deer.

## Altered Soils from Past Agricultural Use

Natural plant communities growing on former agricultural areas are often beset with infestations of invasive species due to degradation of soils. It is not uncommon to find clear demarcations of infestations in forest habitat (e.g., one side of stone wall or stream is severely infested while the other side is minimally infested). Anecdotally, these demarcations are correlated with former agricultural areas as shown in 1930 historical aerial photography. Presumably, areas showing forest cover in 1930 had never been plowed. It appears reasonable to assume that formerly tilled areas are much more susceptible to invasion than untilled areas.

Native forest soils consist of a series of layers. The "O Horizon" is the top layer and consists of fresh and incompletely decomposed organic matter (i.e., leaves and humus). The next layer is the "A Horizon", which consists of mineral soil mixed with organic material leached down from the O Horizon. The remaining horizons (E, B and C) are defined by chemical leaching and accumulation of minerals over time and contain little or no organic material. Bedrock is located under the C Horizon.

Formerly tilled agricultural soils are quite different than native soils. In general, all soil horizons within one foot of the surface have been mixed into a uniform and unnatural soil horizon. In addition, traditional agricultural activities (e.g., repeated tilling, application of lime and phosphorous, utilization of heavy machinery) create long-term soil changes including loss of organic matter, elevated pH, increased amounts of calcium and phosphorous, and compaction from machinery causing poor water infiltration. These changes also induce fundamental changes in nitrogen cycles and composition of soil microorganism species composition. All of these changes have implications for seed germination and root growth. Although many common native species can grow on these altered soils, it appears that weedy invasive species are most aggressive under these conditions.

The impact of earthworms is also associated with former agricultural activity, but adjacent unplowed forest soils can also be infested. Over time, earthworms mix and eliminate the top soil horizons and virtually eliminate the O Horizon and change soil microorganism species composition. In addition to changing physical properties of the soil (i.e., removing the O Horizon), earthworms change the natural nitrogen cycle. The result is the conversion of nitrogen into a form more readily used by plants, but this increased availability also increases leaching of nitrogen out of the soils. In addition, this change in nitrogen availability causes a shift in soil microorganisms from being dominated by fungi to being dominated by bacteria. This change may impact roots of many native plants that can be physically connected to particular soil fungi (called mycorrhizal fungi) in a symbiotic relationship that allows plants to absorb particular nutrients from the soil.

Suspected relationships and impacts are presented in Figure 5. Actual data showing changes in forest and untilled soil measured in Hopewell Township, Mercer County, New Jersey are presented in Figure 6.

The combined impacts of past agricultural tilling, alone or in concert with changes induced by invasive earthworms, are profound. However, it is important to note that even though impacted forests may not achieve perfect health, substantial improvements in most New Jersey forests can be obtained (primarily by reducing deer browse pressure from native plants that have the ability to survive these altered soil conditions).

**Figure 5. Suspected Impacts of Past Agricultural Tilling on Soils**

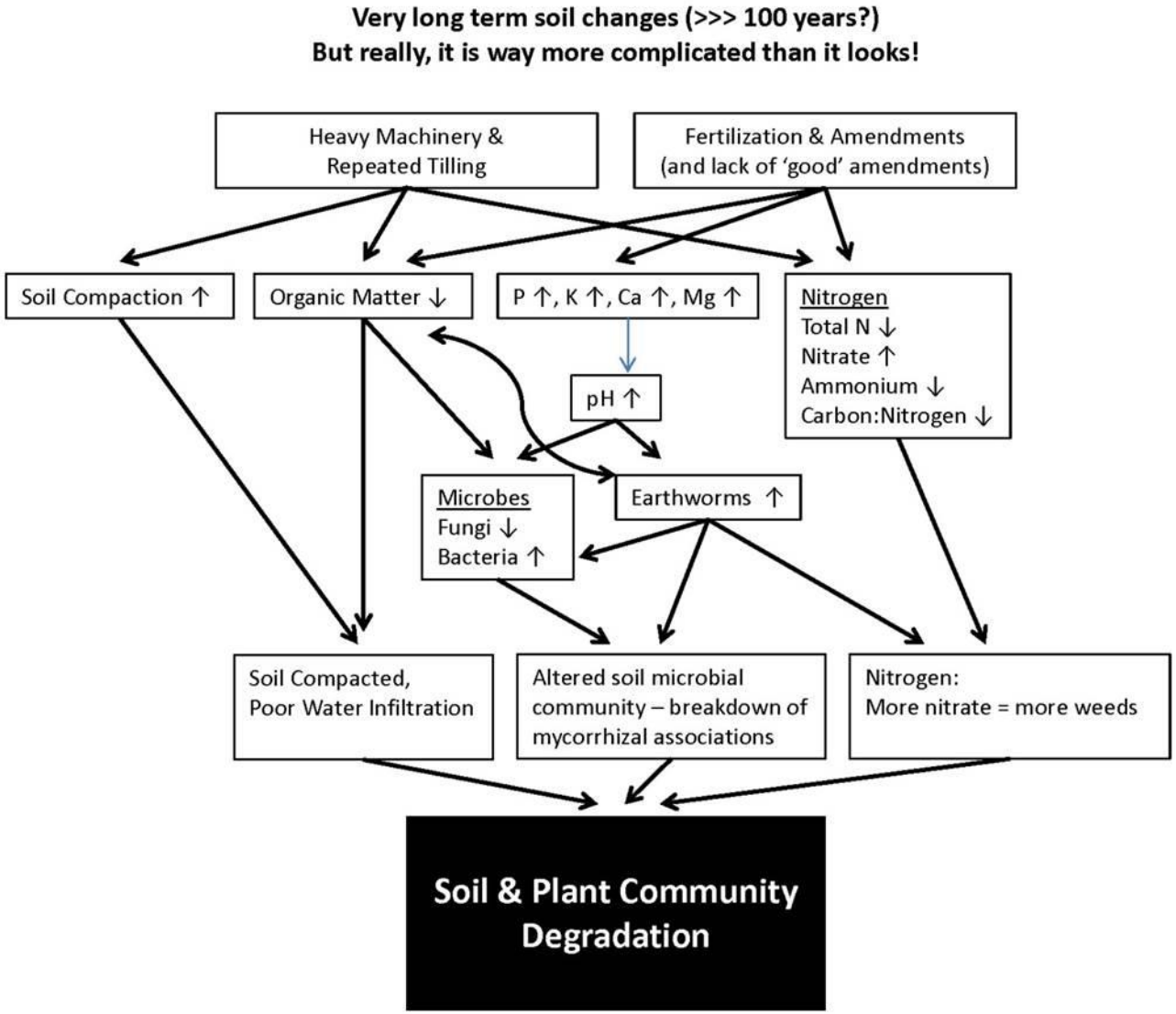
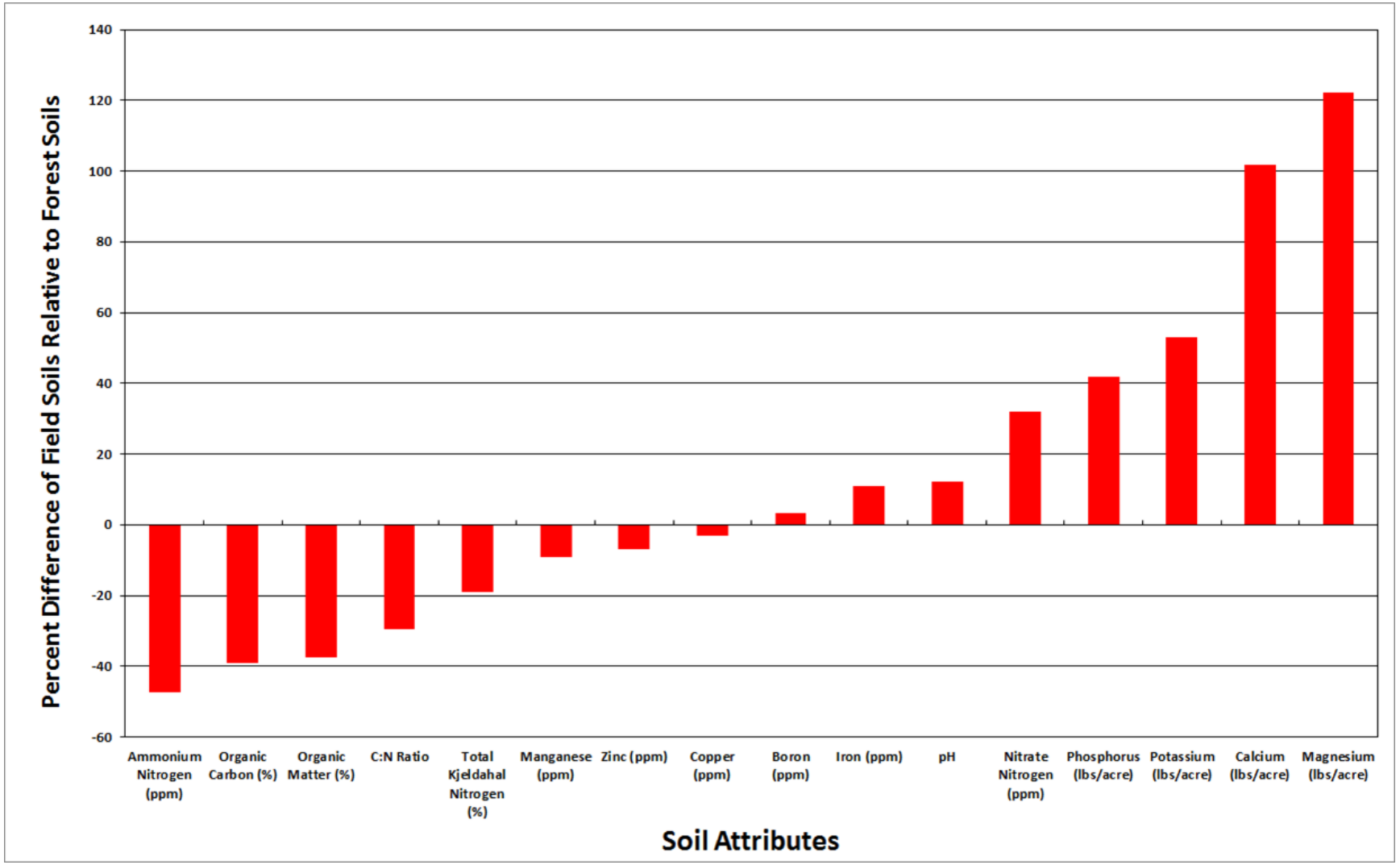


**Figure 6. Measured Chemical Changes in Soils from Tilled and Untilled Soils**



## Stewardship Context

Stewardship activities must consider the context of the project area to maximize effectiveness. This plan section considers physical features, land cover (both historic and current), public sentiment (public survey results related to stewardship are reported here) and co-owners and stakeholders.

### Physical Features

***Geology*** – The presence of Jurassic Diabase bedrock geology, which underlies the northeastern portion of the Preserve, creates unique plant communities. These areas are associated with the highest elevations, moderate cliffs and boulder fields at the ground surface. The Passaic Formation and its subset, Passaic Formation Gray Bed, accounts for the remainder of bedrock within the Preserve. Table 4 provides a summary of the bedrock geology and Map 2 depicts bedrock distribution.

The topography within the Preserve is flat to gently rolling (80% has < 5% slopes). Elevations range from 180 to 300 feet above sea level. Steep slopes occur in particular locations (< 3% of preserve has slopes of 20% or greater), especially along the northeastern edge of the Preserve at the boundary of the Jurassic Diabase. There is a somewhat steep ravine formed by a tributary of Honey Brook in the southwestern portion of the Preserve. Topography is depicted in Map 3.

**Table 4. Bedrock Geology Summary**

| Bedrock Type | Bedrock Description | Acres | Percent of Preserve |
|---|---|---|---|
| Jurassic Diabase | diabase, medium- to coarse-grained | 11 | 3 |
| Passaic Formation | siltstone and shale | 341 | 86 |
| Passaic Formation Gray bed | sandstone, siltstone and shale | 44 | 11 |
| **Totals** | | **397** | **100** |

Large boulder associated with Jurassic Diabase

***Soils*** – There are 30 unique soil series within the Preserve. The three most predominant soils are Reaville silt loam (18%), Klinesville channery loam (12%) and Penn channery silt loam (11%). Nearly half of all soil types are minor (1% or less of the Preserve). A summary of soil types is provided in Table 5 and their distribution is depicted in Map 4.

A summary of related soil characteristics is provided as Table 6. Approximately 90% of the Preserve has potentially erodible lands, nearly half is poorly or somewhat poorly drained, and nearly 90% has bedrock depths greater than two feet.

**Table 5. Soil Type Summary**

| Soil Symbol | Soil Type Description | Acres | Percent of Preserve |
|---|---|---|---|
| RehB | Reaville silt loam, 2 to 6 percent slopes | 70.1 | 17.7 |
| KkoC | Klinesville channery loam, 6 to 12 percent slopes | 49.2 | 12.4 |
| PeoB | Penn channery silt loam, 2 to 6 percent slopes | 42.3 | 10.7 |
| LDXB | Lawrenceville and Mount Lucas silt loams, 2 to 6 percent slopes | 31.0 | 7.8 |
| BoyAt | Bowmansville silt loam, 0 to 2 percent slopes, frequently flooded | 21.7 | 5.5 |
| LemB | Lehigh silt loam, 2 to 6 percent slopes | 20.6 | 5.2 |
| DOZB | Doylestown and Reaville variant silt loams, 2 to 6 percent slopes | 19.4 | 4.9 |
| LDXB2 | Lawrenceville and Mount Lucas silt loams, 2 to 6 percent slopes, erod | 18.6 | 4.7 |
| DOZA | Doylestown and Reaville variant silt loams, 0 to 2 percent slopes | 15.5 | 3.9 |
| BucB | Bucks silt loam, 2 to 6 percent slopes | 14.0 | 3.5 |
| BucB2 | Bucks silt loam, 2 to 6 percent slopes, eroded | 13.4 | 3.4 |
| WasA | Watchung silt loam, 0 to 2 percent slopes | 11.8 | 3.0 |
| RehA | Reaville silt loam, 0 to 2 percent slopes | 11.2 | 2.8 |
| LDXC2 | Lawrenceville and Mount Lucas silt loams, 6 to 12 percent slopes, ero | 10.4 | 2.6 |
| LemB2 | Lehigh silt loam, 2 to 6 percent slopes, eroded | 8.7 | 2.2 |
| REFB | Readington and Abbottstown silt loams, 2 to 6 percent slopes | 8.1 | 2.0 |
| LDXA | Lawrenceville and Mount Lucas silt loams, 0 to 2 percent slopes | 4.6 | 1.1 |
| NehEb | Neshaminy silt loam, 18 to 35 percent slopes, very stony | 4.4 | 1.1 |
| KkoE | Klinesville channery loam, 18 to 35 percent slopes | 4.2 | 1.1 |
| LemC2 | Lehigh silt loam, 6 to 12 percent slopes, eroded | 3.2 | 0.8 |
| RehC2 | Reaville silt loam, 6 to 12 percent slopes, eroded | 2.9 | 0.7 |
| REFB2 | Readington and Abbottstown silt loams, 2 to 6 percent slopes, eroded | 2.6 | 0.6 |
| LegE | Legore gravelly loam, 18 to 30 percent slopes | 2.4 | 0.6 |
| RehB2 | Reaville silt loam, 2 to 6 percent slopes, eroded | 2.3 | 0.6 |
| NehC | Neshaminy silt loam, 6 to 12 percent slopes | 1.5 | 0.4 |
| NehC2 | Neshaminy silt loam, 6 to 12 percent slopes, eroded | 1.1 | 0.3 |
| MonCb | Mount Lucas silt loam, 6 to 12 percent slopes, very stony | 1.1 | 0.3 |
| PeoC | Penn channery silt loam, 6 to 12 percent slopes | 0.1 | 0.03 |
| LegC | Legore gravelly loam, 6 to 12 percent slopes | 0.1 | 0.02 |
| NehB | Neshaminy silt loam, 2 to 6 percent slopes | 0.1 | 0.02 |
| **Totals** | | **397** | **100** |

## Table 6. Soil Attribute Summary

| Attribute | Description | Hopewell Valley Acres | Percent of Hopewell Valley | Preserve Acres | Percent of Preserve |
|---|---|---|---|---|---|
| Farmland Importance Class | No Designation | 5,446 | 14.1 | 73.2 | 18.4 |
| | Prime Farmland | 16,964 | 44.0 | 134.6 | 33.9 |
| | Farmland of Statewide Importance | 13,795 | 35.8 | 153.9 | 38.8 |
| | Farmland of Local Importance | 1,788 | 4.6 | 34.9 | 8.8 |
| | Farmland of Unique Importance | 0 | 0.0 | 0.0 | 0.0 |
| | Water or NA or Not available | 543 | 1.4 | 0.0 | 0.0 |
| Erodible Land Class | Not highly erodible land | 3,337 | 8.7 | 21.7 | 5.5 |
| | Potentially erodible land | 28,071 | 72.8 | 347.3 | 87.5 |
| | Highly erodible land | 6,584 | 17.1 | 27.7 | 7.0 |
| | Water or NA or Not available | 543 | 1.4 | 0.0 | 0.0 |
| Hydric Class | Non-hydric soil | 34,692 | 90.0 | 328.2 | 82.7 |
| | Hydric soil | 3,301 | 8.6 | 68.4 | 17.2 |
| | Water or NA or Not available | 543 | 1.4 | 0.0 | 0.0 |
| Drainage Class | Poorly Drained | 3,224 | 8.4 | 68.4 | 17.2 |
| | Somewhat Poorly Drained | 7,733 | 20.1 | 119.0 | 30.0 |
| | Moderately Well Drained | 4,906 | 12.7 | 76.3 | 19.2 |
| | Well Drained | 20,694 | 53.7 | 79.4 | 20.0 |
| | Somewhat Excessively Drained | 1,370 | 3.6 | 53.5 | 13.5 |
| | Water or NA or Not available | 609 | 1.6 | 0.0 | 0.0 |
| Bedrock Depth Class | < 1 | 11 | 0.0 | 0.0 | 0.0 |
| Feet to Bedrock | 1-2 | 1,552 | 4.0 | 53.5 | 13.5 |
| | 2-3 | 10,573 | 27.4 | 240.3 | 60.5 |
| | 3-4 | 11,240 | 29.2 | 40.5 | 10.2 |
| | >4 | 14,550 | 37.8 | 62.4 | 15.7 |
| | Water or NA or Not available | 609 | 1.6 | 0.0 | 0.0 |
| Stone Cover Class | 0 | 36,099 | 93.7 | 391.2 | 98.5 |
| % Ground Cover | < 2 | 1,660 | 4.3 | 5.5 | 1.4 |
| | 70 | 222 | 0.6 | 0.0 | 0.0 |
| | 100 | 11 | 0.0 | 0.0 | 0.0 |
| | Water or NA or Not available | 543 | 1.4 | 0.0 | 0.0 |
| Groundwater Depth Class | < 1 | 7,449 | 19.3 | 68.4 | 17.2 |
| Feet to Groundwater | 1-2 | 4,758 | 12.3 | 120.1 | 30.3 |
| | 2-3 | 3,808 | 9.9 | 75.2 | 18.9 |
| | 3-4 | 0 | 0.0 | 0.0 | 0.0 |
| | >4 | 164 | 0.4 | 0.0 | 0.0 |
| | Water or NA or Not available | 22,357 | 58.0 | 132.9 | 33.5 |
| Slope Class | < 5 | 27,988 | 72.6 | 315.9 | 79.6 |
| % Slope | 5-10 | 7,393 | 19.2 | 69.7 | 17.6 |
| | 10-15 | 0 | 0.0 | 0.0 | 0.0 |
| | 15-20 | 839 | 2.2 | 0.0 | 0.0 |
| | > 20 | 1,695 | 4.4 | 11.1 | 2.8 |
| | Water or NA or Not available | 620 | 1.6 | 0.0 | 0.0 |

***Water*** – There are two tributaries (totaling 1.2 miles) of Honey Branch located in the western portion of the Preserve. A very small portion of Cleveland Brook (less than 500 feet) is located in the southeastern corner of the Preserve. All streams on the Preserve drain toward the Stony Brook, located west and south of the Preserve. There is a single, small pond (0.15 acres) and two potential vernal pools. Waterbodies are depicted in Map 5.

**Land Cover – Historic and Current**

There have been large changes in land cover at the Preserve since 1930 (See Maps 6 through 14 and Table 6). The 1930 aerial photography shows that only three mature forest patches (totaling 90 acres) with cultivated fields covering almost ¾ of the area. The 1943 aerial photography shows no change from 1930. By 1953 agricultural lands began to diminish. This drop accelerated from 1963 to present with continual decreases in cultivated land. Prior to 1963, developed area was restricted to a farmstead and the corporate building was constructed between 1963 and 1971. Shrubland peaked in 1979, with a slow conversion to forest cover until present day. This pattern of land use requires careful consideration toward the development of stewardship recommendations. For example, former agricultural lands are currently infested with invasive species, while the original forest area seen in 1930 presents the best opportunity to maintain and improve forest health. Current shrublands and meadows are unlikely to develop into healthy forest habitat, possibly for many hundreds of years or longer as the soils slowly recover.

**Table 7. Preserve Land Cover Types (%) – 1930 to 2013**

| Year | Forest | Shrubland | Field | Orchard | Water | Developed | Total |
|---|---|---|---|---|---|---|---|
| 1930 | 23 | 4 | 72 | 0.7 | 0.0 | 1.2 | 100 |
| 1943 | 23 | 6 | 69 | 0.2 | 0.0 | 1.5 | 100 |
| 1953 | 25 | 20 | 53 | 0.2 | 0.1 | 1.3 | 100 |
| 1963 | 25 | 14 | 59 | 0.2 | 0.0 | 1.2 | 100 |
| 1971 | 30 | 27 | 41 | 0.0 | 0.0 | 3.1 | 100 |
| 1979 | 33 | 42 | 22 | 0.0 | 0.0 | 3.3 | 100 |
| 1995 | 44 | 40 | 13 | 0.0 | 0.0 | 3.2 | 100 |
| 2007 | 64 | 20 | 12 | 0.0 | 0.0 | 3.8 | 100 |
| 2013 | 70 | 17 | 9 | 0.0 | 0.0 | 3.8 | 100 |

The land use within one mile of the preserve is summarized below (Tables 8 and 9). Approximately 1/3 of the area is developed and 10% is agricultural lands. The high percentage of developed land will create ongoing challenges toward the stewardship of the Preserve (e.g., deer refugia and sources of invasive species). The majority of natural cover is represented by upland forest habitat (about 75% of natural lands), followed by upland shrubland (about 10%) and wetland forest (about 10%). Meadow habitat represents a very small percentage (< 5%) of the land surrounding the Preserve.

**Table 8. Broad Land Cover Types within 1 Mile of Preserve (2012)**

| Category | Acres | % of Area |
|---|---|---|
| Natural - Upland | 1009 | 50 |
| Natural - Wetland | 126 | 6 |
| Open Water | 13 | 1 |
| Agricultural | 212 | 11 |
| Urban | 643 | 32 |
| Barren | 8 | 0.4 |
| **Total** | **2010** | **100** |

**Table 9. Natural Land Cover Types within 1 Mile of the Preserve (2012)**

| Category | Upland | Wetland | Total |
|---|---|---|---|
| Forest | 836 | 116 | **952** |
| Shrubland | 130 | 7 | **136** |
| Meadow | 43 | 3 | **47** |
| **Total** | **1009** | **126** | **1135** |

***Protected Lands*** – There are several very large preserved lands within one mile of the Preserve. These include the Stony Brook – Millstone Reserve, Mercer Meadows, and St. Michael's Farm Preserve (Map 16). Additional nearby protected lands include Hopewell Borough Park, Stony Brook Greenway, Stony Ford Research Station, Children's Discovery Trail and several private easements (conservation and farmland).

**Public Survey Results**

The public survey was developed to determine interest in both stewardship and recreation/outreach at the Preserve (stewardship-related results are reported in this section, while recreation/outreach results are reported in Section II). Complete survey questions and results are reported in Appendix D. The survey contained 9 questions and was made available on Survey Monkey for just over one month (late January through early March 2016). A press release was utilized to create public awareness of the survey and a link to the survey was provided by members of the co-owners and stakeholders. Several groups also contacted their membership to make them aware of the survey.

- A total of 186 surveys were completed. Approximately 80% of respondents lived in municipalities very close to the Preserve (Hopewell Township, Hopewell Borough, Pennington Borough, Princeton). The remaining respondents lived in 20 different postal zip codes.
- Approximately 40% of respondents were members of co-owner or stakeholder conservation groups and over 50% were interested in management decisions on the Preserve.
- Respondents showed strong interest in the ecology of the Preserve (approximately 70% of those responding to Question #2).
- Respondents were asked about six specific ecological stewardship concerns (Question #7) – respondents showed high levels of concern ranging from 55% to 70% for these topics. The top three topics were habitat restoration, vandalism/littering and off-road vehicle use. Approximately 50% of respondents had high concern for invasive species control, white-tailed deer management and illegal collection of plants and animals.
- Approximately 20% of all survey respondents expressed a willingness to provide volunteer support and provided contact information so that they could be added to a list of volunteers for the Preserve.

## Co-Owners and Stakeholders

The Mount Rose Preserve will be managed by its co-owners (Mercer County, Hopewell Township, New Jersey Conservation Foundation and Friends of Hopewell Valley Open Space) using guidance provided within a Memorandum of Understanding. In addition, stakeholders that can provide assistance/expertise include groups associated with the land and other stakeholder groups interested in the Preserve. This unique group of co-owners and stakeholders can assure successful stewardship through plan implementation.

Additional stakeholders can be organized into a cohesive force to amplify the co-owners' activities. Most notably, the support of private residents will be critical for success and should include encouraging their support for both stewardship within the Preserve and stewardship activities on their own lands. There are several large private lands surrounding the Preserve as well as two private organizations (Educational Testing Service and Princeton University). It is important to communicate with these private landowners and form relationships involving stewardship activities (e.g., deer management, selective invasive species control) to assure the ecological health of the Preserve and its environs.

Finally, co-owners and stakeholders are well-positioned to successfully apply for grants through funders that seek multi-organization groups implementing a well-organized plan.

Large American Beech trees are common in old forest areas at the Preserve.

## Section II. Recreation and Outreach Plan

### Introduction

The Preserve has great potential to foster recreational and outreach opportunities. Currently, a large, paved parking area occurs off of Carter Road that will serve as the single public access point. A new portion of the Lawrence Hopewell Trail is currently under construction on the west side of Carter Road and planning is underway for another addition on the east side of Carter Road that would reach Cleveland Road.

There is a need to coordinate both recreational and outreach opportunities through a cohesive plan to maximize opportunities. This plan section provides a summary of public survey results related to recreation and outreach and provides four related goals to improve both recreational and outreach opportunities. A portion of the proposed work has high potential to be adopted by volunteers with support from co-owner staff.

The total cost to implement all recommendations in this section is $68,650. This estimate excludes construction of the Lawrence Hopewell Trail and costs to install a green paving system on the existing entrance driveway and parking lot (See below).

### Public Survey Results

A total of 186 surveys were completed (See Appendix D for more details). Highlights of survey responses relevant to recreation and outreach are provided below:

- Respondents showed interest in recreational opportunities (approximately 80% of those responding to Question #2).
- The top three most popular activities on nearby open space (Question #3) included hiking (74% of respondents), wildlife observation / bird watching (52%) and botany walks (39%). Other activities with at least 20% of respondents having a 'High Interest' included nature photography, canoeing / kayaking, mountain biking and picnicking. Respondents frequently participate in recreational activities (Question #4) - over 75% recreate over 20 times per year.
- Respondents were asked about their use of other recreational opportunities within 5 miles of the Preserve (Question #5). The top five locations were Mercer Meadows (73% of respondents), Lawrence Hopewell Trail (65%), Stony Brook Millstone Reserve (51%), D&R Greenway Sourland Ecosystem Preserve (50%) and St. Michael's Preserve (44%). Only 7% of respondents currently do not recreate near the Preserve.
- Respondents were asked about their interest in activities / facilities at the Preserve (Question #6). The top five activities receiving 'High Interest' were Hiking (88% of respondents), Wildlife Observation / Bird Watching (52%), Nature Photography (43%), Botany Walks (39%) and Dog Walking (39%).
- High Interest responses for more intensive activities included Mountain Biking (26%), Deer Management (25%), Fishing (16%) and Horseback Riding (9%).
- Amenities that would require particular attention included: Picnicking (27% with High Interest), handicap access (24%) and portable toilets (31%).
- Over 30% of respondents had a high interest in Expert Guided Hikes / Talks.

## Recommendation #1: Create an Integrated Trail System and Outreach Program

This recommendation has four distinct goals; all directly or indirectly support public use and enjoyment of the Preserve. A variety of topics are covered below, including the incorporation of public survey results along with Preserve rules and policies.

The estimated cost to complete all goals under this recommendation is $452,100 over the 10-year implementation period (See Tables 24 - 26). An additional $25,200 of volunteer value is also required for this recommendation.

### Goal #1-1: Create an Integrated Trail System

The Mount Rose Preserve is critical to the eventual completion of the Lawrence Hopewell Trail (LHT). The LHT is a multipurpose trail allowing walking, bicycling, jogging and skating (horseback riding is not allowed, pets are allowed if on a leash). The LHT is nearing completion of a regional 22-mile loop through the eastern portion of the Hopewell Valley (just over 3 miles remain to be completed). This significant recreational trail ranked very high among public survey respondents (second only to Mercer Meadows) and its extension into the Preserve (with ample parking access) will bring a large number of visitors.

Currently, a 0.5-mile portion of the trail is being installed on the western portion of the Preserve (Map 29). An additional 1 mile of trail is being planned for the portion of the Preserve located east of Carter Road. There will be a new road crossing, including road painting and flashing lights to maximize safety for trail users. To access the trail from the Preserve, a 0.1-mile connector trail will be constructed (same pervious pavement as LHT) from the public parking area (see below) to the main LHT.

In addition to the LHT, two loop trails are planned (Map 29). The first will be the Meadow Trail (1 mile), which will wind through the planned meadow restoration areas. It will include a side trail named the Arboretum Branch (0.1 miles), which will be planted with native species in the style of an arboretum. The second will be the Forest Trail (2 miles), which will be located west of the parking area. This trail will traverse mature and young forests, as well as providing views of water features (small pond, two tributaries of Honey Brook).

Both trails are depicted on Map 29, but these should be considered provisional routes that must be verified through careful field investigation. There is also an existing paved trail that connects Bristol Myers Squibb (BMS) to other buildings located adjacent to the Preserve. This trail will be maintained to allow employees to walk between the discontinuous private lands.

The estimated cost to complete this goal is $6,000 over the 10-year implementation period (See Table 24). An additional $12,000 of volunteer value is also required for this goal. These estimates exclude the LHT construction.

Additional information regarding trails and other important aspects of the Preserve are provided below.

Deer Management Program and Trail Use

The goal of the Deer Management Program (DMP) is to foster the ecological health of the Preserve by reducing the local deer population. This will be accomplished while encouraging recreational use of the Preserve. The Preserve will be part of the Hopewell Township Deer Management Program. Signage regarding the timing and location of hunting activities will be located along trails. The importance of deer

management will be included on interpretive signage. The following provides an outline of the DMP showing accommodations for recreational uses. The description below references Map 30.

1) The LHT and Meadow Trail will remain open every day throughout the year. The Forest Trail will be closed to the public during the hunting season (early September through mid-February, except Sundays).

2) The Deer Management Program will be administered through the existing Hopewell Township Deer Management Program. This structured program includes mandatory hunter background checks and attendance at an annual safety meeting. See http://www.hopewelltwp.org/deer_mgmt_comm_main.html

3) Bow hunting (compound and crossbow types) will occur every day of the hunting season throughout the Preserve. Typically, bow seasons occur from early September through mid-February (excluding Sundays). The following limitations will apply:

a) Bow hunting will not occur within 150' safety zones around existing neighboring structures

b) Additional 150' safety zones will include areas around the LHT, Meadow Trail, entrance driveway and public parking lot.

4) Firearm hunting will only occur within the western portions of the Preserve. These areas are all greater than 450' from the LHT and Meadow Trail, entrance driveway, neighboring structures and public parking lot. Gun hunting seasons typically occur from late November through mid-February (excluding Sundays).

5) Signage will be maintained in the following areas:

a) Entrance signs will be installed at the public parking lot and points were the LHT enters/exits the Preserve. Signs will inform trail users of the timing and sporting arms (bow or firearms) being utilized for deer management activities.
b) Signs along the length of the LHT will remind trail users to stay on trails throughout the hunting season.
c) Signs will delineate safety zones described above to inform hunters to keep away from trails.

Parking Areas

There will be a single public access parking lot located on the west side of Carter Road. This large lot will be maintained as asphalt, but it will need to be repaired or replaced within the next 5-10 years. The current plan is to replace the existing asphalt with a green surface known as "grass pavers".

There will be three management access points that will not be open to the public (Map 29). The very large parking lot utilized by multiple businesses (toward southeastern portion of Preserve) is accessible for management activities under an easement agreement with the property owner.

Preserve Signage

A relatively large entrance sign at the driveway entrance on Carter Road will be installed (allowing visibility of travelers from the north and south). Preserve boundary signs will be designed and installed around the perimeter of the Preserve. FoHVOS will install signage by August 2016 and maintain boundary signs annually. These signs will contain the logos of the three permanent landowners (NJCF, Hopewell Township and FoHVOS).

Preserve Uses and Rules

The Mount Rose Preserve is primarily considered a passive recreation area. Facilities will be limited to trails and a picnic pavilion with portable toilets (located within or adjacent to the parking area). The following prohibitions will apply to the Preserve:

- Preserve will be open from dawn to dusk
- Motorized vehicles are prohibited on all trails and natural areas
- Bicycles will be allowed on the LHT only
- Horseback riding will be allowed on the Forest and Meadow Trails only
- Removal of plants or animals is prohibited
- Camping and fires are prohibited
- Fishing will be not be allowed
- Hunting of white-tailed deer will only be allowed as part of the Hopewell Township Deer Management Program (see below). No other animals will be hunted on the Preserve.

Trail Creation and Maintenance

The New Jersey Conservation Foundation (NJCF) and Friends of Hopewell Valley Open Space (FoHVOS) have staff and volunteers that can design, construct, mark, and maintain the Meadow and Forest Trails. Hopewell Township will lead all planning, construction and maintenance of the LHT. Public comment received from Washington Crossing Audubon Society regarding recommendations to avoid impacts to important bird habitat will be followed during the trail creation process.

The allowance of horseback riding on the Forest and Meadow Trails may require significant maintenance and it is expected that the equestrian community utilizing the Preserve will contribute to regular trail maintenance. The goal is to have an overarching trail maintenance program that is robust enough to handle typical maintenance and respond to damage created by large storms.

Preserve Easements

The Preserve contains approximately 15 acres of reserved easement rights from various parties (Map 31). Easements include above and below ground utility access rights (e.g., water, gas, communications, electricity). It is important that all recreation and stewardship activities account for these easements.

**Goal #1-2: Integrate Cultural, Historic and Natural Heritage Education**

Knowledge of the importance and beauty of the Preserve should be made easily available to the public. The co-owners have expertise to create content for trail signage, kiosks and web content. These skills include a variety of ecological topics that would build a sense of place for the public. In addition, the co-owners will highlight cultural and site history elements by reaching out the Hopewell Valley Arts Council, Hopewell Valley Historical Society and other local historians. Ideally, rotating art exhibits could be placed along the LHT.

Areas along the Arboretum Branch will be designed and planted with a variety of native species using a traditional arboretum design. Approximately 100 trees and shrubs will be planted along with 1,000 native grasses and wildflowers (planted as attractive meadow patches).

Full-color interpretive trail signage would be placed approximately every 0.25 miles along trails throughout the Preserve (approximately 20 signs total). A trailhead kiosk will be located at the entrance

of the LHT in the public parking area. Signage and kiosk content should be tied to website content so that the public has access to ample information to inform and entice them to visit. The website content will be maintained by NJCF, with links from all co-owner websites. Grants will be sought to provide partial funding of this goal.

The estimated cost to complete this goal is $25,400 over the 10-year implementation period (See Table 24). An additional $6,000 of volunteer value is also required for this goal.

**Goal #1-3: Annually Provide 5 Guided Hikes**

The public survey showed a strong interest in expert guided hikes at the Preserve and members of the co-owners have skills and experience leading guided hikes and educational programs. To encourage an interest in the ecology, culture and history of the area, a variety of hikes should be provided throughout the year. A consistent program (e.g., every first Saturday of the month during the spring, summer and fall) with a minimum of five hikes per year would provide a service to the community and foster their desire to protect the area's resources.

The estimated cost to complete this goal is $3,500 over the 10-year implementation period (See Table 24). An additional $2,400 of volunteer value is also required for this goal.

**Goal #1-4: Perform Preserve Maintenance**

There are several key aspects of preserve maintenance related to public uses. These include boundary posting and removal of existing small structures (e.g., softball backstops) and trash identified during the ecological mapping. NJCF and FoHVOS will lead joint volunteer events to remove all structures and trash by October 2016. Trash collected from the Preserve can be disposed of during the Hopewell Valley fall Clean Communities event scheduled for October 15, 2016. Boundary posting will be initially performed and annually maintained by FoHVOS.

The estimated cost to complete this goal is $37,250 over the 10-year implementation period (See Table 24). An additional $6,000 of volunteer value is also required for this goal.

### Goal #1-5: Provide Parking and Public Amenities

The Preserve entrance driveway and parking lot are currently asphalt with approximately 5-10 more useable years. Ideally, 1.1 acres of these surfaces will be converted to a green paving system (0.6 acre entrance driveway and 0.5 acre portion of current paved parking area). The removal of existing asphalt and installation of the green paving system are likely to cost approximately $5 per square foot for a total cost of $250,000 for the 1.1 acre area. Removal of an additional 1.2 acres of the existing paved parking area will cost an additional $130,700 ($2.50 per square foot). The total project cost, including staff time ($1,500) will be approximately $382,200. If funding cannot be obtained for this major project, then alternative surface options will be explored (e.g., porous pavement).

Additional amenities to be included at the Preserve include a picnic pavilion and composting toilets within or adjacent to the public parking area. These amenities will attract a wider public use at the Preserve. Planning will be conducted to determine the exact location, size and style, but it is expected that total cost for these items will be approximately $29,500.

The estimated cost to complete this goal is $411,700 over the 10-year implementation period (See Table 24). An additional $1,200 of volunteer value is also required for this goal.

## Section III. Conservation Values

### Introduction

This section provides conservation values within and adjacent to the Preserve. It includes landscape-scale values provided through review of information available from the Endangered and Nongame Species Program and Natural Heritage Program of the NJ Department of Environmental Protection. It also includes botanical and bird surveys completed by Washington Crossing Audubon Society. Finally, this section provides results of ecological community mapping performed throughout the Preserve by FoHVOS.

The primary habitat conservation values include: 1) forest, 2) shrubland and 3) meadows. Forest communities serve as the basis for a broad range of common plant and animal species typical of the Eastern United States. All habitats provide stopover feeding opportunities for Neotropical migrant birds and nesting habitat for many species. If restored, there is also great potential for high quality shrubland and meadow habitat that would support a large variety of birds and pollinators at the Preserve.

### Landscape-scale Values

The Landscape Project is a product of the New Jersey Department of Environmental Protection, Division of Fish & Wildlife, Endangered and Nongame Species Program (ENSP). The Landscape Project prioritizes sites based upon the biodiversity significance of animal species utilizing patches of habitat. Habitat patches are ranked from 5 (highest) to 1 (lowest). Patch ranks are based upon the level of rarity of the rarest species known to occur within the patch (Note: A single habitat patch may contain multiple species with various ranks, but the overall patch ranking is derived from the occurrence of the species with the highest rank.). A rank of '5' signifies patches containing federally endangered and threatened species, Rank 4 patches contain state endangered species, Rank 3 patches contain state threatened species, Rank 2 patches contain state species of concern, and Rank 1 patches have suitable habitat for rare animals, but do not contain confirmed occurrences.

Patch ranks at the Preserve are depicted in Map 17 and summarized in Table 10. Habitat patches that intersect with the Preserve are primarily Rank 4 because they contain state endangered species including Bobcat and Bald Eagle. However, it should be noted that the presence of breeding populations of these species on the Preserve is low.

The Landscape Project also characterizes habitat patch sizes, which are shown in Map 18 and summarized in Table 11. Habitat patches wholly or partially within the Preserve have a maximum size range of less than 250 acres (most of the largest patch is located east of the Preserve). Therefore, it is unlikely that the Preserve can harbor area-demanding species such as Barred Owl or Kentucky Warbler. However, the Preserve can serve as excellent breeding habitat for a number of species that do not require large contiguous habitat patches and can also serve as stop-over habitat for migrating birds.

**Table 10. Landscape Project Patch Rank Summary**

| Rank | Preserve Acres | % of Preserve |
|---|---|---|
| 5 | 0 | 0.0 |
| 4 | 341.7 | 86.1 |
| 3 | 0.3 | 0.1 |
| 2 | 0.3 | 0.1 |
| 1 | 9.7 | 2.4 |
| Non-Habitat | 45 | 11.3 |
| **Total** | **397** | **100** |

**Table 11. Landscape Project Patch Size Summary**

| Contiguous Patch Size (acres) | Preserve Acres | % of Preserve |
|---|---|---|
| < 10 | 202.9 | 51.1 |
| 10 - 25 | 56.7 | 14.3 |
| 25 - 100 | 89.1 | 22.4 |
| 100 - 250 | 3.3 | 0.8 |
| > 250 | 0 | 0.0 |
| Non-Habitat | 45 | 11.3 |
| **Total** | **397** | **100** |

The New Jersey Natural Heritage Program (NJNHP) is part of the New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management. The NJNHP produces two GIS products that allow rapid assessment of any area. The first product provides locations of priority sites that harbor imperiled plants and ecological communities throughout the state. The second product provides generalized locations of imperiled plants and ecological communities that fall within a predefined grid system that covers the entire state. There are no Heritage priority sites within or immediately adjacent to the Preserve. Rare plant species are reported later in this plan section.

The New Jersey Audubon Society (NJAS) has a program called the Important Bird and Birding Areas that identifies important sites for avian biodiversity. Sites are nominated by individuals or organizations and are vetted by NJAS in consultation with avian biologists/naturalists. There are no sites located within the immediate vicinity of the Preserve.

## Ecological Communities

Ecological communities were mapped at the Preserve from September through October 2015. Communities were mapped through a process of crosschecking between three sources of information, which included field survey, 2012 aerial orthophotography, GIS-based 2012 land cover classifications and NJDEP GIS wetland status. Field observations of species present within the canopy, sub-canopy, shrub, and herbaceous layers were recorded and correlated with a 'signature' on aerial photography. There was an attempt to assign named ecological communities from Breden et al. (2001), which described 26 potential ecological communities within the Gettysburg Piedmont physiographic region that includes the Preserve. However, field observations and previously described communities did not match closely. Generally, observed patches tended to occur as combinations of two or more described communities [Note: The definitions for broad types based upon the amount of canopy or shrub cover; i.e., forest,

woodland, shrubland, meadow) provided by Breden were retained for this project.]. Therefore, ecological community patches occurring within the Preserve were provided with one of 82 types assigned by M. Van Clef (See Tables 12 to 14). This includes 62 forest types, 18 woodland types, shrublands (uncategorized) and meadows (uncharacterized).

There were a total of 184 mapped ecological community patches (See Appendix E) across 397 mapped acres. In some cases, adjacent patches with the same ecological community designation were provided separate patch designations because of differences in the mapped invasive species cover, which is often a proxy for differences in past land use and canopy density (former agricultural lands and forests with more open canopies have higher amounts of invasive species). Maps depicting various attributes reported in Appendix E are depicted in the following maps and summarized in associated tables below:

- Map 19 and Table 12 – Broad ecological communities

  Forest and woodland habitats (ca. 72% of Preserve cover) are the dominant ecological communities with shrubland (8%) and meadow (12%) communities accounting for lessor, but still significant coverage at the Preserve. Specific ecological community types are provided in Table 13.

**Table 12. Broad Ecological Community Type Summary**

| Broad Habitat Type | Acreage | Percent of Total Area |
|---|---|---|
| Forest | 248 | 62.3 |
| Woodland | 41 | 10.4 |
| Shrubland-Woodland | 16 | 4.1 |
| Shrubland | 31 | 7.8 |
| Meadow | 47 | 11.8 |
| Pond | 0.1 | 0.0 |
| Disturbed | 11 | 2.9 |
| Lawn | 0.6 | 0.1 |
| Paved | 2.3 | 0.6 |
| **Totals** | **397** | **100** |

## Table 13. Specific Ecological Community Type Summary

| Broad Habitat Type | Specific Community Name | Moisture | Acreage | Percent of Total Area |
|---|---|---|---|---|
| Disturbed | Disturbed | Upland | 11.4 | 2.9 |
| Forest | Ash - Balck Walnut - Red Cedar - Red Maple - Sugar Maple Forest | Wet-Moist | 8.8 | 2.2 |
| Forest | Ash - Red Cedar Forest | Upland | 6.5 | 1.6 |
| Forest | Ash - Red Maple - Black Walnut Forest | Upland | 6.7 | 1.7 |
| Forest | Ash - Red Maple - Elm - Shagbark Hickory - Silver Maple Forest | Wet-Moist | 1.9 | 0.5 |
| Forest | Ash - Red Maple - Pin Oak - Elm - Red Oak Forest | Wet-Moist | 2.9 | 0.7 |
| Forest | Ash - Red Maple Forest | Wet-Moist | 3.0 | 0.7 |
| Forest | Ash - Shagbark Hickory - Red Oak Forest | Upland | 5.3 | 1.3 |
| Forest | Ash - Shagbark Hickory - White Oak Forest | Wet-Moist | 1.9 | 0.5 |
| Forest | Ash - Tulip Poplar - Beech Forest | Upland | 0.5 | 0.1 |
| Forest | Ash - Tulip Poplar - Red Cedar - Red Maple Forest | Wet-Moist | 2.0 | 0.5 |
| Forest | Ash - Tulip Poplar Forest | Upland | 2.4 | 0.6 |
| Forest | Ash - White Oak -Balck Walnut - Red Cedar - Red Maple - Sugar Maple Forest | Wet-Moist | 3.2 | 0.8 |
| Forest | Ash Forest | Upland | 2.8 | 0.7 |
| Forest | Beech - Sugar Maple - Sweet Birch Forest | Upland | 14.3 | 3.6 |
| Forest | Beech - Sweet Birch - Ash - White Oak Forest | Upland | 5.6 | 1.4 |
| Forest | Beech - Sweet Birch - Oak (White, Red) - Tulip Poplar Forest | Upland | 3.0 | 0.8 |
| Forest | Beech - Sweet Birch Forest | Upland | 1.4 | 0.3 |
| Forest | Beech - Tulip Poplar - Ash Forest | Upland | 0.9 | 0.2 |
| Forest | Beech - White Oak - Sweet Birch - Pin Oak - Shagbark Hickory Forest | Upland | 2.3 | 0.6 |
| Forest | Norway Spruce - Ash - Red Cedar Forest | Upland | 1.2 | 0.3 |
| Forest | Pin Oak - Swamp White Oak - Red Maple - Red Cedar Forest | Wet-Moist | 2.6 | 0.6 |
| Forest | Red Cedar - Ash - Black Walnut Forest | Upland | 1.6 | 0.4 |
| Forest | Red Cedar - Ash - Pin Oak - Red Maple Forest | Wet-Moist | 1.8 | 0.5 |
| Forest | Red Cedar - Ash - Pin Oak Forest | Wet-Moist | 4.5 | 1.1 |
| Forest | Red Cedar - Ash - Red Maple - Elm - Pin Oak Forest | Wet-Moist | 2.4 | 0.6 |
| Forest | Red Cedar - Ash - Red Maple Forest | Upland | 3.4 | 0.9 |
| Forest | Red Cedar - Ash - Red Oak Forest | Upland | 0.4 | 0.1 |
| Forest | Red Cedar - Red Maple - Pin Oak - Ash - White Oak Forest | Wet-Moist | 1.7 | 0.4 |
| Forest | Red Cedar - Red Maple Forest | Upland | 18.6 | 4.7 |
| Forest | Red Cedar Forest | Upland | 14.4 | 3.6 |
| Forest | Red Maple - Ash - Pin Oak - Beech Forest | Upland | 2.8 | 0.7 |
| Forest | Red Maple - Ash - Pin Oak - Norway Spruce Forest | Upland | 1.5 | 0.4 |
| Forest | Red Maple - Ash - Pin Oak Forest | Upland | 2.0 | 0.5 |
| Forest | Red Maple - Ash - Pine Oak - Red Cedar - Black Walnut Forest | Upland | 1.5 | 0.4 |
| Forest | Red Maple - Ash - Red Cedar Forest | Upland | 12.8 | 3.2 |
| Forest | Red Maple - Ash Forest | Upland | 1.3 | 0.3 |
| Forest | Red Maple - Beech -White Oak Forest | Wet-Moist | 0.9 | 0.2 |
| Forest | Red Maple - Black Tupelo - Red Cedar Forest | Wet-Moist | 2.3 | 0.6 |
| Forest | Red Maple - Elm Forest | Wet-Moist | 0.6 | 0.1 |
| Forest | Red Maple - Pin Oak - Elm - Ash - Red Cedar Forest | Wet-Moist | 1.9 | 0.5 |
| Forest | Red Maple - Pin Oak - Elm - Ash Forest | Wet-Moist | 1.9 | 0.5 |
| Forest | Red Maple - Pin Oak Forest | Wet-Moist | 4.8 | 1.2 |
| Forest | Red Maple - Red Cedar - Ash - Elm - Pin Oak Forest | Wet-Moist | 2.8 | 0.7 |
| Forest | Red Maple - Red Cedar - Pin Oak Forest | Wet-Moist | 1.2 | 0.3 |
| Forest | Red Maple - Red Cedar Forest | Wet-Moist | 3.4 | 0.8 |
| Forest | Red Maple - Shagbark Hickory - Ash - Sugar Maple Forest | Wet-Moist | 6.1 | 1.5 |
| Forest | Red Maple - Silver Maple Forest | Wet-Moist | 0.6 | 0.2 |
| Forest | Red Maple - Tulip Poplar - Pin Oak Forest | Wet-Moist | 1.0 | 0.3 |
| Forest | Red Maple - Tulip Poplar Forest | Wet-Moist | 2.4 | 0.6 |
| Forest | Red Maple Forest | Wet-Moist | 10.2 | 2.6 |
| Forest | Shagbark Hickory - Red Maple - Ash - Pin Oak Forest | Wet-Moist | 1.1 | 0.3 |
| Forest | Shagbark Hickory - White Oak - Beech Forest | Upland | 0.8 | 0.2 |
| Forest | Sugar Maple - Ash - Red Oak - Shagbark Hickory Forest | Upland | 4.2 | 1.1 |
| Forest | Sugar Maple - Beech - White Oak - Shagbark Hickory Forest | Upland | 10.9 | 2.7 |
| Forest | Sugar Maple Forest | Wet-Moist | 1.0 | 0.3 |
| Forest | Sweet Birch - Tulip Poplar - Red Maple - Black Tupelo Forest | Upland | 0.9 | 0.2 |

**Table 13. Specific Ecological Community Type Summary (continued)**

| Broad Habitat Type | Specific Community Name | Moisture | Acreage | Percent of Total Area |
|---|---|---|---|---|
| Forest | Tulip Poplar - Ash - Shagbark Hickory - Beech Forest | Upland | 0.9 | 0.2 |
| Forest | Tulip Poplar - Ash - White Oak - Beech Forest | Upland | 2.92 | 0.7 |
| Forest | Tulip Poplar - Beech - Shagbark Hickory Forest | Upland | 1.4 | 0.4 |
| Forest | Tulip Poplar - Red Maple - Beech Forest | Wet-Moist | 0.5 | 0.1 |
| Forest | Tulip Poplar Forest | Upland | 1.1 | 0.3 |
| Forest | White Oak - Pin Oak - Red Maple - Sugar Maple - Red Oak - Pignut Hickory Forest | Wet-Moist | 32.6 | 8.2 |
| Lawn | Lawn | Upland | 0.6 | 0.1 |
| Meadow | Meadow | Upland | 7.55 | 1.9 |
| Meadow | Meadow | Wet-Moist | 39.5 | 9.9 |
| Paved | Paved | Upland | 2.3 | 0.6 |
| Pond | Pond | NA | 0.1 | 0.0 |
| Shrubland | Shrubland | Upland | 10.3 | 2.6 |
| Shrubland | Shrubland | Wet-Moist | 20.6 | 5.2 |
| Woodland | Ash - Black Cherry - Pin Oak Woodland | Upland | 0.3 | 0.1 |
| Woodland | Ash - Red Cedar - Red Maple - Pin Oak Woodland | Wet-Moist | 8.0 | 2.0 |
| Woodland | Ash - Red Cedar - Red Maple Woodland | Upland | 8.6 | 2.2 |
| Woodland | Ash - Red Cedar Woodland | Upland | 2.6 | 0.7 |
| Woodland | Ash - Tulip Poplar - Red Cedar Woodland | Upland | 3.6 | 0.9 |
| Woodland | Black Cherry - Red Cedar - Maple (Silver, Red) Woodland | Upland | 2.6 | 0.6 |
| Woodland | Black Locust - Silver Maple Woodland | Wet-Moist | 4.1 | 1.0 |
| Woodland | Pin Oak - Ash - Red Maple - Black Cherry Woodland | Wet-Moist | 0.6 | 0.2 |
| Woodland | Red Cedar - Ash - Pin Oak Woodland | Wet-Moist | 0.8 | 0.2 |
| Woodland | Red Cedar - Red Maple - Ash Woodland | Wet-Moist | 0.8 | 0.2 |
| Woodland | Red Cedar Woodland | Upland | 4.8 | 1.2 |
| Woodland | Red Maple - Ash - Black Walnut Woodland | Upland | 2.7 | 0.7 |
| Woodland | Red Maple - Black Tupelo Woodland | Wet-Moist | 7.3 | 1.8 |
| Woodland | Red Maple - Pin Oak - Ash Woodland | Wet-Moist | 1.4 | 0.4 |
| Woodland | Red Maple - Red Cedar - Pin Oak - Ash Woodland | Wet-Moist | 4.5 | 1.1 |
| Woodland | Red Maple Woodland | Wet-Moist | 0.7 | 0.2 |
| Woodland | Tulip Poplar - Weeping Willow Woodland | Wet-Moist | 0.6 | 0.1 |
| Woodland | White Pine - Red Maple - Red Cedar - Ash Woodland | Upland | 3.3 | 0.8 |
| | | | **397** | **100** |

- Map 20 and Table 14 – Dominant Tree Canopy Species

  Forest and woodland habitats were most often dominated by Red Maple (20% of Preserve), but Ash (18%) and Red Cedar (14%) were also very common. The highest quality forest areas were associated with American Beech and White Oak dominance (combined areas approximately 15% of Preserve). It is important to note that various degrees of 'ash decline' was observed in 18 acres of patches where ash was present (either as dominant or subordinate canopy cover, See Map 20). Unfortunately, the impending impacts of Emerald Ash Borer are likely to largely eliminate ash throughout the Preserve, with resulting increases of invasive species cover as the tree canopy thins.

**Table 14. Dominant Tree Species Summary**

| Dominant Tree Species | Acreage | Percent of Total Area |
|---|---|---|
| Non Forest/Woodland | 92.3 | 23.3 |
| Red Maple | 78.8 | 19.8 |
| Ash | 70.5 | 17.8 |
| Red Cedar | 55.3 | 13.9 |
| White Oak | 32.6 | 8.2 |
| American Beech | 27.4 | 6.9 |
| Sugar Maple | 16.1 | 4.1 |
| Tulip Poplar | 7.4 | 1.9 |
| Conifer | 4.4 | 1.1 |
| Black Locust | 4.1 | 1.0 |
| Pin Oak | 3.2 | 0.8 |
| Black Cherry | 2.6 | 0.6 |
| Shagbark Hickory | 1.9 | 0.5 |
| Sweet Birch | 0.9 | 0.2 |
| **Totals** | **397** | **100** |

- Map 21 and Table 15 – Soil moisture category

  Soil moisture was classified as either "Upland" for moist to dry areas (ca. 60% of mapped areas) or "Wet" (ca. 40%) for areas that have at least some wetland characteristics (this does not equate to formal wetland delineations).

**Table 15. Ecological Community Soil Moisture Summary**

| Moisture Status | Acreage | Percent of Total Area |
|---|---|---|
| Wet-Moist | 228.6 | 57.6 |
| Upland | 154.7 | 39.0 |
| N/A | 13.9 | 3.5 |
| **Totals** | **397** | **100** |

- Map 22 and Table 16 – Relative patch quality

  This is a subjective characterization based upon the following attributes: proportion of patch suspected to have no history of agricultural tilling, amount of invasive species cover, and amount of native shrub and herbaceous cover. The relative quality ranks were 'High' for about 17% of Preserve and 'Low' for nearly 73%. Quality rankings and other listed attributes were used to formulate stewardship strategies (See Section IV).

**Table 16. Ecological Community Relative Patch Quality Summary**

| Relative Quality Rank | Acreage | Percent of Total Area |
|---|---|---|
| Very High | 0 | 0.0 |
| High | 65.8 | 16.6 |
| Moderate | 26.6 | 6.7 |
| Low | 290.9 | 73.2 |
| NA | 13.9 | 3.5 |
| **Totals** | **397** | **100** |

- Maps 23 and 24; Tables 17 and 18 – Native Shrub and Herbaceous Cover

  Native shrubs and herbaceous species (both vulnerable to deer browse) was relatively low throughout the Preserve. Ideally, native shrub cover would be above 70%, which occurred in less than 1% of the Preserve. Approximately 2% of the Preserve had greater than 25% shrub cover. Native herbaceous species (wildflowers and grasses) were also sparse throughout the Preserve (especially in forest habitats). Less than 12% of the Preserve had greater than 50% herbaceous cover.

**Table 17. Native Shrub Cover Summary**

| Cover Category | Acreage | Percent of Total Area |
|---|---|---|
| NA | 13.9 | 3.5 |
| Absent | 84.4 | 21.2 |
| < 1% | 12.5 | 3.2 |
| 1-10% | 223.6 | 56.3 |
| 11-25% | 56.0 | 14.1 |
| 26-50% | 3.2 | 0.8 |
| 51-75% | 3.6 | 0.9 |
| 76-100% | 0.0 | 0.0 |
| **Totals** | **397** | **100** |

**Table 18. Native Herbaceous Cover Summary**

| Cover Category | Acreage | Percent of Total Area |
|---|---|---|
| NA | 13.9 | 3.5 |
| Absent | 54.1 | 13.6 |
| < 1% | 4.3 | 1.1 |
| 1-10% | 204.3 | 51.4 |
| 11-25% | 45.4 | 11.4 |
| 26-50% | 28.7 | 7.2 |
| 51-75% | 39.0 | 9.8 |
| 76-100% | 7.5 | 1.9 |
| **Totals** | **397** | **100** |

## Flora

A complete list of the flora within the Preserve is not available, but members of the Washington Crossing Audubon Society have begun to create a plant list that currently totals 116 species (Appendix F, surveys conducted in Fall 2015 and Spring 2016). A list of woody plants of Mercer County (Appendix G - Brooklyn Botanic Garden, Metropolitan Flora Project) were compiled to create a potential species list, which includes over 350 species.

*Rare Plant Species* – The Natural Heritage database search did not have records of rare plants within or adjacent to the Preserve. However, two rare species were documented by M. Van Clef during the ecological mapping and evaluation (Table 19, Map 25). These species include Wild Comfrey and Leatherwood – both species are considered S2 or "threatened" in New Jersey (this status is not an official state status). There were a total of nine small Wild Comfrey populations, with the largest population having only 10 individual plants. Leatherwood was found as a single, small individual in one location. It is strongly recommended that additional surveys for all rare plant species, including an assessment of population sizes and condition, be conducted to determine appropriate stewardship plans for their conservation. Where appropriate, specific stewardship recommendations are provided in Section IV.

Wild Comfrey (Photo was not taken within the Preserve).

**Table 19. Rare Plants and Animals of the Preserve and Its Environs**

| Taxa | Common Name | State Rank | Stewardship Notes |
|---|---|---|---|
| Birds | Bald Eagle | Endangered | Foraging habitat nearby - Foster overall ecological health |
| Birds | Barred Owl | Threatened | Breeding habitat nearby - Foster overall ecological health |
| Birds | Bobolink | Threatened | Breeding habitat nearby - Foster overall ecological health, epecially meadow restoration |
| Birds | Brown Thrasher | Special Concern | Potential nesting habitat at Preserve - Conduct shrubland habitat restoration |
| Birds | Eastern Meadowlark | Special Concern | Breeding habitat nearby - Foster overall ecological health, epecially meadow restoration |
| Birds | Great Blue Heron | Special Concern | Foraging habitat nearby - Foster overall ecological health |
| Mammal | Bobcat | Endangered | Potential breeding habitat nearby and on Preserve - Foster overall ecological health |
| Reptile | Eastern Box Turtle | Special Concern | Potential nesting habitat at Preserve - Foster overall ecological health, especially meadow restoration |
| Reptile | Wood Turtle | Threatened | Breeding habitat nearby - Foster overall ecological health. Investiage potential for nesting along streams on Preserve. |
| Plant | Leatherwood | S2 - "Threatened" | Confirmed at Preserve. Conduct thorough survey to determine population size and extent. Perform targeted invasive species control. |
| Plant | Wild Comfrey | S2 - "Threatened" | Confirmed at Preserve. Conduct thorough survey to determine population size and extent. Perform targeted invasive species control. |

## Fauna

A complete list of the fauna within the Preserve is not available, but species lists for various taxa are provided as appendices and summarized below.

- *Amphibians* - There are a total of 23 species of amphibians that may be found in Mercer County (See Appendix H).

- *Reptiles* - There are a total of 27 species of reptiles that may be found in Mercer County (See Appendix I). Eastern Box Turtle was observed by M. Van Clef during ecological surveys.

- *Birds* - There are a total of 90 species documented at the Preserve (Appendix J). Washington Crossing Audubon Society has begun to document species (fall 2015, spring 2016) and Mark Manning performed a Christmas Bird Count in December 2015. WCAS plans on continuing surveys to document species and provide stewardship recommendations.

- *Mammals* - There are a total of 35 species of mammals that may be found in Mercer County (See Appendix K).

- *Freshwater Fish* - There are a total of 85 species of freshwater fish that may be found in New Jersey (See Appendix L).

- *Freshwater Mussels* - There are a total of 10 species of freshwater mussels that may be found in Mercer County (See Appendix M).

- *Invertebrates* - There are a total of 100 species of butterflies (See Appendix N) and 57 species of dragonflies and damselflies (See Appendix O) that may be found in Mercer County.

*Rare Species* - There are nine rare animal species within or nearby the Preserve (See Table 19 above). At this time, specific stewardship recommendations are not provided because fostering these species is part of stewardship activities related to improving overall ecological health (e.g., shrubland restoration for species requiring this for nesting habitat). However, further investigation may result in species-specific stewardship recommendations (e.g., Wood Turtle nesting structures, Eastern Box Turtle nesting areas protected from predators).

Eastern Box Turtle found near Wild Comfrey populations.

## Section IV. Conservation Challenges

### Introduction

This section describes an evaluation of the two primary threats to ecological health at the Preserve – overabundance of white-tailed deer and invasive species. FoHVOS evaluated impacts of white-tailed deer and mapped the extent and severity of invasive plant species infestations from September to October 2015. Deer management has occurred on portions of the Preserve, but there was significant ecological damage due to deer overabundance. Quantification of impacts through the "Sentinel Seedling" and "Forest Secchi" protocols will be conducted in June 2016. The scope of the invasive species problem is significant with approximately 80% of the mapped areas having severe infestations of one or more species. Less than 2% of the area was virtually free of invasive species, while approximately 15% is lightly to moderately infested (the remaining 3% of the Preserve consisted of paved areas and the former buildings).

A brief discussion is provided for two additional factors that impact ecological health – relatively small habitat patch size and past agricultural land uses. These factors cannot be remedied, but inform stewardship strategies (See Section IV).

### Evaluation of White-tailed Deer Impacts

Currently, ecological impacts of white-tailed deer are severe throughout the Preserve's forests. Young saplings of canopy tree species are virtually absent. Forest shrubs are similarly uncommon with greater than 85% of the Preserve containing less than 10% shrub cover and there were no mapped areas with greater than 25% shrub cover (Note: Healthy forests should have greater than 70% native shrub cover). Forest herbs are extremely rare and it is likely that multiple species were locally extirpated. This reduction in native plant cover fostered the proliferation of less palatable invasive species in many areas (primarily those that had received past agricultural tilling - See Section I). Despite ongoing deer management on portions of the Preserve, the majority of forests at the Preserve show either the "Empty Forest Syndrome" or the "Infested Forest Syndrome" (See Section I). Importantly, native tree regeneration in natural forest canopy gaps is virtually absent, which threatens the long-term existence of forest cover at the Preserve.

However, there are some opportunities for ecological recovery, especially in forest areas that had never been under agricultural uses (approximately 65 acres). There areas have relatively low levels of invasive species (except for canopy gaps) and directed stewardship activities can begin the restoration process (See Section IV).

A series of photographs with captions are provided below to highlight both the severity of deer impacts at the Preserve.

An example of a very healthy forest (above – photo not taken on Preserve), which is filled with a dense native understory providing ecological control of invasive species. Bottom left photo from Preserve shows an understory almost completely devoid of plants due to severe deer browse ('Empty Forest Syndrome'). Bottom right photo shows a dense infestation of unpalatable invasive plants ('Infested Forest Syndrome').

Native tree seedlings are extremely uncommon.
This small white oak seedling will not become part of the future forest canopy due to excessive deer browse.

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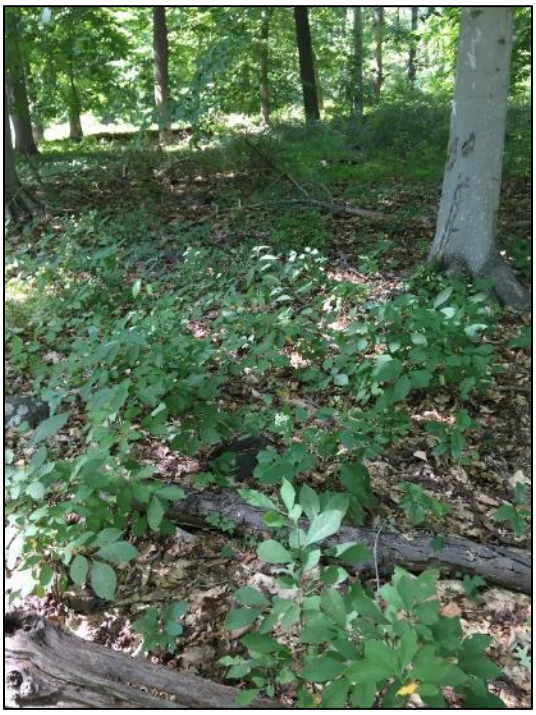
Above and below: Large canopy gaps created by Superstorm Sandy became infested by unpalatable invasive species and lack the next generation of native trees required to regenerate the forest. Left unchecked, forest cover will continue to be replaced by thickets of invasive species.




Left: Badly browsed native Spicebush. Right: Relatively tall Spicebush.
Over many years, deer have completely removed Spicebush from most places in the Preserve.
These two photos are exceptions, but they show the potential for future improvements.


Left: White Wood Aster. Right: Solomon's Seal.
Native forest wildflowers were virtually absent from the Preserve. Both of these plants should be exceptionally common.

## Evaluation of Invasive Species Impacts

### Mapping Protocols

The method used to map invasive plant species involved the delineation of mapping areas. The mapping area technique is a coarse method to broadly define the extent and intensity of invasive species infestations. Mapping areas were delineated as locations containing relatively uniform ground cover for each invasive species present within the defined area or 'patch'. Within each patch, each invasive plant species was assigned a cover class score. Cover class scores included: "0": absent, "Trace" or < 1% cover, "1": 1-10% ground cover, "2": 11-25% ground cover, "3": 26-50% ground cover, "4": 51-75%, and "5": 76-100% ground cover.

### Overall Scope

A total of 184 unique mapped patches totaling 397 acres were recorded (Table 20). There were 8 acres (approximately 2%) where invasive species were absent or only present at trace levels. Approximately 80% of the mapped area is considered severely infested (invasive cover > 50%). Map 26 depicts the cumulative infestation scores by mapped patches.

**Table 20. Summary of Invasive Species Infestations by Mapped Patch**

| Combined Infestation Score per Patch | Combined Infestation Score Category | Total Acreage | Percentage of Reserve |
|---|---|---|---|
| N/A | N/A | 13.9 | 3.5 |
| 0* | "Clean" | 7.5 | 1.9 |
| 1 | Low | 15.9 | 4.0 |
| 2 | Low | 0.0 | 0.0 |
| 3 | Moderate | 0.7 | 0.2 |
| 4 | Moderate | 46.3 | 11.6 |
| 5 | High | 13.7 | 3.5 |
| 6 | High | 16.1 | 4.0 |
| 7 | High | 31.0 | 7.8 |
| 8 | High | 34.9 | 8.8 |
| 9 | High | 29.0 | 7.3 |
| 10 | High | 27.4 | 6.9 |
| 11 | Very High | 32.9 | 8.3 |
| 12 | Very High | 12.4 | 3.1 |
| 13 | Very High | 36.6 | 9.2 |
| 14 | Very High | 35.3 | 8.9 |
| 15 | Very High | 22.7 | 5.7 |
| 16 | Very High | 3.2 | 0.8 |
| 17 | Very High | 12.2 | 3.1 |
| 18 | Very High | 2.7 | 0.7 |
| 19 | Very High | 2.9 | 0.7 |
| **Totals** | | **397** | **100** |

*May contain one or more species at "Trace" amounts

| Combined Infestation Score per Patch | Combined Infestation Score Category | Total Acreage | Percentage of Preserve |
|---|---|---|---|
| N/A | N/A | 13.9 | 3.5 |
| 0* | "Clean" | 7.5 | 1.9 |
| 1-2 | Low | 15.9 | 4.0 |
| 3-4 | Moderate | 47.0 | 11.8 |
| 5-10 | High | 152.1 | 38.3 |
| > 10 | Very High | 160.9 | 40.5 |
| **Totals** | | **397** | **100** |

*May contain one or more species at "Trace" amounts

Each invasive species was assigned an 'Action Code' based upon its threat level to conservation values, current extent of infestation within the Preserve and known invasive status in New Jersey (Table 21). Overall, 32 species are considered invasive – seven should be subject to an eradication program, eleven should be subject to a selective control program. Specific management recommendations for particular species and areas within the Preserve are presented in Section IV.

**Table 21. Invasive Species Action Code Summary**

| Action Code | Action Code Explanation | Treatment Recommendations | Number of Species |
|---|---|---|---|
| 1 | Species has limited distribution (but is highly threatening) within the Preserve | Eradicate | 7 |
| 2 | Species has widespread distribution within the Preserve and is considered highly threatening | Selective Control | 11 |
| 3 | Species has limited distribution and/or is not considered to be highly threatening to conservation values and/or control is not feasible within the Preserve | No Treatment | 14 |
| **TOTAL** | | | **32** |

**Species Patterns**

There were eight different emerging invasive plant species detected within the Preserve. Several of these are too abundant to consider eradication, but others have a limited number of populations and eradication may be possible (See Table 22). All of these species are considered highly threatening to ecological health.

Oriental Photinia is one of the most threatening emerging invasive species at the Preserve. It is becoming very abundant in the nearby Princeton area, but control efforts should be a high priority to avoid ever increasing ecological damage across the Preserve.

## Table 22. Invasive Species Control Strategy Summary

| Scientific Name | Common Name | Growth Form | Action Code | Control Strategy |
|---|---|---|---|---|
| *Ailanthus altissima* | Tree-of-Heaven | Tree | 2 | Selective Control - Eradicate Fruiting Individuals (esp. high quality areas) |
| *Alliaria petiolata* | Garlic Mustard | Herb | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Aralia elata* | Japanese Aralia | Tree | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Artemisia vulgaris* | Mugwort | Herb | 2 | Selective Control - Control via potential restoration project |
| *Arthraxon hispidus* | Carpgrass | Herb | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Berberis thunbergii* | Japanese Barberry | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Catalpa bignoniodes* | Catalpa | Tree | 2 | Selective Control - Control via potential restoration project |
| *Celastrus orbiculata* | Asiatic Bittersweet | Vine | 2 | Selective Control - Eradicate Fruiting Individuals (esp. high quality areas) |
| *Cirsium arvense* | Canada Thistle | Herb | 2 | Selective Control - Treatment as observed within meadow habitat |
| *Elaeagnus umbellata* | Autumn Olive | Shrub | 2 | Selective Control - Forest - Eradicate Fruiting Individuals (esp. high quality areas); Meadow - Eradication of all known occurrences; Control via potential restoration project |
| *Euonymus alata* | Winged Burning Bush | Shrub | 2 | Selective Control - Eradicate Fruiting Individuals (esp. high quality areas) |
| *Hedera helix* | English Ivy | Vine | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Hosta ventricosa* | Blue Plantain Lily | Herb | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Lespedeza cuneata* | Chinese Bushclover | Herb | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Ligustrum obtusifolium* | Privet | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Lonicera japonica* | Japanese Honeysuckle | Vine | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Lonicera maackii* | Bush Honeysuckle | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Lonicera morrowii* | Bush Honeysuckle | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Malus toringo* | Toringo Crabapple | Tree | 2 | Selective Control - Forest - Eradicate Fruiting Individuals (esp. high quality areas); Meadow - Eradication of all known occurrences; Control via potential restoration project |
| *Microstegium vimineum* | Japanese Stiltgrass | Herb | 3 | No Direct Action - Ecological control through deer herd reduction |
| *N/A* | Cool season hay grass | Herb | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Phalaris arundinacea* | Reed Canary Grass | Herb | 2 | Selective Control - Control via potential restoration project |
| *Photinia villosa* | Oriental Photinia | Shrub | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Phragmites australis* | Common Reed | Herb | 2 | Selective Control - Control via potential restoration project |
| *Picea abies* | Norway Spruce | Tree | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Polygonum perfoliatum* | Mile-a-Minute | Herb | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Pyrus calleryana* | Callery Pear | Tree | 2 | Selective Control - Forest - Eradicate Fruiting Individuals (esp. high quality areas); Meadow - Eradication of all known occurrences; Control via potential restoration project |
| *Robinia pseduoacacia* | Black Locust | Tree | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Rosa multiflora* | Multiflora Rose | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Rubus phoenicolasius* | Wineberry | Shrub | 3 | No Direct Action - Ecological control through deer herd reduction |
| *Viburnum dilitatum* | Linden Viburnum | Shrub | 1 | Eradicate all known occurrences; Maintain continual searching and eradication |
| *Zelkova serrata* | Zelkova | Tree | 1 | Eradicate all known occurrences; Maintain continual searching and eradication [Planted specimens along entrance driveway] |

Specific locations and population sizes for each population are accessible through the New Jersey Invasive Species Strike Team's interactive map (www.njisst.org). See Map 27 for an overview of their distribution within the Preserve – individual species maps are attached to this plan.

Table 23 contains data for each invasive species mapped within the Preserve (See individual species maps depicting distribution and intensity of infestations for each species). Table 23 also contains the "Relative Infestation Index Category." This index provides a coarse characterization of both distribution and intensity of infested acreage within the Preserve. It is intended to provide a rapid assessment of species that currently have the greatest impacts. Values include 'High', 'Medium', and 'Low', which correspond to ranges of Infestation Index Scores derived by multiplying the number of acres where a species was present by its cover class score within mapped patches. Species labeled as 'High' are those with widespread distributions and/or consist of dense stands. Conversely, 'Low' species have limited distribution and/or primarily occur at low cover classes.

The three most abundant/widespread invasive species are Japanese Stiltgrass, Multiflora Rose and Autumn Olive. Japanese Stiltgrass had a score that was more than double the next most abundant invasive species (Multiflora Rose and Autumn Olive). Similarly, rose and olive both had Infestation Index Scores that were nearly double the next most abundant species. Additional species with very high infestation levels were (in order of index scores): Japanese Barberry, Japanese Honeysuckle and Wineberry.

**Spatial Patterns**

The most severe infestations (See Map 26) tended to occur in former agricultural areas. Further amplifying this phenomenon is the prominence of ash decline within some of these same areas, which decreases shade provided by canopy trees and therefore increases the growth of invasive species such as Multiflora Rose.

Areas without a history of agricultural tilling were the only areas considered to be "Clean" or have "Low" or "Moderate" infestation levels. However, some areas without agricultural tilling still had significant infestations of species, especially Japanese Stiltgrass where the forest canopy was reduced by past storm damage.

Regardless of past agricultural land use, canopy gaps were highly infested by a variety of invasive species. Deer frequent canopy gaps (probably instinctively to seek plants with robust growth due to increased sunlight) and remove palatable native species while leaving behind unpalatable invasive species.

## Table 23. List of Invasive Species and Their Relative Infestation Levels - Emerging invasive species are highlighted in yellow

| | | | | | Acreage by Percent Ground Cover Categories | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Scientific Name | Common Name | Infestation Index Score[1] | Relative Infestation Index Category[2] | Total Acres Present | Category 0: 0% | Category Trace: < 1% | Category 1: 1-10% | Category 2: 10-25% | Category 3: 25-50% | Category 4: 50-75% | Category 5: 75-100% |
| *Ailanthus altissima* | Tree-of-Heaven | 4.3 | Low | 3.2 | 394.0 | 0.0 | 2.2 | 1.1 | 0.0 | 0.0 | 0.0 |
| *Alliaria petiolata* | Garlic Mustard | 52.6 | Medium | 44.7 | 352.5 | 0.0 | 36.9 | 7.9 | 0.0 | 0.0 | 0.0 |
| *Aralia elata* | Japanese Aralia | POINT ONLY | Low | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Artemisia vulgaris* | Mugwort | 7.4 | Low | 2.8 | 394.4 | 0.0 | 0.3 | 0.5 | 1.8 | 0.0 | 0.1 |
| *Arthraxon hispidus* | Carpgrass | 50.7 | Medium | 28.7 | 368.5 | 0.0 | 17.0 | 2.1 | 9.2 | 0.0 | 0.4 |
| *Berberis thunbergii* | Japanese Barberry | 238.0 | High | 193.6 | 203.6 | 35.0 | 85.8 | 70.8 | 1.1 | 0.9 | 0.0 |
| *Catalpa bignoniodes* | Catalpa | 2.2 | Low | 2.2 | 395.1 | 0.0 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Celastrus orbiculata* | Asiatic Bittersweet | 29.7 | Medium | 33.7 | 363.5 | 10.3 | 18.1 | 5.3 | 0.0 | 0.0 | 0.0 |
| *Cirsium arvense* | Canada Thistle | 15.8 | Medium | 14.8 | 382.4 | 0.0 | 13.9 | 1.0 | 0.0 | 0.0 | 0.0 |
| *Elaeagnus umbellata* | Autumn Olive | 469.2 | High | 216.2 | 181.1 | 6.5 | 104.1 | 34.5 | 13.1 | 33.6 | 24.4 |
| *Euonymus alata* | Winged Burning Bush | 10.7 | Medium | 28.3 | 368.9 | 19.6 | 8.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Hedera helix* | English Ivy | POINT ONLY | Low | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Hosta ventricosa* | Blue Plantain Lily | POINT ONLY | Low | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Lespedeza cuneata* | Chinese Bushclover | 6.5 | Low | 6.5 | 390.7 | 0.0 | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Ligustrum obtusifolium* | Privet | 88.7 | Medium | 76.2 | 321.0 | 1.2 | 61.4 | 13.6 | 0.0 | 0.0 | 0.0 |
| *Lonicera japonica* | Japanese Honeysuckle | 215.7 | High | 148.5 | 248.8 | 15.0 | 57.2 | 71.9 | 4.4 | 0.0 | 0.0 |
| *Lonicera maackii* | Amur Bush Honeysuckle | 6.9 | Low | 10.4 | 386.9 | 3.8 | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Lonicera morrowii* | Morrow's Bush Honeysuckle | 89.8 | Medium | 58.4 | 338.8 | 0.0 | 27.0 | 31.4 | 0.0 | 0.0 | 0.0 |
| *Malus toringo* | Toringo Crabapple | 83.0 | Medium | 62.7 | 334.6 | 5.3 | 40.2 | 9.2 | 8.0 | 0.0 | 0.0 |
| *Microstegium vimineum* | Japanese Stiltgrass | 1230.8 | High | 336.6 | 60.6 | 7.5 | 22.0 | 72.3 | 34.4 | 41.8 | 158.6 |
| *N/A* | Cool season hay grass | 159.1 | High | 37.5 | 359.7 | 0.0 | 0.9 | 6.0 | 0.5 | 5.6 | 24.4 |
| *Phalaris arundinacea* | Reed Canary Grass | 60.1 | Medium | 34.0 | 363.2 | 0.0 | 16.2 | 14.4 | 0.2 | 1.8 | 1.5 |
| *Photinia villosa* | Oriental Photinia | 21.4 | Medium | 51.3 | 345.9 | 35.7 | 13.4 | 2.2 | 0.0 | 0.0 | 0.0 |
| *Phragmites australis* | Common Reed | 12.3 | Medium | 6.2 | 391.0 | 0.5 | 4.1 | 0.0 | 0.0 | 0.0 | 1.6 |
| *Picea abies* | Norway Spruce | 10.2 | Medium | 6.6 | 390.6 | 0.0 | 5.4 | 0.0 | 0.0 | 1.2 | 0.0 |
| *Polygonum perfoliatum* | Mile-a-Minute | 43.3 | Medium | 59.7 | 337.5 | 29.5 | 20.0 | 10.1 | 0.1 | 0.0 | 0.0 |
| *Pyrus calleryana* | Callery Pear | 31.1 | Medium | 27.4 | 369.8 | 0.9 | 21.9 | 4.6 | 0.0 | 0.0 | 0.0 |
| *Robinia pseduoacacia* | Black Locust | 22.7 | Medium | 10.0 | 387.2 | 0.0 | 0.0 | 7.4 | 2.6 | 0.0 | 0.0 |
| *Rosa multiflora* | Multiflora Rose | 494.5 | High | 219.2 | 178.1 | 26.6 | 65.1 | 29.0 | 41.7 | 40.3 | 16.5 |
| *Rubus phoenicolasius* | Wineberry | 178.7 | High | 134.7 | 262.5 | 17.4 | 72.1 | 37.0 | 2.0 | 6.2 | 0.0 |
| *Viburnum dilitatum* | Linden Viburnum | 4.8 | Low | 17.4 | 379.8 | 14.0 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Zelkova serrata* | Zelkova | POINT ONLY | Low | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**[1] The Infestation Index Score combines the extent of acreage infested and the intensity of the infestation. It was derived by multiplying the cover class number by the number of acres within each cover class.**

**[2] The Relative Infestation Index Categories include Low, Medium and High to represent Infestation Index Scores of < 10, 10-100 and > 100, respectively.**

## Section V. Strategies and Actions

**Figure 7. Stewardship Philosophy**

'Nature manages itself' is commonly heard from those that feel stewardship of natural lands is inappropriate. In some cases, this is based upon a simplistic understanding of natural systems and the forces that create or maintain them. Some proponents of this view fail to acknowledge that there are many indirect impacts of human activities on natural systems (e.g., introductions of non-native species, irreversible fragmentation of natural areas that support deer population growth, profound alteration of soils from past agricultural use, etc.). Other proponents of this view suggest that nature will have to balance itself within the framework established by human activities and that we should not intervene further. Finally, there are well-qualified experts including some experienced natural historians and research professors that understand that our knowledge of natural systems is incomplete and suggest that stewardship should not be practiced until we learn more about natural systems and how they will react to particular management regimes.

In contrast, proponents of stewardship proceed from the viewpoint that human activities directly and indirectly shape the remainder of our natural world and that there is an obligation to intervene to promote ecological health and avoid further loses to biodiversity. In short, stewardship may be defined as 'the mitigation of human impacts on natural systems'. Stewards feel that action is required when human impacts severely threaten ecological health, thereby consciously reducing human impacts through management strategies and actions.

In most cases, stewards strive for short-term interventions that correct natural systems with declining trajectories. Examples of short-term interventions include significant reductions of the white-tailed deer population (i.e., culling) and control of nascent populations of invasive species. In other cases, the continuing needs of the human population require that active management be perpetual (e.g., creation and maintenance of early successional habitats because catastrophic wildfires must be suppressed or a continuing Deer Management Programs to maintain a smaller deer herd).

In general, there are relatively few compromises available to proponents of the extremes of these two opposing viewpoints. However, most individuals realize that a balance is possible, especially when stewardship is coupled with careful monitoring or designed research experiments that provide greater insights to practice adaptive management. Overall, stewardship strategies should seek to utilize minimal human intervention to foster ecological health and stimulate research to provide a better understanding of the natural world.

### Introduction

A significant and persistent effort will be required to improve ecological health at the Preserve. There are four primary recommendations – 1) Perform Forest, Shrubland and Meadow Habitat Restorations, 2) Perform Strategic Invasive Species Control, 3) Provide Stewardship of Rare Species and Perform Ecological Monitoring , and 4) Implement an Effective White-tailed Deer Management Program. Note that recommendation numbers below begin at #2 (recreation and outreach topics are recommendation #1). Each of these recommendations is accompanied by specific goals that are numbered sequentially across all primary recommendations. There are a total of 10 specific goals.

It is essential that a very effective Deer Management Program continue in perpetuity across the entire Preserve, while continually attempting to influence efforts on nearby private lands whenever possible. Significant reduction of the deer herd is absolutely critical to improve ecological health through increased native plant growth, which in turn will exert ecological control over invasive species (thereby lessening the need for ongoing chemical control). Invasive species are likely to be present in perpetuity, but they are much less likely to form dense infestations with lower deer densities.

Recommendations for control of particular invasive species were prioritized based upon their level of threat to further degrade ecological health (e.g., potential to significantly increase their abundance at the Preserve and infestations located within or adjacent to areas with high conservation value). Species-specific recommendations, treatment prescriptions and phenology are provided in Appendix C. An overview of control methods and detailed information on herbicides are provided in Appendices A and B,

respectively. These appendices are intended to provide practical guidelines toward plan implementation by Preserve stewards.

A summary of specific goals with suggested completion timeframes and estimated costs is summarized in Tables 24-26. Full plan implementation is estimated to require 7,855 hours of co-owner staff (estimated cost of $119,250) and require 4,130 volunteer hours (estimated value of $99,120) and require approximately $304,250 for contractors and materials over the next 10 years. Total cost for co-owner staff, contractors and materials is estimated at $423,500 over the 10-year plan implementation period.

It is realized that full plan implementation costs may be prohibitive. Recommendations #3 and #5 are considered minimal requirements to steward the Preserve. The combined estimated costs for these recommendations is $64,400. Implementing Recommendations #2 and #4 will require significant fundraising through private donations and private and public grant sources. The combined estimated costs to implement these recommendations is $379,600.

**Recommendation #2: Perform Forest, Shrubland and Meadow Habitat Restorations**

Proposed restoration activities will require support from all co-owners and stakeholders, along with substantial funding from private donations and grants. It is also important to note that the scale of each proposed restoration project can be reduced based upon available funds (e.g., restore 10 acres of wildflower meadow instead of 36 acres). The estimated cost to complete all goals under this recommendation is $356,700 over the 10-year implementation period (See Table 24). An additional $54,000 of volunteer value is also required for this recommendation.

Public comment was received regarding the potential strategy to "pre-restore" forest areas currently dominated by ash in light of the expected Emerald Ash Borer impacts. This strategy will be employed through the planting of oak seedlings protected by tree tubes. A budget and specific plan will be formulated after other goals listed below have been completed.

**Goal #2-1: Restore Canopy Gaps and Wildflowers on 5 acres of Old Forest Habitat**

The restoration should begin with selection of twenty 0.25-acre areas (See Map 28). Half of the locations will be existing forest canopy gaps. These areas will be protected by deer fencing to allow the natural establishment of native trees and shrubs required to maintain forest cover.

The other ten locations will include areas of intact canopy and will also receive deer fencing, but plantings of native forest wildflowers will be installed to 'kick start' wildflower abundance across the Preserve. This is the 'Noah's Ark' concept whereby restoring small areas could ultimately restore the entire Preserve (following deer herd reduction). Ideally, seeds should be collected from local sources within the Hopewell Valley for germination by native plant nurseries familiar with propagating each species. A total of 100 plants will be installed within each area. Preparation (as removal of any invasive and/or woody plants) and installation can be conducted by co-owner staff and volunteers. Costs for this goal are relatively high, but it is an investment that can compound on its own by spreading from initial planting areas.

The estimated cost to complete this goal is $93,000 over the 10-year implementation period (See Table 24). An additional $18,000 of volunteer value is also required for this goal.

**Goal #2-2: Restore 27 acres of Shrubland and Guide Natural Development on 13 acres**

High quality native shrubland habitat is exceedingly rare in the Hopewell Valley and throughout New Jersey. This goal has two strategies to restore shrubland community.

The first involves the removal of invasive shrub cover followed by the installation of deer fencing and native shrubs on 27 acres (See Map 28). Currently, the area is heavily infested with invasive species including Autumn Olive, Callery Pear, Toringo Crabapple, Multiflora Rose and other invasive species. The restoration process would include the following steps:

1) Utilize heavy mowing equipment to remove all woody invasive plants
2) Treat with herbicide to eliminate woody invasive species (after allowing cut plants to resprout)
3) Seed with native grasses and wildflowers to provide ecologically beneficial cover while shrubs establish
4) Install perimeter fencing to exclude deer (to be removed after 10 years)
5) Install native shrub species (50 per acre)

The second strategy involves guiding natural shrub establishment on 13 acres (See Map 28). Areas that currently have meadow vegetation becoming mixed with both native and non-native shrubs were selected for this goal. By controlling invasive shrubs and implementing effective deer management, native shrubs will continue to spread in these areas.

The estimated cost to complete this goal is $164,200 over the 10-year implementation period (See Table 24). An additional $28,800 of volunteer value is also required for this goal.

**Goal #2-3: Restore 34 acres of Native Wildflower Meadow**

The Preserve currently contains 34 acres of former lawn areas that are converting to low quality meadow habitat (See Map 28). If stewardship is not employed, these areas will ultimately develop into shrublands consisting of invasive species (see above). The restoration of high quality meadows will provide critical pollinator habitat and an aesthetically pleasing landscape that can be enjoyed by the public. Cost estimates included in Table 24 include an initial herbicide application, purchase and installation of native grass and wildflower seeds, and annual mowing maintenance. Meadow restorations are often partially funded by grants.

The estimated cost to complete this goal is $79,000 over the 10-year implementation period (See Table 24). An additional $7,200 of volunteer value is also required for this goal.

The former corporate park will be restored to native meadow habitat.

**Recommendation #3: Perform Strategic Invasive Species Control**

A complete list of invasive species along with control goals (i.e., Action Code), treatment prescriptions and plant phenology is provided in Table 22 and Appendix C. The following annotated recommendations are provided as specific tasks within Table 24 along with cost estimates and timeframes. Co-owner staff have substantial knowledge and professional license requirements to effectively guide invasive species control efforts that would primarily performed by seasonal interns.

Ecological control exerted by native species is the ultimate goal to curb invasive plant species. This should not be expected without further reduction of the deer herd (See Goal #1), however, the majority of recommended control work is focused on species where ecological control is expected to have the lowest rates of success (e.g., tall, shade tolerant species such as Oriental Photinia and Linden Viburnum). Specific control measures for species that would be most susceptible to ecological control (e.g., Japanese Stiltgrass and Multiflora Rose) are not recommended.

The estimated cost to complete all goals under this recommendation is $56,900 over the 10-year implementation period (See Table 24). An additional $8,040 of volunteer value is also required for this recommendation.

**Goal #3-1: Eradicate 7 Emerging Invasive Species**

Emerging invasive species should be the highest priority for control efforts because they threaten the Preserve and the region with future ecological degradation. This strategy, known as Early Detection & Rapid Response, represents an efficient and effective strategy to prevent damage (and minimize future stewardship costs). There are currently seven emerging species designated as 'Action Code 1' (i.e., eradication is the ultimate goal, See Table 22). Table 24 provides specific time and cost estimates for each species.

The estimated cost to complete this goal is $17,900 over the 10-year implementation period (See Table 24). An additional $6,480 of volunteer value is also required for this goal.

**Goal #3-2: Perform Selective Control of 11 Widespread Invasive Species**

This goal involves treatment of eleven invasive species (See Table 22). However, control efforts for nine of the species would be incorporate under restoration activities (Goal #3). The two directly targeted species are widespread throughout New Jersey (Winged Burning Bush and Asiatic Bittersweet), but control efforts on the Preserve would reduce significant future degradation.

The estimated cost to complete this goal is $18,500 over the 10-year implementation period (See Table 24). An additional $1,200 of volunteer value is also required for this goal.

### Goal #3-3: Maintain <10% Cover of Invasive Species within "Clean Areas" on 65 acres of Old Forest Habitat

There are approximately 65 acres that are less impacted by invasive species infestations (See Table 20). The goal for "clean" areas is to maintain cover at less than 10% cover for all invasive species. The goal for areas listed as having "low" or "moderate" cover is to reduce cover and maintain less than 10% cover of woody invasive plants (herbaceous invasives would not be considered in these areas). All selected areas should be monitored annually and invasive species should be treated to obtain/maintain invasive species at goals listed above within the next 10 years. Ultimately, ecological control of invasive species should maintain these areas with minimal risk of new infestations.

The estimated cost to complete this goal is $20,500 over the 10-year implementation period (See Table 24). Volunteer support is not required for this goal.

**Recommendation #4: Provide Stewardship of Rare Species and Perform Ecological Monitoring**

This recommendation includes higher levels of stewardship activity including ecological monitoring of the three habitat conservation targets, botanical survey and monitoring and stewardship of rare species. Ecological monitoring provides accountability and forms the basis for the adaptive management process.

The estimated cost to complete all goals under this recommendation is $22,900 over the 10-year implementation period (See Table 24). An additional $25,440 of volunteer value is also required for this recommendation.

**Goal #4-1: Perform Complete Botanical Survey / Floristic Quality Assessment**

A complete botanical survey should be conducted across the Preserve to completely assess plant diversity and inform stewardship activities. The survey should include specific population location, size, condition, and habitat descriptions for all detected rare species. This work should be completed by a professional botanist with significant past experience performing botanical surveys.

The estimated cost to complete this goal is $5,300 over the 10-year implementation period (See Table 24). Volunteer support is not required for this goal.

**Goal #4-2: Implement Ecological Health Monitoring Program for Forest, Shrubland and Meadow Habitats**

Ecological health should be monitored regularly across the Preserve to evaluate stewardship activities and guide adaptive management over time. Forest health should be monitored every three years (baseline monitoring performed in 2016). This should be completed using established protocols utilized elsewhere in the Hopewell Valley (i.e., Sentinel Seedling and Forest Secchi protocols). In addition, shrubland and meadow habitats should also be evaluated using methods established by FoHVOS. These methods will be performed by staff and volunteers of the co-owners.

The estimated cost to complete this goal is $9,100 over the 10-year implementation period (See Table 24). An additional $1,440 of volunteer value is also required for this goal.

**Goal #4-3: Perform Rare Species Monitoring and Stewardship**

There are a total of eleven rare animals and plants known to occur within or nearby the Preserve (Table 19). Two rare plants were discovered during field mapping in 2015 (Wild Comfrey and Leatherleaf). The full extent of these species should be determined through the completion of Goal #4-1 above (which might lead to additional discoveries). While the full scope of stewarding these rare plants cannot be determined until a more thorough search is conducted, known populations should be maintained through invasive species control in the immediate vicinity of plants.

Rare animal species will also require additional investigation to determine their use of the Preserve. Washington Crossing Audubon Society will continue to conduct bird surveys in 2016, which will be very valuable to informing stewardship strategies and plan implementation (6 of 9 rare animals are birds). The co-owners will seek volunteers to conduct surveys of reptiles (two rare animals are turtles) and amphibians. This will also be essential to for plan implementation. While targeting overall habitat health is the primary goal of this plan, additional specific rare species stewardship strategies may be necessary based upon results of new surveys.

The estimated cost to complete this goal is $8,500 over the 10-year implementation period (See Table 24). An additional $24,000 of volunteer value is also required for this goal.

**Recommendation #5: Implement an Effective White-tailed Deer Management Program**

**Goal #5-1: Reduce deer density to meet forest health goals including a dense, native understory**

Hopewell Township has been conducting deer management on portions of the Preserve that they previously owned (Bayberry Road and Carter Road parcels – See Table 1). While this has likely contributed to modest deer herd reduction, a lack of sufficient management on neighboring lands and throughout the Hopewell Valley has resulted in an extremely large herd size and the resulting severe ecological impacts at the Preserve that are described in Section III.

The estimated cost to complete this goal is $7,500 over the 10-year implementation period (See Table 24). An additional $6,000 of volunteer value is also required for this goal.

In order to improve ecological health, there will have to be significant and strategic approach to locally (preserve and its environs) reduce the deer herd to 10 deer per square mile. This goal is supported by the literature.

- The historical analysis of the white-tailed deer population density in North America (pre-European colonization) is approximately 10 per square mile (McCabe and McCabe 1984).
- In general, native species diversity / abundance and overall forest health drop significantly with increasing deer herd size. An often cited research project that provides quantitative guidance on deer population levels associated with ecological damage was performed by David deCalesta, based at the US Forest Service in Pennsylvania (deCalesta 1994, deCalesta 1997). Over the course of a 10-year study using forest enclosures with known densities of deer, deCalesta determined that native forest herbs and tree seedlings became less abundant with deer densities between 10 and 20 per square mile. At densities exceeding 20 per square mile, palatable native plant species disappear and forest shrub-nesting song birds drop in abundance with the loss of the shrub layer.
- Human health impacts may also be associated with deer densities exceeding 10 deer per square mile. According to a study reported from Connecticut (Stafford 2007), deer population size is linked to incidences of Lyme disease. This relationship is dependent upon a threshold deer population size, requiring a population size of 10-12 deer per square mile to show substantial reduction in human cases of Lyme disease.

Specific methods to obtain this goal should be devised by the Hopewell Township Deer Management Advisory Committee along with the other co-owners. It is likely that significant effort will be required to reach this goal and more intense or novel approaches may be necessary and the goal may not be reached in the short term (e.g., < 5 years). The use of coordinated deer drives to simultaneously harvest large numbers of deer will likely be necessary, along with requiring Preserve hunters to harvest 2-3 deer each throughout the hunting season.

In addition, sustained or increased deer management activities will be required on nearby protected lands owned by D&R Greenway Land Trust, Stony Brook – Millstone Watershed Association, and Mercer County (See Map 16 and page 21). Participation by private landowners of large, neighboring parcels will also be necessary (See page 22).

## Table 24. Detailed Goals for 10-Year Implementation Period

| Category | Goal | Activity | Mapped Area Number(s) | Total Estimated Level of Effort (All Hours) | Total Estimated Level of Effort (Staff Hours) | Total Estimated Level of Effort (Volunteer Hours) | Estimated Staff Costs @ $30/hour (Permanent and Seasonal) | Estimated Contractor / Material Cost | Total Cost | Volunteer Value @ $24/hour |
|---|---|---|---|---|---|---|---|---|---|---|
| Recreation / Outreach | 1-1 | Trail Creation and Maintenance (excluding LHT) | Multiple | 650 | 150 | 500 | $4,500 | $1,500 | $6,000 | $12,000 |
| Recreation / Outreach | 1-2 | Signage, Kiosks, Displays | Trails, Parking Area | 280 | 230 | 50 | $6,900 | $7,500 | $14,400 | $1,200 |
| Recreation / Outreach | 1-2 | Arboretum Branch plantings | Trails | 400 | 200 | 200 | $6,000 | $5,000 | $11,000 | $4,800 |
| Recreation / Outreach | 1-3 | Guided Hikes (5 per year) | All | 200 | 100 | 100 | $3,000 | $500 | $3,500 | $2,400 |
| Recreation / Outreach | 1-4 | Preserve Management & Maintenance | All | 300 | 150 | 150 | $4,500 | $1,000 | $5,500 | $3,600 |
| Recreation / Outreach | 1-5 | Parking lot replacement | All | 50 | 50 | 0 | $1,500 | $380,700 | $382,200 | $0 |
| Recreation / Outreach | 1-5 | Public Amenities - picnic pavillion and composting toilets | All | 200 | 150 | 50 | $4,500 | $25,000 | $29,500 | $1,200 |
| Forest Stewardship | 2-1 | Forest Restoration as 1) Wildflower Restoration and 2) Canopy Gap Protection Fencing (20 selected 1/4 acre patches for each activity) | 70, 71, 77, 78, 121, 125, 127, 128, 129, 161, 163 | 1350 | 600 | 750 | $18,000 | $75,000 | $93,000 | $18,000 |
| Shrubland Stewardship | 2-2 | 'Guided' Succession from Meadow to Shrubland (13 acres) -- Treatment of Invasive Shrubs and Trees | 173, 175, 176, 177, 181 | 500 | 500 | 0 | $15,000 | $35,000 | $50,000 | $0 |
| Shrubland Stewardship | 2-2 | Complete Restoration and Maintenance - 27 acres | 21, 22, 23, 24, 64, 65, 66, 72 | 1340 | 140 | 1200 | $4,200 | $110,000 | $114,200 | $28,800 |
| Meadow Stewardship | 2-3 | Complete Restoration and Maintenance - 34 acres | 25, 29, 30, 31, 32, 38, 61, 62, 159. Former building area (63) represents 13 of the 36 total acres | 600 | 300 | 300 | $9,000 | $70,000 | $79,000 | $7,200 |

## Table 24 (continued). Detailed Goals for 10-Year Implementation Period

| Category | Goal | Activity | Mapped Area Number(s) | Total Estimated Level of Effort (All Hours) | Total Estimated Level of Effort (Staff Hours) | Total Estimated Level of Effort (Volunteer Hours) | Estimated Staff Costs @ $30/hour (Permanent and Seasonal) | Estimated Contractor / Material Cost | Total Cost | Volunteer Value @ $24/hour | Volunteer Support Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Invasive Species Eradication | 3-1 | Searching / Eradication - Blue Plantain Lily | 183 --> All Forests (especially streamside) | 50 | 20 | 30 | $600 | $50 | $650 | $720 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - Chinese Bushclover | 173, 177 --> All Meadows | 50 | 20 | 30 | $600 | $50 | $650 | $720 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - English Ivy | 50, 96 --> All Forests | 50 | 20 | 30 | $600 | $50 | $650 | $720 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - Japanese Aralia | 51 --> All | 55 | 5 | 50 | $150 | $50 | $200 | $1,200 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - Linden Viburnum | 20, 39, 76, 81, 121 --> All | 210 | 160 | 50 | $4,800 | $1,000 | $5,800 | $1,200 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - Oriental Photinia | 48, 70, 75, 77, 81, 89, 97-106, 112, 114, 116, 118, 119, 131, 133, 164 --> All Forests | 310 | 260 | 50 | $7,800 | $1,500 | $9,300 | $1,200 | Searching |
| Invasive Species Eradication | 3-1 | Searching / Eradication - Zelkova | 25, 31 --> All Meadows | 50 | 20 | 30 | $600 | $50 | $650 | $720 | Searching |
| Forest Stewardship | 3-2 | Selective Control - Asiatic Bittersweet | 4, 17, 48, 49, 56, 68, 99, 131, 133, 136, 137, 145, 182, 184 --> All Forests | 300 | 275 | 25 | $8,250 | $1,000 | $9,250 | $600 | Searching |
| Forest Stewardship | 3-2 | Selective Control - Winged Burning Bush | 17, 43, 76, 86, 115, 121, 129, 142, 158 --> All Forests | 300 | 275 | 25 | $8,250 | $1,000 | $9,250 | $600 | Searching |
| Meadow Stewardship | 3-2 | Selective Control - Autumn Olive | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 | Searching |
| Meadow Stewardship | 3-2 | Selective Control - Callery Pear | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 | Searching |
| Meadow Stewardship | 3-2 | Selective Control - Canada Thistle | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 | Searching |
| Meadow Stewardship | 3-2 | Selective Control - Catalpa | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 | Searching |
| Meadow Stewardship | 3-2 | Selective Control - Common Reed | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 | Searching |

## Table 24 (continued). Detailed Goals for 10-Year Implementation Period

| Category | Goal | Activity | Mapped Area Number(s) | Total Estimated Level of Effort (All Hours) | Total Estimated Level of Effort (Staff Hours) | Total Estimated Level of Effort (Volunteer Hours) | Estimated Staff Costs @ $30/hour (Permanent and Seasonal) | Estimated Contractor / Material Cost | Total Cost | Volunteer Value @ $24/hour |
|---|---|---|---|---|---|---|---|---|---|---|
| Meadow Stewardship | 3-2 | Selective Control - Mugwort | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 |
| Meadow Stewardship | 3-2 | Selective Control - Reed Canary Grass | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 |
| Meadow Stewardship | 3-2 | Selective Control - Toringo Crabapple | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 |
| Meadow Stewardship | 3-2 | Selective Control - Tree-of-Heaven | Accounted for under other activities | 0 | 0 | 0 | $0 | $0 | $0 | $0 |
| Forest Stewardship | 3-3 | Maintenance of Clean Areas, especially canopy gaps - 65 acres | 70, 71, 77, 78, 121, 125, 127, 128, 129, 161, 163 | 600 | 600 | 0 | $18,000 | $2,500 | $20,500 | $0 |
| Ecological Monitoring | 4-1 | Floristic Quality Assessment / Survey | All | 10 | 10 | 0 | $300 | $5,000 | $5,300 | $0 |
| Ecological Monitoring | 4-2 | Ecological Health Monitoring (Habitat Monitoring) | All | 330 | 270 | 60 | $8,100 | $1,000 | $9,100 | $1,440 |
| Rare Species Stewardship | 4-3 | Monitoring and Stewardship of Rare Plants and Animals | All | 1250 | 250 | 1000 | $7,500 | $1,000 | $8,500 | $24,000 |
| Deer Management | 5-1 | Coordinate with Hopewell Township Deer Management Advisory Committee | All | 250 | 0 | 250 | $0 | $0 | $0 | $6,000 |
| Deer Management | 5-1 | Cooridnate deer management with nearby land owners (public and private) | All | 250 | 250 | 250 | $7,500 | $0 | $7,500 | $6,000 |
| **Totals** | | | | **9,935** | **5,005** | **5,180** | **$150,150** | **$725,450** | **$875,600** | **$124,320** |

## Table 25. Goal Priorities and Costs by Plan Year

| | | | | Cost by Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Goal** | **Activity** | **Priority*** | **Total Cost** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** |
| 1-1 | Trail Creation and Maintenance (excluding LHT) | 1 | $6,000 | $0 | $2,500 | $700 | $500 | $500 | $500 | $325 | $325 | $325 | $325 |
| 1-2 | Signage, Kiosks, Displays | 1 | $14,400 | $2,500 | $7,700 | $1,600 | $500 | $350 | $350 | $350 | $350 | $350 | $350 |
| 1-2 | Arboretum Branch plantings | 3 | $11,000 | $0 | $0 | $0 | $7,000 | $2,000 | $400 | $400 | $400 | $400 | $400 |
| 1-3 | Guided Hikes (5 per year) | 1 | $3,500 | $350 | $350 | $350 | $350 | $350 | $350 | $350 | $350 | $350 | $350 |
| 1-4 | Preserve Management & Maintenance | 1 | $5,500 | $2,750 | $800 | $300 | $300 | $300 | $300 | $300 | $150 | $150 | $150 |
| 1-5 | Parking lot replacement | 3 | $382,200 | $0 | $0 | $0 | $0 | $0 | $382,200 | $0 | $0 | $0 | $0 |
| 1-5 | Public Amenities - picnic pavillion and composting toilets | 3 | $29,500 | $0 | $0 | $0 | $0 | $0 | $28,000 | $600 | $300 | $300 | $300 |
| 2-1 | Forest Restoration as 1) Wildflower Restoration and 2) Canopy Gap Protection Fencing (20 selected 1/4 acre patches for each activity) | 3 | $93,000 | $0 | $37,500 | $32,100 | $11,200 | $3,700 | $2,200 | $2,200 | $1,450 | $1,450 | $1,200 |
| 2-2 | 'Guided' Succession from Meadow to Shrubland (13 acres) -- Treatment of Invasive Shrubs and Trees | 2 | $50,000 | $1,500 | $6,500 | $6,500 | $6,500 | $6,500 | $6,500 | $6,500 | $6,500 | $1,500 | $1,500 |
| 2-2 | Complete Shrubland Restoration and Maintenance - 27 acres | 3 | $114,200 | $0 | $0 | $101,500 | $7,600 | $1,100 | $800 | $800 | $800 | $800 | $800 |
| 2-3 | Complete Meadow Restoration and Maintenance - 34 acres | 3 | $79,000 | $0 | $51,500 | $11,500 | $11,500 | $900 | $900 | $900 | $600 | $600 | $600 |
| 3-1 | Searching / Eradication - Multiple Emerging Invasive Species (See Table 24) | 1 | $17,900 | $2,565 | $5,035 | $2,135 | $2,135 | $1,505 | $905 | $905 | $905 | $905 | $905 |
| 3-2 | Selective Control - Multiple Invasive Species (See Table 24) | 1 | $18,500 | $800 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $1,700 |
| 3-3 | Maintenance of Clean Forest Areas, especially canopy gaps - 65 acres | 1 | $20,500 | $1,750 | $1,750 | $1,750 | $2,500 | $2,500 | $2,500 | $2,500 | $1,750 | $1,750 | $1,750 |
| 4-1 | Floristic Quality Assessment / Survey | 2 | $5,300 | $0 | $5,300 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 4-2 | Ecological Health Monitoring (Habitat Monitoring) | 2 | $9,100 | $1,300 | $1,000 | $850 | $850 | $850 | $850 | $850 | $850 | $850 | $850 |
| 4-3 | Monitoring and Stewardship of Rare Plants and Animals | 2 | $8,500 | $850 | $850 | $850 | $850 | $850 | $850 | $850 | $850 | $850 | $850 |
| 5-1 | Coordinate with Hopewell Township Deer Management Advisory Committee | 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5-1 | Cooridnate deer management with nearby land owners (public and private) | 1 | $7,500 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 |
| **Totals** | | | **$875,600** | **$15,115** | **$123,535** | **$162,885** | **$54,535** | **$24,155** | **$430,355** | **$20,580** | **$18,330** | **$13,330** | **$12,780** |

*1 = Minimum requirement to effectively manage Preserve
2 = Relatively Low Cost goals to reach higher management standards
3 = Relatively High Cost goals to reach highest management standards

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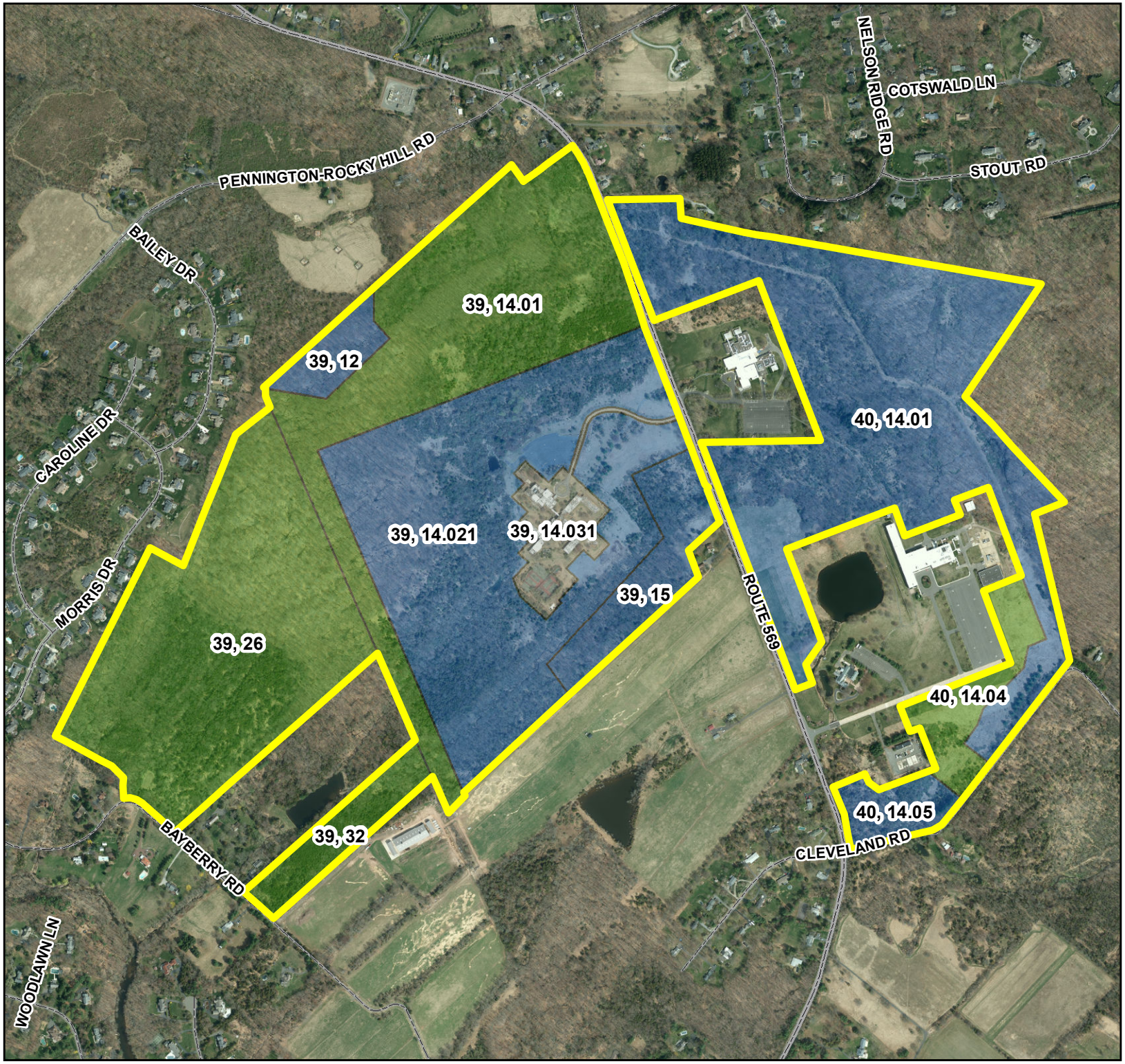
Beautiful stand of Indian Grass growing in a meadow at the Mount Rose Preserve.

# Mount Rose Stewardship Plan

# Preserve Maps




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 1.**

**Preserve Boundaries and Ownership**

**Legend**

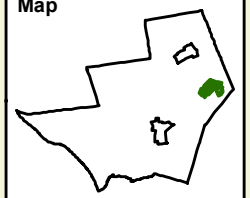
- Preserve Boundary

**Owner**

- Hopewell Township
- Partnership
- Private

N

**Locator Map**



0 500 1,000 Feet


FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 2.**

**Bedrock Geology**

**Legend**

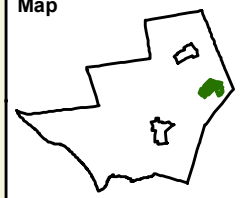
Preserve Boundary

**GEONAME**

- Jurassic Diabase
- Passaic Formation
- Passaic Formation Gray bed

N

**Locator Map**



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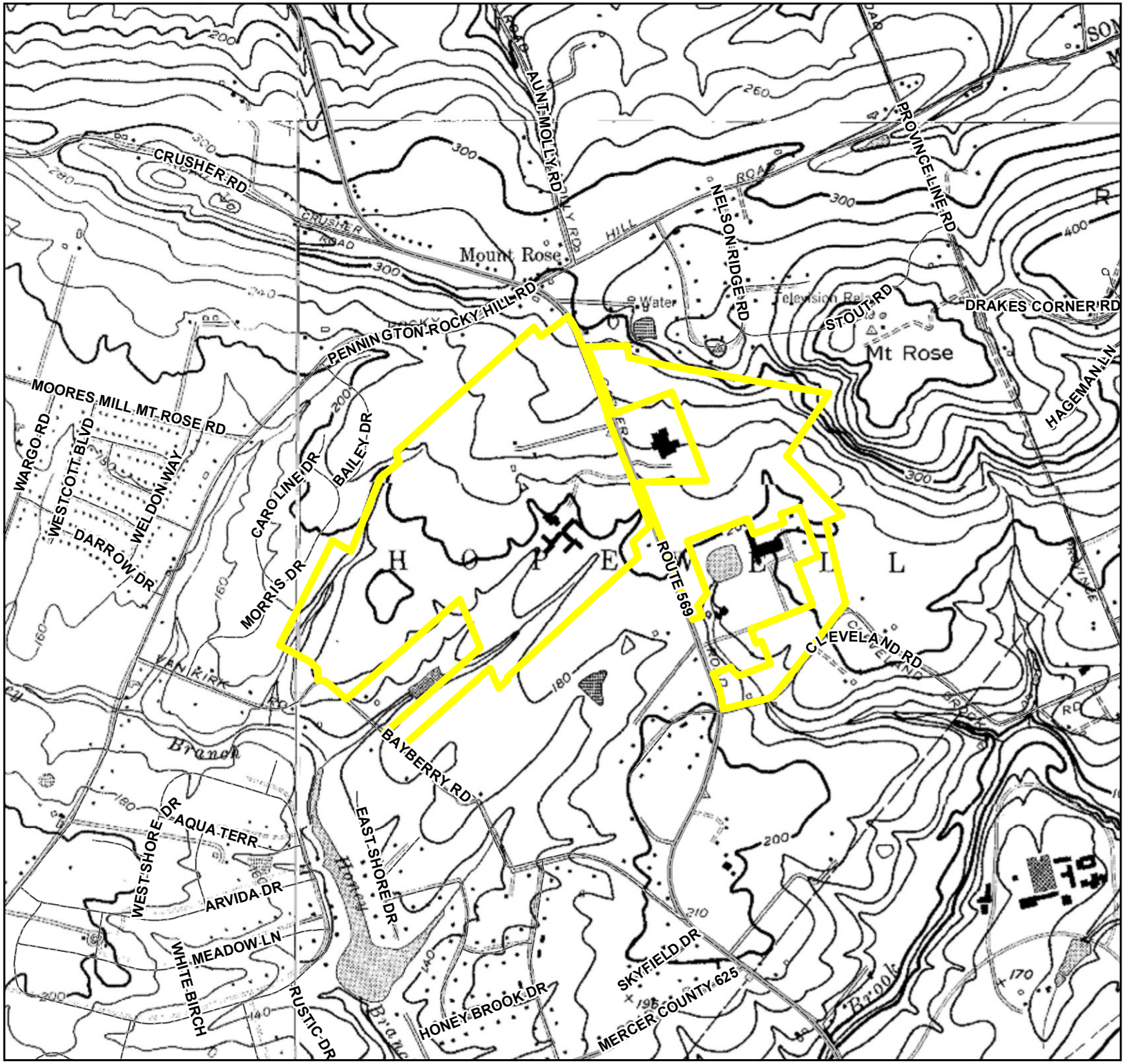



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 3.**

**Topography**

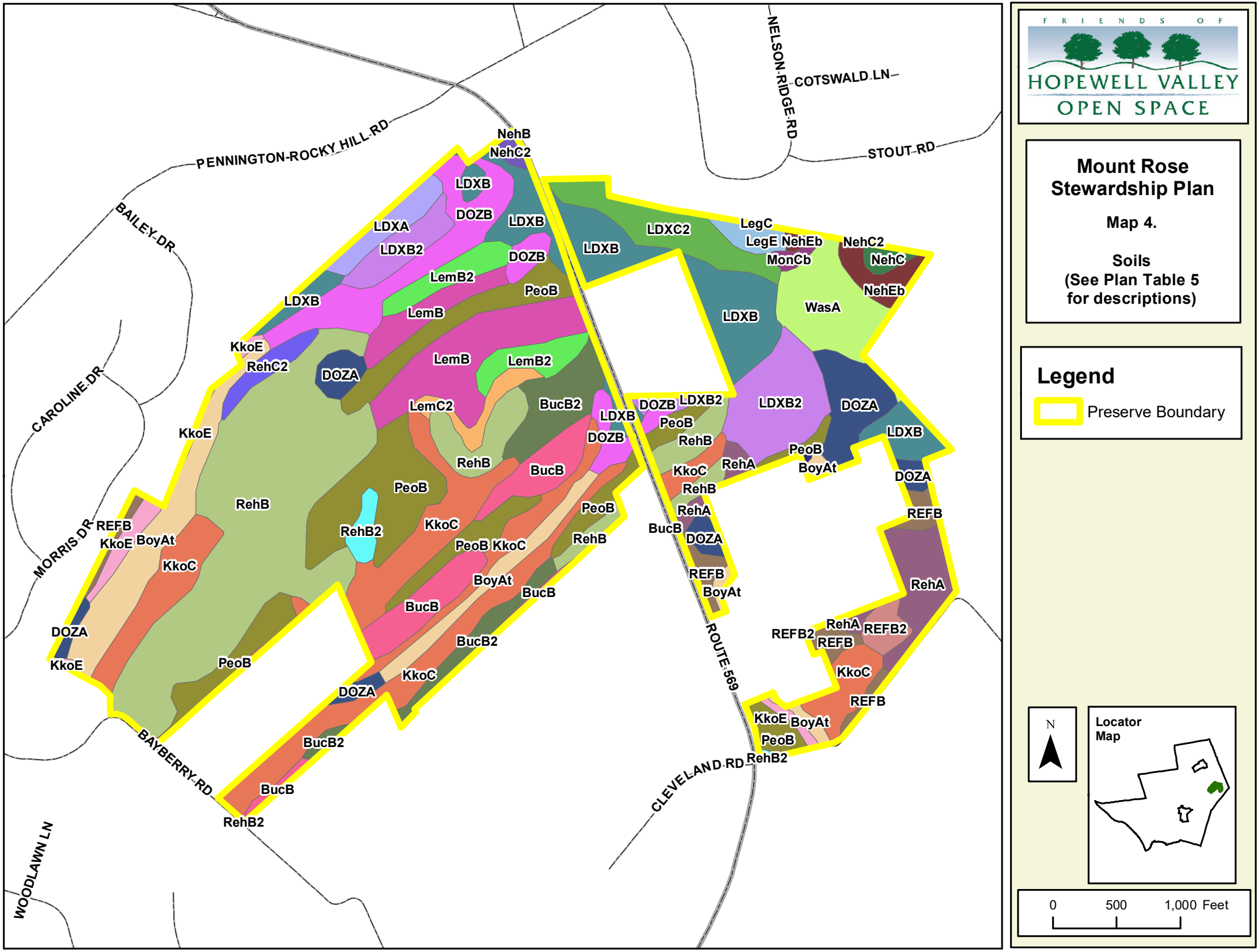
## Legend

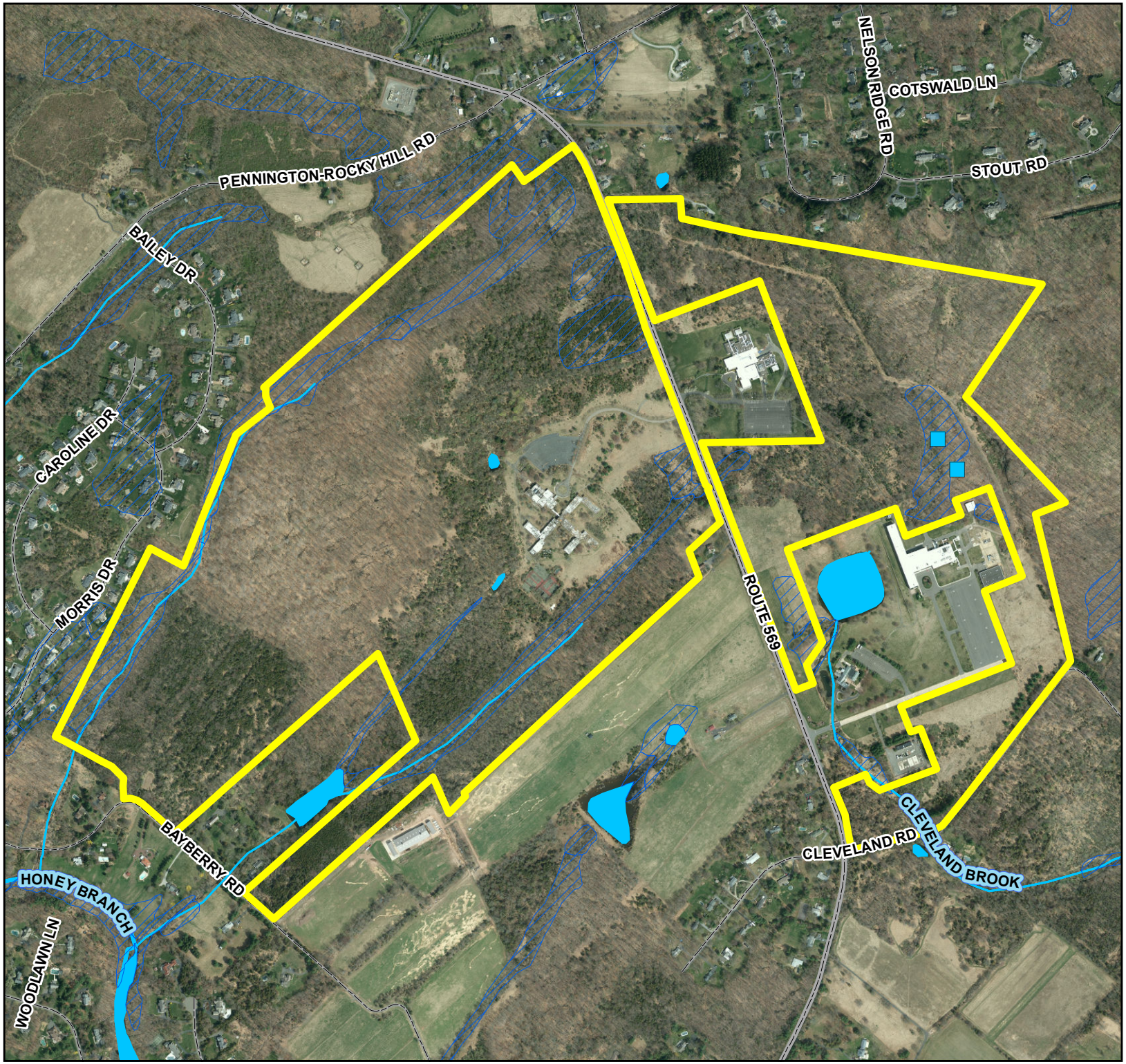
Preserve Boundary

N

Locator Map

0 1,000 2,000 Feet


FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE
Mount Rose
Stewardship Plan
Map 4.
Soils
(See Plan Table 5
for descriptions)
Legend
Preserve Boundary
N
Locator
Map
0
500
1,000 Feet
PENNINGTON-ROCKY HILL RD
BAILEY DR
CAROLINE DR
MORRIS DR
BAYBERRY RD
WOODLAWN LN
NELSON RIDGE RD
COTSWALD LN
STOUT RD
ROUTE 569
CLEVELAND RD
NehB
NehC2
LDXB
DOZB
LDXA
LDXB2
LemB2
PeoB
LemB
KkoE
RehC2
DOZA
LemC2
BucB2
RehB
BucB
PeoB
RehB2
KkoC
BoyAt
REFB
LDXC2
LegC
LegE
NehEb
MonCb
NehC
WasA
LDXB2
RehA
REFB2




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 5.**

**Streams, Ponds, Wetlands and Vernal Pools**

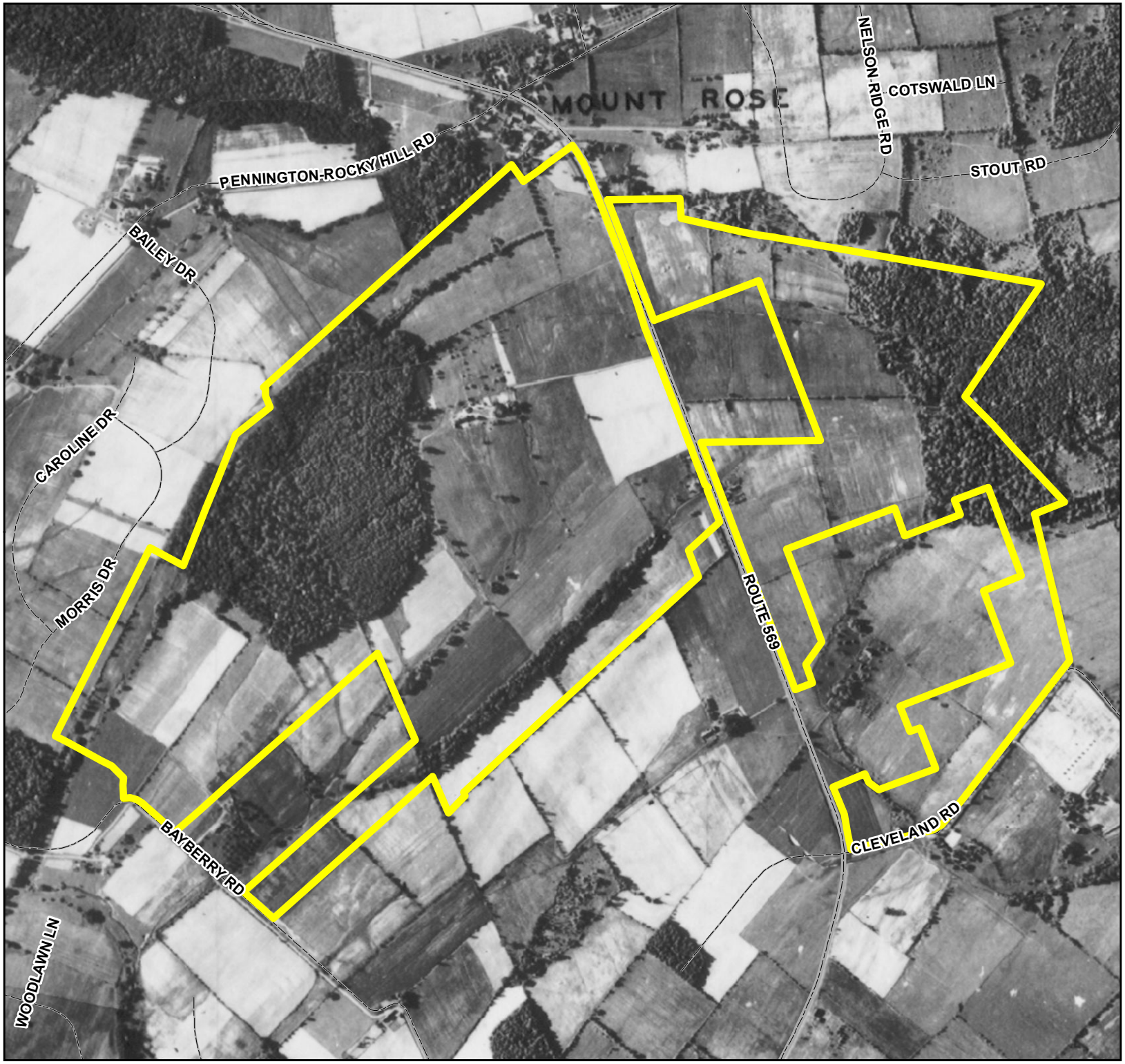
## Legend

- Preserve Boundary
- Wetlands
- Streams
- Potential Vernal Pool

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 6.**

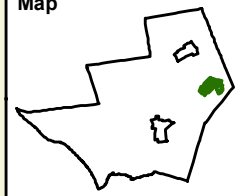
**Historical Aerial Photography 1930**

**Legend**

Preserve Boundary

N

**Locator Map**



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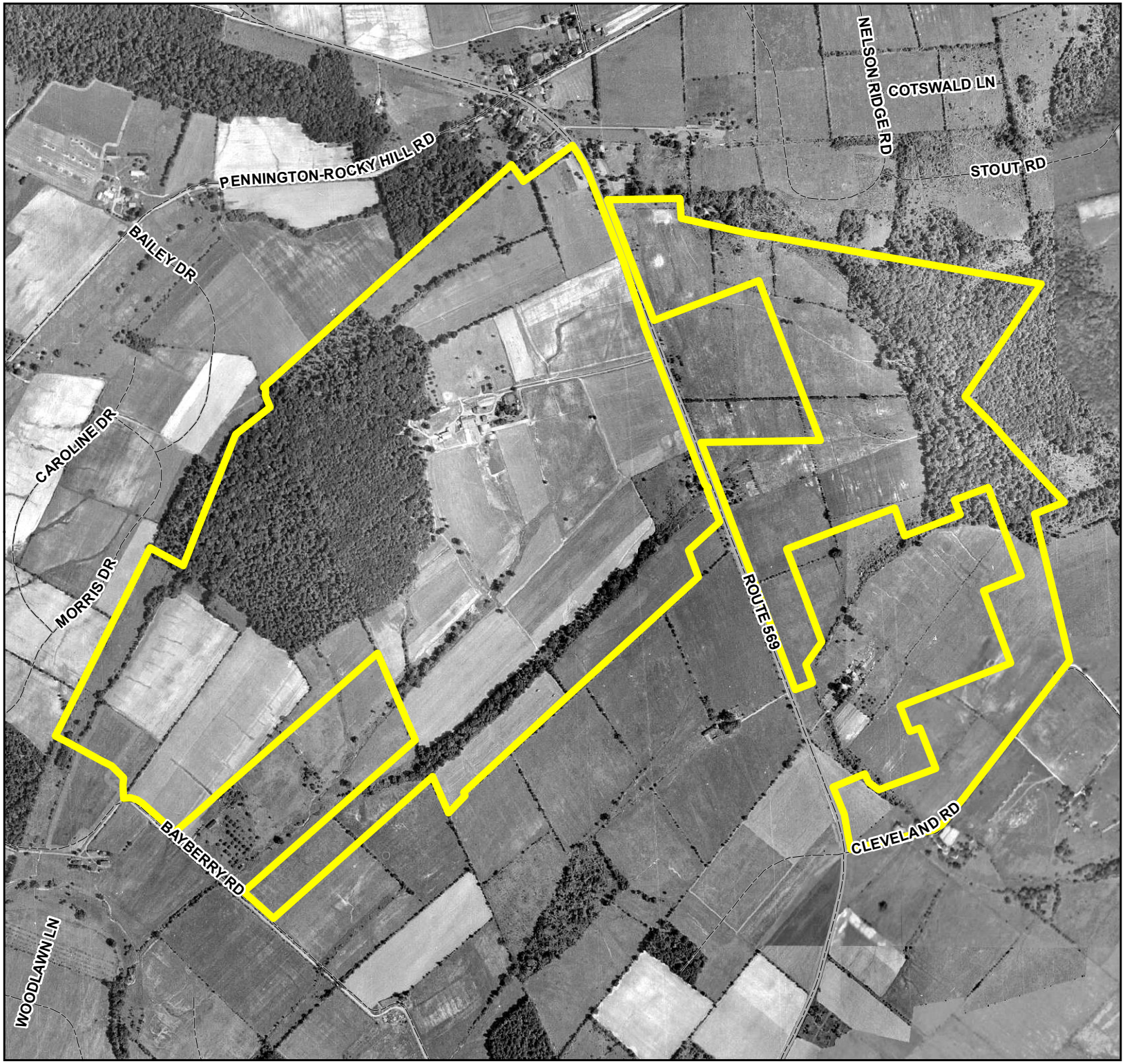



FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 7.**

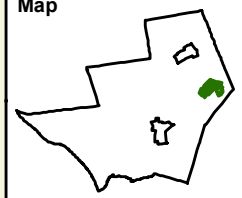
**Historical Aerial Photography 1940**

**Legend**

Preserve Boundary

N

**Locator Map**



0 500 1,000 Feet


FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 8.**

**Historical Aerial Photography 1953**

**Legend**

Preserve Boundary

N

**Locator Map**

0 500 1,000 Feet


FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 9.**

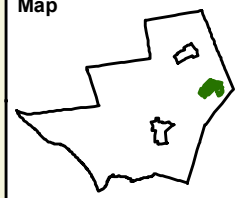
**Historical Aerial Photography 1963**

**Legend**

Preserve Boundary

N

**Locator Map**



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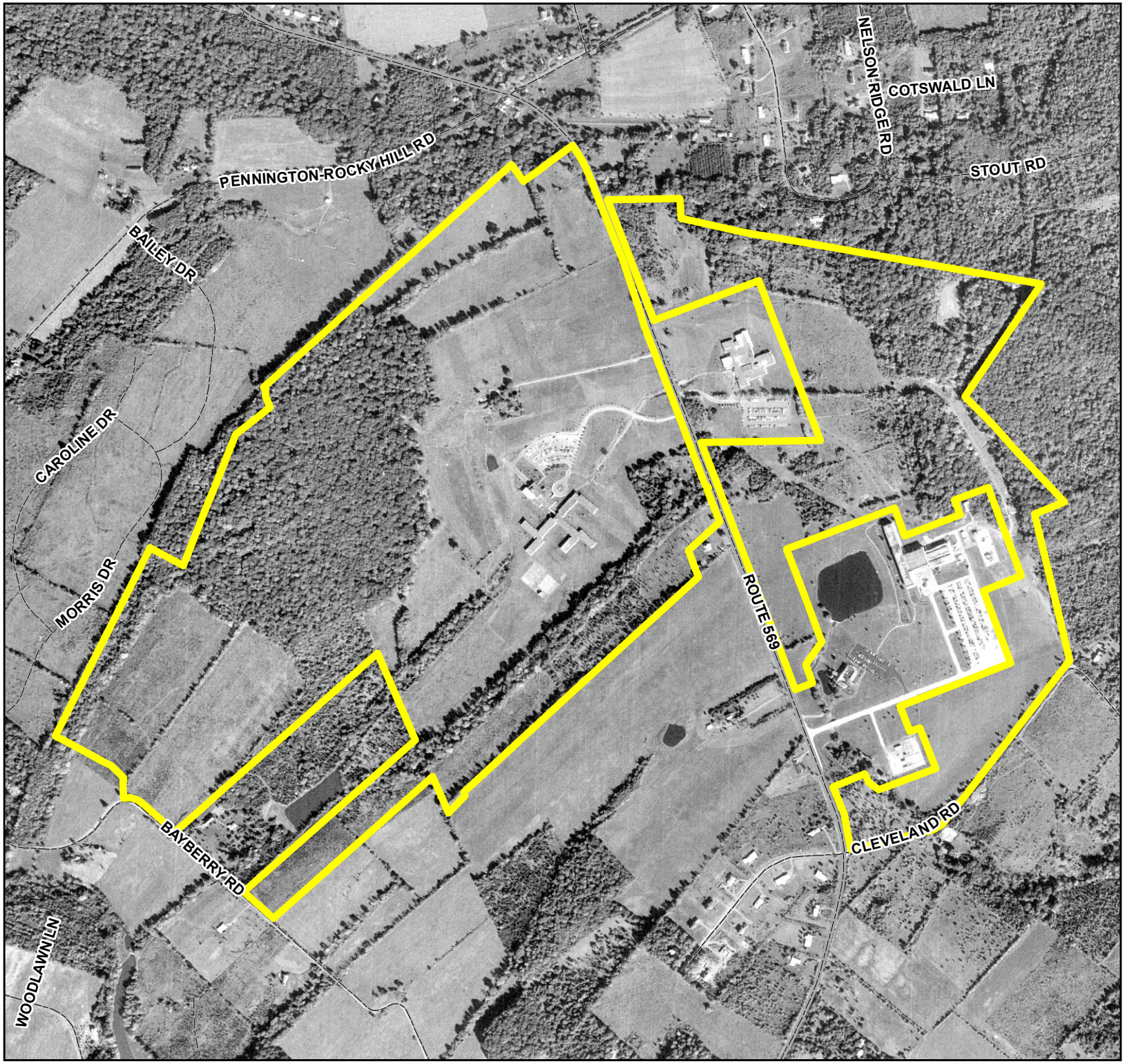



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 10.**

**Historical Aerial Photography 1971**

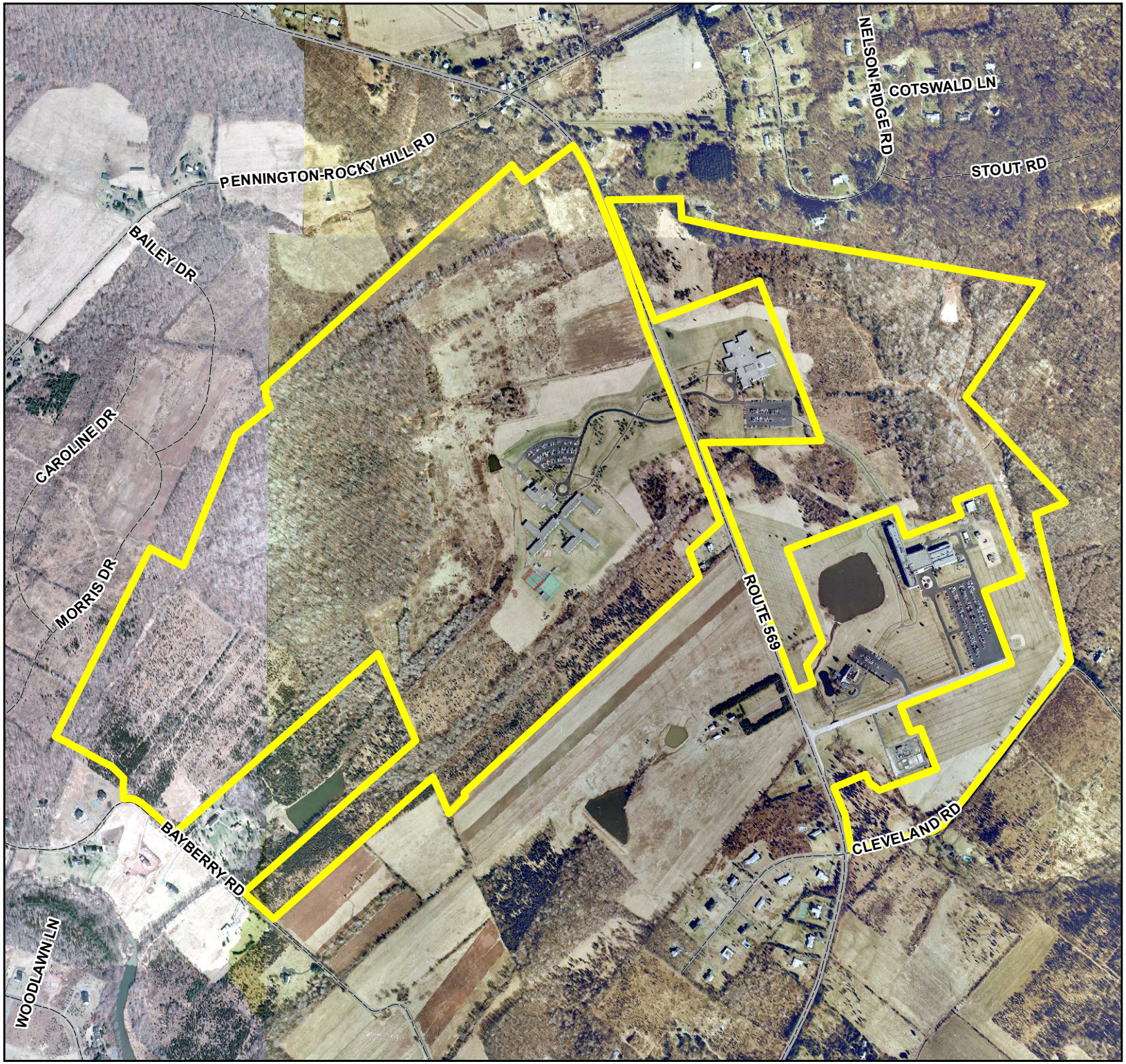
**Legend**

Preserve Boundary

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 11.**

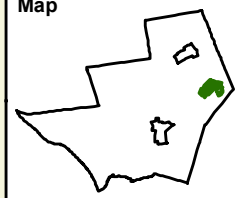
**Historical Aerial Photography 1979**

**Legend**

Preserve Boundary

N

**Locator Map**



0 500 1,000 Feet


FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 12.**

**Historical Aerial Photography 1995**

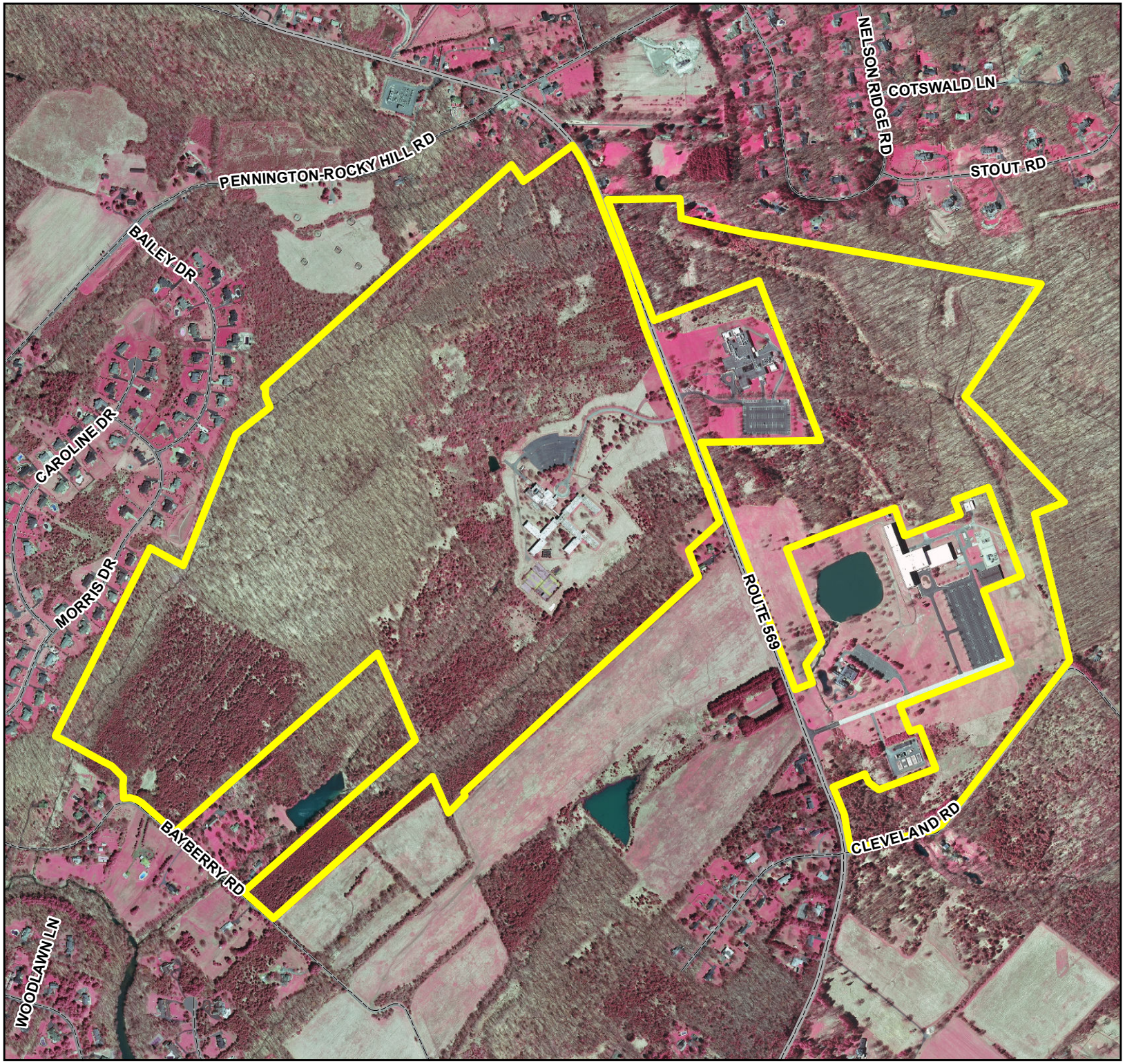
**Legend**

Preserve Boundary

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 13.**

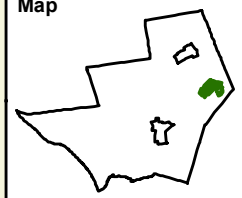
**Historical Aerial Photography 2007**

**Legend**

Preserve Boundary

N

**Locator Map**



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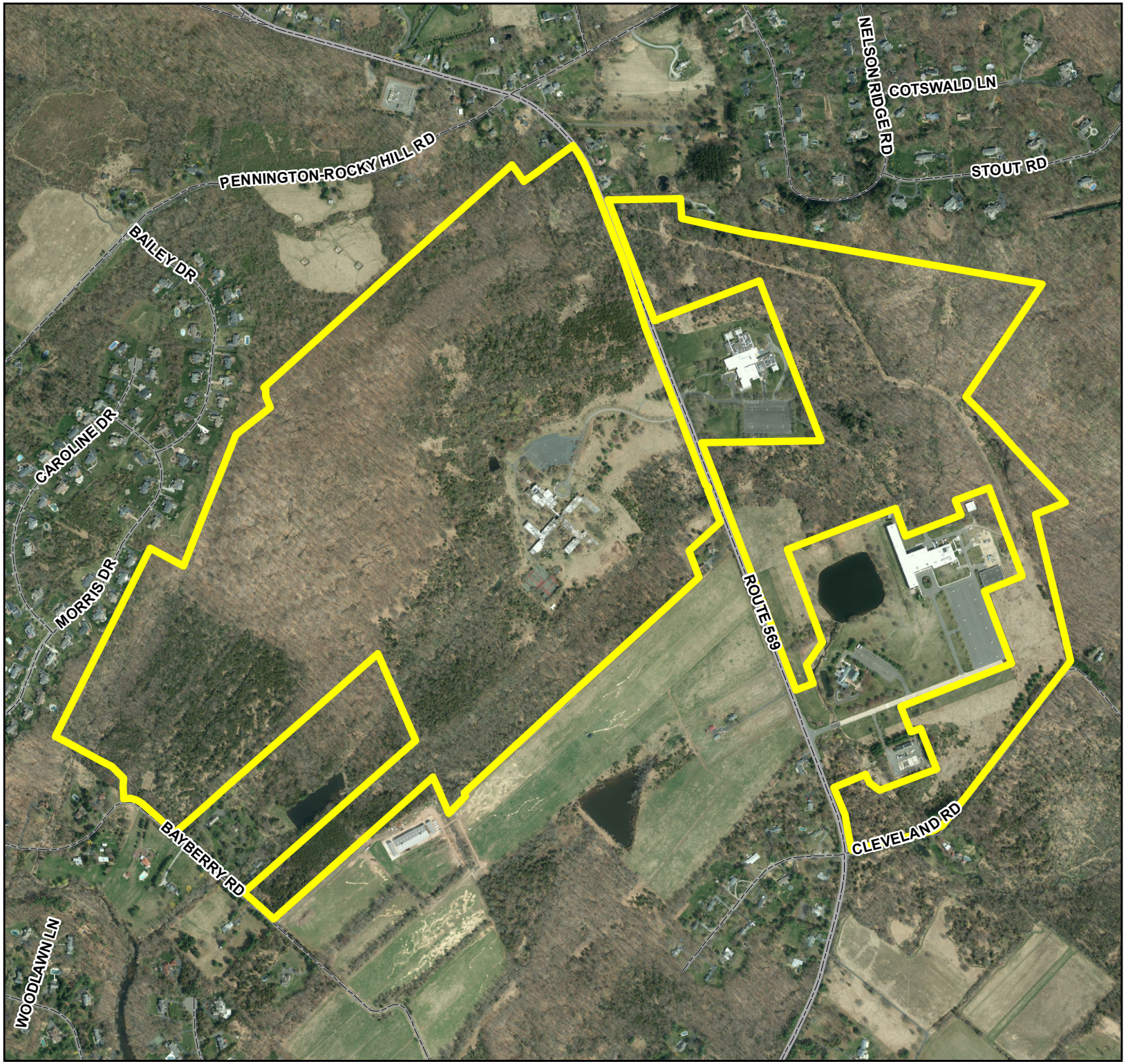



FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 14.**

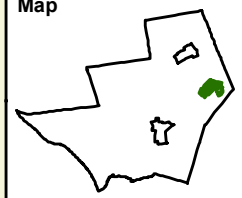
**Current Aerial Photography 2015**

**Legend**

Preserve Boundary

N

**Locator Map**



0 500 1,000 Feet


FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 15.**

**Broad Land Cover Types (2012)**

## Legend

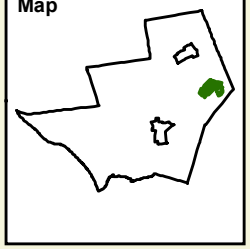
- Preserve Boundary

**Broad Land Cover Types**

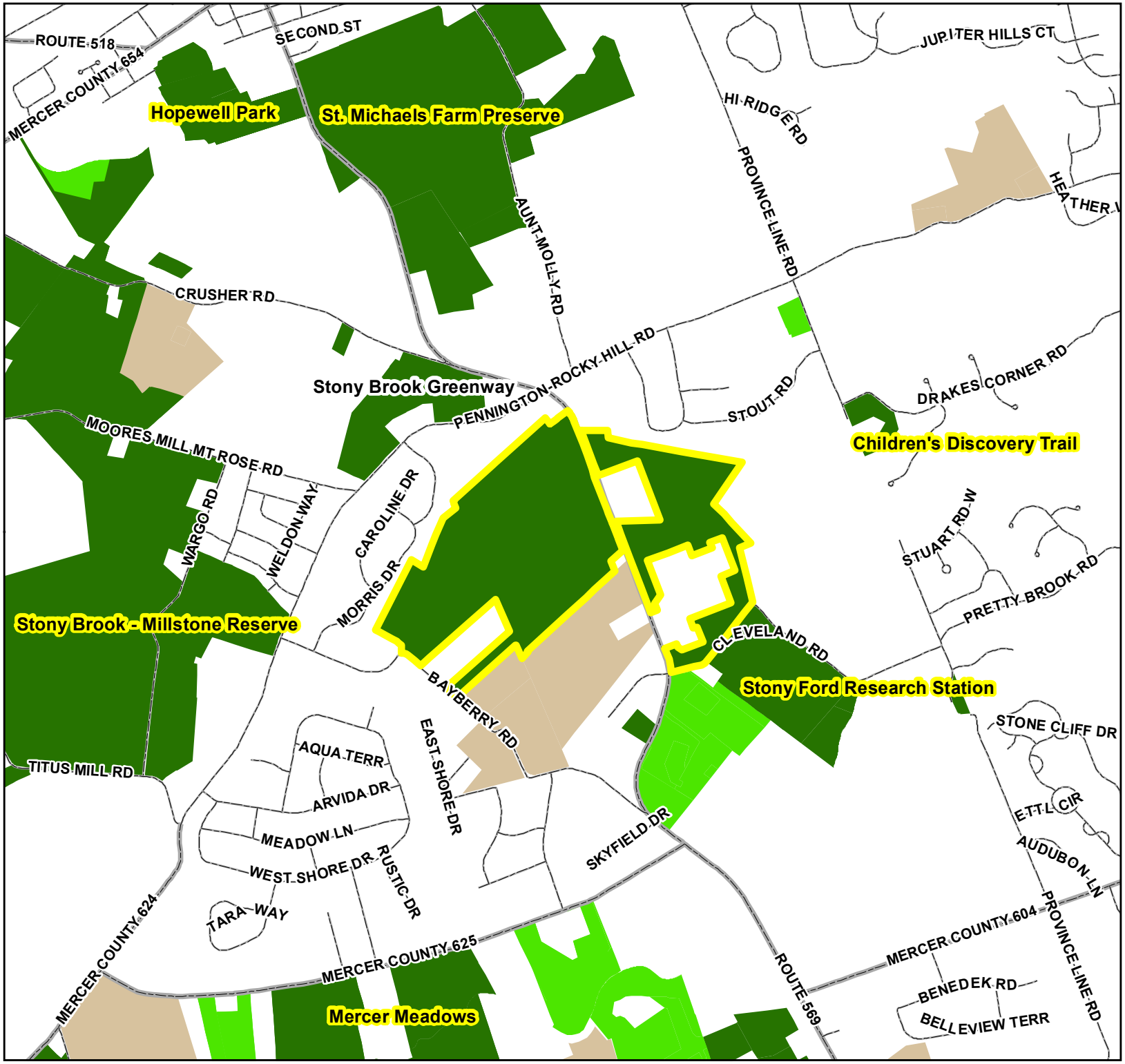
- Natural Cover
- Water
- Agriculture
- Barren Land
- Developed Land

N

**Locator Map**



0 1,000 2,000 3,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 16.**

**Protected Lands**

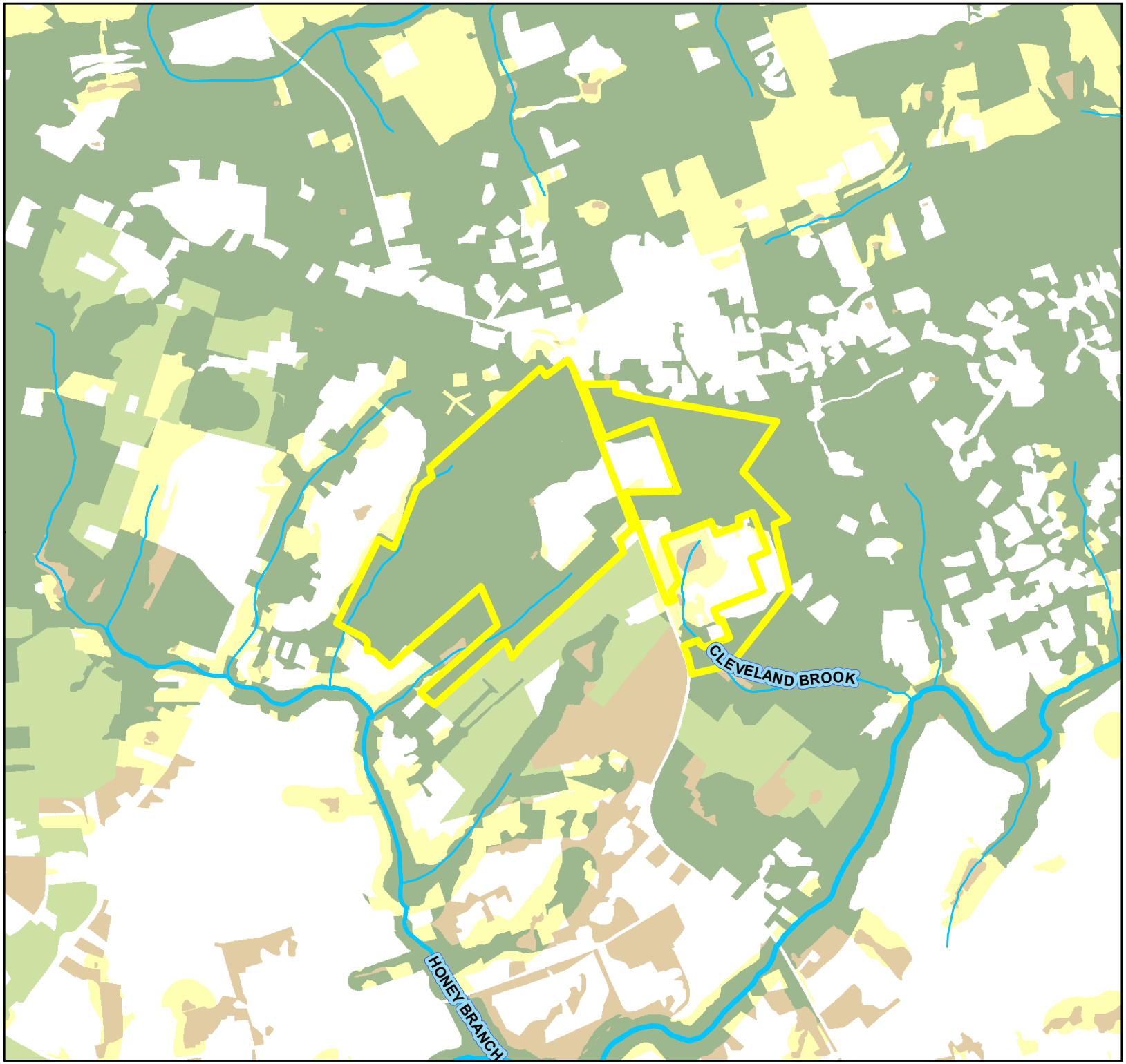
## Legend

- Preserve Boundary
- Protected Open Space
- Conservation Easement
- Preserved Farmland

N

Locator Map

0 1,000 2,000 3,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 17.**

**Landscape Project Habitat Patch Ranks**

**Legend**

- Preserve Boundary
- Streams

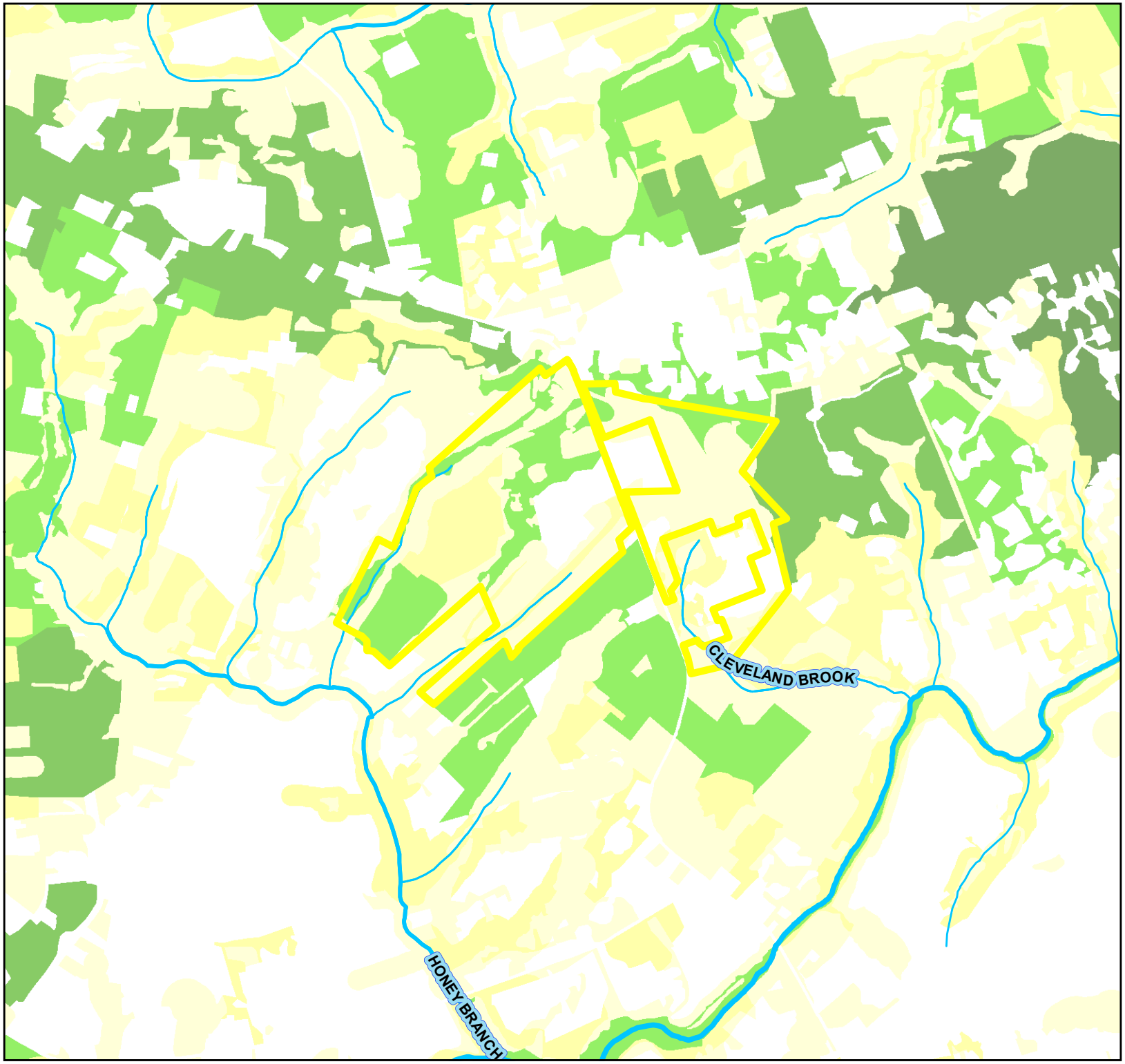
**Habitat Patch Ranks**

- Rank 1 - No Rare Species
- Rank 2 - Special Concern
- Rank 3 - State Threatened
- Rank 4 - State Endangered
- Rank 5 - Federal Listed

N

**Locator Map**

0 1,000 2,000 3,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 18.**

**Landscape Project Habitat Patch Sizes**

**Legend**

- Preserve Boundary
- Streams

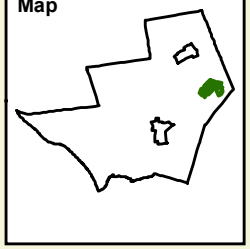
**Habitat Patch Sizes**

**Acres**

- < 10 acres
- 10 - 25 acres
- 25 - 100 acres
- 100 - 250 acres
- > 250 acres

N

**Locator Map**



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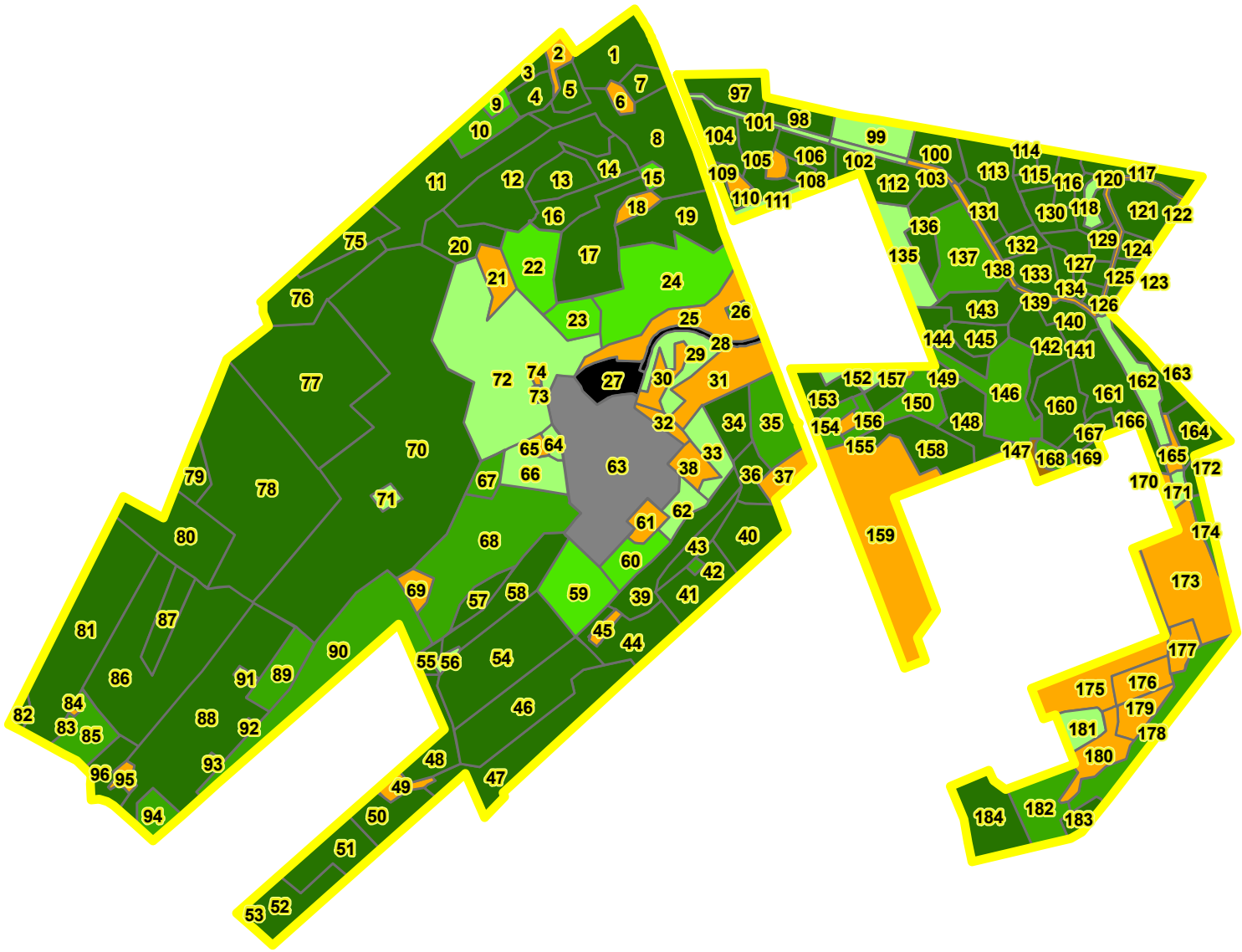


FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 19.**

**Ecological Communities - Broad Types**

**Legend**

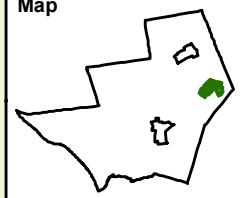
- Preserve Boundary

**Community Type**

- Forest
- Woodland
- Shrubland - Woodland
- Shrubland
- Meadow
- Pond
- Lawn
- Disturbed Area
- Paved

N

**Locator Map**



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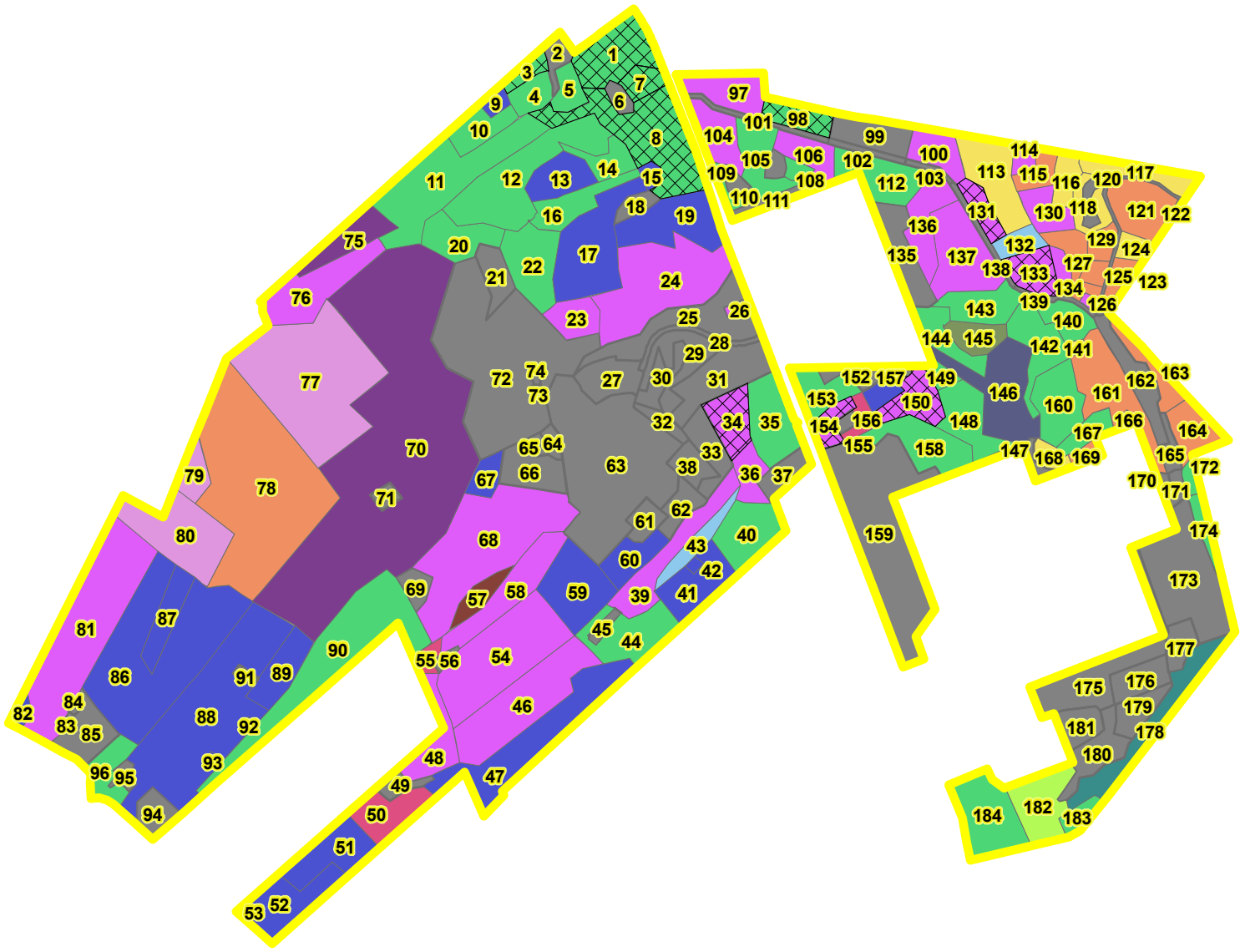


FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Map 20.

## Ecological Communities - Dominant Tree Species

**Legend**

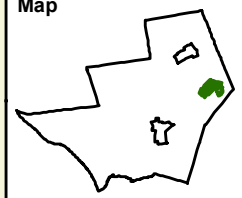
- Preserve Boundary
- Ash Decline Area

**Dominant Canopy Tree**

- NA
- Ash
- Beech
- Black Cherry
- Black Locust
- Norway Spruce
- Pin Oak
- Red Cedar
- Red Maple
- Shagbark Hickory
- Sugar Maple
- Sweet Birch
- Tulip Poplar
- White Oak
- White Pine

N

**Locator Map**



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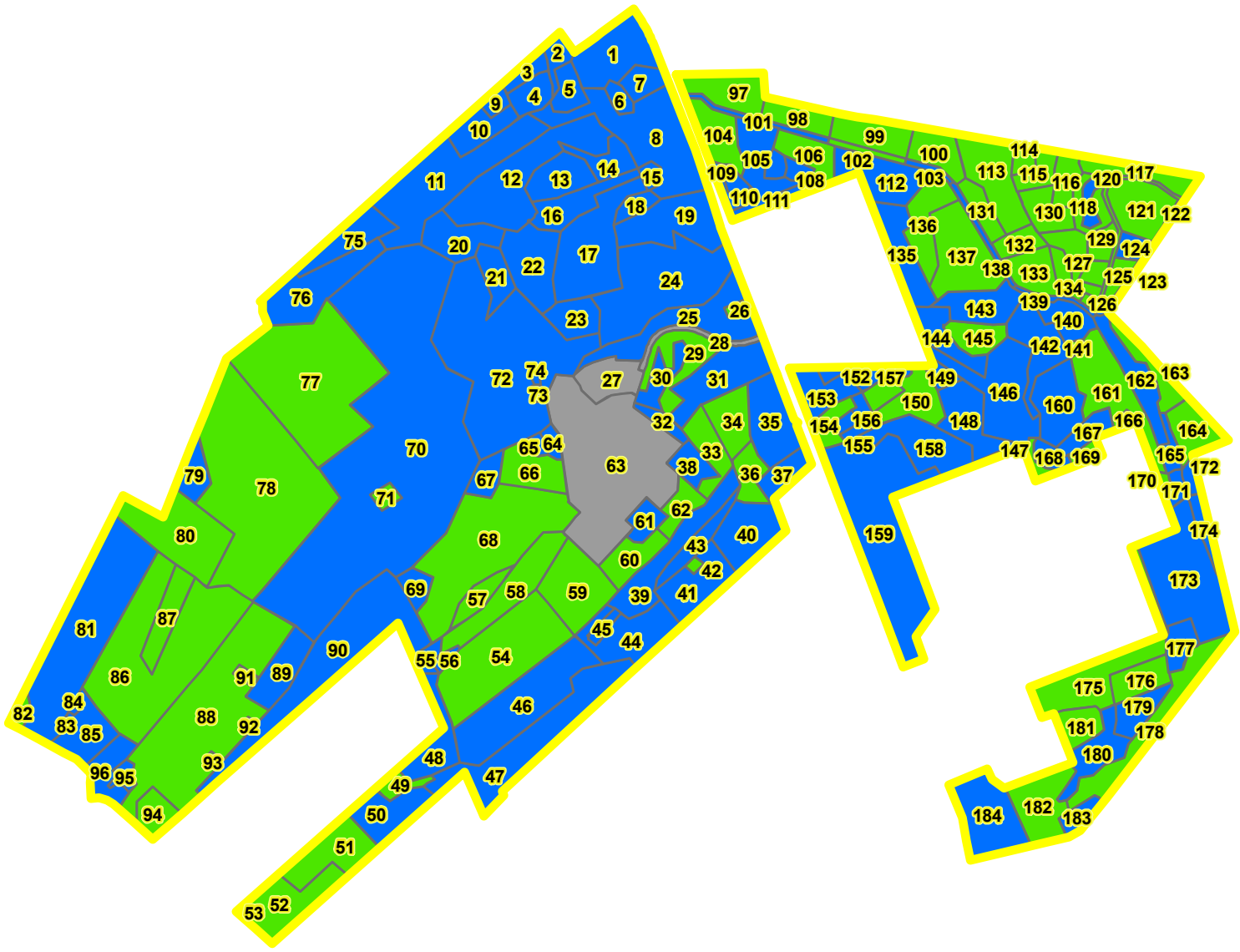


FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 21.**

**Ecological Communities - Soil Moisture**

**Legend**

Preserve Boundary

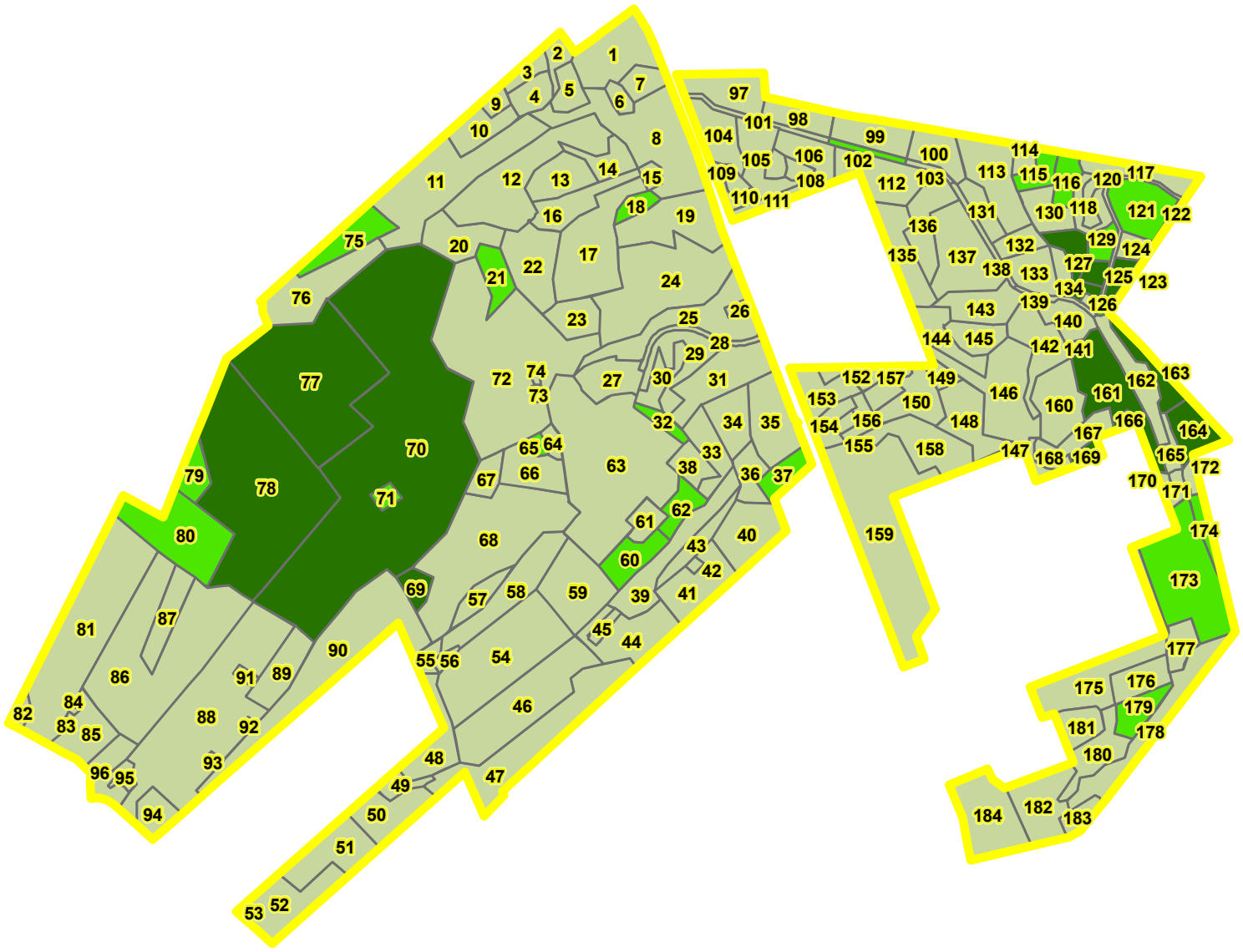
**Soil Moisture Category**

- N/A
- Upland
- Wet-Moist

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 22.**

**Ecological Communities - Relative Patch Quality**

**Legend**

- Preserve Boundary

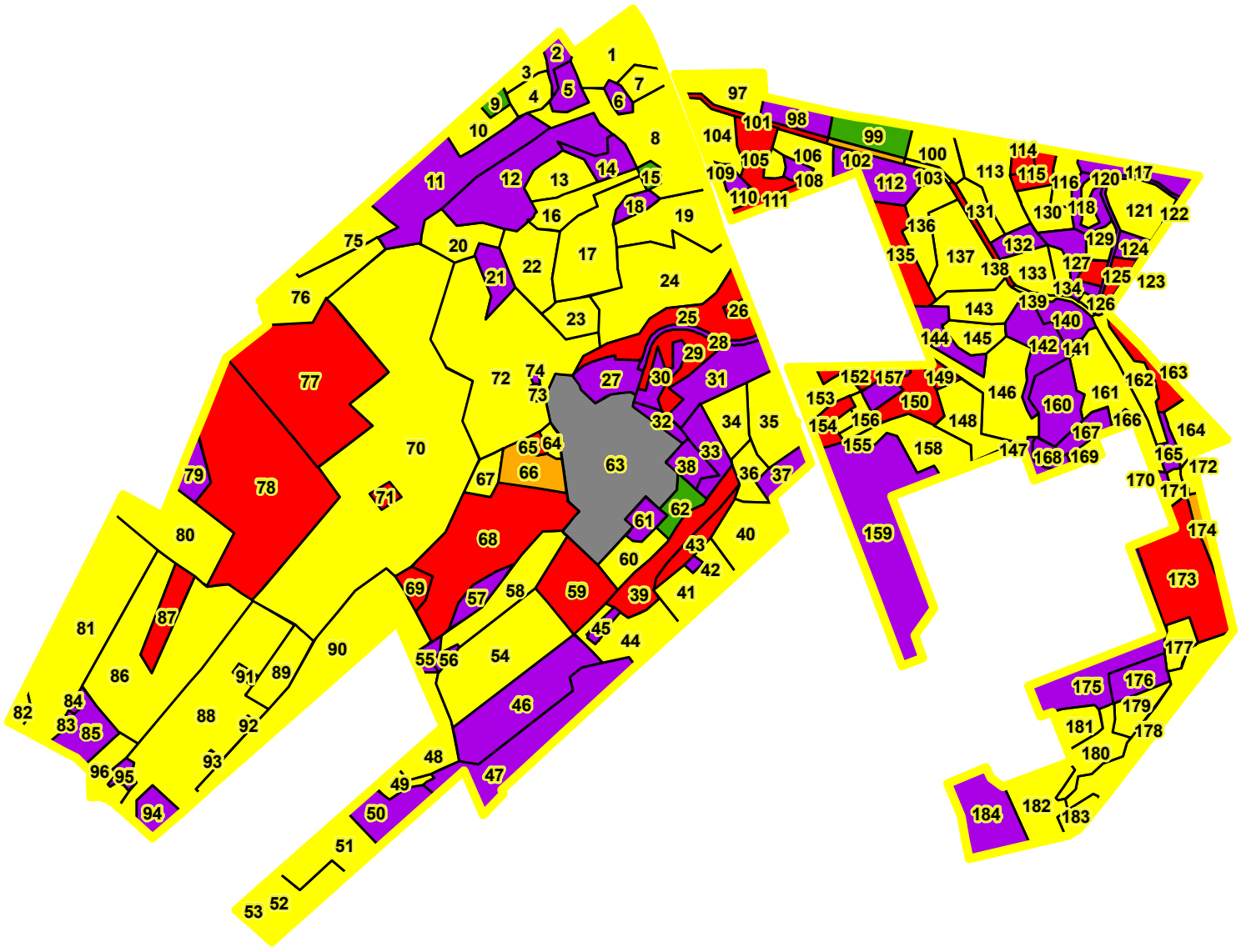
**Relative Quality Category**

- High
- Moderate
- Low

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 23.**

**Ecological Communities - Native Shrub Cover**

**Legend**

- Preserve Boundary

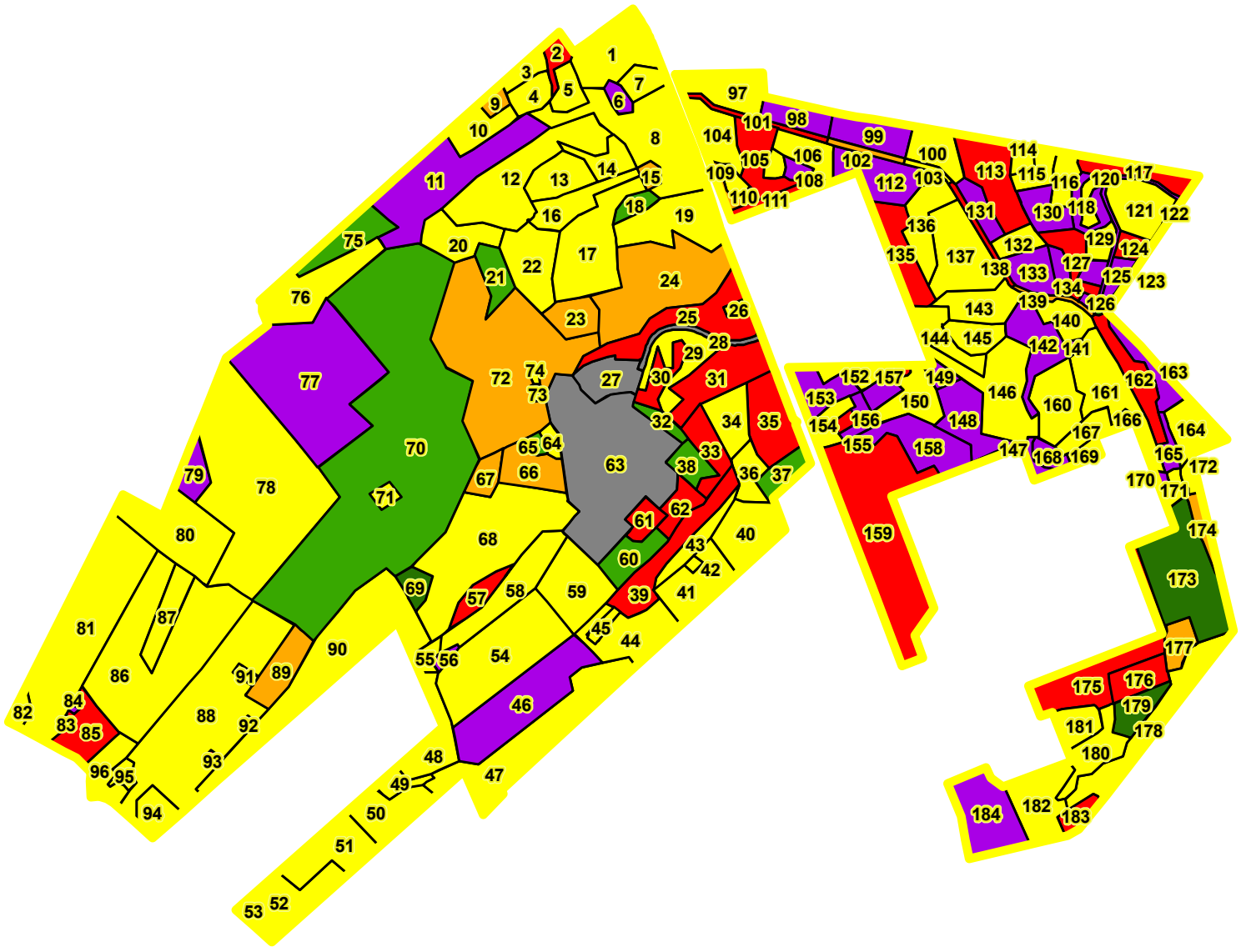
**Native Shrub Cover**

- N/A
- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 24.**

**Ecological Communities - Native Herb Cover**

**Legend**

- Preserve Boundary

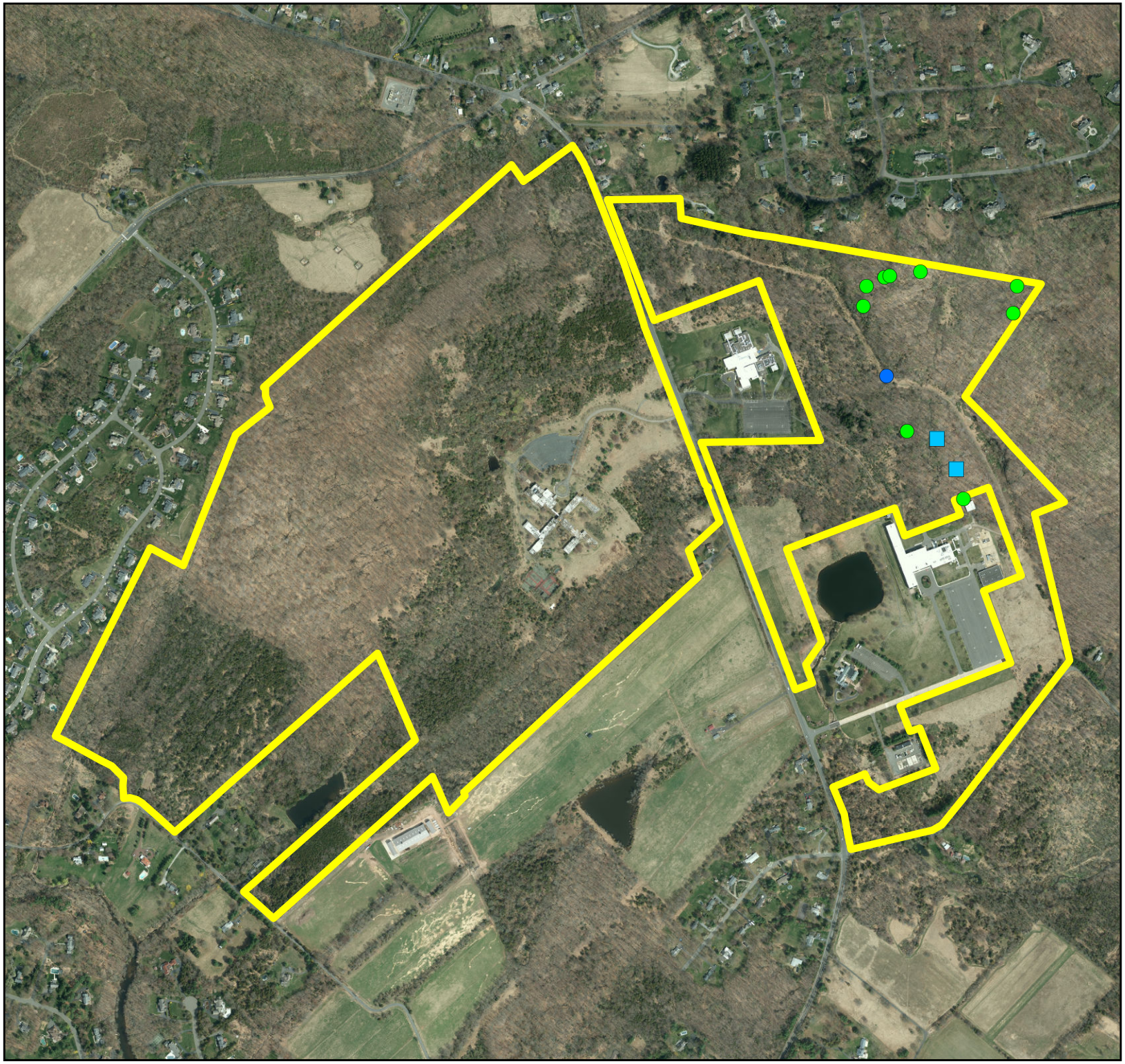
**Native Herb Cover**

- N/A
- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 25.**

**Rare Plants**

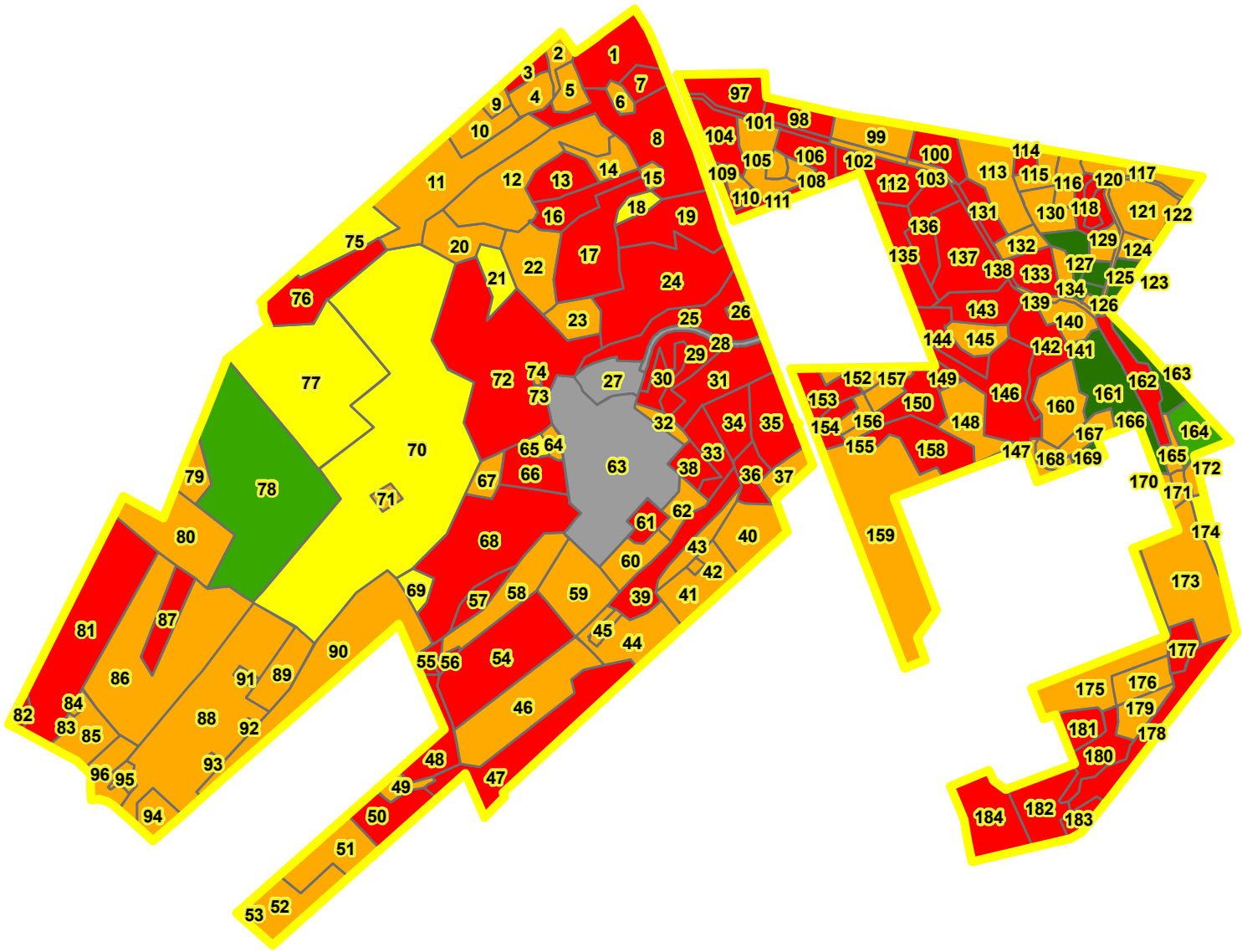
**Legend**

- Preserve Boundary
- Wild Comfrey
- Leatherwood
- Potential Vernal Pool

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 26.**

**Cumulative Infestation Severity by Mapped Patch**

## Legend

- Preserve Boundary

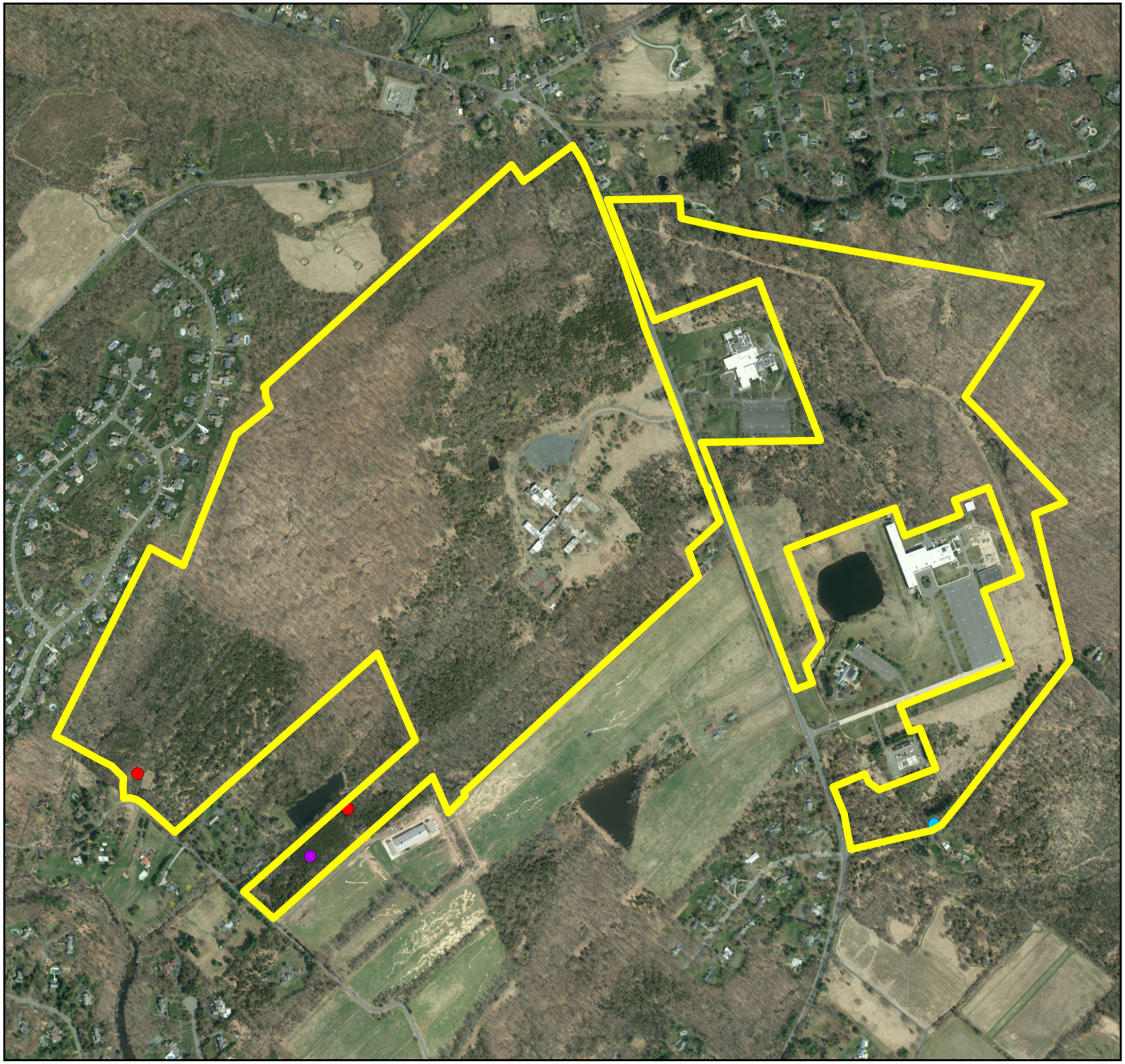
**Infesation Level Category**

- "Clean"
- Low
- Moderate
- High
- Very High
- Developed

N

**Locator Map**

0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 27.**

**Emerging Invasive Species**

## Legend

Preserve Boundary

**Emerging Invasive Species**

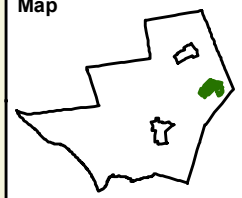
- English ivy
- Japanese angelica tree
- blue plantain lily

**Please note that other emerging species are recorded within mapped patches. These include:**

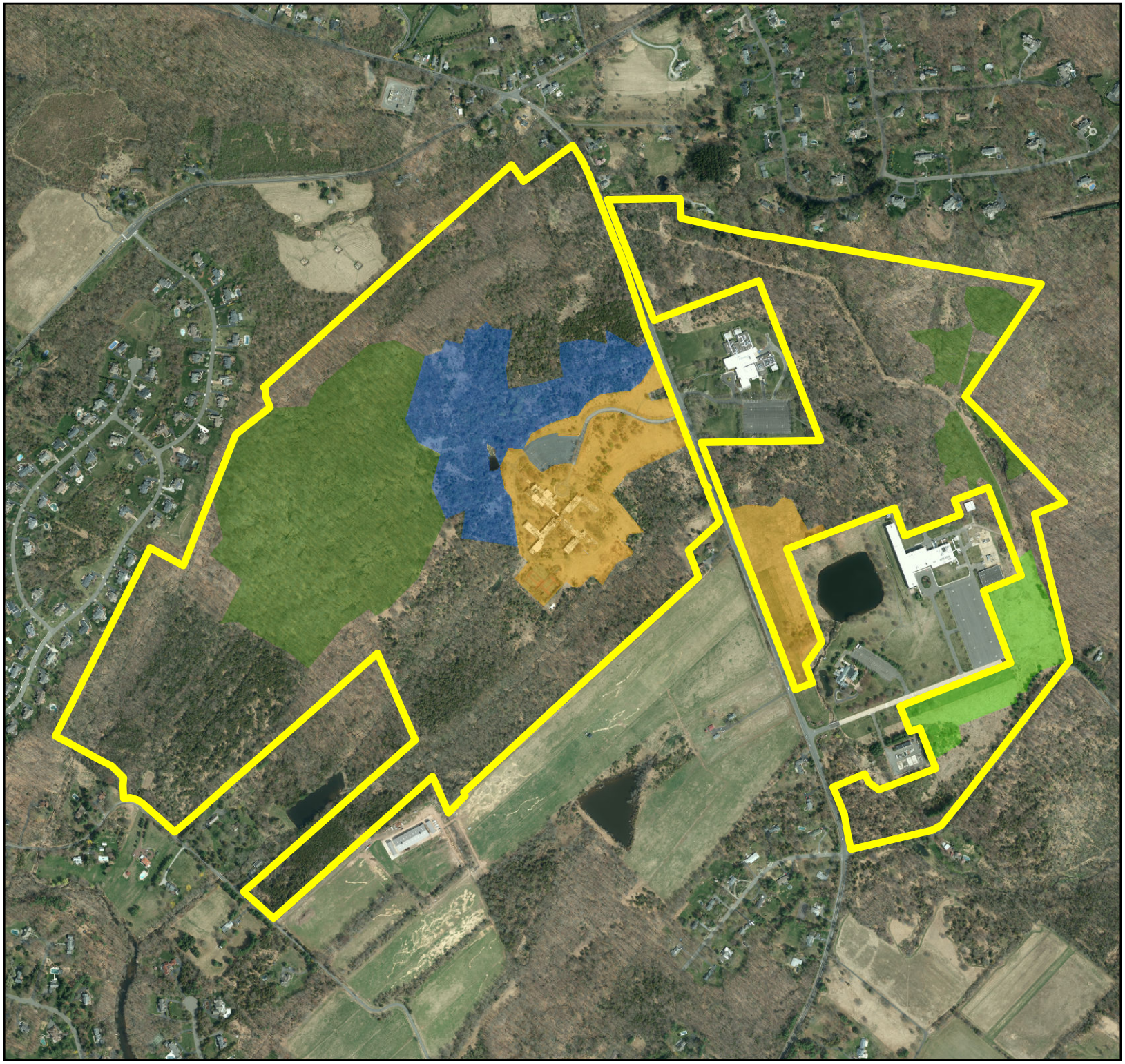
**Callery Pear**
**Chinese Bushclover**
**Linden Viburnum**
**Oriental Photina**
**Toringo Crabapple**

N

**Locator Map**



0 500 1,000 Feet



FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

**Map 28.**

**Restoration Areas**

**Legend**

- Preserve Boundary

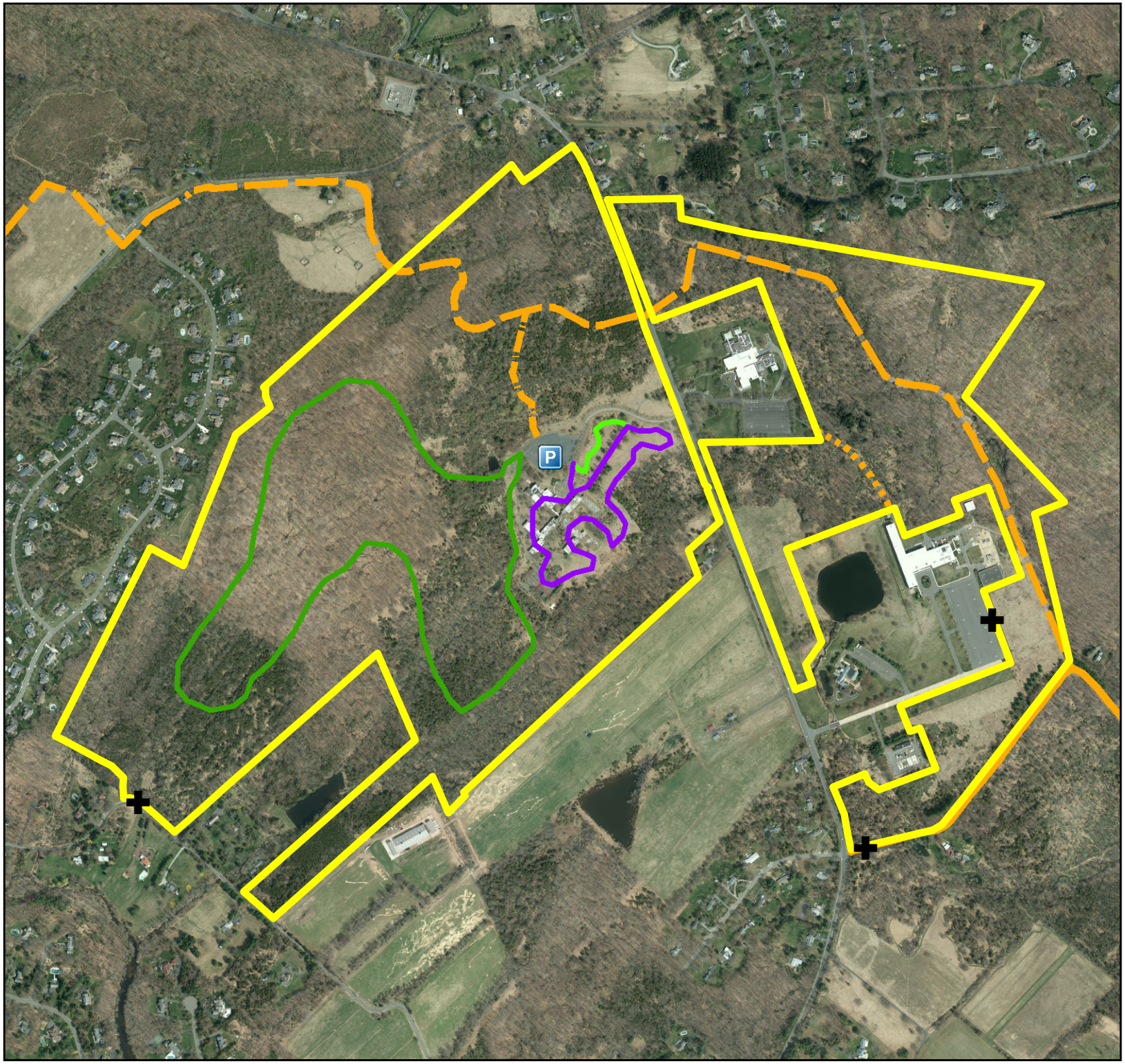
**Restoration Type**

- Forest
- Shrubland - Total
- Shrubland - Guided
- Meadow

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 29.**

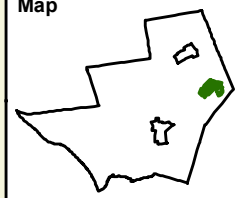
**Proposed Trails**

**Legend**

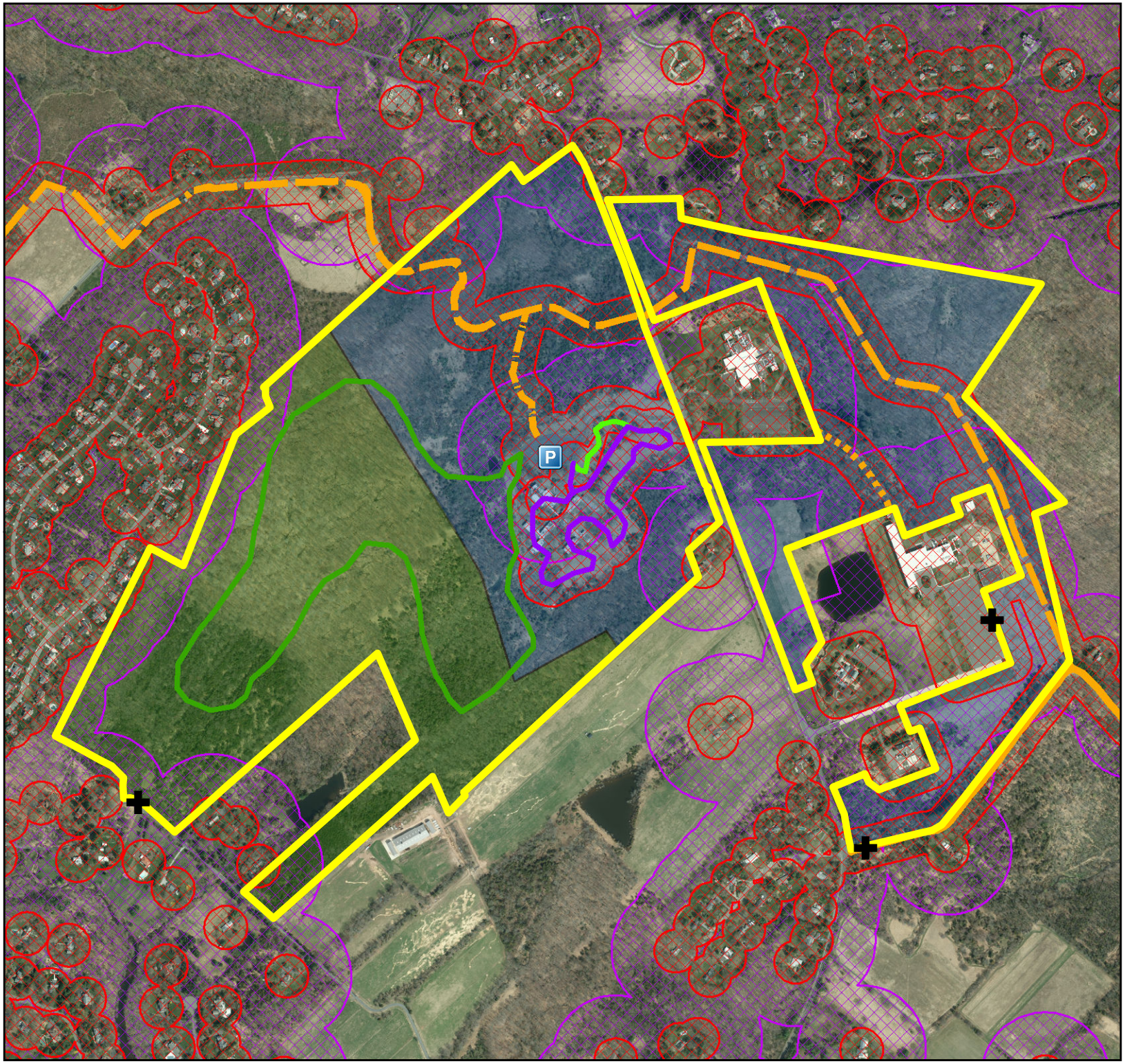
- Preserve Boundary
- Public Parking Lot
- Management Access Point
- Forest Trail
- Meadow Trail
- Arboretum Branch
- LHT - Existing
- LHT - New / Proposed
- LHT - Connector
- BMS Connector Trail

N

**Locator Map**



0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 30.**

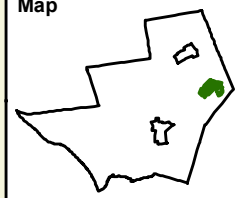
**Trails and Deer Management**

**Legend**

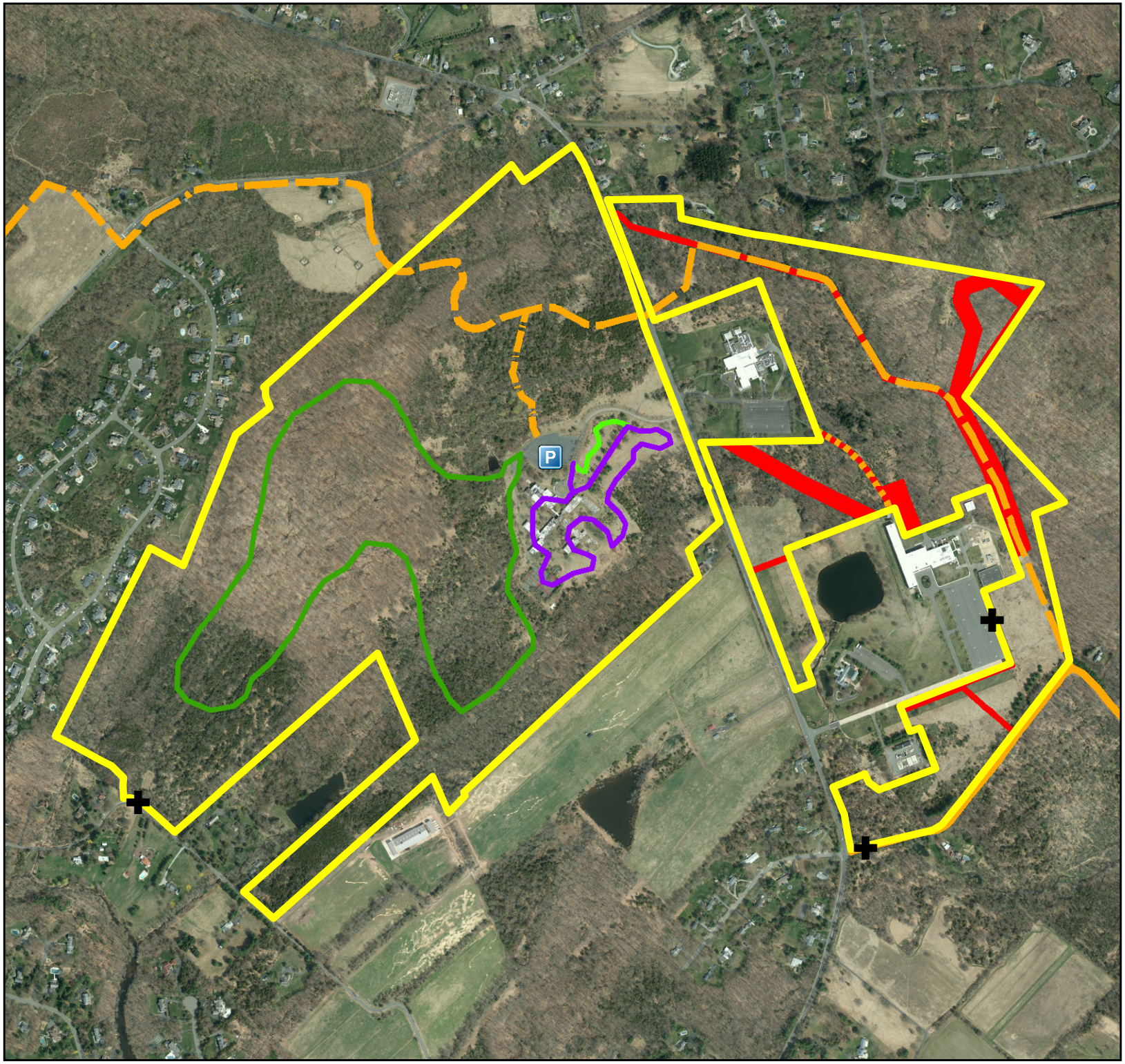
- Preserve Boundary
- Public Parking Lot
- Management Access Point
- Forest Trail
- Meadow Trail
- Arboretum Branch
- LHT - Existing
- LHT - New / Proposed
- LHT - Connector
- BMS Connector Trail
- Safety Zone - 150'
- Safety Zone - 450'
- Bow Hunting Only
- Bow and Gun Hunting

N

**Locator Map**



0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Map 31.**

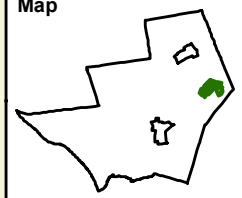
**Retained Easements**

**Legend**

- Preserve Boundary
- Public Parking Lot
- Management Access Point
- Forest Trail
- Meadow Trail
- Arboretum Branch
- LHT - Existing
- LHT - New / Proposed
- LHT - Connector
- BMS Connector Trail
- Retained Easement Areas

N

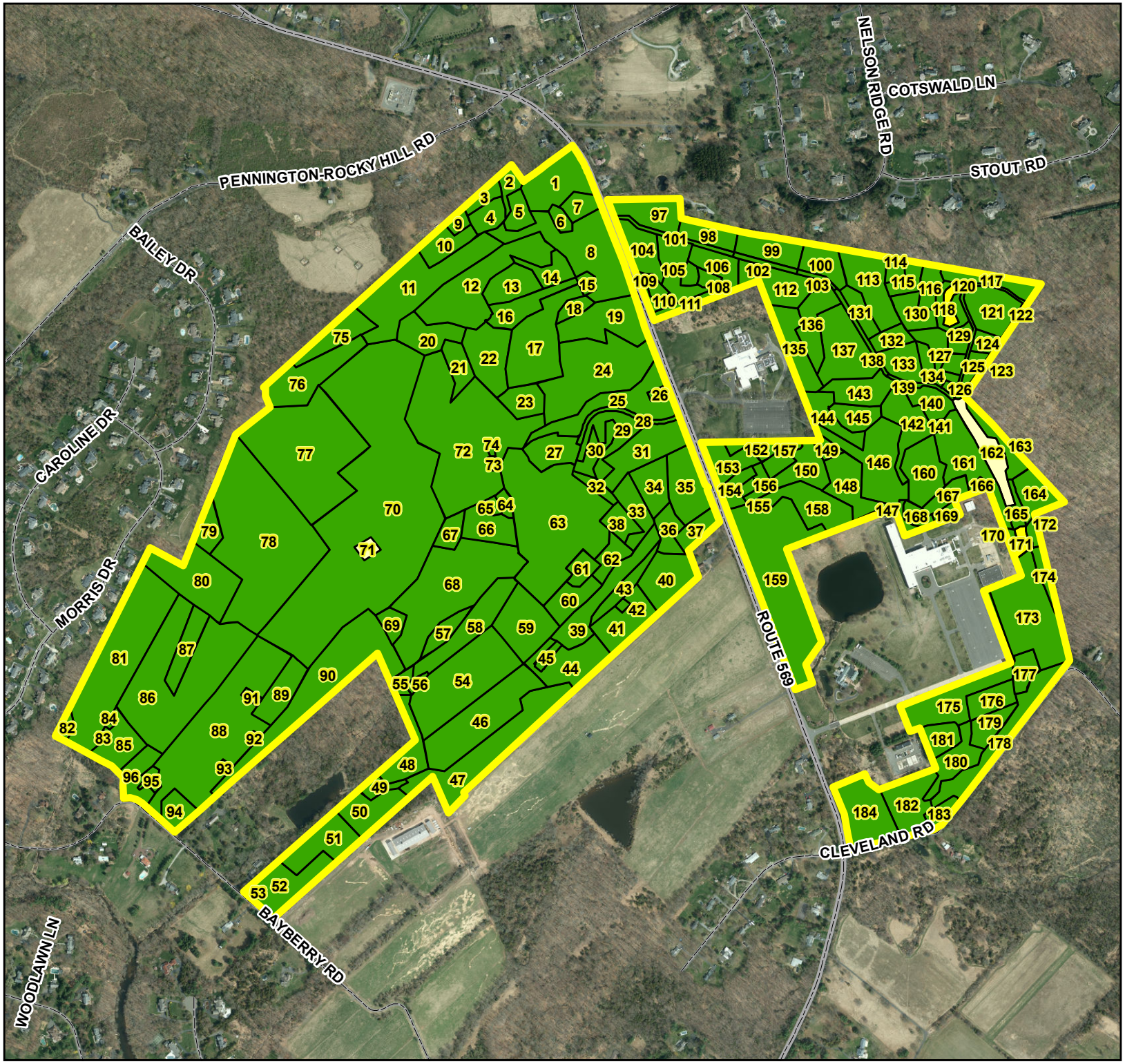
**Locator Map**



0 500 1,000 Feet

# Mount Rose Stewardship Plan

# Invasive Species Maps




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

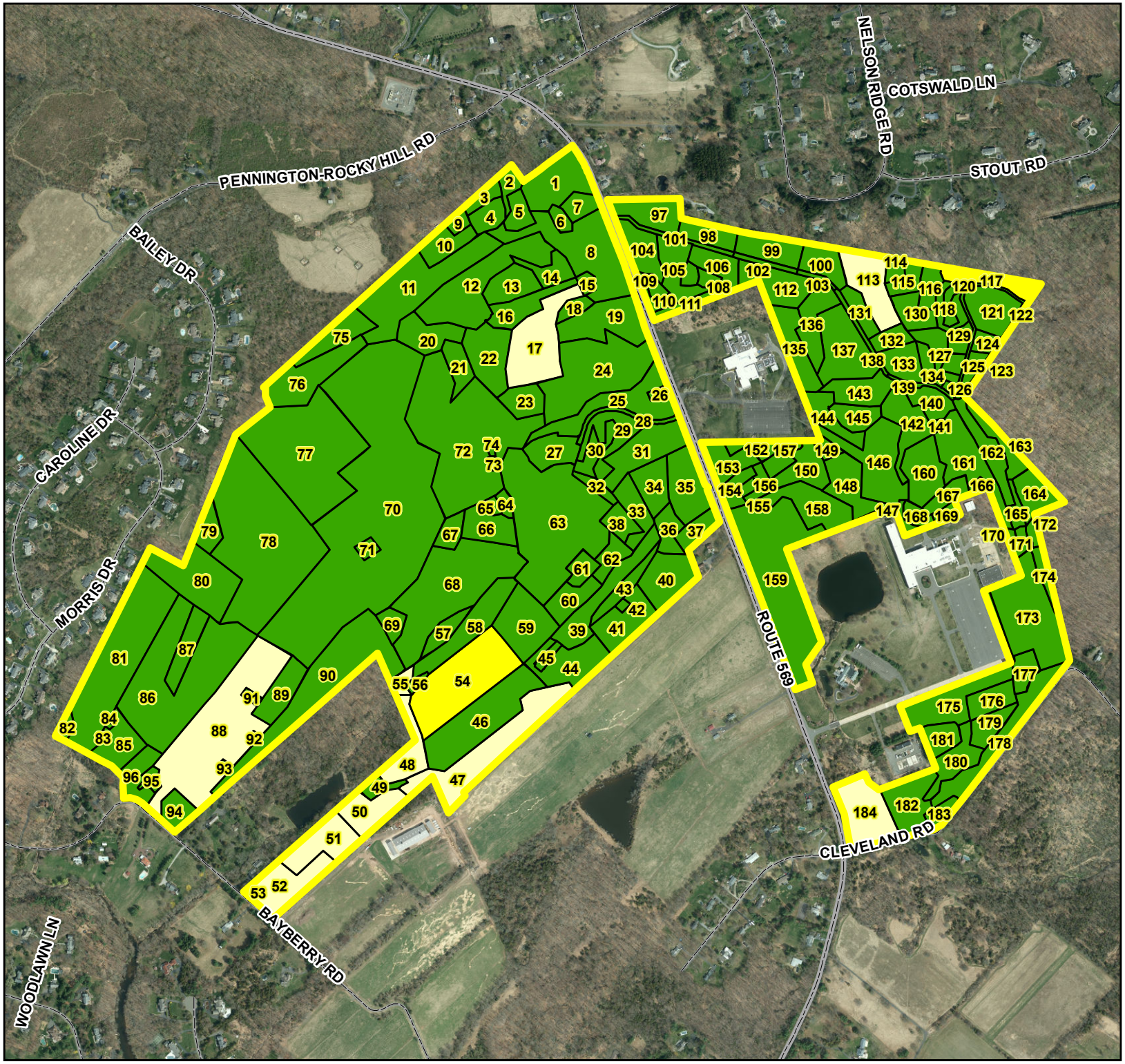
**Tree-of-Heaven**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

**Invasive Species Distribution and Severity**

## Legend

Preserve Boundary

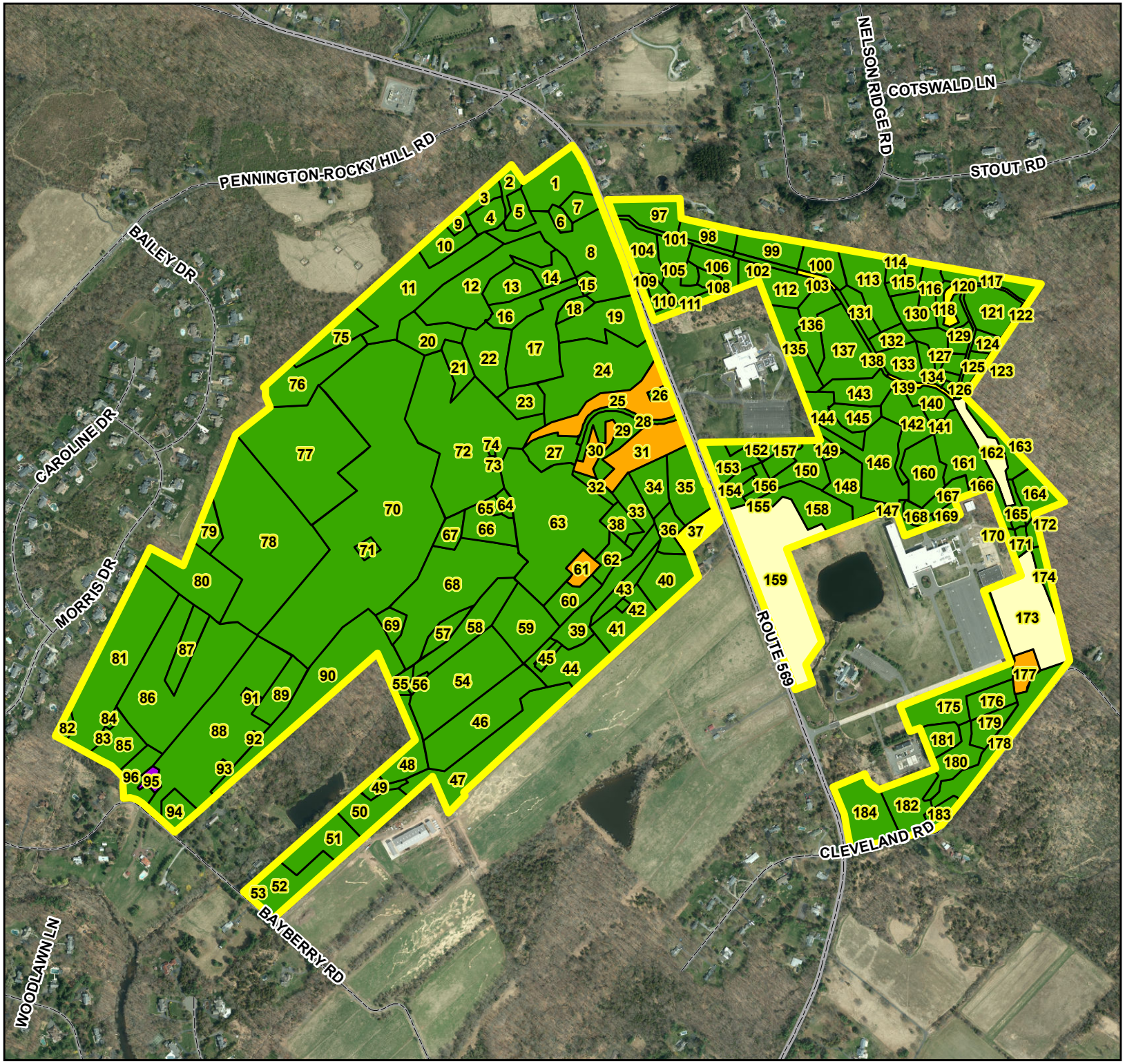
**Garlic Mustard**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

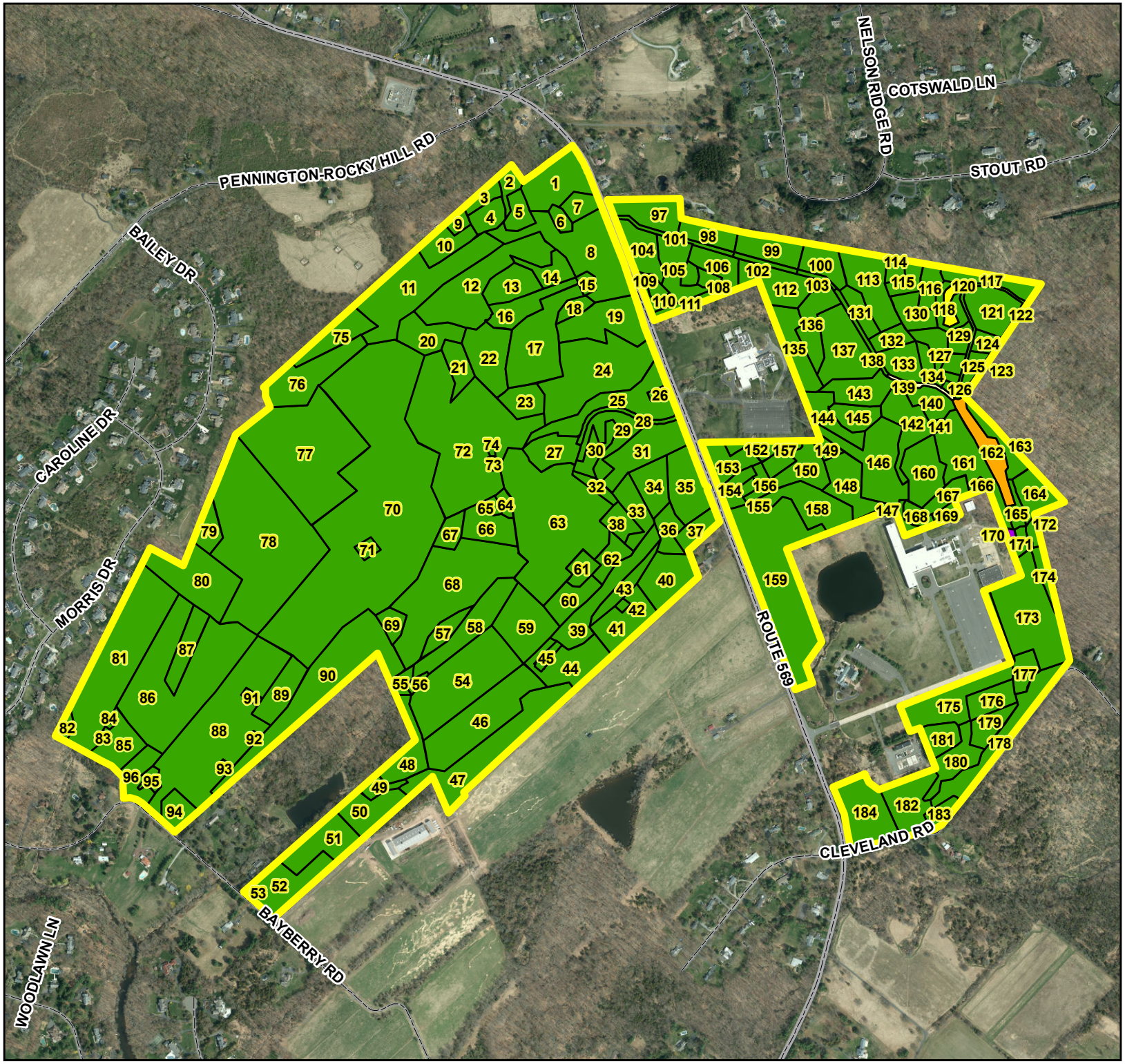
**Carpgrass**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

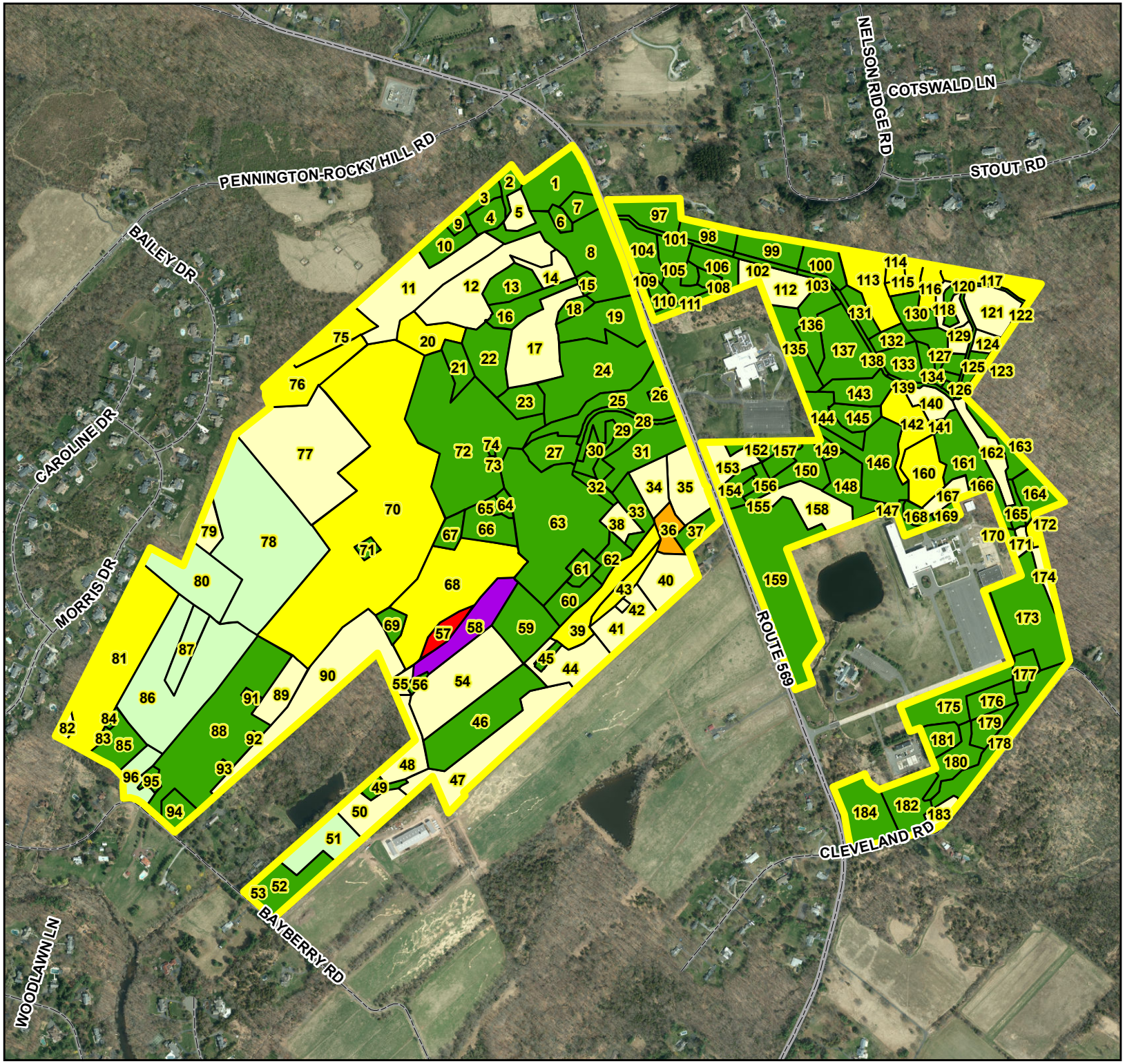
**Mugwort**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

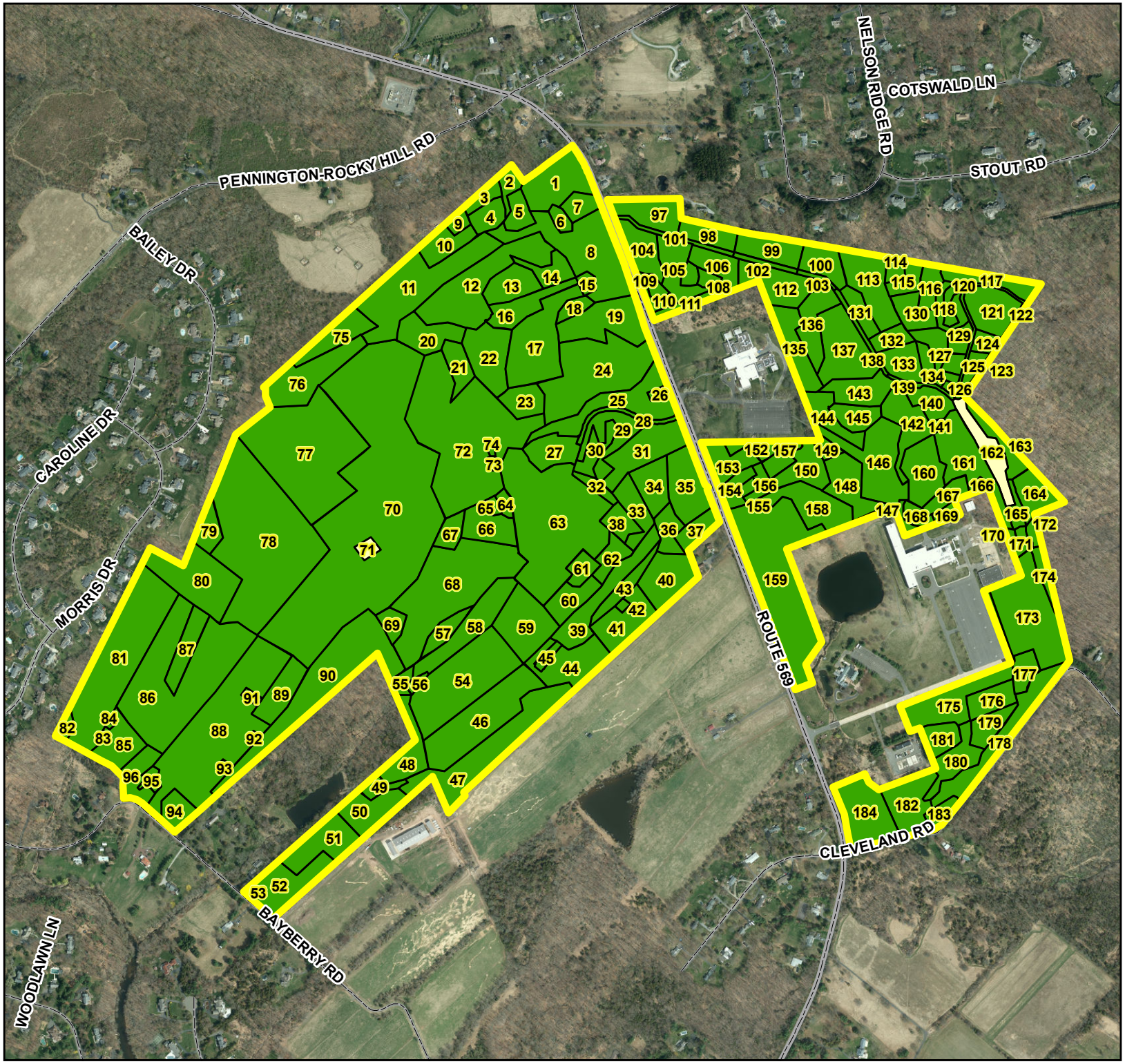
**Japanese Barberry**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

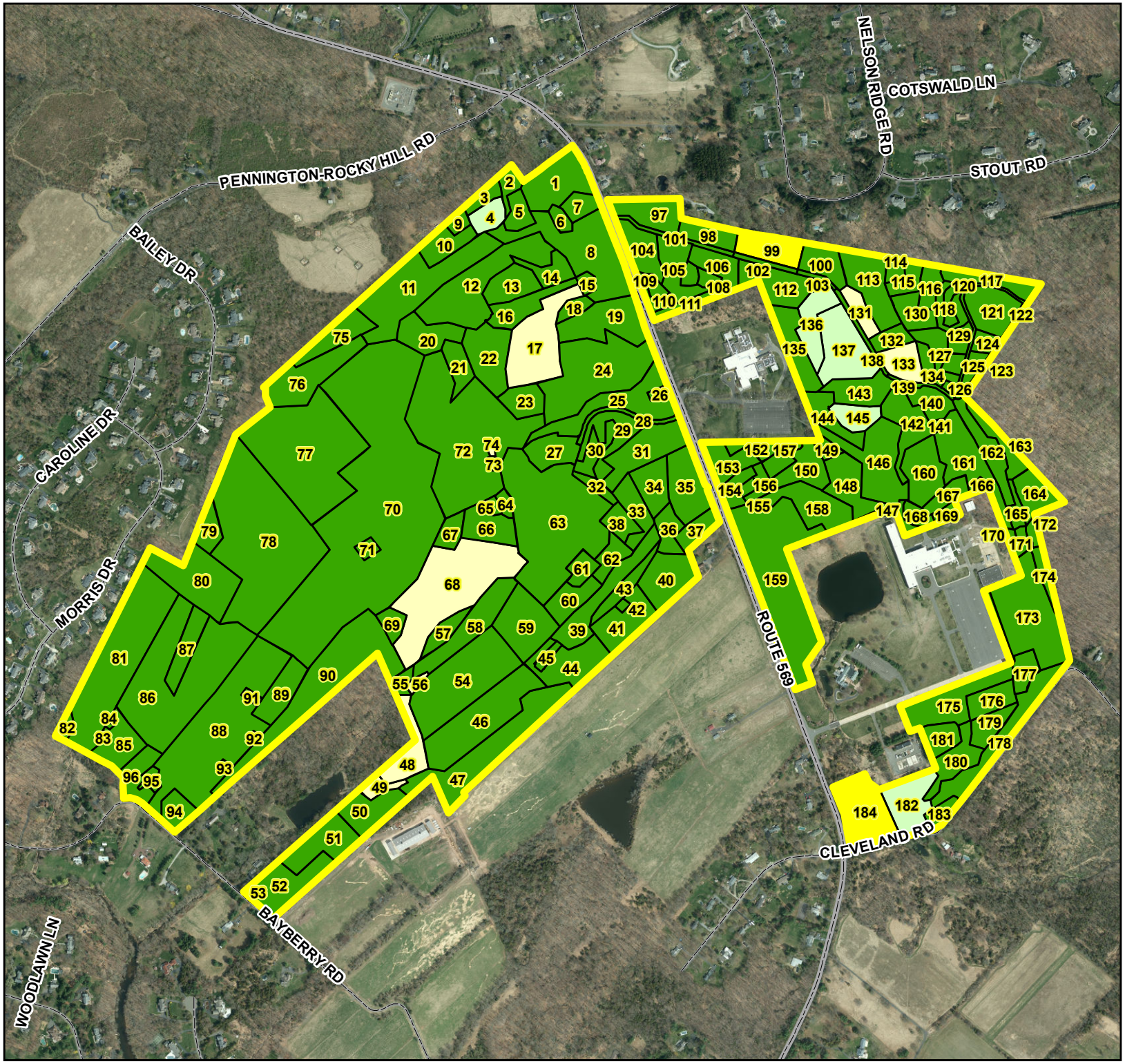
**Catalpa**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

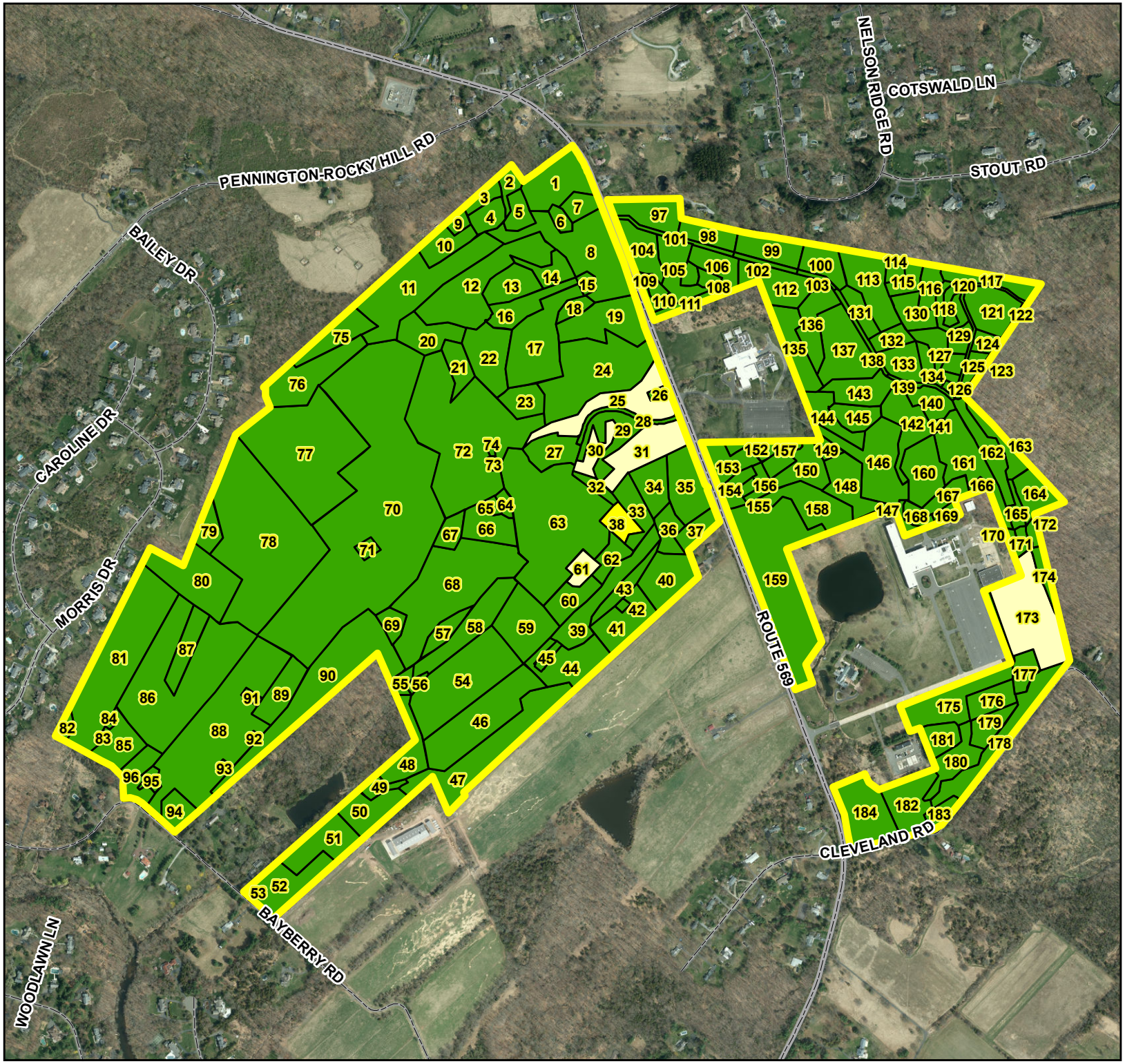
**Asiatic Bittersweet**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

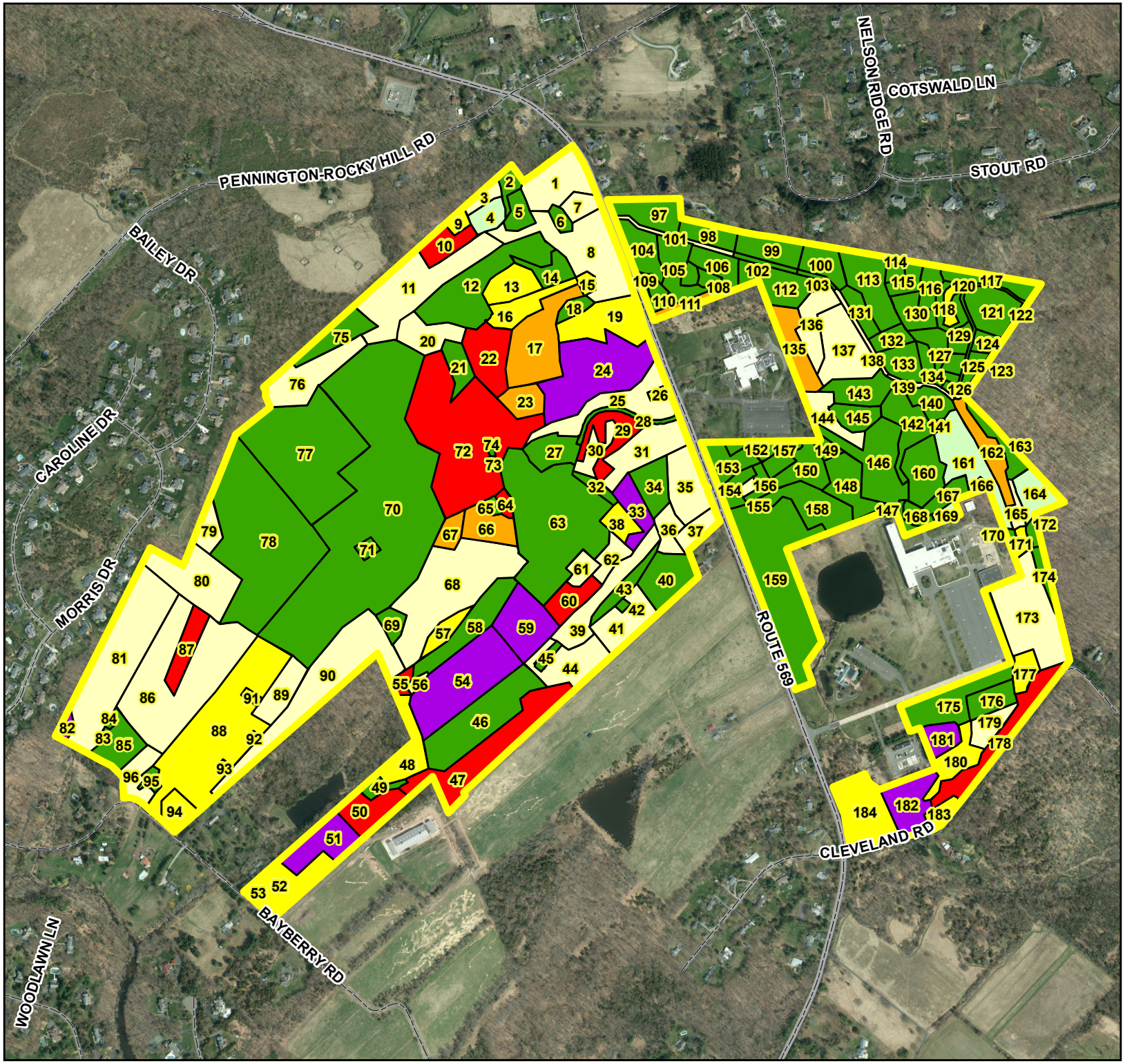
**Canada Thistle**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

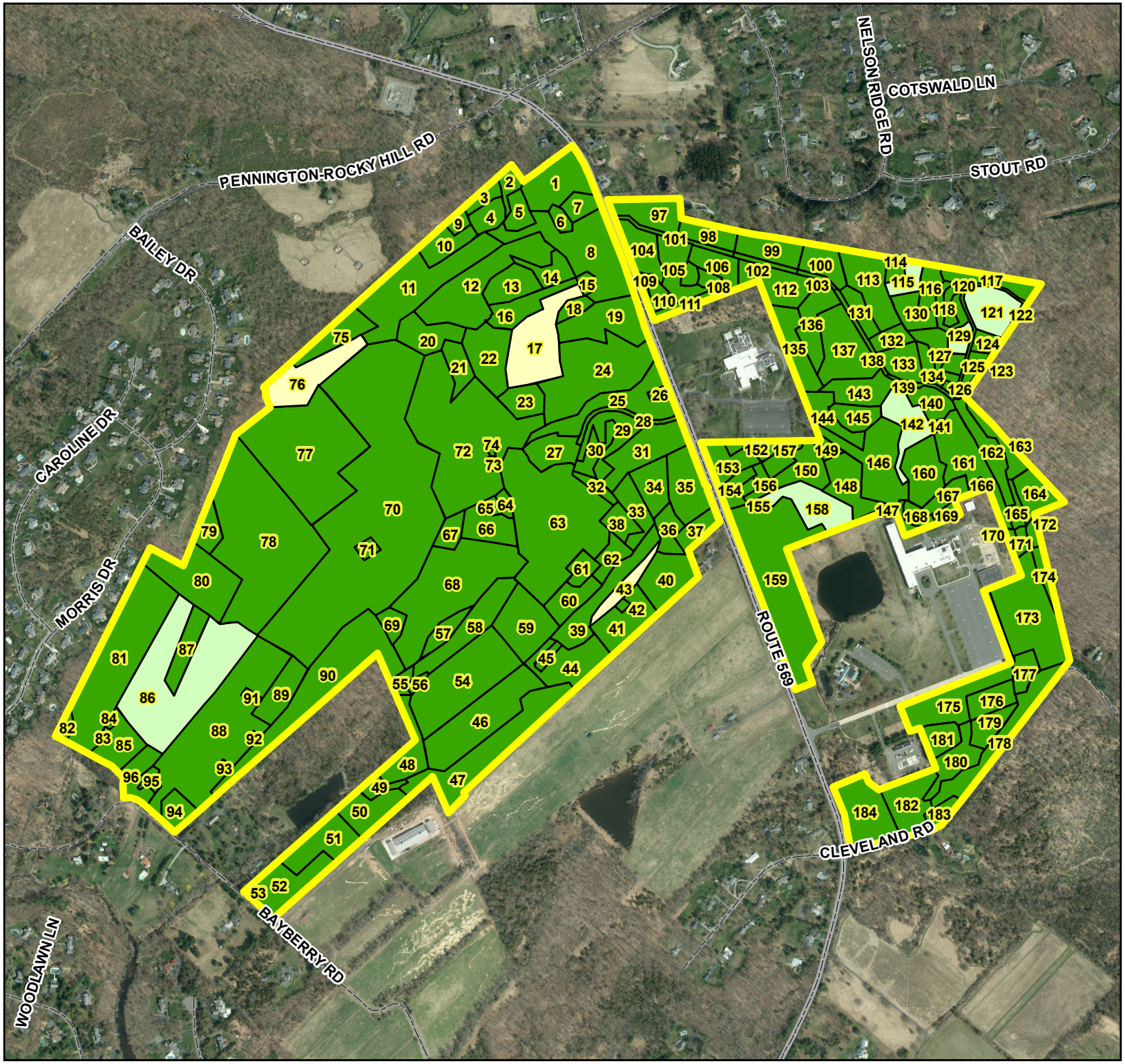
**Autumn Olive**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

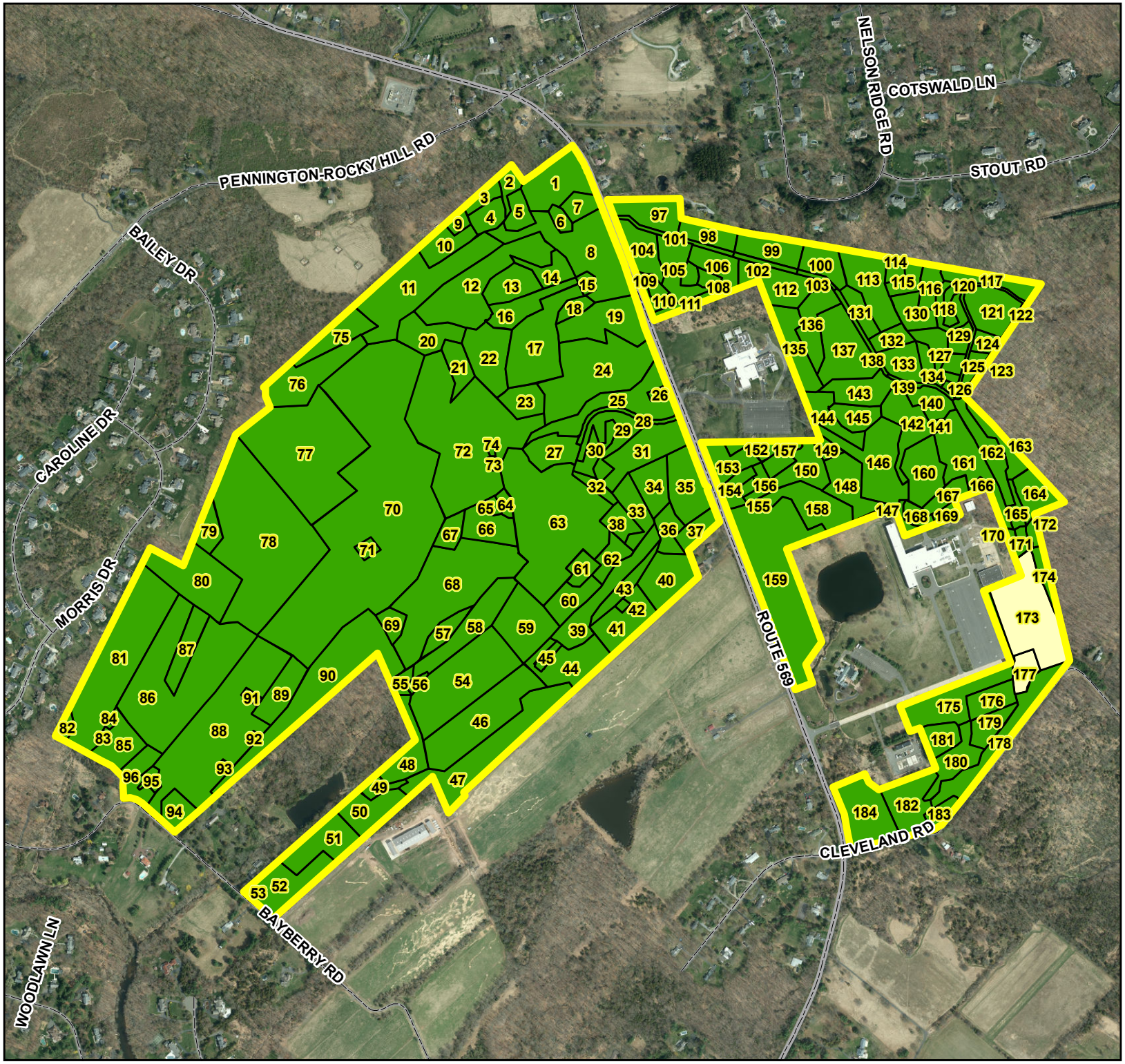
**Winged Burning Bush**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

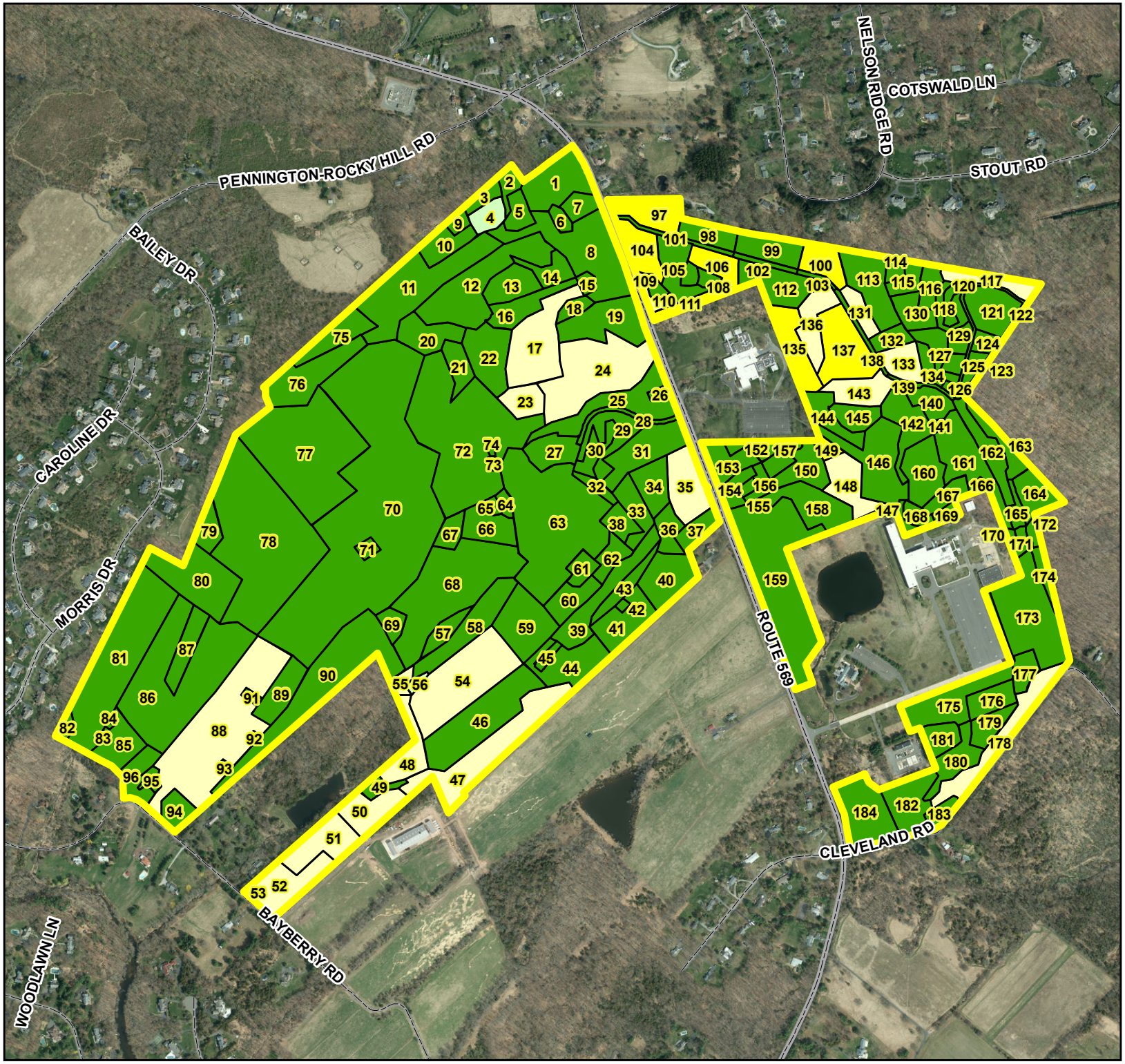
**Chinese Bushclover**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

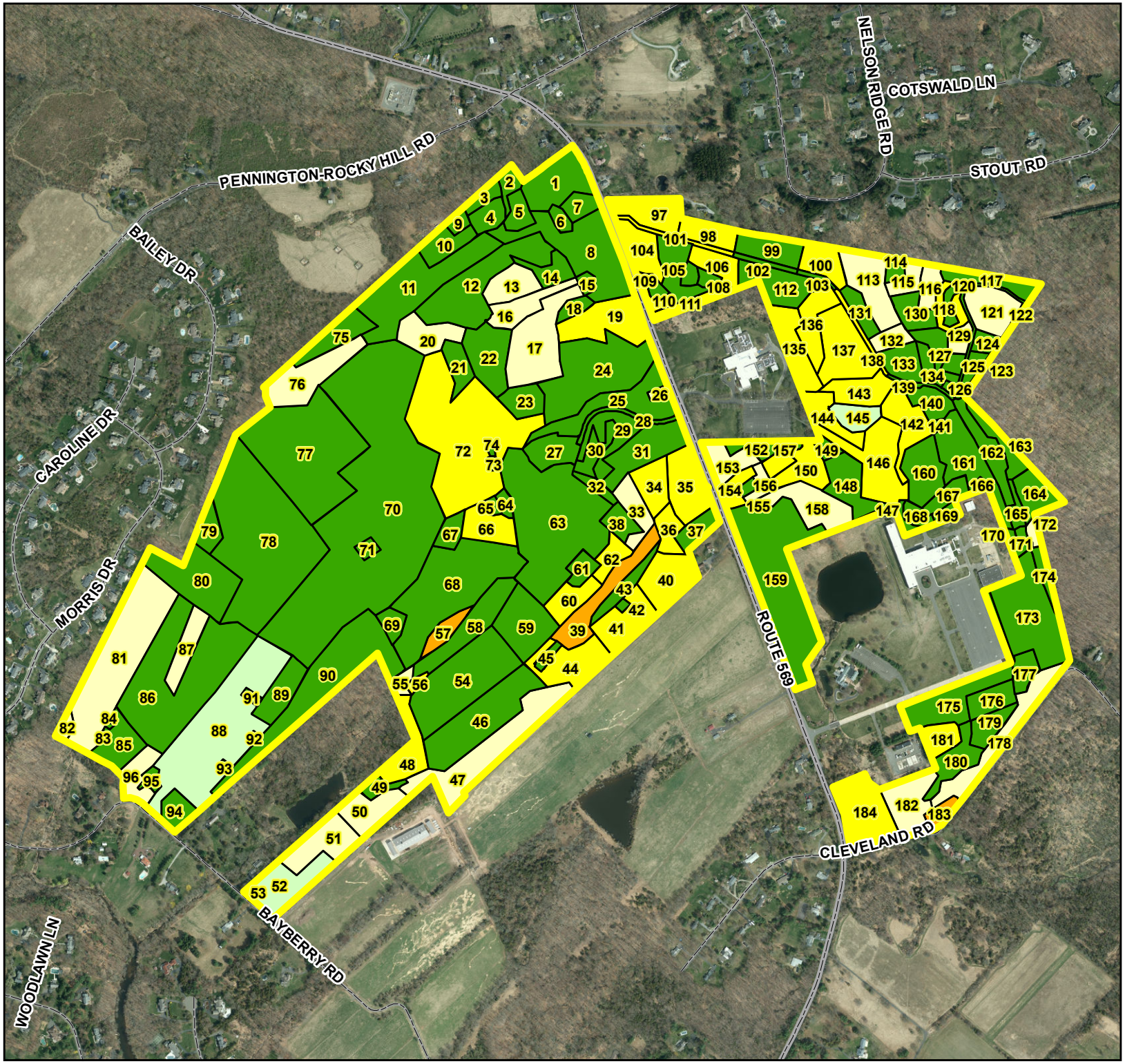
**Privet**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

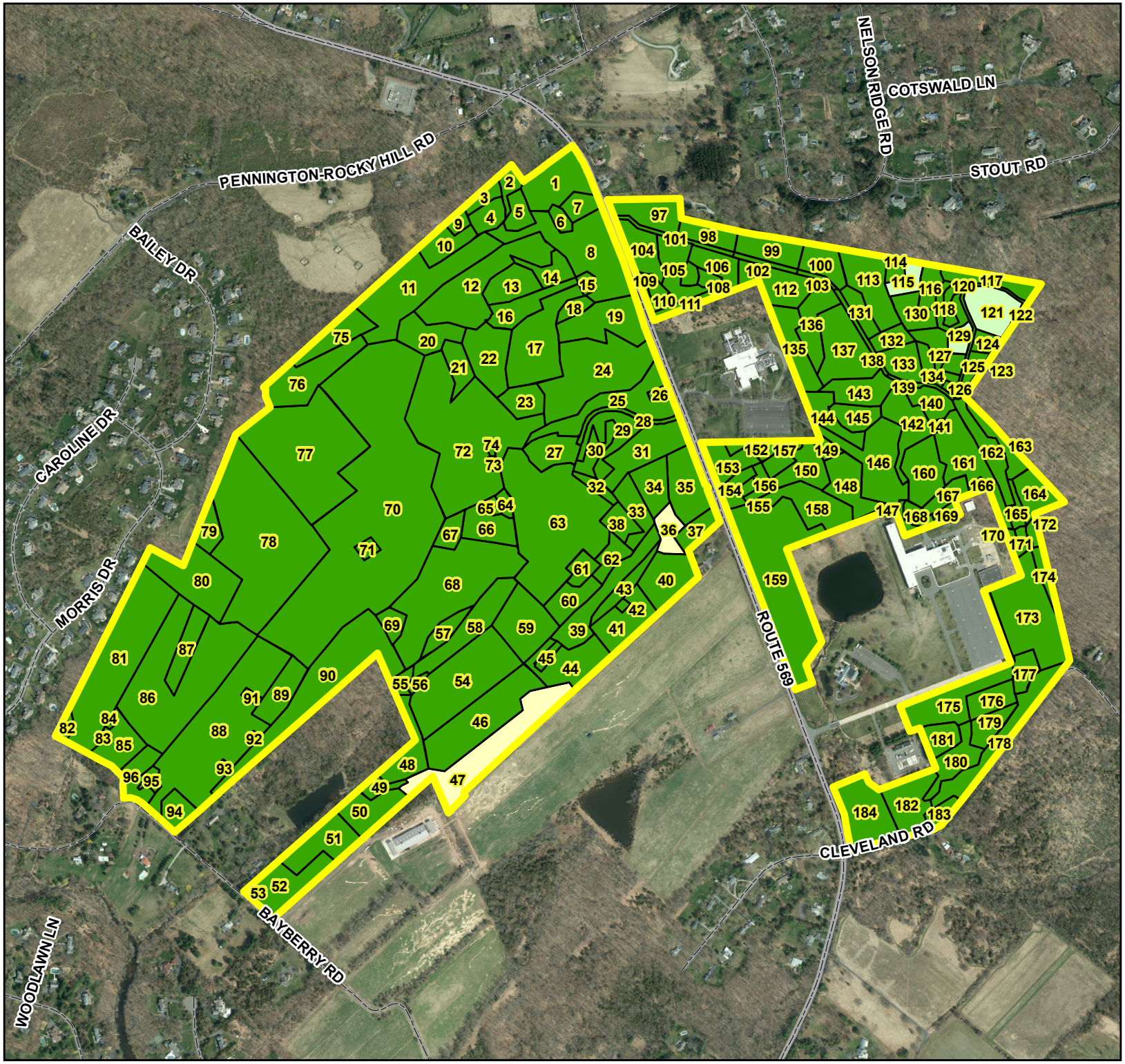
**Japanese Honeysuckle**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

**Legend**

- Preserve Boundary

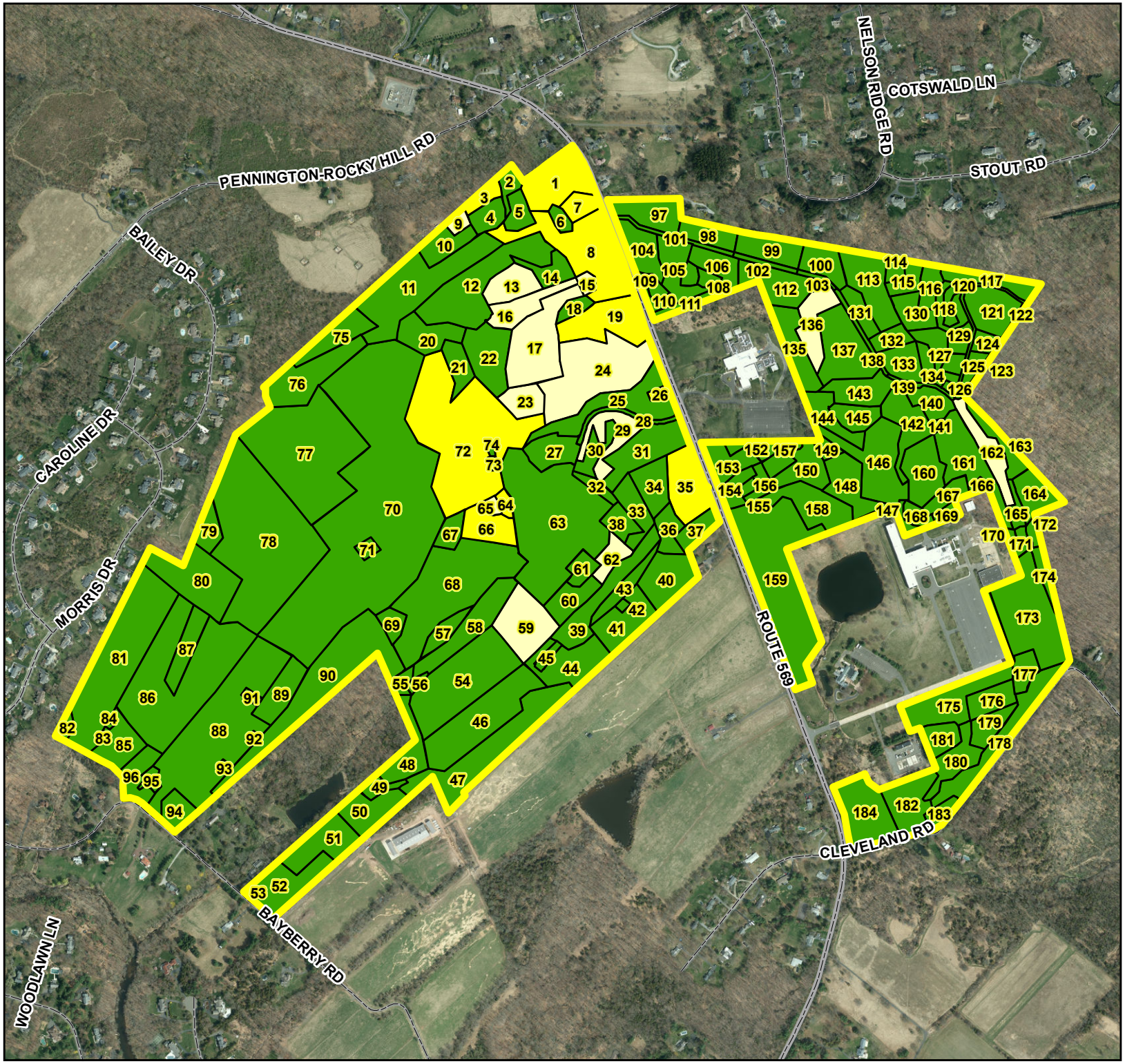
**Amur Bush Honeysuckle**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

**Legend**

- Preserve Boundary

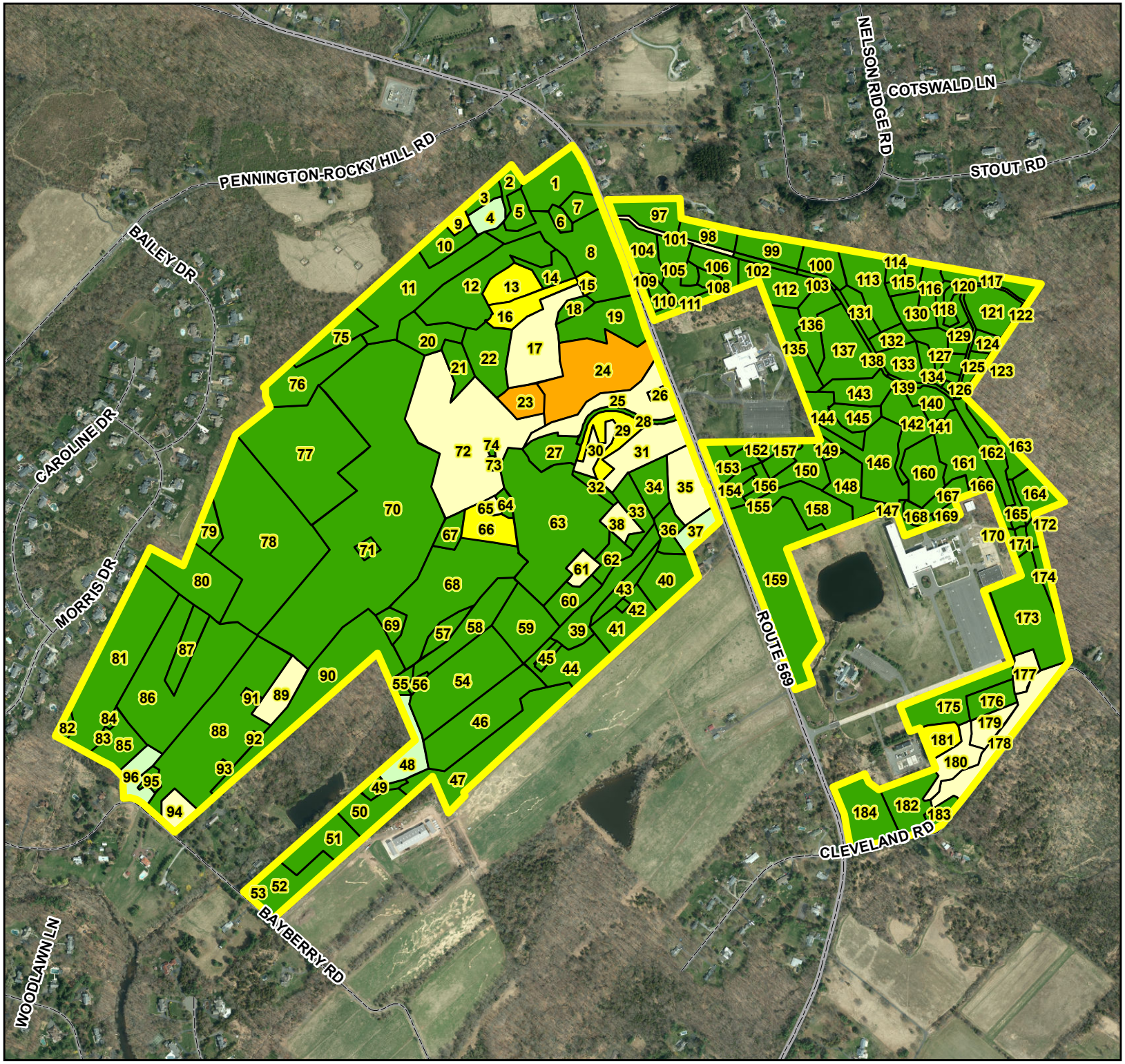
**Morrow's Bush Honeysuckle**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

**Locator Map**

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

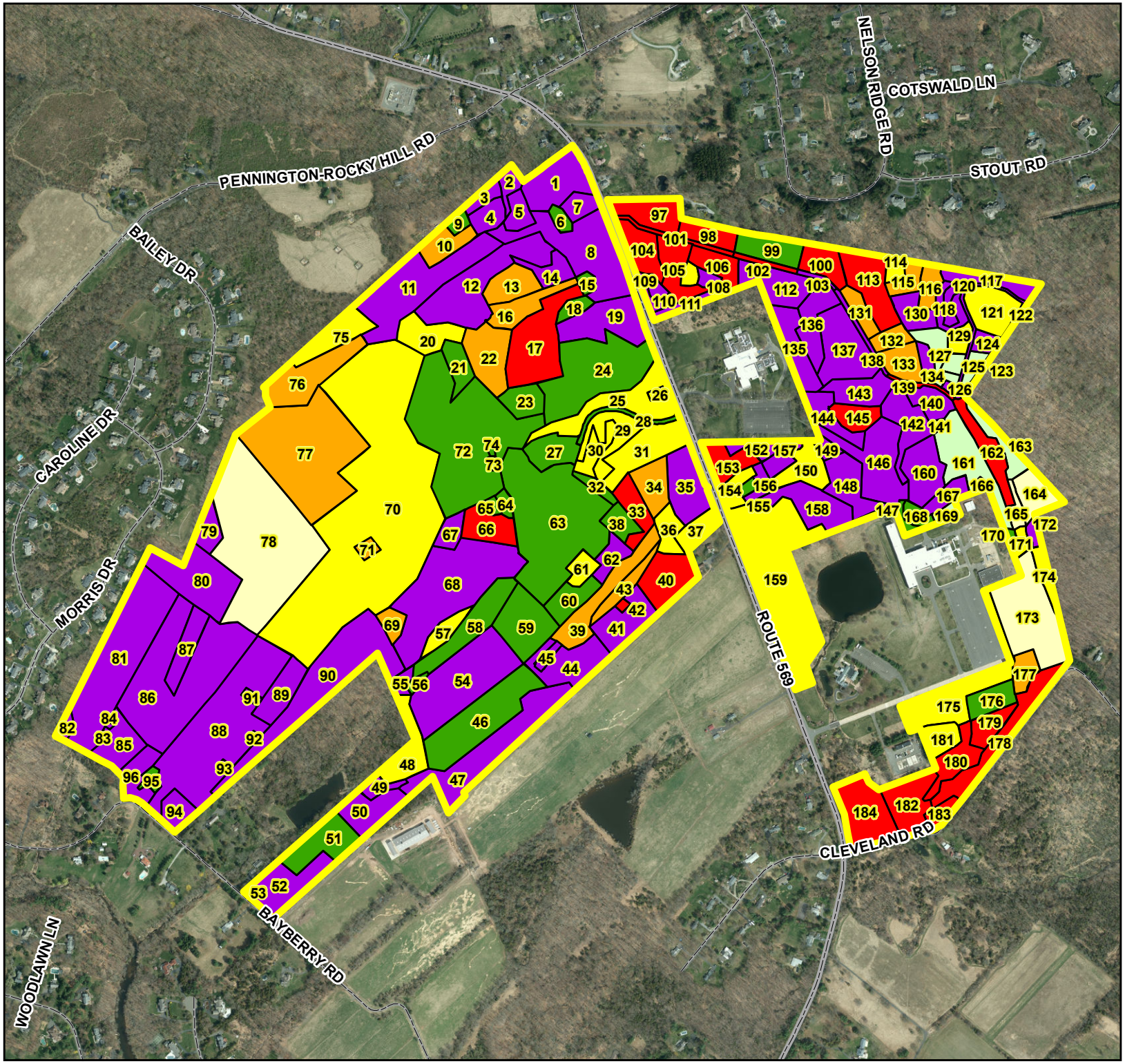
**Toringo Crabapple**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

Preserve Boundary

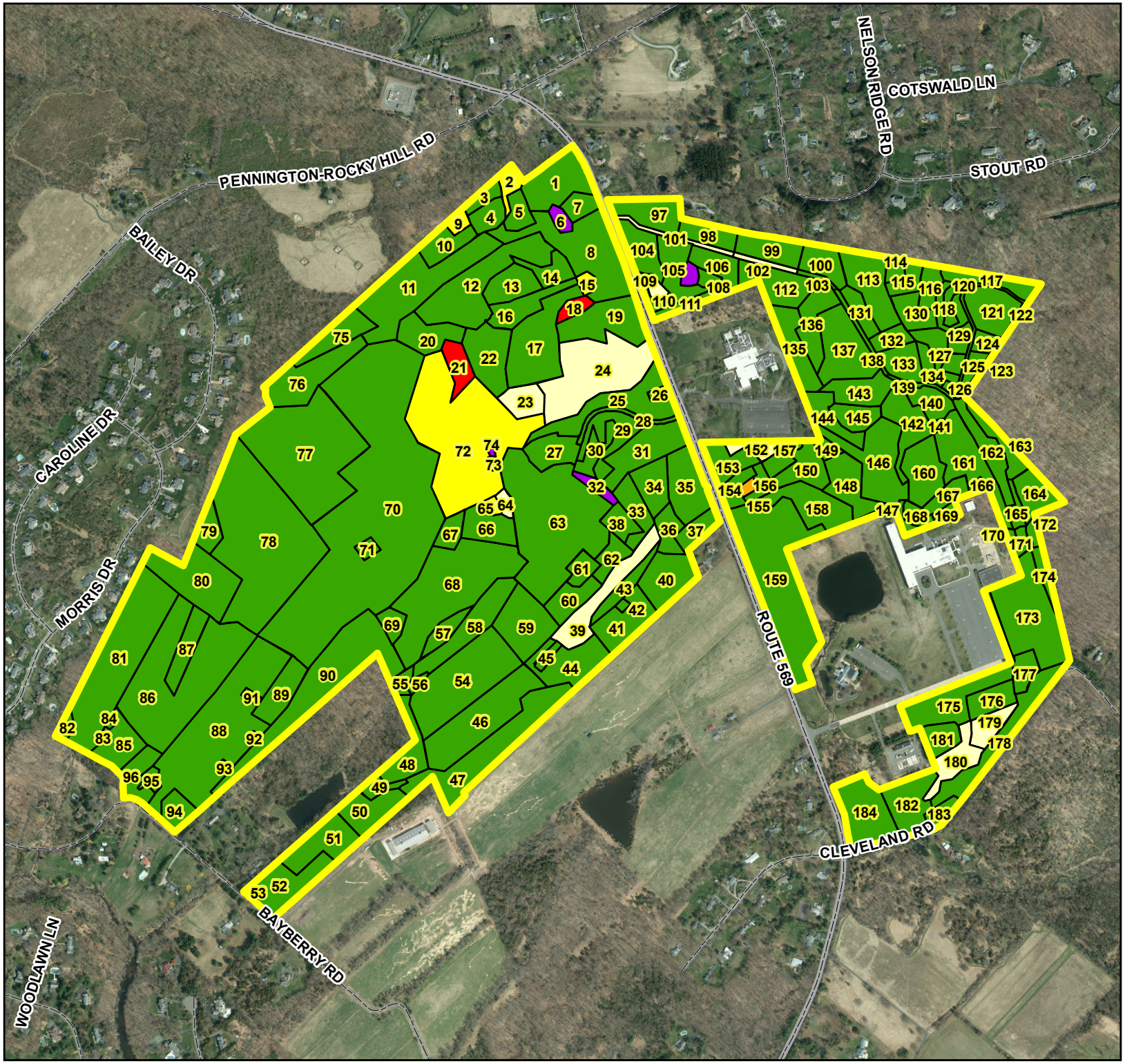
**Japanese Stiltgrass**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

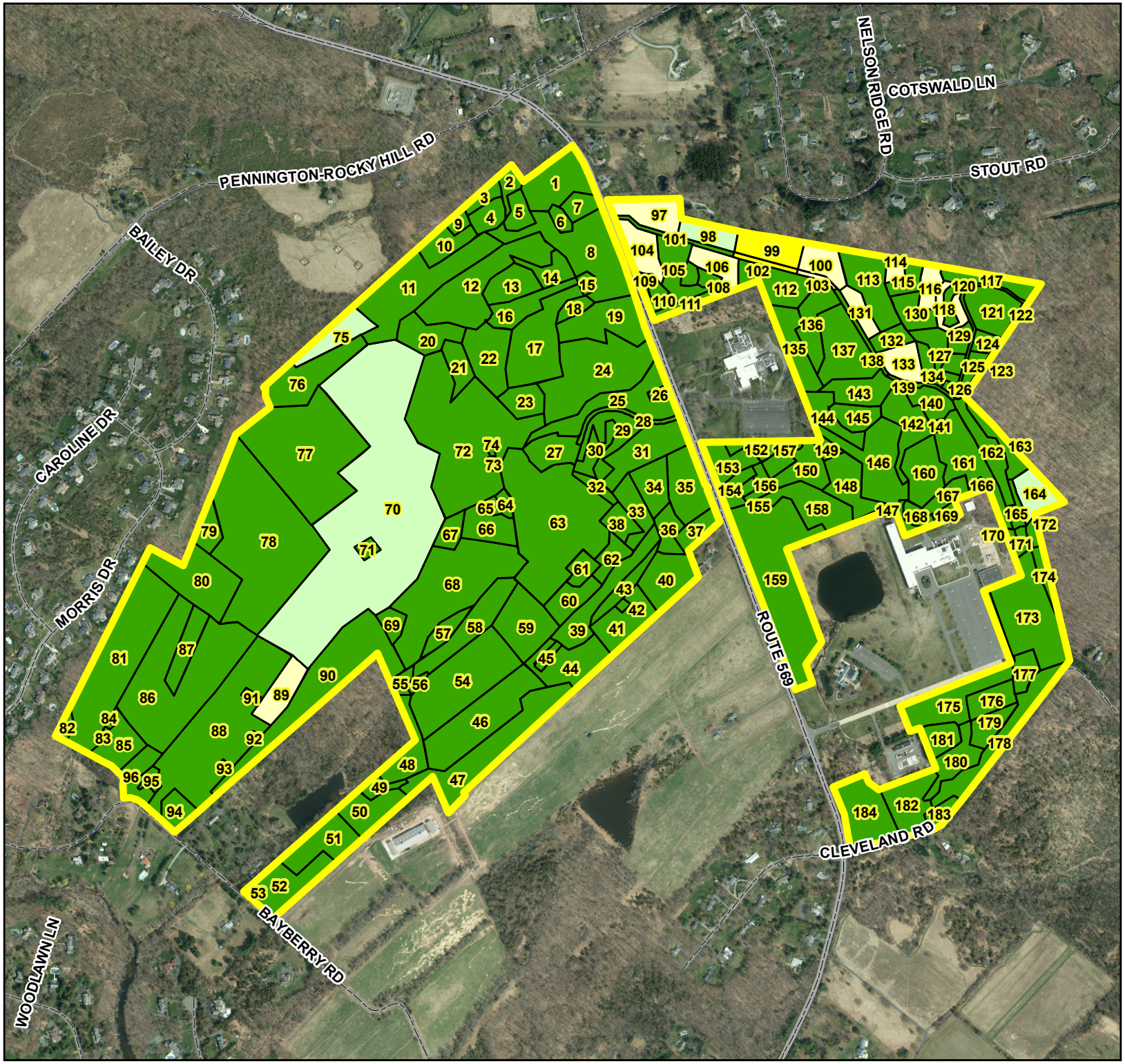
**Reed Canary Grass**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

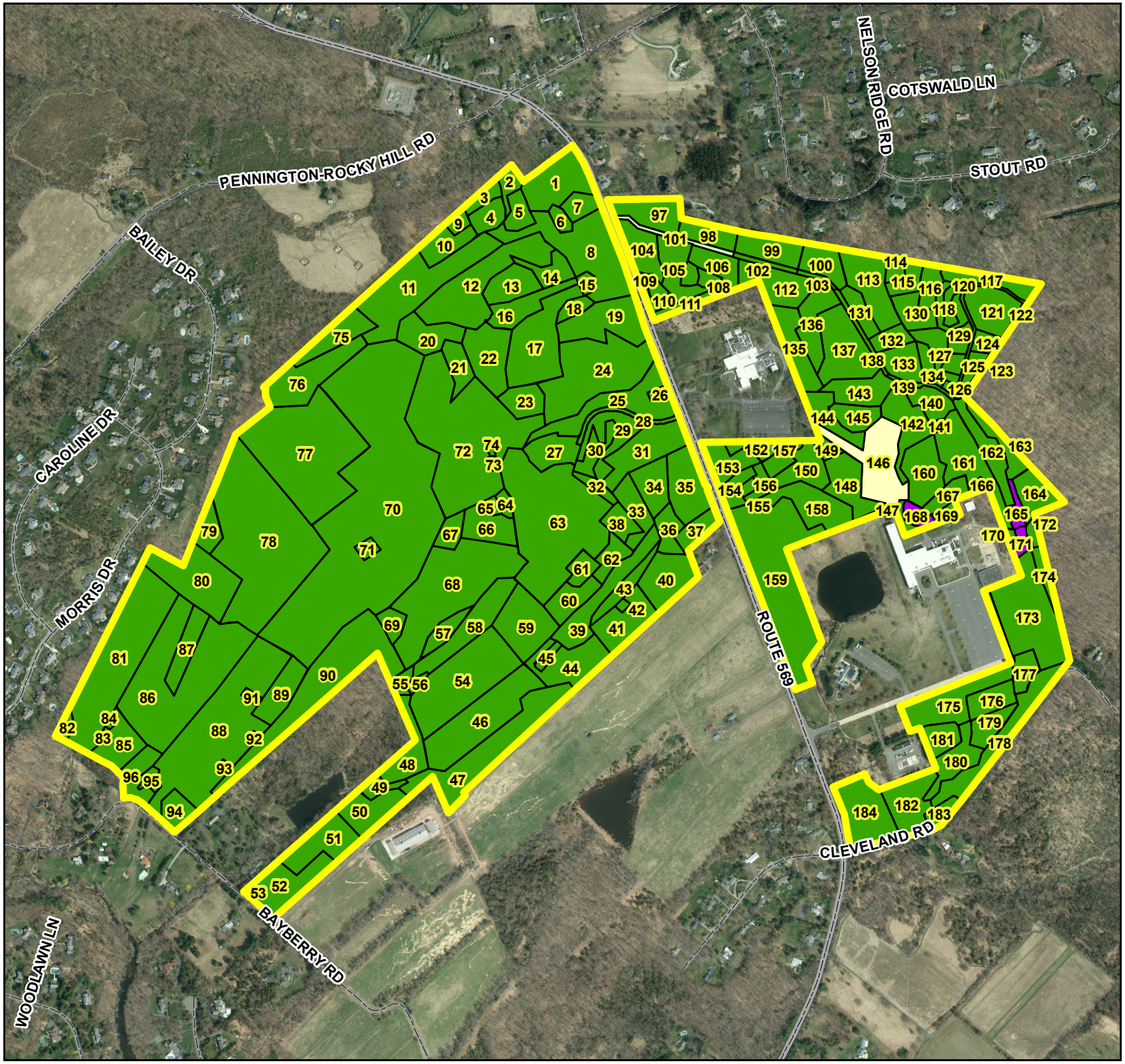
**Oriental Photinia**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

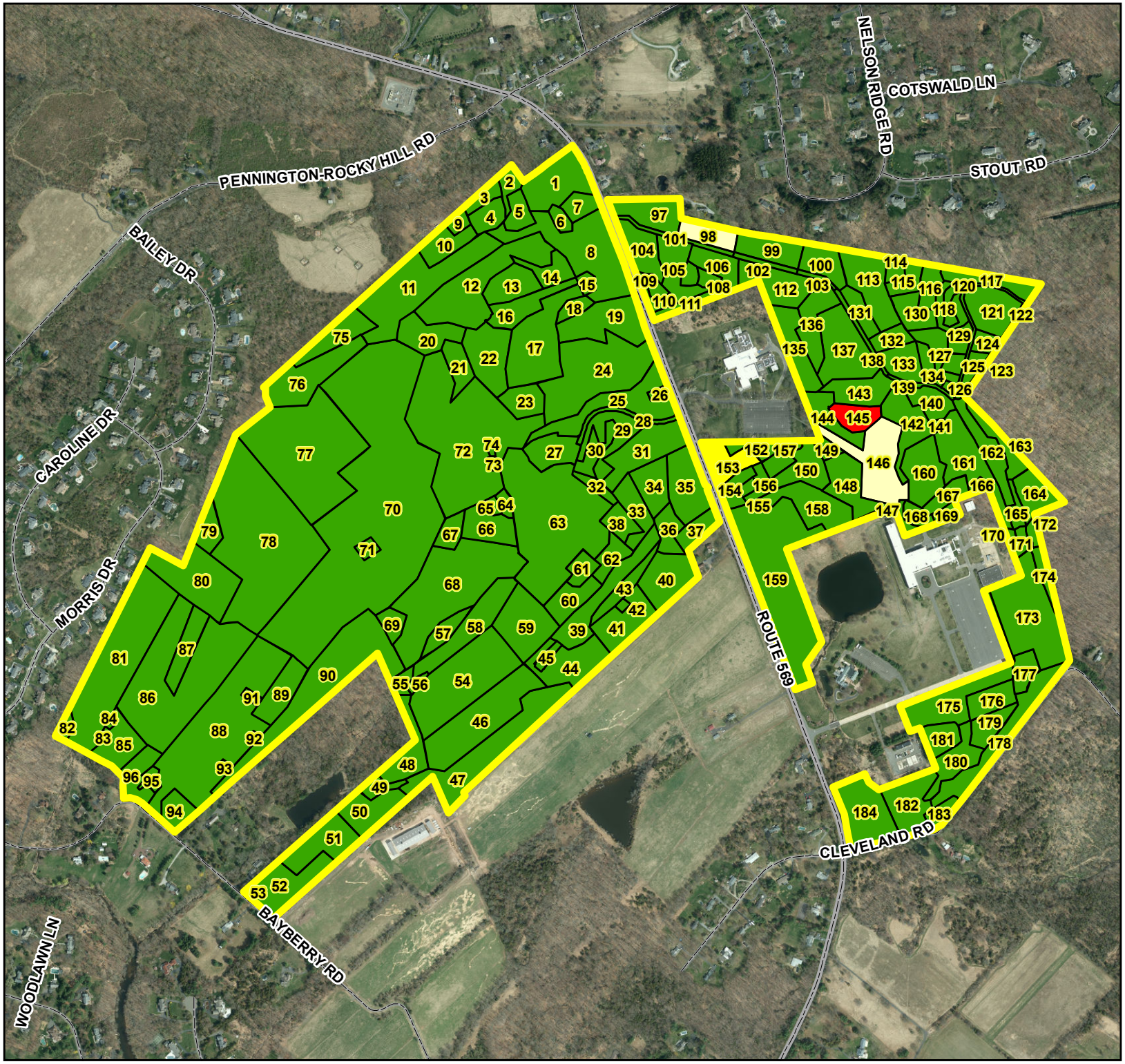
**Common Reed**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

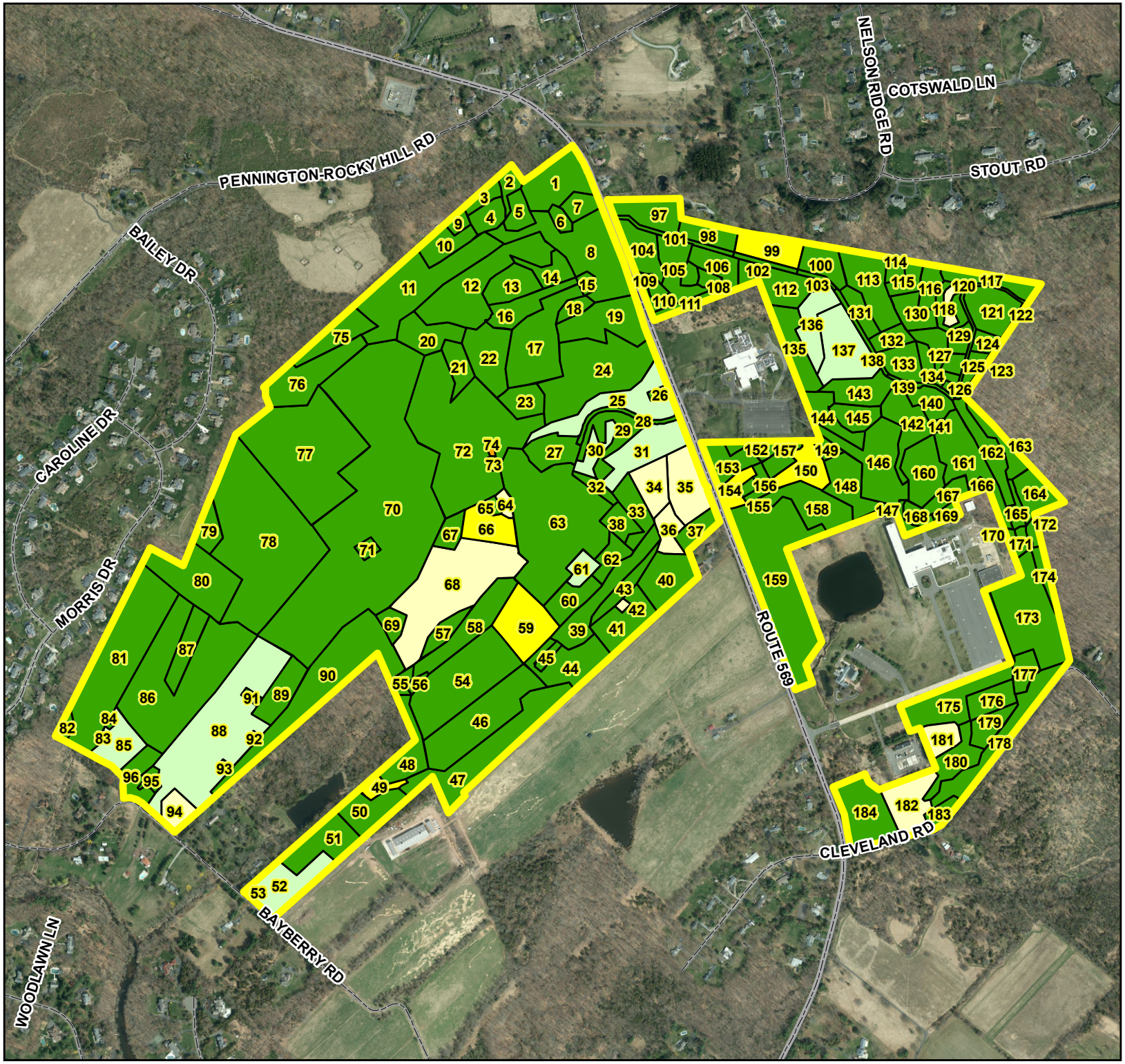
**Norway Spruce**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

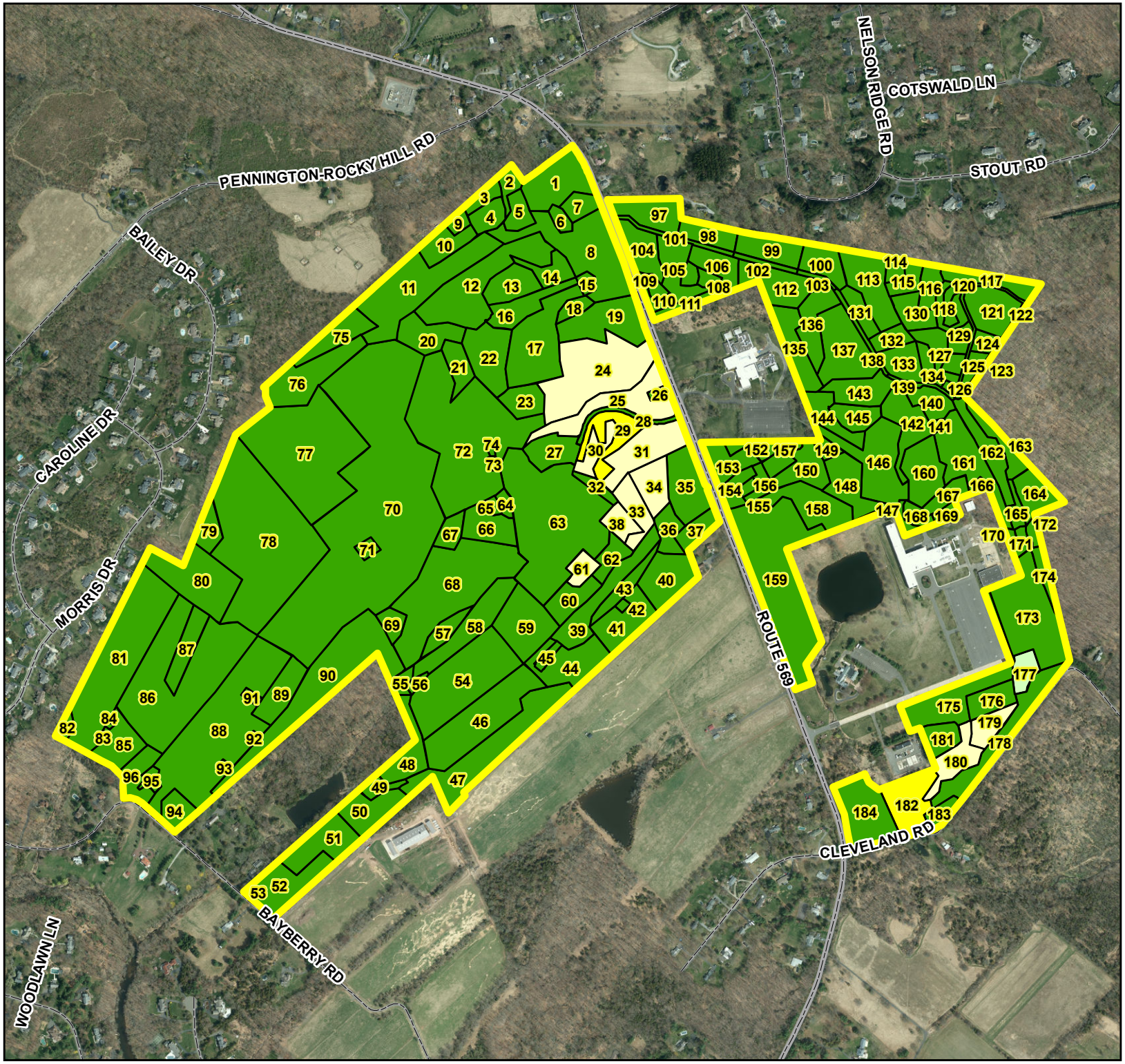
**Mile-a-Minute**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

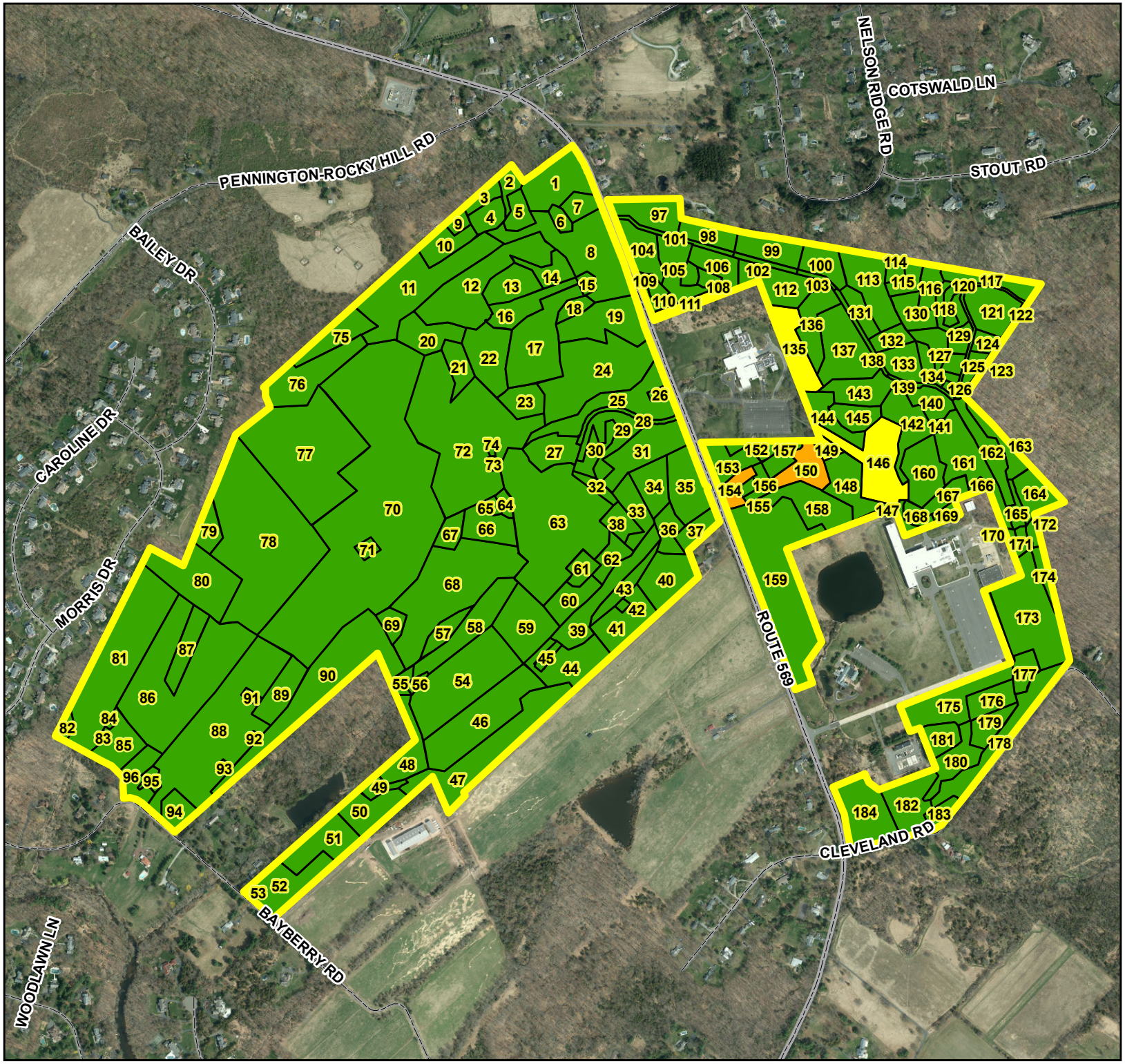
**Callery Pear**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

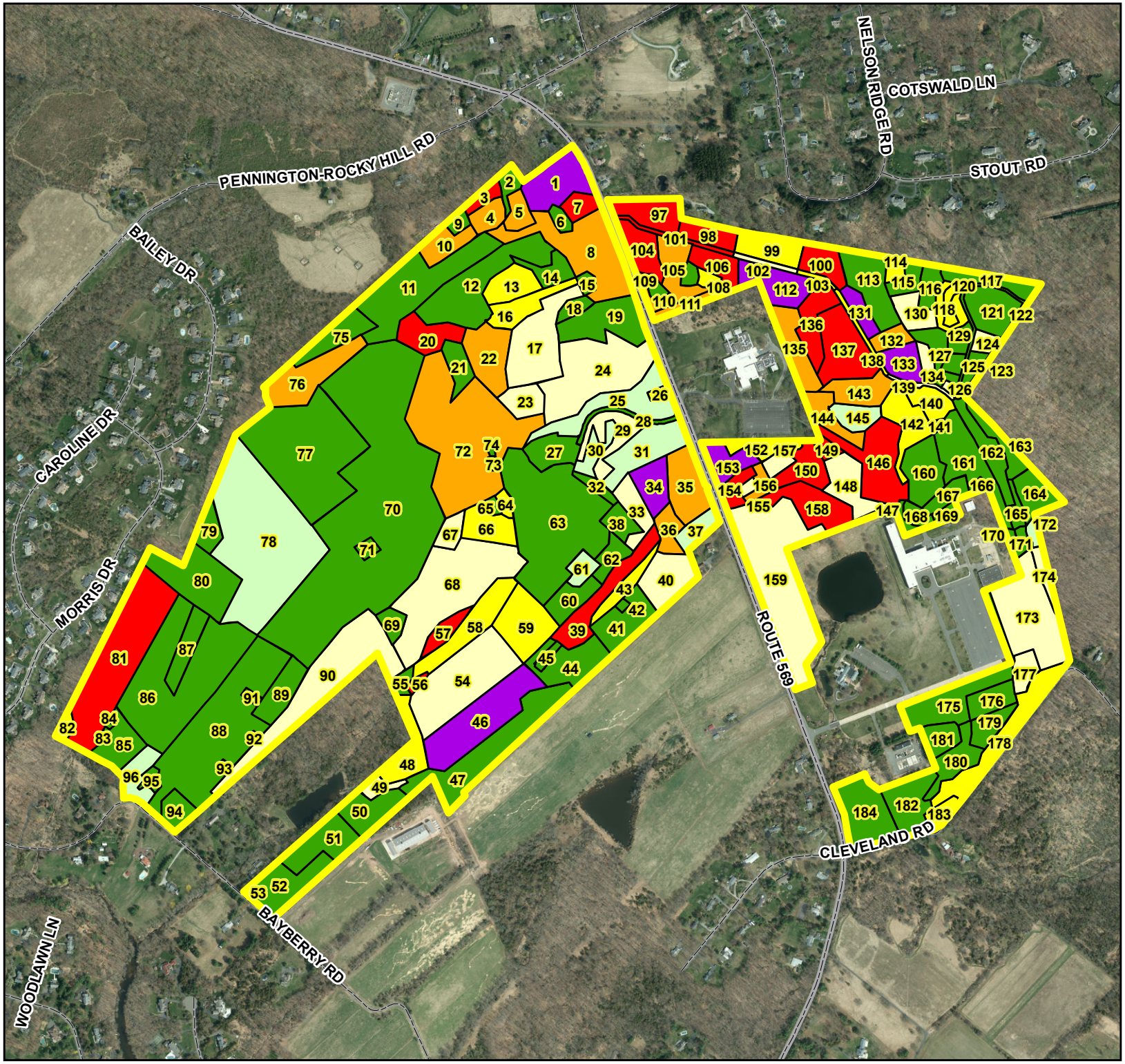
**Black Locust**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

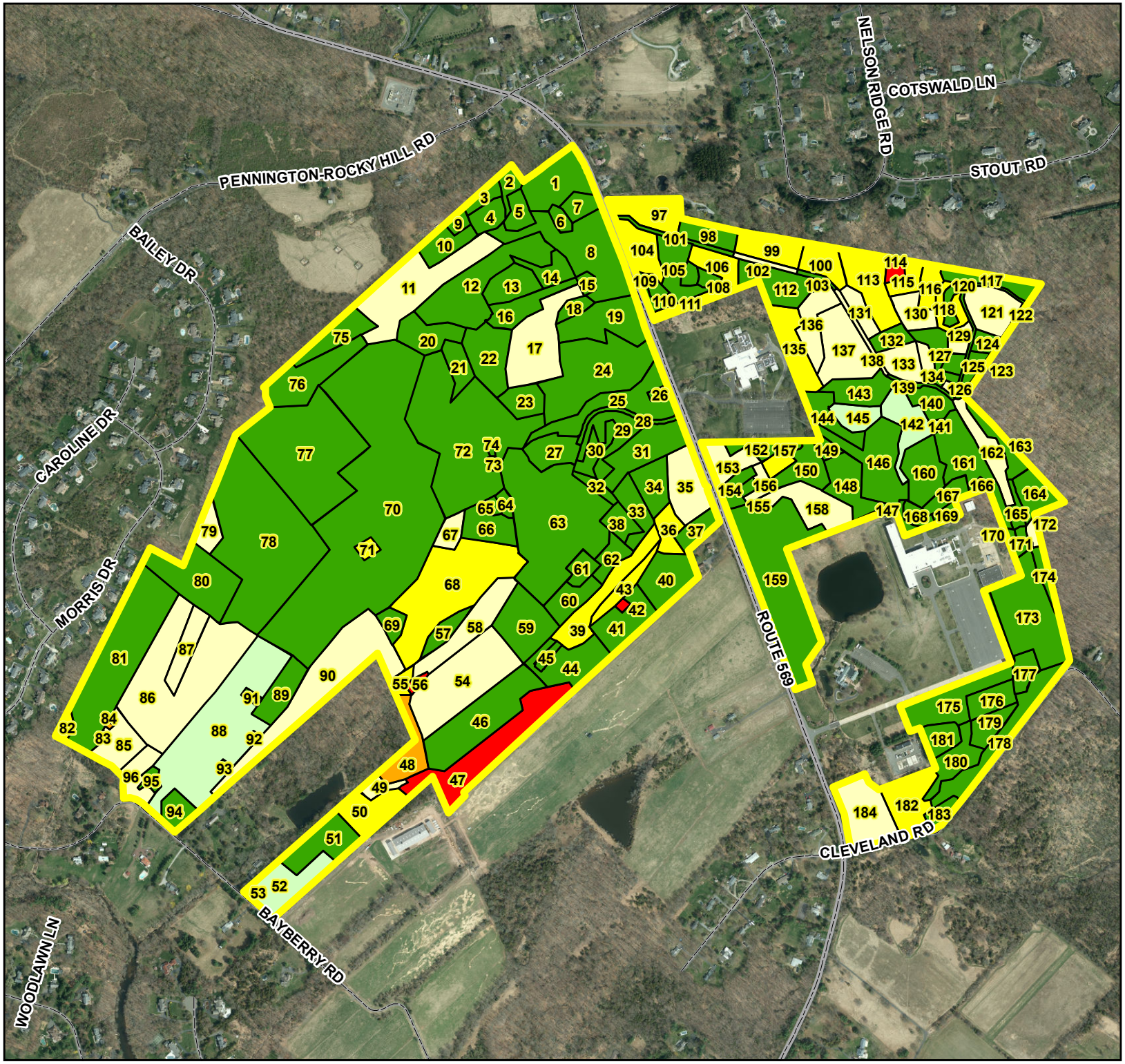
**Multifloral Rose**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

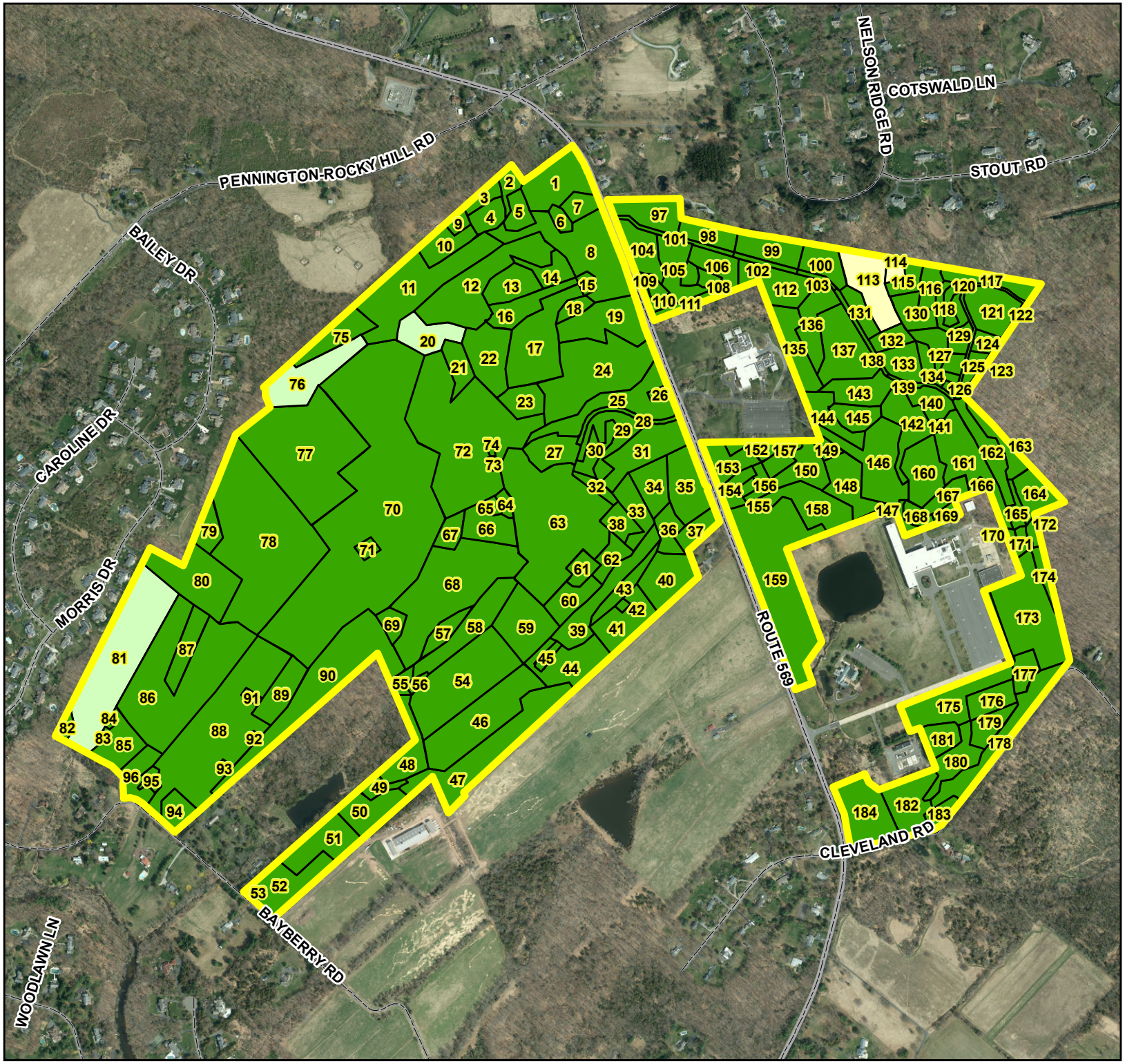
**Wineberry**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF
HOPEWELL VALLEY
OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

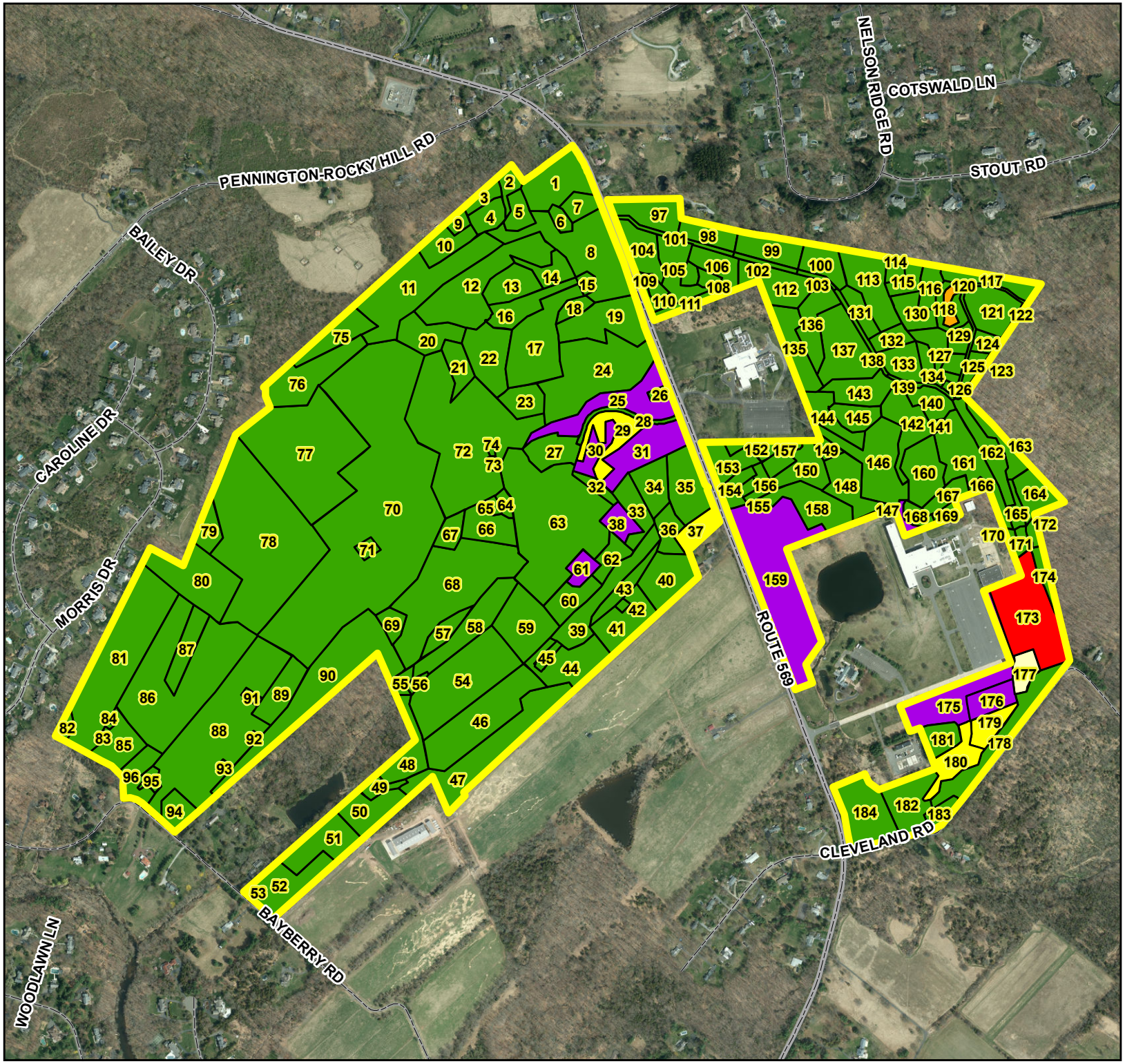
**Linden Viburnum**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet




FRIENDS OF HOPEWELL VALLEY OPEN SPACE

# Mount Rose Stewardship Plan

## Invasive Species Distribution and Severity

### Legend

- Preserve Boundary

**Cool Season Grasses**

- Absent
- Trace (<1%)
- 1-10% Cover
- 11-25% Cover
- 26-50% Cover
- 51-75% Cover
- 76-100% Cover

N

Locator Map

0 500 1,000 Feet

# Mount Rose Stewardship Plan

# Appendices

## Appendix A. Overview of Invasive Species Control Methods
## Mount Rose Preserve Stewardship Plan

| Method Type(s) | Method Name | Method Code | Typical Herbicide Concentrations | Target Type(s) | Basic Technique | Pros | Cons | Notes |
|---|---|---|---|---|---|---|---|---|
| Biological Control | biological control | BC | N/A | few selected species | Release of approved biological control agents that attack only target species | Method can provide effective control and is cost effective | Only mile-a-minute and purple loosestrife have an available biological control agent | A biological control agent for garlic mustard is under development and may be ready for release in the near future. |
| Chemical Control | basal bark | BB | 20 - 25% | woody species | Application of herbicide within a 6-12 inch band around entire stem approximately 12 inches above base of plant | Method provides effective control and is cost effective | Some suggested oil diluents are not environmentally friendly, but mineral, vegetable or citrus oils with triclopyr can be effective (Rathfon 2006) | Herbicide application is performed using a backpack sprayer. Method used for woody stems ≤ 6" in diameter. This method should be considered an important control technique. |
| Chemical Control | foliar spray | FS | 1-3% | Any plant less than 4 feet tall | Application of herbicide using a backpack sprayer to wet all leaves | Method provides effective control and is cost effective | Method has potential to injure non-target species and cannot be used on taller plants due to increased risk to applicator and non-target species (i.e., spraying upward increases risk of drift); Method can be sensitive to weather conditions (e.g., heat may dry spray before effective absorption) | Foliar applications generally include use of a backpack sprayer (Recommend use of Thinvert system[1]). Some foliar application methods include wipe-on applications (e.g., "bloody glove"), but these methods are not recommended because they are extremely time consuming and increase likelihood of exposure to the applicator. The use of boom applications is not recommended, but may be useful in the establishment of native warm season grasses where all existing vegetation must be removed prior to seeding. |
| Chemical Control | pre-emergent spray | PS | 1-3% | herbaceous species | Application of herbicide to prevent seed germination | Method can provide effective control | Requires a broad application in areas known or suspected to contain invasive species; Timing of application can vary between years for targeted species; Supresses germination of all species | This method may be most beneficial for Japanese stiltgrass infestations on trails. |
| Chemical & Mechanical Control | hack-and-squirt | HS | 20 - 25% | woody species | Make downward cuts with a hand axe (one cut per inch of diamter) and apply herbicide to cuts | Method provides effective control and is cost effective; Volunteers can assist with stem cutting | Stem cutting may be difficult for thick-barked plants | Herbicide applied with squirt bottle or paint brush. Herbicide should be applied immediately after cutting. |

## Appendix A. Overview of Invasive Species Control Methods
## Mount Rose Preserve Stewardship Plan

| Method Type(s) | Method Name | Method Code | Typical Herbicide Concentrations | Target Type(s) | Basic Technique | Pros | Cons | Notes |
|---|---|---|---|---|---|---|---|---|
| Chemical & Mechanical Control | stem injection | SI | 20 - 25% | woody species | E-Z-Ject Lance loaded with herbicide pellets | Method provides effective control | Equipment is difficult to operate under field conditions; Injection for thick-barked trees requires signifcant force; Equipment is expensive | A modified approach using a drill and manual insertion of herbicide may be more practical. This method is generally not practical. |
| Chemical & Mechanical Control | cut stump | CS | 20 - 25% | woody species | Cutting stems just above ground level followed by targeted application of herbicide to cut stems | Method provides effective control; Volunteers can assist with stem cutting | Mechanical removal of stems is very time consuming | Cutting is performed by loppers, handsaws or chainsaws depending upon size of stems. Herbicide applied with a squirt bottle, paint brush or backpack sprayer. Herbicide should be applied immediately after cutting. |
| Cultural Control | prescribed fire | PF | N/A | many species | Should follow a site-specific Prescribed Burning Plan that is part of a comprehensive Grassland Management Plan | Method provides effective control and is cost effective | Requires highly trained personnel; Insurance requirements may restrict application to an outside contractor; Requires public outreach to neighbors and public officials | Prescribed fire is most effective for grasslands with dense stands of native warm season grasses that provide ample fuel to eliminate woody seedlings; Prescribed fire may be utilized to remove dense thatch before application of herbicides (e.g., common reed, reed canary grass) in wetland habitats. The effectiveness of presribed fire to control invasive species in forest habitats is currently uncertain. |
| Cultural Control | prescribed grazing | PG | N/A | many species | Rotational system using multiple livestock species; Should follow a site-specific Presribed Grazing Plan that is part of a comprehensive Grassland Management Plan | Method may be effective; Method can be assisted by volunteers | Method requires significant expertise in selection of livestock species, density of animals per unit area and timing of grazing; Method requires installation of fencing; Method may spread some invasive species through feces; Trampling of vegetation may encourage invasive species | Implementation will require consultation with experts in the use of livestock for the purpose of eliminating invasive species; Method may be considered for shrub control in forest settings if native species are currently absent |

## Appendix A. Overview of Invasive Species Control Methods
## Mount Rose Preserve Stewardship Plan

| Method Type(s) | Method Name | Method Code | Typical Herbicide Concentrations | Target Type(s) | Basic Technique | Pros | Cons | Notes |
|---|---|---|---|---|---|---|---|---|
| Cultural Control | soil tilling | ST | N/A | herbaceous species and woody seedlings | Turning of soil using typical farm equipment | Method may provide effective control and is cost effective | Method destroys native species along with invasive species; Method may increase invasive species through extensive soil disturbance | This is an extreme method with limited use in natural areas. Successive tilling events may be used to exhaust weed seed bank prior to re-planting meadows. |
| Cultural Control | mulching | MU | N/A | herbaceous species | Application of a thick layer (3-4 inches) of organic materials | Method is effective for herbaceous species within cultivated garden beds or roadsides; Method can be assisted by volunteers | Method is not practical in natural areas where vehicle access is limited | Only effective on species with small seeds or weakly growing plants that cannot germinate/grow through the mulch. Japanese stiltgrass and garlic mustard are sensitive to heavy mulching. |
| Cultural Control | solarization | SO | N/A | herbaceous species | Application of plastic sheeting over infested areas | Method may be effective in some situations; Method can be assisted by volunteers | Method may alter soil chemistry and biology more significantly than herbicides | Plastic sheeting increases soil temperature to kill seeds and plants. This method is generally not practical in natural areas. |
| Mechanical Control (may be combined with Chemical Control) | girdling | GI | N/A | woody species | Cutting and removing a ≥ 3 inch band of bark from a trunk | Method can provide effective control; Method can be assisted by volunteers | Method may be ineffective on species with re-sprouting ability; Method is time consuming and difficult for thick-barked species; Method cannot be utilized where the risk of standing dead trees is unacceptable | Method may be combined with chemical control (i.e., apply herbicide to girdled area); Do not attempt on species such as black locust, tree-of-heaven or Japanese angelica tree, which will vigorously re-sprout multiple stems in response to girdling (hack-and-squirt may be effective on these species). |
| Mechanical Control | mowing | MO | N/A | many species | Cutting tops of plants using a mower, brush cutter or weed whacker | Method may be used as a pre-treatment for herbicide application to cut stumps or foliar applications to re-sprouts using a backpack sprayer | Method is ineffective for most species because of re-sprouting ability | Japanese stiltgrass can sustain itself as a "lawn" by producing seeds on plants that are two inches or smaller. |

## Appendix A. Overview of Invasive Species Control Methods
## Mount Rose Preserve Stewardship Plan

| Method Type(s) | Method Name | Method Code | Typical Herbicide Concentrations | Target Type(s) | Basic Technique | Pros | Cons | Notes |
|---|---|---|---|---|---|---|---|---|
| Mechanical Control | pulling | PU | N/A | small woody plants and herbaceous species | Removal of entire plant by hand or use of specialized tools such as a "Weed Wrench" | Method can provide effective control; Method can be performed by volunteers | Method is extremely time consuming and ineffective when root system cannot be completely removed; Method creates soil disturbance that stimulates germination of invasive species such as garlic mustard and Japanese stiltgrass | This method should only be considered on a limited basis. |
| Mechanical Control | hot foam spray | HF | N/A | herbaceous species | Rental of Waipuna Hot Foam System | No herbicides are required | System rental cost is $700/month with a two-year lease commitment and there are other related equipment costs; system can only be used within 200 feet of a vehicle that carries the specialized hot foam generator, many herbaceous plants require multiple treatments | This is an innovative system, but has significant financial and practical limitations. |

[1]Thinvert system involves use of specialized spray nozzles combined with a thin invert emulsion spray fluid (instead of using water to mix with herbicides). The primary advantage is less herbicide drift to non-target plants and an overall lower volume of spray required to treat a given area. Although the system is more expensive than typical spray systems, it is ultimately cost effective because of labor-savings generated through reduction of re-filling of sprayers and reduction of herbicide use by minimizing drift.

## Appendix B. Summary of Herbicide Characteristics
## Mount Rose Preserve Stewardship Plan
**Sources: Tu et al. 2001, CDMS 2007**

| | | | | | | Wildlife Risk Category | | Human Risk | |
|---|---|---|---|---|---|---|---|---|---|
| **Herbicide Common Name[1]** | **Recommended Use Grouping[2]** | **Examples of Trade Names** | **Target Species** | **Half-life in Soil (days)** | **Half-life in Water (days)** | **Birds and Mammals** | **Aquatic Species** | **Signal Word[3]** | **Notes** |
| 2,4-D[1] | Infrequent | Navigate, 2,4-D L.V.4 Ester, 2,4-D Amine 4, Aqua-kleen, Barrage | herbaceous broadleaf plants | 10 | hours to months | Moderately toxic | Not reported, but may bioaccumulate | Caution or Danger | Inconclusive evidence implicates 2,4-D as a potential endocrine disrupter; Eye and skin irritant |
| Clopyralid | Infrequent | Reclaim, Curtail, Transline, Stinger, Lontrel | herbaceous broadleaf plants | 40 | 8-40 | Practically non-toxic | Low toxicity | Caution or Danger | May cause serious eye damage |
| Fluazifop-p-Butyl | Limited | Fusilade DX, Fusion, Ornamec, Horizon 2000 | grasses | 15 | stable | Slight toxicity to practically non-toxic | High toxicity | Caution | Eye and nasal irritant - toxic if inhaled |
| Fosamine | Limited | Krenite S | woody plants, some herbaceous broadleaf plants | 8 | stable | Very slight toxicity | Low toxicity | Caution | Eye and skin irritant |
| Glyphosate[1] | Typical | Round-Up, Rodeo, Accord, Glypro, Glyphomax, Touchdown | any plant | 47 | 12 days to 10 weeks | Low toxicity | Moderate toxicity[4] | Caution | Eye and skin irritant |
| Hexazinone | Infrequent | Velpar L | herbaceous broadleaf plants, some grasses & some woody plants | 90 | 3 days to 9 months | Low toxicity | Slight toxicity | Danger | May cause serious eye damage |
| Imazapic | Infrequent | Plateau, Cadre | some grasses, some herbaceous broadleaf plants | 120-140 | < 8 hours | Low toxicity | Moderate toxicity | Caution | Eye and skin irritant |
| Imazapyr[1] | Limited | Arsenal, Chopper, Stalker, Habitat | any plant | 24-141 | 2 days | Low toxicity | Low toxicity | Caution | Eye and skin irritant |

## Appendix B. Summary of Herbicide Characteristics
## Mount Rose Preserve Stewardship Plan
**Sources: Tu et al. 2001, CDMS 2007**

| | | | | | | Wildlife Risk Category | | Human Risk | |
|---|---|---|---|---|---|---|---|---|---|
| **Herbicide Common Name[1]** | **Recommended Use Grouping[2]** | **Examples of Trade Names** | **Target Species** | **Half-life in Soil (days)** | **Half-life in Water (days)** | **Birds and Mammals** | **Aquatic Species** | **Signal Word[3]** | **Notes** |
| Picloram | Typical | Tordon K, Tordon 22K, Grazon PC | herbaceous broadleaf plants, woody plants | 90 | 2-3 days | Slight toxicity to practically non-toxic | Slight to moderate toxicity | Caution | Eye and skin irritant |
| Sethoxydim | Limited | Poast, Torpedo, Ultima, Vantage, Conclude | grasses | 5 | hours in sunlight | Slight toxicity | Slight toxicity | Warning | Eye and skin irritant |
| Triclopyr | Typical | Garlon 3A, Garlon 4, Remedy, Pathfinder II, Crossbow | herbaceous broadleaf plants, woody plants | 30 | 4 days | Slight toxicity | Slight toxicity | Caution or Danger | Garlon 3A can cause severe eye damage and is labeled "Danger"; Most other formulations are labeled "Caution" |

[1] Denotes that some formulations of this herbicide are registered for aquatic applications.

[2] Groupings were based upon risks to humans or wildlife, relative cost compared to other similarly effective products and frequency of use by natural area managers.

[3] Signal Words include "Danger" (highly toxic or highly corrosive), "Warning" (moderately toxic) and "Caution" (slightly toxic or relatively non-toxic). Please note that signal words are assigned to specific formulations and may vary within particular herbicide common names (CDMS 2007).

[4] Glyphosate is essentially non-toxic when using aquatic formulations (e.g., Rodeo with a surfactant registered for aquatic applications).

**Appendix C. Invasive Plant Species Phenology[1] and Treatment Recommendations**
**Mount Rose Preserve Stewardship Plan**

period of flowering
period of flowering and fruiting
period of ripe fruit availabilty

**Utilize phenology for control guidance timelines - this is particularly critical for annual and biennial plants.**

| Scientific Name | Common Name | Current Abundance / Distribution Code | Treatment Options - See NJISST Herbicide Use Suggestions and Mixing Guide for details | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ailanthus altissima | tree-of-heaven | Widespread | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Alliaria petiolata | garlic mustard | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); BIENNIAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines); Treatment recommended from Mid Fall through Late Winter to avoid damaging most native species | | | | | | | | | | | | |
| Aralia elata | Japanese angelica tree | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Artemisia vulgaris | mugwort | Widespread | Foliar Spray: FS-7 (Aminopyralid 0.27%); Apply in early summer; mowing may be utilized as a pre-treatment, but allow 4-8 weeks for re-growth before utilizing FS | | | | | | | | | | | | |
| Arthraxon hispidus | small carpetgrass | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Foliar Spray: FS-8 (Quizalofop 0.38%); Pre-Emergent Spray: PE-1 (Prodiamine - See Label Instructions); ANNUAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines). | | | | | | | | | | | | |
| Berberis thunbergii | Japanese barberry | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Catalpa bignonioides | Southern Catalpa | NA | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |

**Appendix C. Invasive Plant Species Phenology[1] and Treatment Recommendations**
**Mount Rose Preserve Stewardship Plan**

period of flowering
period of flowering and fruiting
period of ripe fruit availabilty

Utilize phenology for control guidance timelines - this is particularly critical for annual and biennial plants.

| Scientific Name | Common Name | Current Abundance / Distribution Code | Treatment Options - See NJISST Herbicide Use Suggestions and Mixing Guide for details | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Celastrus orbiculatus | Oriental bittersweet | Widespread | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); VINE SPECIES; Pre-treatment cutting recommended when tall/dense/multi-stem tangles prohibit safe application via FS. | | | | | | | | | | | | |
| Cirsium arvense | Canada thistle | Widespread | Foliar Spray: FS-6 (Clopyralid 0.63%) | | | | | | | | | | | | |
| Elaeagnus angustifolia | Russian olive | Stage 0 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Euonymus alatus | winged burning bush | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Hedera helix | English ivy | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Pre-treatment cutting recommended when tall/dense/multi-stem tangles prohibit safe application via FS; Species has thick/waxy leaves, utlilize Clean Cut surfactant or equivalent | | | | | | | | | | | | |
| Hosta ventricosa | blue plantain lily | Stage 1 | Foliar Spray: FS-2 (Glyphosate 3.00%) | | | | | | | | | | | | |
| Lespedeza cuneata | sericea lespedeza | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Metsulfuron (0.25%) should be considered an alternate method that is effective on species of the bean family. | | | | | | | | | | | | |
| Ligustrum obtusifolium | border privet | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Lonicera japonica | Japanese honeysuckle | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Lonicera maackii | Amur honeysuckle | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Lonicera morrowii | Morrow's honeysuckle | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |

**Appendix C. Invasive Plant Species Phenology[1] and Treatment Recommendations**
**Mount Rose Preserve Stewardship Plan**

period of flowering
period of flowering and fruiting
period of ripe fruit availabilty

**Utilize phenology for control guidance timelines - this is particularly critical for annual and biennial plants.**

| Scientific Name | Common Name | Current Abundance / Distribution Code | Treatment Options - See NJISST Herbicide Use Suggestions and Mixing Guide for details | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Malus toringo | Japanese crabapple | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Microstegium vimineum | Japanese stiltgrass | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Foliar Spray: FS-8 (Quizalofop 0.38%); Pre-Emergent Spray: PE-1 (Prodiamine - See Label Instructions); ANNUAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines). | | | | | | | | | | | | |
| Phalaris arundinacea | reed canarygrass | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Seek aquatic application permit and use wetlands appropriate herbicides and surfactants; mowing or grazing may be considered as a pre-treatment | | | | | | | | | | | | |
| Photinia villosa | Oriental photinia | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Phragmites australis | common reed | Widespread | Foliar Spray: FS-3 (Glyphosate 5.00%); Seek aquatic application permit and use wetlands appropriate herbicides and surfactants. | | | | | | | | | | | | |
| Picea abies | Norway spruce | NA | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture) | | | | | | | | | | | | |
| Polygonum perfoliata | mile-a-minute vine | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%); Pre-Emergent Spray: PE-1 (Prodiamine - See Label Instructions); NJDA has released biological control agents that may ultimately provide effective control - additional control measures recommended for new, small populations only; ANNUAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines). | | | | | | | | | | | | |

**Appendix C. Invasive Plant Species Phenology[1] and Treatment Recommendations**
**Mount Rose Preserve Stewardship Plan**

period of flowering
period of flowering and fruiting
period of ripe fruit availabilty

| Scientific Name | Common Name | Current Abundance / Distribution Code | Treatment Options - See NJISST Herbicide Use Suggestions and Mixing Guide for details | Utilize phenology for control guidance timelines - this is particularly critical for annual and biennial plants. January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pyrus calleryana | Callery pear (Bradford pear) | Stage 3 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Robinia pseudoacacia | black locust | Widespread | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |
| Rosa multiflora | multiflora rose | Widespread | Foliar Spray: FS-2 (Glyphosate 3.00%), Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%) | | | | | | | | | | | | |
| Rubus phoenicolasius | wine raspberry | Widespread | Foliar Spray: FS-3 (Glyphosate 5.00%) | | | | | | | | | | | | |
| Various | Cool Season Grasses | NA | Foliar Spray: FS-3 (Glyphosate 5.00%) | | | | | | | | | | | | |
| Viburnum dilatatum | linden viburnum | Widespread | Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to- | | | | | | | | | | | | |
| Zelkova serrata | Japanese zelkova | Stage 0 | Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness | | | | | | | | | | | | |

**Question #1.**

## Mount Rose Preserve Public Survey

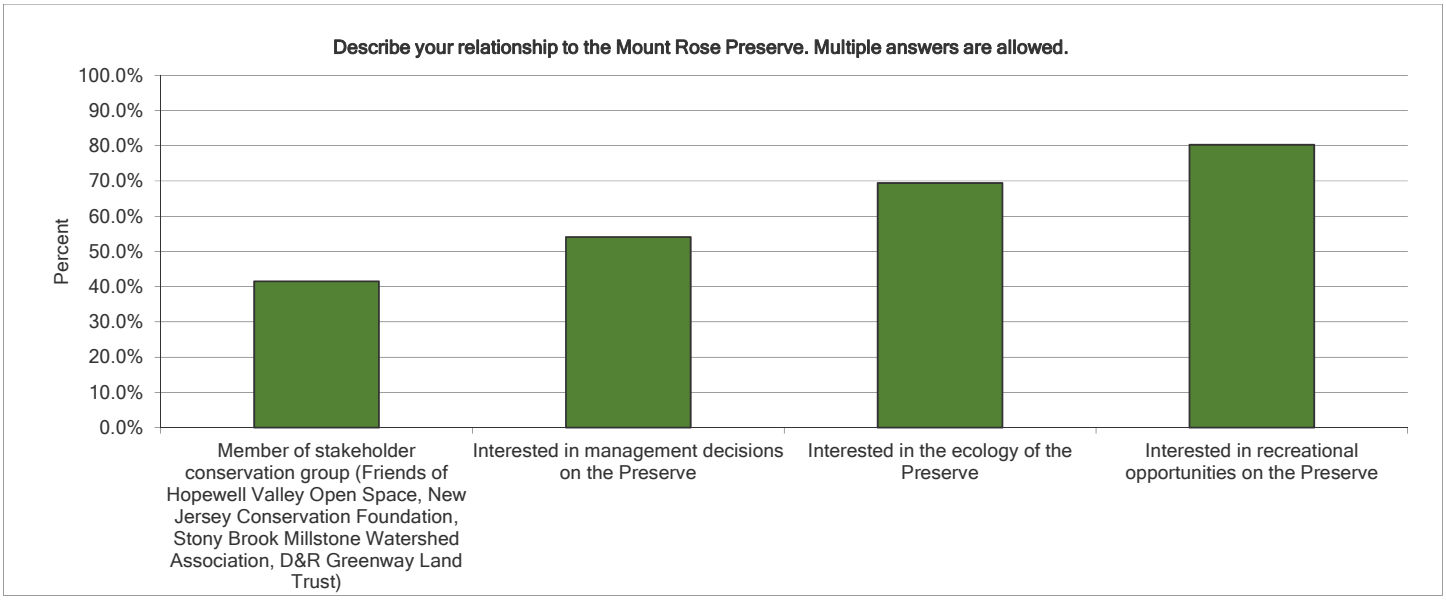
| Please provide the zip code where you live (required to continue with | |
|---|---|
| **Answer Options** | **Response Count** |
| | 186 |
| *answered question* | 186 |
| *skipped question* | 0 |

| Town | Zip Code | Number of Responses | Percentage of Responses |
|---|---|---|---|
| Berkeley Heights | 07922 | 1 | 0.5 |
| Bethlehem, PA | 18017 | 1 | 0.5 |
| Brick | 08723 | 1 | 0.5 |
| Colts Neck | 07722 | 1 | 0.5 |
| Far Hills | 07931 | 1 | 0.5 |
| Flemington | 08822 | 1 | 0.5 |
| Frenchtown | 08825 | 1 | 0.5 |
| Highland Park | 08904 | 2 | 1.1 |
| Hillsborough | 08844 | 2 | 1.1 |
| Hopewell | 08525 | 47 | 25.3 |
| Lambertville | 08530 | 4 | 2.2 |
| Oaks, PA | 19456 | 1 | 0.5 |
| Pennington | 08534 | 62 | 33.3 |
| Princeton | 08540 | 26 | 14.0 |
| Ringoes | 08551 | 1 | 0.5 |
| Skillman | 08558 | 1 | 0.5 |
| Three Bridges | 08887 | 1 | 0.5 |
| Titusville | 08560 | 13 | 7.0 |
| Trenton | 08618 | 1 | 0.5 |
| Trenton | 08619 | 3 | 1.6 |
| Trenton | 08638 | 1 | 0.5 |
| Trenton | 08648 | 10 | 5.4 |
| Trenton | 08690 | 1 | 0.5 |
| West Chester, PA | 13980 | 1 | 0.5 |
| N/A | Invalid Response | 2 | 1.1 |
| | **Totals** | **186** | **100.0** |

**Question #2.**

## Mount Rose Preserve Public Survey

| Describe your relationship to the Mount Rose Preserve. Multiple answers are allowed. | | |
|---|---|---|
| **Answer Options** | **Response Percent** | **Response Count** |
| Member of stakeholder conservation group (Friends | 41.5% | 76 |
| Interested in management decisions on the Preserve | 54.1% | 99 |
| Interested in the ecology of the Preserve | 69.4% | 127 |
| Interested in recreational opportunities on the | 80.3% | 147 |
| *answered question* | | 183 |
| *skipped question* | | 3 |

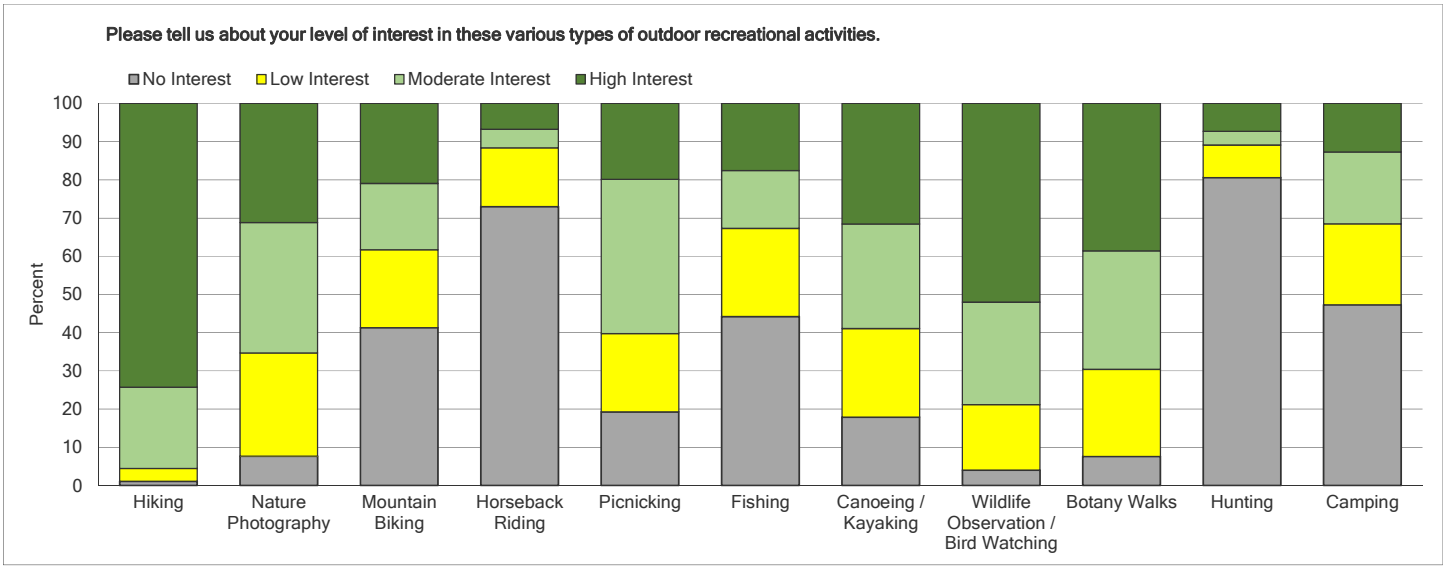


**Question #3.**

## Mount Rose Preserve Public Survey

**Please tell us about your level of interest in these various types of outdoor recreational activities. This question is not spef**

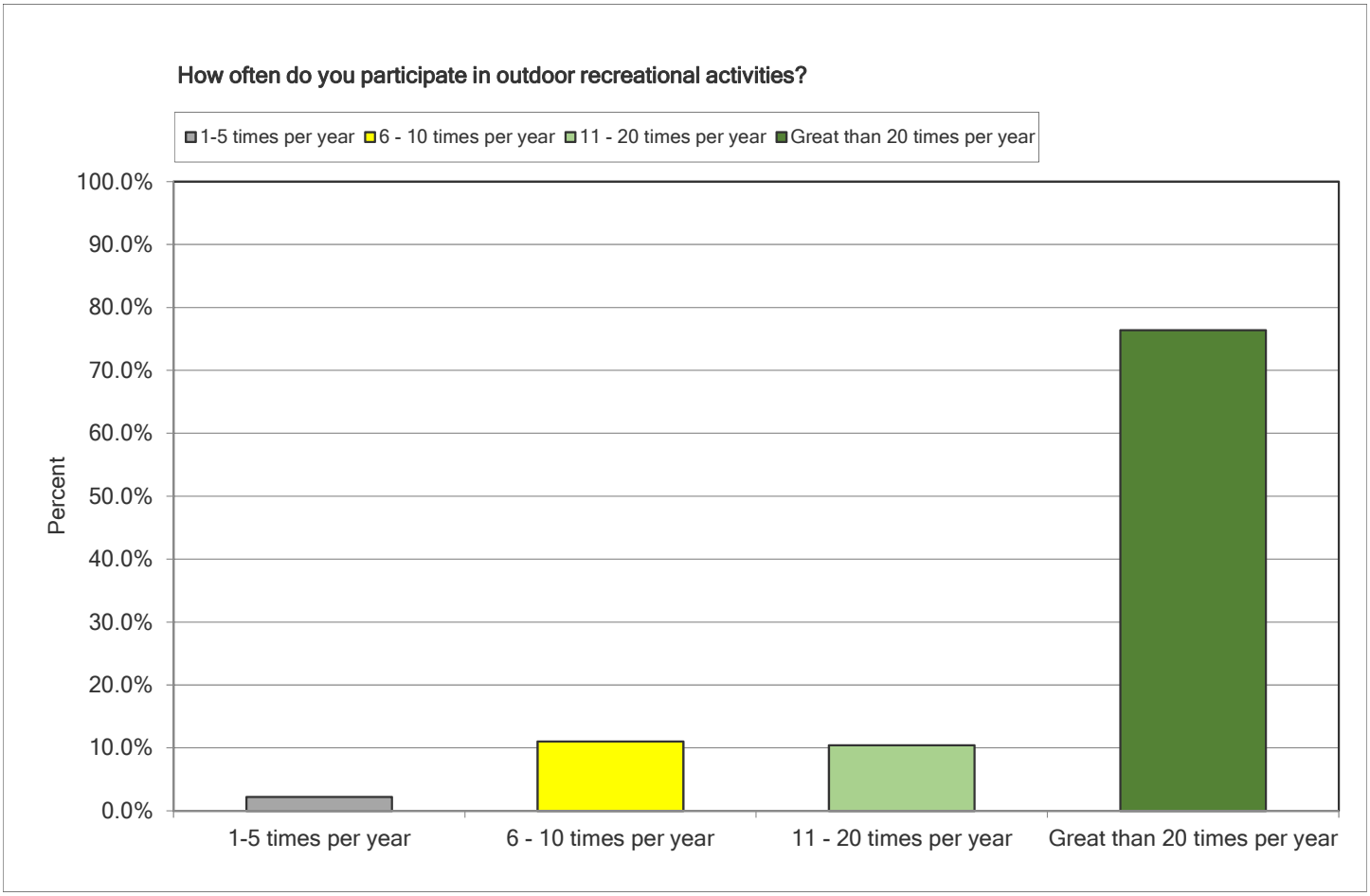
| Answer Options | No Interest | Low Interest | Moderate Interest | High Interest | Rating Average | Response Count |
|---|---|---|---|---|---|---|
| Hiking | 1 | 3 | 21 | 74 | 3.69 | 179 |
| Nature Photography | 8 | 27 | 34 | 31 | 2.89 | 170 |
| Mountain Biking | 41 | 20 | 17 | 21 | 2.18 | 167 |
| Horseback Riding | 73 | 15 | 5 | 7 | 1.45 | 163 |
| Picnicking | 19 | 20 | 40 | 20 | 2.61 | 166 |
| Fishing | 44 | 23 | 15 | 18 | 2.06 | 165 |
| Canoeing / Kayaking | 18 | 23 | 27 | 32 | 2.73 | 168 |
| Wildlife Observation / Bird Watching | 4 | 17 | 27 | 52 | 3.27 | 175 |
| Botany Walks | 8 | 23 | 31 | 39 | 3.01 | 171 |
| Hunting | 81 | 8 | 4 | 7 | 1.38 | 165 |
| Camping | 47 | 21 | 19 | 13 | 1.97 | 165 |
| | | | | | *answered question* | 181 |
| | | | | | *skipped question* | 5 |



**Question #4.**

## Mount Rose Preserve Public Survey

| How often do you participate in outdoor recreational activities? | | |
|---|---|---|
| **Answer Options** | **Response Percent** | **Response Count** |
| 1-5 times per year | 2.2% | 4 |
| 6 - 10 times per year | 11.0% | 20 |
| 11 - 20 times per year | 10.4% | 19 |
| Great than 20 times per year | 76.4% | 139 |
| | ***answered question*** | **182** |
| | ***skipped question*** | **4** |

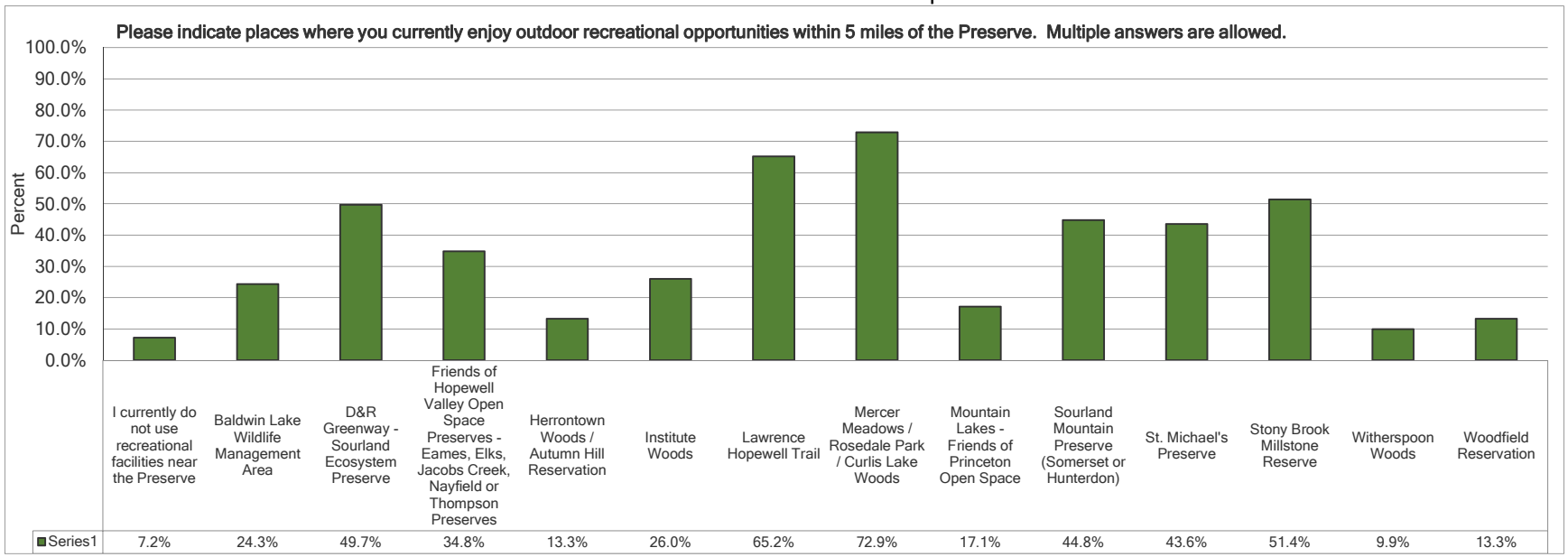


**Question #5.**

## Mount Rose Preserve Public Survey

**Please indicate places where you currently enjoy outdoor recreational opportunities within 5 miles of the Preserve. Multiple answers are allowed.**

| Answer Options | Response Percent | Response Count |
|---|---|---|
| I currently do not use recreational facilities near the Preserve | 7.2% | 13 |
| Baldwin Lake Wildlife Management Area | 24.3% | 44 |
| D&R Greenway - Sourland Ecosystem Preserve | 49.7% | 90 |
| Friends of Hopewell Valley Open Space Preserves - Eames, Elks, Jacobs Creek, Nayfield or Thompson Preserves | 34.8% | 63 |
| Herrontown Woods / Autumn Hill Reservation | 13.3% | 24 |
| Institute Woods | 26.0% | 47 |
| Lawrence Hopewell Trail | 65.2% | 118 |
| Mercer Meadows / Rosedale Park / Curlis Lake Woods | 72.9% | 132 |
| Mountain Lakes - Friends of Princeton Open Space | 17.1% | 31 |
| Sourland Mountain Preserve (Somerset or Hunterdon) | 44.8% | 81 |
| St. Michael's Preserve | 43.6% | 79 |
| Stony Brook Millstone Reserve | 51.4% | 93 |
| Witherspoon Woods | 9.9% | 18 |
| Woodfield Reservation | 13.3% | 24 |
| *answered question* | | **181** |
| *skipped question* | | **5** |

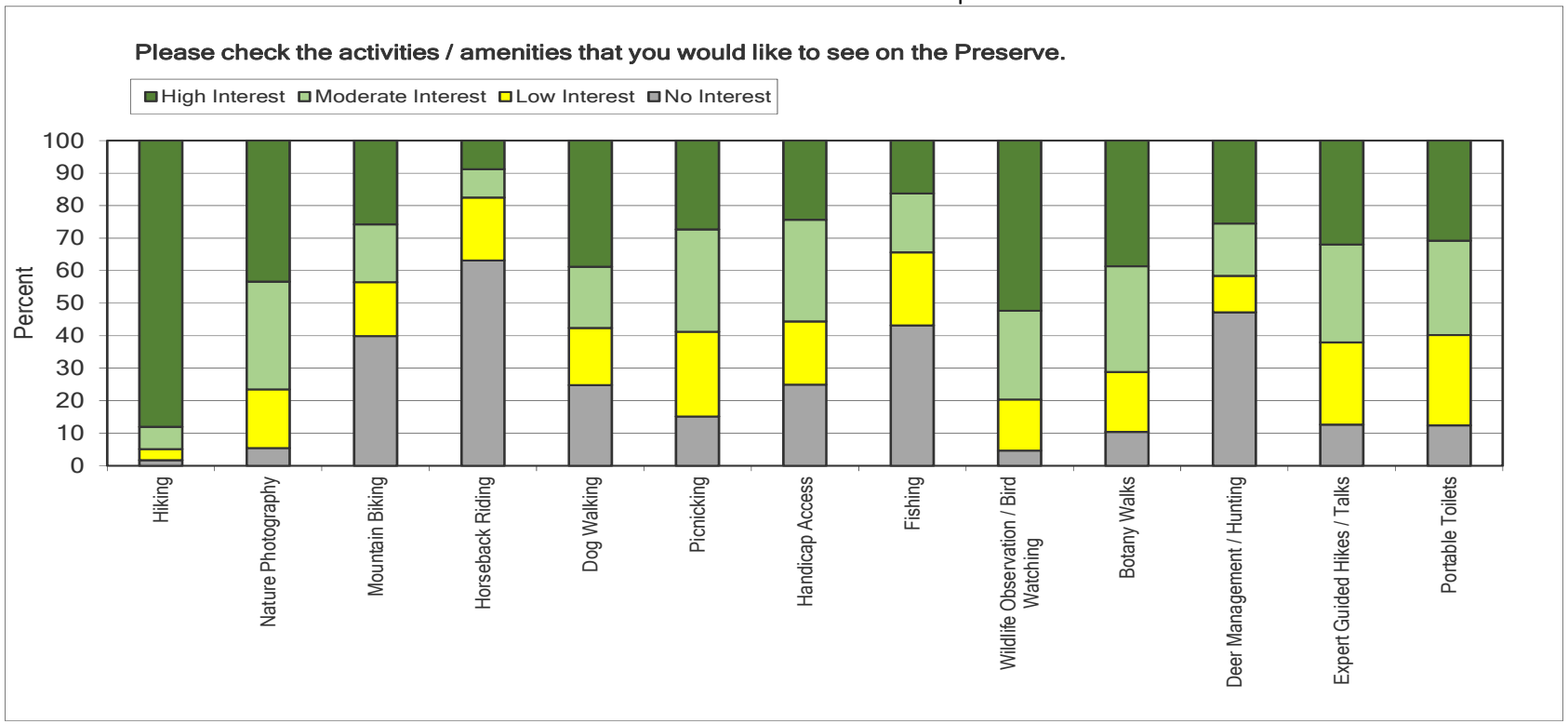

Please indicate places where you currently enjoy outdoor recreational opportunities within 5 miles of the Preserve. Multiple answers are allowed.
Percent
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
I currently do not use recreational facilities near the Preserve
Baldwin Lake Wildlife Management Area
D&R Greenway - Sourland Ecosystem Preserve
Friends of Hopewell Valley Open Space Preserves - Eames, Elks, Jacobs Creek, Nayfield or Thompson Preserves
Herrontown Woods / Autumn Hill Reservation
Institute Woods
Lawrence Hopewell Trail
Mercer Meadows / Rosedale Park / Curlis Lake Woods
Mountain Lakes - Friends of Princeton Open Space
Sourland Mountain Preserve (Somerset or Hunterdon)
St. Michael's Preserve
Stony Brook Millstone Reserve
Witherspoon Woods
Woodfield Reservation
Series1 7.2% 24.3% 49.7% 34.8% 13.3% 26.0% 65.2% 72.9% 17.1% 44.8% 43.6% 51.4% 9.9% 13.3%

**Question #6.**

**Mount Rose Preserve Public Survey**

**Please check the activities / amenities that you would like to see on the Preserve. Please feel free to list additional items under general comments later in this survey.**

| Answer Options | No Interest | Low Interest | Moderate Interest | High Interest | Response Count |
|---|---|---|---|---|---|
| Hiking | 2 | 3 | 7 | 88 | 175 |
| Nature Photography | 5 | 18 | 33 | 43 | 166 |
| Mountain Biking | 40 | 17 | 18 | 26 | 163 |
| Horseback Riding | 63 | 19 | 9 | 9 | 160 |
| Dog Walking | 25 | 18 | 19 | 39 | 165 |
| Picnicking | 15 | 26 | 32 | 27 | 165 |
| Handicap Access | 25 | 19 | 31 | 24 | 160 |
| Fishing | 43 | 23 | 18 | 16 | 160 |
| Wildlife Observation / Bird Watching | 5 | 16 | 27 | 52 | 172 |
| Botany Walks | 10 | 18 | 33 | 39 | 163 |
| Deer Management / Hunting | 47 | 11 | 16 | 25 | 161 |
| Expert Guided Hikes / Talks | 13 | 25 | 30 | 32 | 166 |
| Portable Toilets | 12 | 28 | 29 | 31 | 169 |
| | | | | *answered question* | 176 |
| | | | | *skipped question* | 10 |

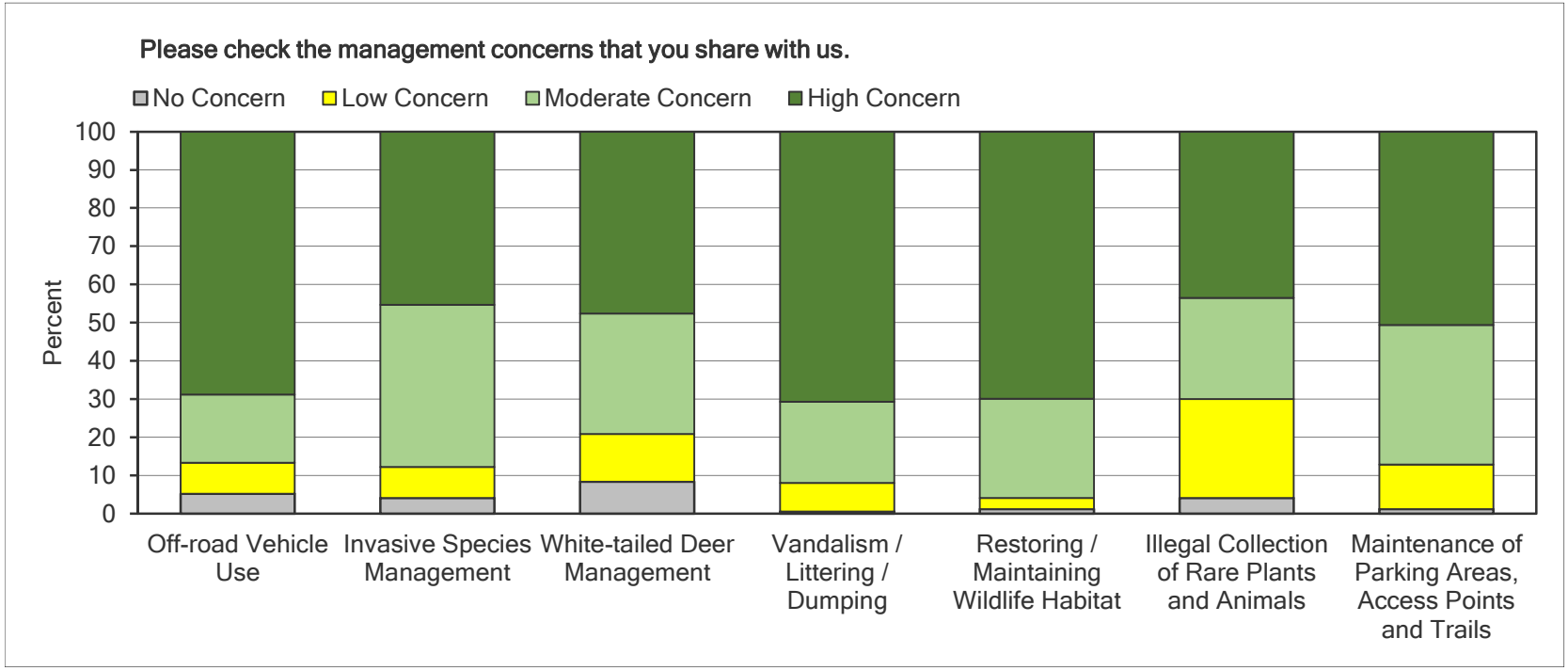

Please check the activities / amenities that you would like to see on the Preserve.
High Interest
Moderate Interest
Low Interest
No Interest
Percent
100
90
80
70
60
50
40
30
20
10
0
Hiking
Nature Photography
Mountain Biking
Horseback Riding
Dog Walking
Picnicking
Handicap Access
Fishing
Wildlife Observation / Bird Watching
Botany Walks
Deer Management / Hunting
Expert Guided Hikes / Talks
Portable Toilets

**Question #7.**

## Mount Rose Preserve Public Survey

**Please check the management concerns that you share with us.**

| Answer Options | No Concern | Low Concern | Moderate Concern | High Concern | Rating Average | Response Count |
|---|---|---|---|---|---|---|
| Off-road Vehicle Use | 5 | 8 | 18 | 69 | 3.50 | 173 |
| Invasive Species Management | 4 | 8 | 42 | 45 | 3.29 | 172 |
| White-tailed Deer Management | 8 | 13 | 32 | 48 | 3.18 | 168 |
| Vandalism / Littering / Dumping | 1 | 7 | 21 | 71 | 3.62 | 174 |
| Restoring / Maintaining Wildlife Habitat | 1 | 3 | 26 | 70 | 3.65 | 173 |
| Illegal Collection of Rare Plants and Animals | 4 | 26 | 26 | 44 | 3.09 | 170 |
| Maintenance of Parking Areas, Access Points and Trai | 1 | 12 | 37 | 51 | 3.37 | 172 |
| | | | | | *answered question* | 176 |
| | | | | | *skipped question* | 10 |



**Question #8.**

## Mount Rose Preserve Public Survey

| Please use this space to make any additional comments about past, present, or future management of the Preserve. | |
|---|---|
| **Answer Options** | **Response Count** |
| | 69 |
| *answered question* | 69 |
| *skipped question* | 117 |

**Question #9.**

## Mount Rose Preserve Public Survey

| Are you interested in volunteering to help us at the Preserve?If so, please supply your contact information below. Volunteer opportunities are | | |
|---|---|---|
| **Answer Options** | **Response Percent** | **Response Count** |
| Name | 100.0% | 34 |
| Address | 94.1% | 32 |
| City | 94.1% | 32 |
| State | 94.1% | 32 |
| Zip Code | 94.1% | 32 |
| Email Address | 91.2% | 31 |
| Phone Number | 73.5% | 25 |
| *answered question* | | 34 |
| *skipped question* | | 152 |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.1 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | Yes | 4 | 5 | 13 | |
| 2 | 0.7 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 2 | 5 | 7 | |
| 3 | 0.6 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | Yes | 4 | 5 | 12 | |
| 4 | 1.0 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 6 | 5 | 8 | |
| 5 | 0.9 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 3 | 5 | 9 | |
| 6 | 0.5 | Low | Wet-Moist | Meadow | NA | 0 | 0 | No | No | 1 | 5 | 5 | |
| 7 | 0.9 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | Yes | 4 | 5 | 12 | |
| 8 | 5.7 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | Yes | 4 | 5 | 11 | |
| 9 | 0.4 | Low | Wet-Moist | Shrubland - Woodland | Red Cedar | 4 | 3 | No | No | 4 | 2 | 7 | |
| 10 | 1.4 | Low | Wet-Moist | Woodland | Red Maple | 1 | 1 | No | No | 3 | 4 | 10 | |
| 11 | 6.1 | Low | Wet-Moist | Forest | Red Maple | 0 | 0 | No | No | 4 | 5 | 8 | |
| 12 | 5.4 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 2 | 5 | 6 | |
| 13 | 1.7 | Low | Wet-Moist | Forest | Red Cedar | 1 | 1 | No | No | 6 | 3 | 11 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 1.1 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 2 | 5 | 6 | |
| 15 | 0.4 | Low | Wet-Moist | Shrubland - Woodland | Red Cedar | 4 | 3 | No | No | 4 | 2 | 7 | |
| 16 | 1.8 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 6 | 3 | 11 | |
| 17 | 4.5 | Low | Wet-Moist | Forest | Red Cedar | 1 | 1 | No | No | 12 | 4 | 17 | |
| 18 | 0.6 | Moderate | Wet-Moist | Meadow | NA | 0 | 4 | No | No | 1 | 4 | 4 | |
| 19 | 3.3 | Low | Wet-Moist | Forest | Red Cedar | 1 | 1 | No | No | 4 | 5 | 11 | |
| 20 | 2.0 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 6 | 4 | 10 | |
| 21 | 1.2 | Moderate | Wet-Moist | Meadow | NA | 0 | 4 | No | No | 1 | 4 | 4 | Shrubland Restoration |
| 22 | 2.8 | Low | Wet-Moist | Shrubland - Woodland | Red Maple | 1 | 1 | No | No | 3 | 4 | 10 | Shrubland Restoration |
| 23 | 1.3 | Low | Wet-Moist | Shrubland - Woodland | Ash | 1 | 3 | No | No | 6 | 3 | 10 | Shrubland Restoration |
| 24 | 6.6 | Low | Wet-Moist | Shrubland - Woodland | Ash | 1 | 3 | No | No | 7 | 5 | 13 | Shrubland Restoration |
| 25 | 3.5 | Low | Wet-Moist | Meadow | NA | Trace | 2 | No | No | 9 | 5 | 14 | Meadow Restoration |
| 26 | 0.3 | Low | Upland | Woodland | Ash | 2 | 1 | No | No | 6 | 2 | 10 | |
| 27 | 1.7 | Low | NA | Paved | NA | 0 | NA | No | No | NA | NA | NA | |
| 28 | 0.6 | Low | NA | Paved | NA | 0 | NA | No | No | NA | NA | NA | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 2.0 | Low | Upland | Shrubland | NA | 2 | 1 | No | No | 7 | 4 | 14 | Meadow Restoration |
| 30 | 1.0 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 9 | 5 | 14 | Meadow Restoration |
| 31 | 3.0 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 9 | 5 | 14 | Meadow Restoration |
| 32 | 0.5 | Moderate | Wet-Moist | Meadow | NA | 0 | 4 | No | No | 1 | 5 | 5 | Meadow Restoration |
| 33 | 1.5 | Low | Upland | Shrubland | NA | 0 | 2 | No | No | 5 | 5 | 12 | |
| 34 | 1.7 | Low | Upland | Forest | Ash | 1 | 1 | No | Yes | 6 | 5 | 13 | |
| 35 | 2.7 | Low | Wet-Moist | Woodland | Red Maple | 1 | 2 | No | No | 10 | 5 | 18 | |
| 36 | 1.1 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 8 | 3 | 15 | |
| 37 | 1.0 | Moderate | Wet-Moist | Meadow | NA | 0 | 4 | No | No | 6 | 2 | 7 | |
| 38 | 1.0 | Low | Wet-Moist | Meadow | NA | 0 | 4 | No | No | 6 | 5 | 12 | Meadow Restoration |
| 39 | 2.8 | Low | Wet-Moist | Forest | Ash | 2 | 2 | No | No | 7 | 4 | 16 | |
| 40 | 2.5 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 4 | 4 | 8 | |
| 41 | 2.4 | Low | Wet-Moist | Forest | Red Cedar | 1 | 1 | No | No | 4 | 5 | 9 | |
| 42 | 0.1 | Low | Upland | Woodland | Red Cedar | 0 | 1 | No | No | 4 | 4 | 10 | |
| 43 | 1.1 | Low | Wet-Moist | Forest | Shagbark Hickory | 2 | 1 | No | No | 5 | 3 | 10 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 2.8 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 4 | 5 | 9 | |
| 45 | 0.3 | Low | Wet-Moist | Meadow | NA | 0 | 1 | No | No | 1 | 5 | 5 | |
| 46 | 5.3 | Low | Wet-Moist | Forest | Ash | 0 | 0 | No | No | 1 | 5 | 5 | |
| 47 | 5.4 | Low | Wet-Moist | Forest | Red Cedar | 0 | 1 | No | No | 8 | 5 | 17 | |
| 48 | 1.8 | Low | Wet-Moist | Forest | Ash | 1 | 1 | No | No | 10 | 3 | 14 | |
| 49 | 0.6 | Low | Upland | Meadow | NA | 1 | 1 | No | No | 5 | 5 | 10 | |
| 50 | 2.1 | Low | Wet-Moist | Forest | Pin Oak | 0 | 1 | No | No | 7 | 5 | 14 | |
| 51 | 2.5 | Low | Upland | Forest | Red Cedar | 1 | 1 | No | No | 5 | 5 | 7 | |
| 52 | 2.8 | Low | Upland | Forest | Red Cedar | 1 | 1 | No | No | 7 | 5 | 8 | |
| 53 | 0.0 | Low | Upland | Meadow | NA | 0 | 1 | No | No | 2 | 5 | 7 | |
| 54 | 6.5 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 7 | 5 | 14 | |
| 55 | 0.5 | Low | Wet-Moist | Forest | Pin Oak | 0 | 1 | No | No | 7 | 5 | 14 | |
| 56 | 0.2 | Low | Wet-Moist | Shrubland | NA | 0 | 0 | No | No | 6 | 4 | 12 | |
| 57 | 0.9 | Low | Upland | Forest | Sweet Birch | 0 | Trace | No | No | 5 | 4 | 15 | |
| 58 | 3.0 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 3 | 5 | 8 | |
| 59 | 3.2 | Low | Upland | Shrubland - Woodland | Red Cedar | 2 | 1 | No | No | 4 | 5 | 10 | |
| 60 | 1.5 | Moderate | Upland | Shrubland - Woodland | Red Cedar | 1 | 4 | No | No | 2 | 4 | 6 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | 0.8 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 9 | 5 | 14 | Meadow Restoration |
| 62 | 1.0 | Moderate | Upland | Shrubland | NA | 4 | 2 | No | No | 4 | 5 | 9 | Meadow Restoration |
| 63 | 11.4 | Low | NA | Disturbed Area | NA | NA | NA | No | No | NA | NA | NA | Meadow Restoration |
| 64 | 0.4 | Low | Wet-Moist | Shrubland | NA | 1 | 1 | No | No | 5 | 4 | 10 | Shrubland Restoration |
| 65 | 0.3 | Moderate | Wet-Moist | Meadow | NA | 2 | 4 | No | No | 3 | 2 | 4 | Shrubland Restoration |
| 66 | 1.8 | Low | Upland | Shrubland | NA | 3 | 3 | No | No | 7 | 4 | 17 | Shrubland Restoration |
| 67 | 0.8 | Low | Wet-Moist | Woodland | Red Cedar | 1 | 3 | No | No | 4 | 5 | 10 | |
| 68 | 8.6 | Low | Upland | Woodland | Ash | 2 | 1 | No | No | 7 | 5 | 13 | |
| 69 | 0.7 | High | Wet-Moist | Meadow | NA | 2 | 5 | No | No | 1 | 3 | 3 | |
| 70 | 30.8 | High | Wet-Moist | Forest | White Oak | 1 | 4 | No | No | 3 | 2 | 4 | Forest Maintenance and Restoration |
| 71 | 0.4 | Moderate | Upland | Shrubland | NA | 2 | 1 | No | No | 4 | 3 | 6 | Forest Maintenance and Restoration |
| 72 | 12.7 | Low | Wet-Moist | Shrubland | NA | 1 | 3 | No | No | 6 | 4 | 14 | Shrubland Restoration |
| 73 | 0.1 | Low | NA | Pond | NA | 0 | NA | No | No | NA | NA | NA | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74 | 0.1 | Low | Wet-Moist | Meadow | NA | 0 | 1 | No | No | 3 | 5 | 9 | |
| 75 | 1.8 | Moderate | Wet-Moist | Forest | White Oak | 1 | 4 | No | No | 3 | 2 | 4 | |
| 76 | 3.2 | Low | Wet-Moist | Forest | Ash | 1 | 1 | No | No | 7 | 3 | 11 | |
| 77 | 10.9 | High | Upland | Forest | Sugar Maple | 2 | 0 | No | No | 2 | 3 | 4 | Forest Maintenance and Restoration |
| 78 | 14.3 | High | Upland | Forest | Beech | 2 | 1 | No | No | 3 | 1 | 1 | Forest Maintenance and Restoration |
| 79 | 1.0 | Moderate | Wet-Moist | Forest | Sugar Maple | 0 | 0 | No | No | 4 | 5 | 8 | |
| 80 | 4.2 | Moderate | Upland | Forest | Sugar Maple | 1 | 1 | No | No | 3 | 5 | 6 | |
| 81 | 8.8 | Low | Wet-Moist | Forest | Ash | 1 | 1 | No | No | 6 | 5 | 13 | |
| 82 | 0.4 | Low | Upland | Forest | Red Cedar | 1 | 1 | No | No | 6 | 5 | 16 | |
| 83 | 0.1 | Low | Wet-Moist | Meadow | NA | 0 | 0 | No | No | 2 | 5 | 8 | |
| 84 | 0.0 | Low | Wet-Moist | Meadow | NA | 0 | 0 | No | No | 2 | 5 | 8 | |
| 85 | 2.0 | Low | Wet-Moist | Woodland | NA | 0 | Trace | No | No | 3 | 5 | 6 | |
| 86 | 10.7 | Low | Upland | Forest | Red Cedar | 1 | 1 | No | No | 5 | 5 | 7 | |
| 87 | 1.6 | Low | Upland | Forest | Red Cedar | Trace | 1 | No | No | 5 | 5 | 11 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | 10.9 | Low | Upland | Forest | Red Cedar | 1 | 1 | No | No | 7 | 5 | 8 | |
| 89 | 1.8 | Low | Wet-Moist | Woodland | Red Cedar | 1 | 3 | No | No | 5 | 5 | 9 | |
| 90 | 7.3 | Low | Wet-Moist | Woodland | Red Maple | 1 | 1 | No | No | 5 | 5 | 9 | |
| 91 | 0.2 | Low | Upland | Shrubland | NA | 1 | 1 | No | No | 2 | 5 | 7 | |
| 92 | 0.1 | Low | Upland | Meadow | NA | 0 | 1 | No | No | 3 | 5 | 8 | |
| 93 | 0.1 | Low | Upland | Woodland | Red Cedar | 2 | 2 | No | No | 1 | 5 | 5 | |
| 94 | 1.1 | Low | Upland | Woodland | NA | 0 | 1 | No | No | 4 | 5 | 9 | |
| 95 | 0.4 | Low | Wet-Moist | Meadow | NA | 0 | 1 | No | No | 1 | 5 | 5 | |
| 96 | 1.4 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 7 | 5 | 8 | |
| 97 | 2.1 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 6 | 4 | 15 | |
| 98 | 1.3 | Low | Upland | Forest | Red Maple | 0 | 0 | No | Yes | 5 | 4 | 11 | |
| 99 | 1.8 | Low | Upland | Shrubland | NA | 4 | 0 | No | No | 5 | 2 | 10 | |
| 100 | 1.5 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 6 | 4 | 15 | |
| 101 | 0.5 | Low | Wet-Moist | Shrubland | NA | 2 | 2 | No | No | 7 | 4 | 13 | |
| 102 | 0.4 | Moderate | Upland | Shrubland | NA | 3 | 3 | No | No | 5 | 4 | 9 | |
| 103 | 0.2 | Low | Wet-Moist | Meadow | NA | 1 | 1 | No | No | 4 | 5 | 10 | |
| 104 | 1.8 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 6 | 4 | 15 | |
| 105 | 1.9 | Low | Wet-Moist | Forest | Red Maple | Trace | 2 | No | No | 2 | 4 | 7 | |
| 106 | 1.4 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 6 | 4 | 15 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 | 0.4 | Low | Wet-Moist | Meadow | NA | 1 | 1 | No | No | 2 | 5 | 7 | |
| 108 | 0.4 | Low | Wet-Moist | Forest | Red Maple | 0 | 0 | No | No | 2 | 5 | 7 | |
| 109 | 0.4 | Low | Wet-Moist | Meadow | NA | 0 | 1 | No | No | 2 | 5 | 6 | |
| 110 | 0.6 | Low | Wet-Moist | Forest | Red Maple | 1 | 3 | No | No | 4 | 5 | 11 | |
| 111 | 0.7 | Low | Wet-Moist | Shrubland | NA | 2 | 2 | No | No | 7 | 5 | 19 | |
| 112 | 2.6 | Low | Wet-Moist | Forest | Red Maple | 0 | 0 | No | No | 3 | 5 | 11 | |
| 113 | 2.9 | Low | Upland | Forest | Tulip Poplar | 1 | 2 | No | No | 6 | 4 | 10 | |
| 114 | 0.5 | Low | Upland | Forest | Ash | 2 | 1 | No | No | 6 | 4 | 12 | |
| 115 | 0.9 | Moderate | Upland | Forest | Beech | 2 | 1 | No | No | 6 | 3 | 8 | |
| 116 | 0.9 | Moderate | Upland | Forest | Tulip Poplar | 1 | 1 | No | No | 5 | 3 | 9 | |
| 117 | 1.4 | Low | Upland | Forest | Tulip Poplar | 0 | 2 | No | No | 4 | 5 | 8 | |
| 118 | 0.9 | Low | Upland | Forest | Tulip Poplar | 0 | 0 | No | No | 6 | 5 | 13 | |
| 119 | 0.5 | Low | Wet-Moist | Shrubland | NA | 1 | 1 | No | No | 8 | 5 | 17 | |
| 120 | 0.6 | Low | Upland | Meadow | NA | 0 | 0 | No | No | 1 | 5 | 5 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | 2.3 | Moderate | Upland | Forest | Beech | 1 | 1 | No | No | 6 | 2 | 5 | Forest Maintenance and Restoration |
| 122 | 0.1 | Moderate | Upland | Shrubland | NA | 1 | Trace | No | No | 4 | 2 | 8 | |
| 123 | 0.4 | Moderate | Wet-Moist | Shrubland | NA | 3 | 4 | No | No | 3 | 5 | 8 | |
| 124 | 0.5 | Low | Wet-Moist | Forest | Tulip Poplar | 0 | 2 | No | No | 3 | 5 | 7 | |
| 125 | 0.6 | High | Upland | Forest | Beech | 2 | 0 | No | No | 1 | 0 | 0 | Forest Maintenance and Restoration |
| 126 | 0.2 | Low | Upland | Forest | Ash | 1 | 0 | No | No | 3 | 5 | 7 | |
| 127 | 1.4 | High | Upland | Forest | Beech | 0 | Trace | No | No | 1 | 0 | 0 | Forest Maintenance and Restoration |
| 128 | 0.4 | High | Upland | Forest | Beech | 2 | 0 | No | No | 1 | 0 | 0 | Forest Maintenance and Restoration |
| 129 | 0.7 | Moderate | Upland | Forest | Beech | 1 | 1 | No | No | 6 | 2 | 5 | Forest Maintenance and Restoration |
| 130 | 1.3 | Low | Upland | Forest | Ash | 1 | 0 | No | No | 3 | 5 | 7 | |
| 131 | 0.9 | Low | Upland | Forest | Ash | 1 | 0 | No | Yes | 6 | 5 | 12 | |
| 132 | 0.8 | Low | Upland | Forest | Shagbark Hickory | 0 | 1 | No | No | 3 | 3 | 7 | |
| 133 | 1.4 | Low | Upland | Forest | Ash | 1 | 0 | No | Yes | 6 | 5 | 12 | |
| 134 | 0.5 | Low | Upland | Forest | Ash | 1 | 0 | No | No | 3 | 5 | 7 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 135 | 2.1 | Low | Wet-Moist | Shrubland | NA | 2 | 2 | No | No | 7 | 5 | 19 | |
| 136 | 2.0 | Low | Upland | Forest | Ash | 1 | 1 | No | No | 9 | 5 | 15 | |
| 137 | 3.6 | Low | Upland | Woodland | Ash | 1 | 1 | No | No | 8 | 5 | 15 | |
| 138 | 0.5 | Low | Wet-Moist | Meadow | NA | 2 | 2 | No | No | 5 | 5 | 11 | |
| 139 | 0.3 | Low | Wet-Moist | Meadow | NA | 1 | 3 | No | No | 5 | 4 | 9 | |
| 140 | 1.2 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 3 | 5 | 8 | |
| 141 | 0.2 | Low | Upland | Forest | Tulip Poplar | 0 | 0 | No | No | 5 | 4 | 6 | |
| 142 | 2.3 | Low | Wet-Moist | Forest | Red Maple | 0 | 0 | No | No | 6 | 5 | 11 | |
| 143 | 1.9 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 4 | 5 | 11 | |
| 144 | 1.4 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 4 | 5 | 11 | |
| 145 | 1.2 | Low | Upland | Forest | Norway Spruce | 1 | 1 | No | No | 6 | 4 | 8 | |
| 146 | 4.1 | Low | Wet-Moist | Woodland | Black Locust | 1 | 1 | No | No | 6 | 5 | 15 | |
| 147 | 0.6 | Low | Upland | Lawn | NA | 0 | 0 | No | No | 1 | 5 | 5 | |
| 148 | 2.2 | Low | Wet-Moist | Forest | Red Maple | 1 | 0 | No | No | 3 | 5 | 7 | |
| 149 | 0.4 | Low | Wet-Moist | Forest | Red Maple | 2 | 0 | No | No | 4 | 5 | 13 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 150 | 1.8 | Low | Upland | Woodland | Ash | 2 | 1 | No | Yes | 5 | 4 | 13 | |
| 151 | 0.2 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 2 | 5 | 7 | |
| 152 | 0.8 | Low | Wet-Moist | Shrubland | NA | 2 | 1 | No | No | 3 | 5 | 8 | |
| 153 | 1.5 | Low | Wet-Moist | Forest | Red Maple | 1 | 0 | No | No | 6 | 5 | 14 | |
| 154 | 0.9 | Low | Upland | Woodland | Ash | 2 | 1 | No | Yes | 5 | 4 | 13 | |
| 155 | 0.2 | Low | Wet-Moist | Meadow | NA | 1 | 2 | No | No | 3 | 3 | 5 | |
| 156 | 0.6 | Low | Wet-Moist | Woodland | Pin Oak | 1 | 0 | No | No | 4 | 5 | 10 | |
| 157 | 0.6 | Low | Upland | Forest | Red Cedar | 0 | 0 | No | No | 4 | 5 | 10 | |
| 158 | 2.8 | Low | Wet-Moist | Forest | Red Maple | 1 | 0 | No | No | 6 | 5 | 12 | |
| 159 | 9.6 | Low | Wet-Moist | Meadow | NA | 0 | 2 | No | No | 4 | 5 | 9 | Meadow Restoration |
| 160 | 2.4 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 2 | 5 | 7 | |
| 161 | 3.5 | High | Upland | Forest | Beech | 1 | 1 | No | No | 2 | 0 | 0 | Forest Maintenance and Restoration |
| 162 | 1.8 | Low | Wet-Moist | Shrubland | NA | 1 | 2 | No | No | 9 | 4 | 15 | |
| 163 | 1.2 | High | Upland | Forest | Beech | 2 | 0 | No | No | 1 | 0 | 0 | Forest Maintenance and Restoration |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 164 | 1.6 | High | Upland | Forest | Beech | 1 | 1 | No | No | 3 | 1 | 1 | |
| 165 | 0.5 | Low | Wet-Moist | Meadow | NA | 0 | 0 | No | No | 3 | 5 | 7 | |
| 166 | 0.1 | Low | Upland | Forest | Beech | 0 | 0 | No | No | 2 | 4 | 5 | |
| 167 | 0.9 | Low | Wet-Moist | Forest | Red Maple | 0 | 1 | No | No | 2 | 5 | 6 | |
| 168 | 0.6 | Low | Wet-Moist | Woodland | Tulip Poplar | 0 | 0 | No | No | 1 | 5 | 5 | |
| 169 | 0.4 | High | Upland | Forest | Beech | 1 | 1 | No | No | 2 | 0 | 0 | |
| 170 | 0.1 | Low | Upland | Meadow | NA | 0 | 0 | No | No | 1 | 5 | 5 | |
| 171 | 0.5 | Low | Wet-Moist | Shrubland | NA | 1 | 1 | No | No | 5 | 5 | 10 | |
| 172 | 0.3 | Low | Wet-Moist | Forest | Red Maple | 1 | 1 | No | No | 5 | 5 | 9 | |
| 173 | 5.6 | Moderate | Wet-Moist | Meadow | NA | Trace | 5 | No | No | 7 | 4 | 10 | Shrubland Guided |
| 174 | 0.7 | Moderate | Wet-Moist | Woodland | Red Maple | 3 | 3 | No | No | 3 | 2 | 4 | |
| 175 | 3.7 | Low | Upland | Meadow | NA | 0 | 2 | No | No | 2 | 5 | 7 | Shrubland Guided |
| 176 | 1.3 | Low | Upland | Meadow | NA | 0 | 2 | No | No | 1 | 5 | 5 | Shrubland Guided |
| 177 | 0.9 | Low | Wet-Moist | Meadow | NA | 1 | 3 | No | No | 8 | 3 | 12 | Shrubland Guided |
| 178 | 3.2 | Low | Upland | Woodland | White Pine | 1 | 1 | No | No | 6 | 4 | 13 | |
| 179 | 1.2 | Moderate | Wet-Moist | Meadow | NA | 1 | 5 | No | No | 6 | 4 | 10 | |
| 180 | 1.8 | Low | Wet-Moist | Meadow | NA | 1 | 1 | No | No | 6 | 4 | 11 | |

**Appendix E. Ecological Community Patch Information**
**Mount Rose Preserve Stewardship Plan**

*** denotes cover categories where Trace= < 1%, 1=1-10%, 2=11-25%, 3=26-50%, 4=51-75%, 5= > 75%**

| Patch ID | Patch Acres | Relative Quality Category | Soil Moisture Cateogry | Broad Community Type | Dominant Tree Species | Native Shrub Cover* | Native Herb Cover* | Native Tree Regeneration Present | Ash Decline Present | Invasive Species - # of Species | Invasive Species - Maxium Cover of Single Species* | Invasive Species - Sum of Cover Classes | Restoration Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 181 | 1.1 | Low | Upland | Shrubland | NA | 1 | 1 | No | No | 5 | 5 | 12 | Shrubland Guided |
| 182 | 2.5 | Low | Upland | Woodland | Black Cherry | 1 | 1 | No | No | 7 | 5 | 15 | |
| 183 | 0.6 | Low | Wet-Moist | Forest | Red Maple | 1 | 2 | No | No | 5 | 4 | 12 | |
| 184 | 3.4 | Low | Wet-Moist | Forest | Red Maple | 0 | 0 | No | No | 6 | 4 | 11 | |

| Appendix F. Plant Species List | | |
|---|---|---|
| Mount Rose Preserve Stewardship Plan | | |
| Compiled by Washington Crossing Audubon Society | | |
| | | |
| **Growth Form** | **Scientific Name** | **Common Name** |
| Fern | Asplenium platyneuron | Ebony Spleenwort |
| Fern | Dryopteris spinulosa | Spinulose Wood Fern |
| Fern | Onoclea sensibilis | Sensitive Fern |
| Fern | Polystichym acrostichoides | Christmas Fern |
| Fern | Thelypteris Noveboracensis | New York Fern |
| Graminoid | Andropogon virginicus | Broom Sedge |
| Graminoid | Anthoxanthum odoratum | Sweet Vernal Grass |
| Graminoid | Anthraxon hispidus | Carp Grass* |
| Graminoid | Carex pensylvanica | Pennsylvania Sedge |
| Graminoid | Erogrostis spectabilis | Purple Love Grass |
| Graminoid | Festuca sp. | lawn grass, Fescue |
| Graminoid | Microstegium vinimum | Stilt Grass* |
| Graminoid | Panicum lanuginosum | Deer Tongue Grass |
| Graminoid | Phalarus arundinacea | Reed Canary Grass |
| Graminoid | Setaria geniculatum | Bristly Foxtail* |
| Graminoid | Setaria glauca | Yellow Foxtail |
| Graminoid | Sorgastrum nutans | Indian Grass |
| Graminoid | Typha latifolia | Common Cattail |
| Herb | Agrimony parviflora | Small-flowered Agrimony |
| Herb | Alliaria officinalis | Garlic Mustard* INVASIVE |
| Herb | Ambrosia artemisiifolia | Common Ragweed |
| Herb | Apocynum androsaemifolium | Spreading Dogbane |
| Herb | Archillea millefolium | Yarrow* |
| Herb | Artemesia vulgaris | Common Mugwort |
| Herb | Asclepias incarnata | Swamp Milkweed |
| Herb | Asclepias syrsain | Common Milkweed |
| Herb | Barbarea Vulgaris | Wintercress* |
| Herb | Bidens laevis | Larger Bur Marigold |
| Herb | Cardamine parviflora | Small-flowered Bittercress |
| Herb | Circium arvense | Canada Thistle* |
| Herb | Cirsium discolor | Field Thistle |
| Herb | Cirsium pumilum | Pasture Thistle |
| Herb | Cirsium vulgare | Bull Thistle* |
| Herb | Claytonia virginica | Spring Beauty |
| Herb | Dacnis carota | Queen Anne's Lace* |
| Herb | Epifagus virginiana | Beechdrops |
| Herb | Erechtites hieracifolia | Pilewort |
| Herb | Erigeron annus | Daisy Fleabane |
| Herb | Erigeron canadensis | Horseweed |
| Herb | Erythronium americanum | Trout Lily |
| Herb | Eupatorium rugosum | White Snakeroot |
| Herb | Euthamia graminifolia | Grass-leaved Goldenrod |
| Herb | Galium aparine | Cleavers |
| Herb | Gonaphalium obtusifolium | Sweet Everlasting |
| Herb | Impatiens capensis | Spotted Jewelweed |

| Appendix F. Plant Species List | | |
|---|---|---|
| Mount Rose Preserve Stewardship Plan | | |
| Compiled by Washington Crossing Audubon Society | | |
| | | |
| **Growth Form** | **Scientific Name** | **Common Name** |
| Herb | Linaria vulgaris | Butter and Eggs* |
| Herb | Lotus corniculatus | Birdsfoot trefoil |
| Herb | Oxalis europaea | European Sorrel* |
| Herb | Phytolacca americana | Pokeweed |
| Herb | Phytolacca americana | Pokeweed |
| Herb | Pilea pumila | Clearweed |
| Herb | Plantago lanceolata | English Plantain |
| Herb | Podophyllum peltatum | May-apple |
| Herb | Polygonum aviculare | Doorweed*, Common Knotgrass |
| Herb | Polygonum hydropiper | Common Smartweed |
| Herb | Polygonum pensylvanicum | Pinkweed |
| Herb | Polygonum sagittatum | Arrow-leaved Tearthumb |
| Herb | Potentilla canadensis | Dwarf Cinquefoil |
| Herb | Pycanthemum tenuifolium | Narrow-leaved Mountain Mint |
| Herb | Ranunculus abortivus | Small-flowerd Crowfoot |
| Herb | Ranunculus ficaria | Lesser Celandine* INVASIVE |
| Herb | Rubus allegheniensis | Common Blackberry |
| Herb | Rubus sp. | Blackberry, prostrate, creeping |
| Herb | Senecio vulgaris | Common Groundsel* |
| Herb | Simplocarpus foetodis | Skunk Cabbage (in leaf) |
| Herb | Smilacina racemosa | False Solomon's Seal |
| Herb | Solanum carolinense | Horse Nettle |
| Herb | Solidago altissima | Tall Goldenrod |
| Herb | Solidago canadensis | Canada Goldenrod |
| Herb | Solidago patula | Rough-leaved Goldenrod |
| Herb | Solidago rugosa | Rough-stemmed Goldenrod |
| Herb | Stellaria media | Common Chickweed* |
| Herb | Symphiotrichum divaricatus | White Wood Aster |
| Herb | Symphyotrichum lateriflorus | Calico Aster |
| Herb | Symphyotrichum novae-angliae | New-England Aster |
| Herb | Symphyotrichum pilosus | Heath Aster |
| Herb | Symphyotrichum viminous | Small White Aster |
| Herb | Taraxacum erythrospermum | Red-seeded Dandilion |
| Herb | Verbascum thapsus | Common Mullein* |
| Herb | Viola affinis | Pale Early Violet |
| Shrub | Amelanchier Sp. | Shadbush |
| Shrub | Berberis thunbergii | Japanese Barberry* |
| Shrub | Elaeagnus umbellatum | Autumn Olive* |
| Shrub | Hamamelis virginiana | Witch Hazel |
| Shrub | Ligustrum spp. | Privet* |
| Shrub | Malus sp. | Crabapple |
| Shrub | Myrica Sp. | Bayberry |
| Shrub | Rosa multiflora | Multiflora Rose* |
| Shrub | Rubus phoenicolosius | Wineberry* |
| Shrub | Vaccinium sp. | Low Blueberry |

## Appendix G. Woody Plants of Mercer County
## Mount Rose Preserve Stewardship Plan
**Source: Brooklyn Botanic Garden**

| Scientific Name | Common Name | Growth Type | Nativity | Invasive Status | Frequency |
|---|---|---|---|---|---|
| *Acer negundo* | boxelder | Tree | Native | N/A | Common |
| *Acer nigrum* | black maple | Tree | Native | N/A | Not Recorded |
| *Acer platanoides* | Norway maple | Tree | Non-Native | Yes | Common |
| *Acer pseudoplatanus* | sycamore maple | Tree | Non-Native | Yes | Frequent |
| *Acer rubrum* | red maple | Tree | Native | N/A | Common |
| *Acer saccharinum* | silver maple | Tree | Native | N/A | Frequent |
| *Acer saccharum* | sugar maple | Tree | Native | N/A | Common |
| *Aesculus hippocastanum* | horse chestnut | Tree | Non-Native | No | Not Recorded |
| *Ailanthus altissima* | tree-of-heaven | Tree | Non-Native | Yes | Common |
| *Albizia julibrissin* | mimosa | Tree | Non-Native | No | Frequent |
| *Alnus glutinosa* | black alder | Tree | Non-Native | Yes | Occassional |
| *Alnus incana* | speckled alder | Shrub | Native | N/A | Occassional |
| *Alnus serrulata* | smooth alder | Shrub | Native | N/A | Common |
| *Amelanchier arborea* | shadbush | Shrub | Native | N/A | Common |
| *Amelanchier canadensis* | serviceberry | Shrub | Native | N/A | Common |
| *Amelanchier stolonifera* | running juneberry | Shrub | Native | N/A | Not Recorded |
| *Amorpha fruticosa* | false indigo | Shrub | Non-Native | Yes | Frequent |
| *Ampelopsis brevipedunculata* | porcelainberry | Vine | Non-Native | Yes | Common |
| *Aralia spinosa* | Chinese angelica-tree | Tree | Non-Native | Yes | Frequent |
| *Aronia arbutifolia* | red chokeberry | Shrub | Native | N/A | Common |
| *Aronia melanocarpa* | black chokeberry | Shrub | Native | N/A | Common |
| *Aronia x prunifolia* | purple chokeberry | Shrub | Native | N/A | Not Recorded |
| *Asimina triloba* | pawpaw | Tree | Native | N/A | Rare |
| *Berberis thunbergii* | Japanese barberry | Shrub | Non-Native | Yes | Common |
| *Berberis vulgaris* | common barberry | Shrub | Non-Native | Yes | Occassional |
| *Betula lenta* | sweet birch | Tree | Native | N/A | Common |
| *Betula nigra* | river birch | Tree | Native | N/A | Occassional |
| *Betula populifolia* | gray birch | Tree | Native | N/A | Common |
| *Broussonetia papyrifera* | paper birch | Tree | Non-Native | No | Occassional |
| *Campsis radicans* | trumpet creeper | Vine | Native | N/A | Occassional |
| *Carpinus caroliniana* | ironwood | Tree | Native | N/A | Common |
| *Carya cordiformis* | bitternut hickory | Tree | Native | N/A | Common |
| *Carya glabra* | pignut hickory | Tree | Native | N/A | Common |
| *Carya ovalis* | sweet pignut hickory | Tree | Native | N/A | Not Recorded |
| *Carya ovata* | shagbark hickory | Tree | Native | N/A | Common |
| *Carya tomentosa* | mockernut hickory | Tree | Native | N/A | Common |
| *Castanea dentata* | American chestnut | Tree | Native | N/A | Frequent |
| *Castanea pumila* | chinquapin | Shrub | Native | N/A | Rare |
| *Catalpa bignonioides* | catalpa | Tree | Non-Native | No | Frequent |
| *Ceanothus americanus* | New Jersey tea | Shrub | Native | N/A | Not Recorded |
| *Celastrus orbiculata* | Asiatic bittersweet | Vine | Non-Native | Yes | Common |
| *Celastrus scandens* | American bittersweet | Vine | Native | N/A | Rare |
| *Celtis occidentalis* | hackberry | Tree | Native | N/A | Common |
| *Cephalanthus occidentalis* | buttonbush | Tree | Native | N/A | Frequent |
| *Cercis canadensis* | redbud | Tree | Native | N/A | Rare |
| *Chamaedaphne calyculata* | leatherleaf | Shrub | Native | N/A | Common |
| *Chimaphila maculata* | striped wintergreen | Sub-shrub | Native | N/A | Common |
| *Chimaphila umbellata* | pipsessiwa | Sub-shrub | Native | N/A | Occassional |
| *Clematis terniflora* | Virgin's bower | Vine | Non-Native | Yes | Not Recorded |
| *Clematis virginiana* | Virgin's bower | Vine | Native | N/A | Frequent |
| *Clethra alnifolia* | sweet pepperbush | Shrub | Native | N/A | Common |
| *Comptonia peregrina* | sweetfern | Shrub | Native | N/A | Common |

## Appendix G. Woody Plants of Mercer County
## Mount Rose Preserve Stewardship Plan
**Source: Brooklyn Botanic Garden**

| Scientific Name | Common Name | Growth Type | Nativity | Invasive Status | Frequency |
|---|---|---|---|---|---|
| *Cornus alternifolia* | pagoda dogwood | Tree | Native | N/A | Frequent |
| *Cornus amomum* | silky dogwood | Shrub | Native | N/A | Common |
| *Cornus canadensis* | bunchberry | Sub-shrub | Native | N/A | Rare |
| *Cornus florida* | flowering dogwood | Tree | Native | N/A | Common |
| *Cornus foemina* | gray dogwood | Shrub | Native | N/A | Common |
| *Cornus sericea* | red-osier dogwood | Shrub | Native | N/A | Occassional |
| *Corylus americana* | American hazelnut | Shrub | Native | N/A | Common |
| *Corylus cornuta* | beaked hazelnut | Shrub | Native | N/A | Frequent |
| *Crataegus crusgalli* | cockspur hawthorn | Tree | Native | N/A | Common |
| *Crataegus intricata* | Biltmore hawthorn | Tree | Native | N/A | Common |
| *Crataegus pruinosa* | frosted hawthorn | Tree | Native | N/A | Rare |
| *Crataegus uniflora* | oneflower hawthorn | Tree | Native | N/A | Rare |
| *Deutzia scabra* | duetzia | Shrub | Non-Native | No | Not Recorded |
| *Diospyros virginiana* | persimmon | Tree | Native | N/A | Frequent |
| *Dirca palustris* | leatherwood | Shrub | Native | N/A | Rare |
| *Elaeagnus umbellata* | autumn olive | Shrub | Non-Native | Yes | Common |
| *Epigaea repens* | trailing arbutus | Sub-shrub | Native | N/A | Occassional |
| *Euonymus alata* | winged burning bush | Shrub | Non-Native | Yes | Common |
| *Euonymus americana* | strawberry bush | Shrub | Native | N/A | Rare |
| *Euonymus atropurpurea* | wahoo | Shrub | Native | N/A | Rare |
| *Euonymus europaea* | European spindle tree | Shrub | Non-Native | Yes | Occassional |
| *Fagus grandifolia* | American beech | Tree | Native | N/A | Common |
| *Fraxinus americana* | white ash | Tree | Native | N/A | Common |
| *Fraxinus nigra* | black ash | Tree | Native | N/A | Occassional |
| *Fraxinus pennsylvanica* | green ash | Tree | Native | N/A | Common |
| *Gaultheria procumbens* | wintergreen | Sub-shrub | Native | N/A | Common |
| *Gaylussacia baccata* | black huckleberry | Shrub | Native | N/A | Common |
| *Gaylussacia dumosa* | dwarf huckleberry | Shrub | Native | N/A | Rare |
| *Gaylussacia frondosa* | dangleberry | Shrub | Native | N/A | Common |
| *Gleditsia triacanthos* | honeylocust | Tree | Native | N/A | Frequent |
| *Hamamelis virginiana* | witchhazel | Shrub | Native | N/A | Common |
| *Hedera helix* | English ivy | Vine | Non-Native | Yes | Occassional |
| *Hibiscus syriacus* | rose-of-sharon | Shrub | Non-Native | No | Not Recorded |
| *Hydrangea arborescens* | wild hydrangea | Shrub | Native | N/A | Not Recorded |
| *Hypericum hypericoides* | St. Andrew's cross | Shrub | Native | N/A | Rare |
| *Ilex crenata* | Japanese holly | Shrub | Non-Native | No | Occassional |
| *Ilex glabra* | inkberry | Shrub | Native | N/A | Occassional |
| *Ilex laevigata* | smooth winterberry | Shrub | Native | N/A | Occassional |
| *Ilex opaca* | American holly | Tree | Native | N/A | Frequent |
| *Ilex verticillata* | winterberry | Shrub | Native | N/A | Common |
| *Juglans cinerea* | butternut | Tree | Native | N/A | Occassional |
| *Juglans nigra* | black walnut | Tree | Native | N/A | Common |
| *Juniperus communis* | common juniper | Shrub | Native | N/A | Rare |
| *Juniperus virginiana* | red cedar | Tree | Native | N/A | Common |
| *Kalmia angustifolia* | sheep laurel | Shrub | Native | N/A | Frequent |
| *Kalmia latifolia* | mountain laurel | Shrub | Native | N/A | Frequent |
| *Leucothoe racemosa* | sweet bells | Shrub | Native | N/A | Common |
| *Ligustrum obtusifolium* | regal privet | Shrub | Non-Native | Yes | Common |
| *Ligustrum vulgare* | privet | Shrub | Non-Native | Yes | Not Recorded |
| *Lindera benzoin* | spicebush | Shrub | Native | N/A | Common |
| *Liquidambar styraciflua* | sweet gum | Tree | Native | N/A | Frequent |
| *Liriodendron tulipifera* | tulip poplar | Tree | Native | N/A | Common |

## Appendix G. Woody Plants of Mercer County
## Mount Rose Preserve Stewardship Plan
**Source: Brooklyn Botanic Garden**

| Scientific Name | Common Name | Growth Type | Nativity | Invasive Status | Frequency |
|---|---|---|---|---|---|
| *Lonicera fragrantissima* | fragrant honeysuckle | Shrub | Non-Native | Yes | Rare |
| *Lonicera japonica* | Japanese honeysuckle | Vine | Non-Native | Yes | Common |
| *Lonicera maackii* | Amur honeysuckle | Shrub | Non-Native | Yes | Frequent |
| *Lonicera morrowii* | Morrow's honeysuckle | Shrub | Non-Native | Yes | Common |
| *Lonicera sempervirens* | trumpet honeysuckle | Vine | Native | N/A | Occassional |
| *Lonicera tatarica* | Tatarian Honeysuckle | Shrub | Non-Native | Yes | Occassional |
| *Lyonia ligustrina* | maleberry | Shrub | Native | N/A | Common |
| *Lyonia mariana* | staggerbush | Shrub | Native | N/A | Common |
| *Magnolia acuminata* | cucumber magnolia | Tree | Non-Native | No | Rare |
| *Magnolia tripetala* | umbrella magnolia | Tree | Non-Native | No | Occassional |
| *Magnolia virginiana* | sweetbay magnolia | Tree | Native | N/A | Occassional |
| *Malus coronaria* | sweet crab | Tree | Native | N/A | Rare |
| *Malus sieboldii* | toringo crab apple | Tree | Non-Native | Yes | Rare |
| *Malus sylvestris* | European crab apple | Tree | Non-Native | No | Occassional |
| *Menispermum canadense* | moonseed | Vine | Native | N/A | Occassional |
| *Morus alba* | white mulberry | Tree | Non-Native | No | Common |
| *Morus rubra* | red mulberry | Tree | Native | N/A | Occassional |
| *Myrica pensylvanica* | bayberry | Shrub | Native | N/A | Common |
| *Nemopanthus mucronatus* | mountain holly | Shrub | Native | N/A | Rare |
| *Nyssa sylvatica* | black tupelo | Tree | Native | N/A | Not Recorded |
| *Ostrya virginiana* | hop hornbeam | Tree | Native | N/A | Frequent |
| *Parthenocissus quinquefolia* | Virginia creeper | Vine | Native | N/A | Common |
| *Paulownia tomentosa* | paulonia | Tree | Non-Native | Yes | Occassional |
| *Philadelphus coronarius* | mock orange | Shrub | Non-Native | No | Occassional |
| *Physocarpus opulifolius* | ninebark | Tree | Native | N/A | Occassional |
| *Picea abies* | Norway spruce | Tree | Non-Native | No | Occassional |
| *Pinus echinata* | short leaf pine | Tree | Native | N/A | Occassional |
| *Pinus rigida* | pitch pine | Tree | Native | N/A | Common |
| *Pinus strobus* | white pine | Tree | Native | N/A | Frequent |
| *Pinus virginiana* | Virginia pine | Tree | Native | N/A | Rare |
| *Platanus occidentalis* | American sycamore | Tree | Native | N/A | Common |
| *Populus alba* | white poplar | Tree | Non-Native | No | Occassional |
| *Populus deltoides* | cottonwood | Tree | Native | N/A | Common |
| *Populus grandidentata* | big tooth aspen | Tree | Native | N/A | Common |
| *Populus heterophylla* | swamp cottonwood | Tree | Native | N/A | Rare |
| *Populus nigra* | black cottonwood | Tree | Non-Native | No | Rare |
| *Populus tremuloides* | quaking aspen | Tree | Native | N/A | Common |
| *Prunus americana* | hedge plum | Tree | Native | N/A | Occassional |
| *Prunus avium* | sweet cherry | Tree | Non-Native | No | Frequent |
| *Prunus domestica* | plum | Tree | Non-Native | No | Rare |
| *Prunus serotina* | black cherry | Tree | Native | N/A | Common |
| *Prunus virginiana* | fire cherry | Tree | Native | N/A | Frequent |
| *Ptelea trifoliata* | hop tree | Tree | Native | N/A | Rare |
| *Quercus alba* | white oak | Tree | Native | N/A | Common |
| *Quercus bicolor* | swamp white oak | Tree | Native | N/A | Not Recorded |
| *Quercus coccinea* | scarlet oak | Tree | Native | N/A | Common |
| *Quercus ilicifolia* | scrub oak | Shrub | Native | N/A | Common |
| *Quercus marilandica* | blackjack oak | Tree | Native | N/A | Occassional |
| *Quercus montana* | chestnut oak | Tree | Native | N/A | Common |
| *Quercus palustris* | pin oak | Tree | Native | N/A | Common |
| *Quercus phellos* | willow oak | Tree | Native | N/A | Occassional |
| *Quercus prinoides* | dwarf chestnut oak | Shrub | Native | N/A | Occassional |

## Appendix G. Woody Plants of Mercer County
## Mount Rose Preserve Stewardship Plan
**Source: Brooklyn Botanic Garden**

| Scientific Name | Common Name | Growth Type | Nativity | Invasive Status | Frequency |
|---|---|---|---|---|---|
| *Quercus rubra* | red oak | Tree | Native | N/A | Common |
| *Quercus stellata* | post oak | Tree | Native | N/A | Occassional |
| *Quercus velutina* | black oak | Tree | Native | N/A | Common |
| *Rhamnus cathartica* | common buckthorn | Shrub | Non-Native | Yes | Frequent |
| *Rhamnus frangula* | smooth buckthorn | Shrub | Non-Native | Yes | Frequent |
| *Rhododendron maximum* | great laurel | Shrub | Native | N/A | Not Recorded |
| *Rhododendron periclymenoides* | pinkster azalea | Shrub | Native | N/A | Frequent |
| *Rhododendron prinophyllum* | early azalea | Shrub | Native | N/A | Rare |
| *Rhododendron viscosum* | swamp azalea | Shrub | Native | N/A | Frequent |
| *Rhus aromatica* | fragrant sumac | Shrub | Native | N/A | Occassional |
| *Rhus copallinum* | winged sumac | Shrub | Native | N/A | Common |
| *Rhus glabra* | smooth sumac | Shrub | Native | N/A | Common |
| *Rhus hirta* | staghorn sumac | Shrub | Native | N/A | Common |
| *Ribes americanum* | Eastern black currant | Shrub | Native | N/A | Occassional |
| *Robinia hispida* | bristly locust | Shrub | Non-Native | No | Occassional |
| *Robinia pseudo-acacia* | black locust | Tree | Non-Native | Yes | Common |
| *Robinia viscosa* | clammy locust | Shrub | Non-Native | No | Occassional |
| *Rosa carolina* | Carolina rose | Shrub | Native | N/A | Common |
| *Rosa multiflora* | multiflora rose | Shrub | Non-Native | Yes | Common |
| *Rosa palustris* | swamp rose | Shrub | Native | N/A | Common |
| *Rosa virginiana* | Virginia rose | Shrub | Native | N/A | Frequent |
| *Rubus allegheniensis* | common blackberry | Shrub | Native | N/A | Common |
| *Rubus canadensis* | smooth blackberry | Shrub | Native | N/A | Occassional |
| *Rubus flagellaris* | Northern dewberry | Shrub | Native | N/A | Common |
| *Rubus hispidus* | swamp dewberry | Shrub | Native | N/A | Common |
| *Rubus occidentalis* | black raspberry | Shrub | Native | N/A | Common |
| *Rubus odoratus* | flowering raspberry | Shrub | Native | N/A | Frequent |
| *Rubus phoenicolasius* | wineberry | Shrub | Non-Native | Yes | Common |
| *Salix babylonica* | weeping willow | Tree | Non-Native | No | Occassional |
| *Salix bebbiana* | beaked willow | Tree | Native | N/A | Occassional |
| *Salix discolor* | pussy willow | Tree | Native | N/A | Common |
| *Salix eriocephala* | diamond willow | Tree | Native | N/A | Frequent |
| *Salix exigua* | sandbar willow | Tree | Native | N/A | Occassional |
| *Salix fragilis* | crack willow | Tree | Non-Native | No | Not Recorded |
| *Salix humilis* | upland willow | Tree | Native | N/A | Occassional |
| *Salix nigra Marsh.* | black willow | Tree | Native | N/A | Common |
| *Salix petiolaris* | meadow willow | Tree | Native | N/A | Occassional |
| *Salix purpurea* | basket willow | Tree | Non-Native | No | Occassional |
| *Salix sericea* | silky willow | Shrub | Native | N/A | Frequent |
| *Sambucus canadensis* | common elderberry | Shrub | Native | N/A | Common |
| *Sassafras albidum* | sassafras | Tree | Native | N/A | Common |
| *Smilax glauca* | catbrier | Vine | Native | N/A | Common |
| *Smilax rotundifolia* | greenbrier | Vine | Native | N/A | Common |
| *Sorbus americana* | American mountain-ash | Tree | Native | N/A | Rare |
| *Spiraea alba* | meadowsweet | Shrub | Native | N/A | Frequent |
| *Spiraea tomentosa* | steeplebush | Shrub | Native | N/A | Not Recorded |
| *Staphylea trifolia* | bladdernut | Tree | Native | N/A | Frequent |
| *Symphoricarpos orbiculatus* | coralberry | Shrub | Native | N/A | Occassional |
| *Tilia americana* | American basswood | Tree | Native | N/A | Frequent |
| *Toxicodendron radicans* | poison ivy | Vine | Native | N/A | Common |
| *Toxicodendron vernix* | poison sumac | Shrub | Native | N/A | Occassional |
| *Tsuga canadensis* | Eastern hemlock | Tree | Native | N/A | Frequent |

## Appendix G. Woody Plants of Mercer County
## Mount Rose Preserve Stewardship Plan
**Source: Brooklyn Botanic Garden**

| Scientific Name | Common Name | Growth Type | Nativity | Invasive Status | Frequency |
|---|---|---|---|---|---|
| *Ulmus americana* | American elm | Tree | Native | N/A | Common |
| *Ulmus rubra* | slippery elm | Tree | Native | N/A | Frequent |
| *Vaccinium angustifolium* | lowbush blueberry | Shrub | Native | N/A | Common |
| *Vaccinium corymbosum* | highbush blueberry | Shrub | Native | N/A | Common |
| *Vaccinium macrocarpon* | large cranberry | Sub-shrub | Native | N/A | Occassional |
| *Vaccinium pallidum* | hillside blueberry | Shrub | Native | N/A | Common |
| *Vaccinium stamineum* | deerberry | Shrub | Native | N/A | Frequent |
| *Viburnum acerifolium* | maple-leaved viburnum | Shrub | Native | N/A | Common |
| *Viburnum dentatum* | arrowwood | Shrub | Native | N/A | Common |
| *Viburnum dilatatum* | linden viburnum | Shrub | Non-Native | Yes | Not Recorded |
| *Viburnum lentago* | nannyberry | Shrub | Native | N/A | Frequent |
| *Viburnum nudum* | naked witherod | Shrub | Native | N/A | Not Recorded |
| *Viburnum opulus* | cranberry viburnum | Shrub | Native | N/A | Occassional |
| *Viburnum prunifolium* | blackhaw | Shrub | Native | N/A | Frequent |
| *Viburnum rafinesquianum* | downy arrowwood | Shrub | Native | N/A | Occassional |
| *Viburnum sieboldii* | Siebold viburnum | Shrub | Non-Native | Yes | Not Recorded |
| *Vitis aestivalis* | summer grape | Vine | Native | N/A | Common |
| *Vitis labrusca* | fox grape | Vine | Native | N/A | Common |
| *Vitis riparia* | frost grape | Vine | Native | N/A | Common |
| *Wisteria sinensis* | Chinese wisteria | Vine | Non-Native | Yes | Frequent |
| *Yucca filamentosa* | yucca | Shrub | Native | N/A | Occassional |

Nativity: Native to Metropolitan area or not
Frequency Notes: Common > Frequent > Occassional > Rare
Invasive Status: Yes = Widespread or Emerging Invasive Species

# Appendix H. Amphibians of Mercer County
# Mount Rose Preserve Stewardship Plan

**Source: Field Guide to Reptiles and Amphibians of New Jersey**
**Schwartz and Golden 2002**

| Common Name | Scientific Name | Status | Nativity |
|---|---|---|---|
| American Toad | *Bufo americanus* | S | Native |
| Blue-spotted Salamander | *Ambystoma laterale* | E | Native |
| Bullfrog | *Rana catesbeiana* | S | Native |
| Four-toed Salamander | *Hemidactylium scutatum* | D | Native |
| Fowler's Toad | *Bufo woodhousii fowleri* | SC | Native |
| Green Frog | *Rana clamitans melanota* | S | Native |
| Long-tailed Salamander | *Eurycea l. longicauda* | T | Native |
| Marbled Salamander | *Ambystoma opacum* | SC | Native |
| New Jersey Chorus Frog | *Pseudacris triseriata kalmi* | S | Native |
| Northern Cricket Frog | *Acris c. crepitans* | U | Native |
| Northern Dusky Salamander | *Desmognathus f. fuscus* | S | Native |
| Northern Gray Treefrog | *Hyla versicolor* | S | Native |
| Northern Red Salamander | *Pseudotriton r. ruber* | D | Native |
| Northern Spring Peeper | *Hyla c. crucifer* | S | Native |
| Northern Spring Salamander | *Gyrinophilus p. porphyriticus* | SC | Native |
| Northern Two-lined Salamander | *Eurycea b. bislineata* | S | Native |
| Pickerel Frog | *Rana palustris* | S | Native |
| Red-backed Salamander | *Plethodon c. cinereus* | S | Native |
| Red-spotted Newt | *Notophthalmus v. viridescens* | S | Native |
| Slimy Salamander | *Plethodon g. glutinosus* | S | Native |
| Southern Leopard Frog | *Rana spenocephala* | S | Native |
| Spotted Salamander | *Ambystoma maculatum* | D | Native |
| Wood Frog | *Rana sylvatica* | S | Native |

Wildlife Action Plan priority species are highlighted.

Species Status:

E - Endangered
T - Threatened
D - Decreasing
SC - Special Concern
S - Stable
U - Undertermined
I - Introduced
GS - Game Species

# Appendix I. Reptiles of Mercer County
# Mount Rose Preserve Stewardship Plan

**Source: Field Guide to Reptiles and Amphibians of New Jersey**
**Schwartz and Golden 2002**

| Common Name | Scientific Name | Status | Nativity |
|---|---|---|---|
| Black Rat Snake | *Elaphe o. obsoleta* | U | Native |
| Bog Turtle | *Clemmys muhlenbergi* | Federally Threatened, State Endangered | Native |
| Common Snapping Turtle | *Chelydra s. serpentina* | S | Native |
| Eastern Box Turtle | *Terrapene c. carolina* | S - SC | Native |
| Eastern Garter Snake | *Thamnophis s. sirtalis* | S | Native |
| Eastern Hognose Snake | *Heterodon platyrhinos* | D | Native |
| Eastern Milk Snake | *Lampropeltis t. triangulum* | S | Native |
| Eastern Mud Turtle | *Kinosternon s. subrubrum* | U | Native |
| Eastern Painted Turtle | *Chrysemys p. picta* | S | Native |
| Eastern Ribbon Snake | *Thamnophis s. sauritus* | S | Native |
| Eastern Smooth Earth Snake | *Virginia v. valeriae* | U | Native |
| Eastern Worm Snake | *Carphophis a. amoenus* | U | Native |
| Five-lined Skink | *Eumeces fasciatus* | U | Native |
| Map Turtle | *Graptemys geographica* | U | Native |
| Northern Black Racer | *Coluber c. constrictor* | U | Native |
| Northern Brown Snake | *Storeria d. dekayi* | S | Native |
| Northern Copperhead | *Agkistrodon contortrix mokasen* | U - SC | Native |
| Northern Fence Lizard | *Sceloporus undulatus hyacinthinus* | S | Native |
| Northern Red-bellied Snake | *Storeria o. occipitomaculata* | S | Native |
| Northern Ringneck Snake | *Diadophis punctatus edwardsi* | S | Native |
| Northern Scarlet Snake | *Cemophora coccinea copei* | U | Native |
| Northern Water Snake | *Nerodia s. sipedon* | S | Native |
| Red-bellied Turtle | *Pseudemys rubriventris* | U | Native |
| Red-eared Turtle | *Pseudemys scripta elegans* | I | Non-Native |
| Spotted Turtle | *Clemmys guttata* | U - SC | Native |
| Stinkpot | *Sternotherus odoratus* | S | Native |
| Wood Turtle | *Clemmys insculpta* | T | Native |

*Wildlife Action Plan priority species are highlighted

Species Status:

E - Endangered
T - Threatened
D - Decreasing
SC - Special Concern
S - Stable
U - Undertermined
I - Introduced
GS - Game Species

## Appendix J. Preserve Bird L
## Mount Rose Stewardship Pl

**Source: Washington Crossing Audub**
**and Mark Manning**

| Common Name |
|---|
| American Crow |
| American Goldfinch |
| American Redstart |
| American Robin |
| American Tree Sparrow |
| American Woodcock |
| Bald Eagle |
| Black Vulture |
| Black-and-white Warbler |
| Black-billed Cuckoo |
| Black-capped Chickadee |
| Black-throated Blue Warbler |
| Blue Jay |
| Blue-gray Gnatcatcher |
| Blue-winged Warbler |
| Brown Creeper |
| Brown Thrasher |
| Brown-headed Cowbird |
| Canada Goose |
| Carolina Chickadee |
| Carolina Wren |
| Cedar Waxwing |
| Chestnut-sided Warbler |
| Chimney Swift |
| Chipping Sparrow |
| Common Raven |
| Common Yellowthroat |
| Cooper’s Hawk |
| Dark-eyed Junco |
| Downy Woodpecker |
| Eastern Bluebird |
| Eastern Phoebe |
| Eastern Towhee |
| Eastern Wild Turkey |
| Field Sparrow |
| Fish Crow |
| Fox Sparrow |
| Golden-crowned Kinglet |
| Gray Catbird |
| Great Crested Flycatcher |
| Great Horned Owl |
| Hermit Thrush |
| House Wren |
| Indigo Bunting |
| Kentucky Warbler |
| Killdeer |
| Least Flycatcher |
| Lincoln's Sparrow |

## Appendix J. Preserve Bird L
## Mount Rose Stewardship Pl

**Source: Washington Crossing Audub**
**and Mark Manning**

| Common Name |
|---|
| Magnolia Warbler |
| Mourning Dove |
| Northern Cardinal |
| Northern Flicker |
| Northern Harrier |
| Northern Harrier |
| Northern Mockingbird |
| Ovenbird |
| Palm Warbler |
| Pine Warbler |
| Prairie Warbler |
| Purple Finch |
| Red-bellied Woodpecker |
| Red-eyed Vireo |
| Red-shouldered Hawk |
| Red-tailed Hawk |
| Red-winged Blackbird |
| Ring-necked Pheasant |
| Rose-breasted Grosbeak |
| Ruby-crowned Kinglet |
| Ruffed Grouse |
| Scarlet Tanager |
| Sharp-shinned Hawk |
| Song Sparrow |
| Swainson's Thrush |
| Swamp Sparrow |
| Tree Swallow |
| Tufted Titmouse |
| Turkey Vulture |
| Veery |
| White-breasted Nuthatch |
| White-crowned Sparrow |
| White-eyed Vireo |
| White-throated Sparrow |
| Winter Wren |
| Wood Thrush |
| Worm-eating Warbler |
| Yellow Warbler |
| Yellow-bellied Sapsucker |
| Yellow-billed Cuckoo |
| Yellow-rumped Warbler |
| Yellow-throated Vireo |

## Appendix K. Mammals of Mercer County
## Mount Rose Preserve Stewardship Plan

**(Source: The Mammals of the State of New Jersey,**
**A Preliminary Annotated List,**
**Richard Van Gelder, 1984)**

| COMMON NAME | SCIENTIFIC NAME | STATUS |
|---|---|---|
| Beaver | Castor candensis | INC |
| Big Brown Bat | Eptesicus fuscus | S |
| Black Bear | Ursus americanus | INC |
| Bobcat | Felis rufus | E |
| Brown Rat | Rattus norvegicus | I |
| Eastern Chipmunk | Tamias striatus | S |
| Eastern Cottontail | Sylvilagus floridanus | S |
| Eastern Coyote | Canis latrans, var. | INC |
| Eastern Mole | Scalopus aquaticus | S |
| Eastern Pipistrel | Pipistrellus subflavus | U |
| Gray Fox | Urocyon cinereoargenteus | S |
| Gray Squirrel | Sciurus carolinensis | S |
| House mouse | Mus musculus | I |
| Little Brown Bat | Myotis lucifugus | S |
| Long-tailed Weasel | Mustela frenata | S |
| Masked Shrew | Sorex cinereus | S |
| Meadow Jumping Mouse | Zapus hudsonius | U |
| Meadow Vole | Microtus pennsylvanicus | S |
| Mink | Mustela vison | S |
| Muskrat | Ondatra zibethicus | S |
| Opossum | Didelphis marsupialis | S |
| Pine Vole | Microtus pinetorum | S |
| Raccoon | Procyon lotor | S |
| Red Bat | Lasiurus borealis | S - SC |
| Red Fox | Vulpes vulpes | S |
| Red Squirrel | Tamiasciurus hudsonicus | S |
| River Otter | Lutra canadensis | S - GS |
| Short-tailed Shrew | Blarina brevicauda | S |
| Silver-haired Bat | Lasionycteris noctivagans | U - SC |
| Southern Flying Squirrel | Glaucomys volans | U |
| Star-nosed Mole | Condylura cristata | U |
| Striped Skunk | Mephitis mephitis | S |
| White-footed Mouse | Peromyscus leucopus | S |
| White-tailed Deer | Odocoileus virginianus | D |
| Woodchuck | Marmota monax | S |

*Wildlife Action Plan priority species are highlighted

Species Status:

| | |
|---|---|
| E - Endangered | S - Stable |
| T - Threatened | U - Undertermined |
| D - Decreasing | I - Introduced |
| INC - Increasing | P - Peripheral |
| SC - Special Concern | GS - Game Species |

## Appendix L. Freshwater Fish of New Jersey
## Mount Rose Preserve Stewardship Plan

| Common Name | Scientific Name | Family Name | State Status | Nativity |
|---|---|---|---|---|
| Alewife | *Alosa pseudoharengus* | Clupeidae | None | Native |
| American Brook Lamprey | *Lampetra appendix* | Petromyzontidae | SC | Native |
| American Eel | *Anguilla rostrata* | Anguillidae | None | Native |
| American Shad | *Alosa sapidissima* | Clupeidae | None | Native |
| Atlantic Sturgeon | *Acipenser oxyrhynchus* | Acipenseridae | SC | Native |
| Banded Killifish | *Fundulus diaphanus* | Cyprinodontidae | None | Native |
| Banded Sunfish | *Eleacanthus obesus* | Centrarchidae | None | Native |
| Black Bullhead | *Ameiurus melas* | Ictaluridae | None | Non-Native |
| Black Crappie | *Pomoxis nigromaculatus* | Centrarchidae | None | Non-Native |
| Blackbanded Sunfish | *Eleacanthus chaetodon* | Centrarchidae | None | Native |
| Blacknose Dace | *Rhinichthys atratulus* | Cyprinidae | None | Native |
| Blueback Herring | *Alosa aestivalis* | Clupeidae | None | Native |
| Bluegill | *Lepomis macrochirus* | Centrarchidae | None | Non-Native |
| Bluespotted Sunfish | *Eleacanthus gloriosus* | Centrarchidae | None | Native |
| Bluntnose Minnow | *Pimephales notatus* | Cyprinidae | None | Non-Native |
| Bowfin | *Amia calva* | Amiidae | None | Non-Native |
| Bridle Shiner | *Notropis bifrenatus* | Cyprinidae | SC | Native |
| Brook Trout | *Salvelinus fontinalis* | Salmonidae | None | Native |
| Brown Bullhead | *Ameiurus nebulosus* | Ictaluridae | None | Native |
| Brown Trout | *Salmo trutta* | Salmonidae | None | Non-native |
| Chain Pickerel | *Esox niger* | Esocidae | None | Native |
| Channel Catfish | *Ictalurus punctatus* | Ictaluridae | None | Non-Native |
| Comely Shiner | *Notropis amoenus* | Cyprinidae | None | Native |
| Common Carp | *Cyprinus carpio* | Cyprinidae | None | Non-Native |
| Common Shiner | *Luxilis cornutus* | Cyprinidae | None | Native |
| Creek Chub | *Semotilus atromaculatus* | Cyprinidae | None | Native |
| Creek Chubsucker | *Erimyzon oblongus* | Catostomidae | None | Native |
| Cutlips Minnow | *Exoglossum maxillingua* | Cyprinidae | None | Native |
| Eastern Mosquitofish | *Gambusia holbrooki* | Poeciliidae | None | Native |
| Eastern Mudminnow | *Umbra pygmaea* | Umbridae | None | Native |
| Eastern Silvery Minnow | *Hybognathus regius* | Cyprinidae | None | Native |
| Fallfish | *Semotilus corporalis* | Cyprinidae | None | Native |
| Fathead Minnow | *Pimephales promelas* | Cyprinidae | None | Non-Native |
| Fourspine Stickleback | *Apletes quadracus* | Gasterosteidae | None | Native |
| Gizzard Shad | *Drosoma cepedianum* | Clupeidae | None | Native |
| Golden Shiner | *Notemigonus crysoleucas* | Cyprinidae | None | Native |
| Goldfish | *Carassius auratus* | Cyprinidae | None | Non-Native |
| Grass Carp | *Ctenopharyngodon idella* | Cyprinidae | None | Non-Native |
| Green Sunfish | *Lepomis cyanellus* | Centrarchidae | None | Non-Native |
| Hickory Shad | *Alosa mediocris* | Clupeidae | WAP Priority | Native |
| Hogchoker | *Trinectes maculatus* | Soleidae | None | Native |
| Ironcolor Shiner | *Notropis chalybaeus* | Cyprinidae | None | Native |
| Lake Trout | *Salvelinus namaycush* | Salmonidae | None | Non-Native |
| Largemouth Bass | *Micropterus salmoides* | Centrarchidae | None | Non-Native |
| Longnose Dace | *Rhinichthys cataractae* | Cyprinidae | None | Native |
| Longnose Gar | *Lepisosteus osseus* | Lepisosteidae | None | Native - Extirpated |
| Margined Madtom | *Noturus insignis* | Ictaluridae | WAP Priority | Native |
| Mosquitofish | *Gambusia affinis* | Poeciliidae | None | Non-Native |
| Mud Sunfish | *Acantharchus pomotis* | Centrarchidae | None | Native |
| Mummichog | *Fundulus heteroclitus* | Cyprinodontidae | None | Native |
| Muskellunge | *Esox masquinongy* | Esocidae | None | Non-Native |
| Ninespine Stickleback | *Pungitius pungitius* | Gasterosteidae | None | Native |
| Northern Hog Sucker | *Hypentelium nigricans* | Catostomidae | None | Native |
| Northern Pike | *Esox lucius* | Esocidae | None | Non-Native |
| Oriental Weatherfish | *Misgurnus anguillicaudatus* | Cobitidae | None | Non-Native |
| Pirate Perch | *Aphredoderus sayanus* | Aphredoderidae | None | Native |
| Pumpkinseed | *Lepomis gibbosus* | Centrarchidae | None | Native |
| Quillback | *Carpiodes cyprinus* | Cyprinidae | None | Native |
| Rainbow Smelt | *Osmerus mordax* | Osmeridae | None | Native |
| Rainbow Trout | *Oncorhynchus mykiss* | Salmonidae | None | Non-Native |
| Redbreasted Sunfish | *Lepomis auritus* | Centrarchidae | None | Native |
| Redfin Pickerel | *Esox americanus* | Esocidae | None | Native |
| Rock Bass | *Ambloplites rupestris* | Centrarchidae | None | Non-Native |
| Satinfin Shiner | *Cyprinella analostana* | Cyprinidae | None | Native |
| Sea Lamprey | *Petromyzon marinus* | Petromyzontidae | None | Native |
| Shield Darter | *Percina peltata* | Percidae | WAP Priority | Native |
| Shortnose Sturgeon | *Acipenser brevirostrum* | Acipenseridae | Federally and State Endangered | Native |

## Appendix L. Freshwater Fish of New Jersey
## Mount Rose Preserve Stewardship Plan

| Common Name | Scientific Name | Family Name | State Status | Nativity |
|---|---|---|---|---|
| Slimy Sculpin | *Cottus cognatus* | Cottidae | None | Native |
| Smallmouth Bass | *Micropterus dolomieu* | Centrarchidae | None | Non-Native |
| Spotfin Shiner | *Cyprinella spiloptera* | Cyprinidae | None | Native |
| Spottail Shiner | *Notropis husdonius* | Cyprinidae | None | Native |
| Striped Bass | *Morone saxatilis* | Moronidae | None | Native |
| Swallowtail Shiner | *Notropis procne* | Cyprinidae | None | Native |
| Swamp Darter | *Etheostoma fusiforme* | Percidae | None | Native |
| Tadpole Madtom | *Noturus gyrinus* | Ictaluridae | None | Native |
| Tessellated Darter | *Etheostoma olmstedi* | Percidae | None | Native |
| Threespoine Stickleback | *Gasterosteus aculeatus* | Gasterosteidae | None | Native |
| Walleye | *Sander vitreus* | Percidae | None | Non-Native |
| Warmouth | *Lepomis gulosus* | Centrarchidae | None | Non-Native |
| White Catfish | *Ameiurus catus* | Ictaluridae | None | Native |
| White Crappie | *Pomoxis alularis* | Centrarchidae | None | Non-Native |
| White Perch | *Morone americana* | Moronidae | None | Native |
| White Sucker | *Catostomus commersoni* | Catostomidae | None | Native |
| Yellow Bullhead | *Ameiurus natalis* | Ictaluridae | None | Native |
| Yellow Perch | *Perca flavescens* | Percidae | None | Native |

*Wildlife Action Plan priority species are highlighted

Species Status:

| | |
|---|---|
| E - Endangered | S - Stable |
| T - Threatened | U - Undertermined |
| D - Decreasing | I - Introduced |
| SC - Special Concern | GS - Game Species |

## Appendix M. Freshwater Mussels of Mercer County
## Mount Rose Preserve Stewardship Plan

**Source: Center for Biodiversity and Conservation at the American Museum of Natural History**
**http://cbc.amnh.org/mussel/index.html**

| Scientific Name | Common Name | AMNH Abundance | State Status | Nativity |
|---|---|---|---|---|
| *Alasmidonta varicosa* | brook floater | rare | None | Native |
| *Alasmidonta undulata* | triangle floater | rare | T | Native |
| *Elliptio complanata* | Eastern elliptio | abundant | None | Native |
| *Lampsilis cariosa* | yellow lampmuseel | rare | T | Native |
| *Lampsilis radiata* | Eastern lampmussel | rare | None | Native |
| *Lasmigona subviridus* | green floater | rare - Mercer County only | None | Native |
| *Leptodea ochracea* | tidewater mucket | rare | T | Native |
| *Ligumia nasuta* | Eastern pondmussel | rare | None | Native |
| *Pyganodon cataracta* | Eastern floater | abundant | None | Native |
| *Strophitus undulatus* | creeper | common to abundant | SC | Native |

*Wildlife Action Plan priority species are highlighted

Species Status:

| | |
|---|---|
| E - Endangered | S - Stable |
| T - Threatened | U - Undertermined |
| D - Decreasing | I - Introduced |
| SC - Special Concern | GS - Game Species |

## Appendix N. Butterflies of Mercer County
## Mount Rose Preserve Stewardship Plan

**Source: National Biological Information Infrastructure and Montana State University**
**www.butterfliesandmoths.org**

**Note: Each species has a link to its own webpage.**

| Common Name (Scientific Name) and Family and Sub-Family Name | Status |
|---|---|
| **Brush-footed Butterflies (*Nymphalidae*)** | N/A |
| **Admirals and Relatives (*Limenitidinae*)** | N/A |
| 'Astyanax' Red-spotted Purple (Limenitis arthemis astyanax) | None |
| Red-spotted Purple or White Admiral (Limenitis arthemis) | None |
| Viceroy (Limenitis archippus) | None |
| **Emperors (*Apaturinae*)** | N/A |
| Hackberry Emperor (Asterocampa celtis) | None |
| Tawny Emperor (Asterocampa clyton) | None |
| **Longwings (*Heliconiinae*)** | N/A |
| Aphrodite Fritillary (Speyeria aphrodite) | None |
| Great Spangled Fritillary (Speyeria cybele) | None |
| Meadow Fritillary (Boloria bellona) | None |
| Regal Fritillary (Speyeria idalia) | None |
| Silver-bordered Fritillary (Boloria selene) | T |
| Variegated Fritillary (Euptoieta claudia) | None |
| **Milkweed Butterflies (*Danainae*)** | N/A |
| Monarch (Danaus plexippus) | None |
| **Satyrs and Wood-Nymphs (*Satyrinae*)** | N/A |
| Appalachian Brown (Satyrodes appalachia) | None |
| Common Wood Nymph (Cercyonis pegala) | None |
| Eyed Brown (Satyrodes eurydice) | None |
| Little Wood Satyr (Megisto cymela) | None |
| **Snouts (*Libytheinae*)** | N/A |
| American Snout (Libytheana carinenta) | None |
| **True Brushfoots (*Nymphalinae*)** | N/A |
| Baltimore (Euphydryas phaeton) | None |
| Common Buckeye (Junonia coenia) | None |
| Eastern Comma (Polygonia comma) | None |
| Gray Comma (Polygonia progne) | None |
| Green Comma (Polygonia faunus) | None |
| Milbert's Tortoiseshell (Aglais milberti) | None |
| Pearl Crescent (Phyciodes tharos) | None |
| Question Mark (Polygonia interrogationis) | None |
| Red Admiral (Vanessa atalanta) | None |
| Silvery Checkerspot (Chlosyne nycteis) | None |
| | |
| **Gossamer-wing Butterflies (*Lycaenidae*)** | N/A |
| **Blues (*Polyommatinae*)** | None |
| Appalachian Azure (Celastrina neglecta-major) | None |
| Eastern Tailed-Blue (Cupido comyntas) | None |
| Spring Azure (Celastrina "ladon") | None |
| **Coppers (*Lycaeninae*)** | N/A |
| American Copper (Lycaena phlaeas) | None |
| **Hairstreaks (*Theclinae*)** | N/A |
| Banded Hairstreak (Satyrium calanus) | None |
| Brown Elfin (Callophrys augustinus) | None |
| Coral Hairstreak (Satyrium titus) | None |
| Eastern Pine Elfin (Callophrys niphon) | None |
| Edwards' Hairstreak (Satyrium edwardsii) | None |
| Frosted Elfin (Callophrys irus) | T |

## Appendix N. Butterflies of Mercer County
## Mount Rose Preserve Stewardship Plan

**Source: National Biological Information Infrastructure and Montana State University**
**www.butterfliesandmoths.org**

**Note: Each species has a link to its own webpage.**

| Common Name (Scientific Name) and Family and Sub-Family Name | Status |
|---|---|
| Gray Hairstreak (Strymon melinus) | None |
| Henry's Elfin (Callophrys henrici) | None |
| Hickory Hairstreak (Satyrium caryaevorum) | None |
| Juniper Hairstreak (Callophrys gryneus) | None |
| Red-banded Hairstreak (Calycopis cecrops) | None |
| Striped Hairstreak (Satyrium liparops) | None |
| White M Hairstreak (Parrhasius m-album) | None |
| **Harvesters (*Miletinae*)** | N/A |
| Harvester (Feniseca tarquinius) | None |
| | |
| **Parnassians and Swallowtails (*Papilionidae*)** | N/A |
| **Swallowtails (*Papilioninae*)** | N/A |
| Eastern Tiger Swallowtail (Papilio glaucus) | None |
| Giant Swallowtail (Papilio cresphontes) | None |
| Pipevine Swallowtail (Battus philenor) | None |
| Spicebush Swallowtail (Papilio troilus) | None |
| | |
| **Skippers (*Hesperiidae*)** | N/A |
| **Grass Skippers (*Hesperiinae*)** | N/A |
| Black Dash (Euphyes conspicua) | None |
| Broad-winged Skipper (Poanes viator) | None |
| Cobweb Skipper (Hesperia metea) | None |
| Common Roadside-Skipper (Amblyscirtes vialis) | None |
| Crossline Skipper (Polites origenes) | None |
| Delaware Skipper (Anatrytone logan) | None |
| Dusted Skipper (Atrytonopsis hianna) | None |
| European Skipper (Thymelicus lineola) | None |
| Fiery Skipper (Hylephila phyleus) | None |
| Indian Skipper (Hesperia sassacus) | None |
| Least Skipper (Ancyloxypha numitor) | None |
| Leonard's Skipper (Hesperia leonardus) | None |
| Little Glassywing (Pompeius verna) | None |
| Long Dash (Polites mystic) | None |
| Mulberry Wing (Poanes massasoit) | None |
| Swarthy Skipper (Nastra lherminier) | None |
| Tawny-edged Skipper (Polites themistocles) | None |
| Two-spotted Skipper (Euphyes bimacula) | None |
| Zabulon Skipper (Poanes zabulon) | None |
| **Spread-wing Skippers (*Pyrginae*)** | N/A |
| Columbine Duskywing (Erynnis lucilius) | None |
| Common Checkered-Skipper (Pyrgus communis) | None |
| Dreamy Duskywing (Erynnis icelus) | None |
| Hoary Edge (Achalarus lyciades) | None |
| Horace's Duskywing (Erynnis horatius) | None |
| Juvenal's Duskywing (Erynnis juvenalis) | None |
| Long-tailed Skipper (Urbanus proteus) | None |
| Mottled Duskywing (Erynnis martialis) | None |
| Northern Cloudywing (Thorybes pylades) | None |
| Silver-spotted Skipper (Epargyreus clarus) | None |
| Sleepy Duskywing (Erynnis brizo) | None |

## Appendix N. Butterflies of Mercer County
## Mount Rose Preserve Stewardship Plan

**Source: National Biological Information Infrastructure and Montana State University**
**www.butterfliesandmoths.org**

**Note: Each species has a link to its own webpage.**

| Common Name (Scientific Name) and Family and Sub-Family Name | Status |
|---|---|
| Southern Cloudywing (Thorybes bathyllus) | None |
| Wild Indigo Duskywing (Erynnis baptisiae) | None |
| | |
| **Sphinx Moths, Hawkmoths (*Sphingidae*)** | N/A |
| **Macroglossinae (*Macroglossinae*)** | N/A |
| Pandorus sphinx (Eumorpha pandorus) | None |
| | |
| **Tiger Moths and Lichen Moths (*Arctiidae*)** | N/A |
| **Tiger Moths (*Arctiinae*)** | N/A |
| Bella Moth (Utetheisa ornatrix) | None |
| Confused Haploa (Haploa confusa) | None |
| Isabella Tiger Moth or Banded Woolybear (Pyrrharctia isabella) | None |
| | |
| **Whites and Sulphurs (*Pieridae*)** | N/A |
| **Sulphurs (*Coliadinae*)** | N/A |
| Clouded Sulphur (Colias philodice) | None |
| Cloudless Sulphur (Phoebis sennae) | None |
| Little Yellow (Pyrisitia lisa) | None |
| Orange Sulphur (Colias eurytheme) | None |
| **Whites (*Pierinae*)** | N/A |
| Cabbage White (Pieris rapae) | None |
| Falcate Orangetip (Anthocharis midea) | None |
| | |
| **Wild Silk Moths (*Saturniidae*)** | N/A |
| **Giant Silkworm Moths (*Saturniinae*)** | N/A |
| Ailanthus silkmoth (Samia cynthia) | None |
| **Royal Moths (*Citheroniinae*)** | N/A |
| Imperial moth (Eacles imperialis) | None |
| Pink-striped oakworm moth (Anisota virginiensis) | None |

*Wildlife Action Plan priority species are highlighted

Species Status:
E - Endangered, S - Stable
T - Threatened, U - Undetermined
D - Decreasing, I - Introduced
SC - Special Concern, GS - Game Species

## Appendix O. Dragonflies & Damselflies of Mercer County
## Mount Rose Stewardship Plan

**Source: www.njodes.com**

**Note: Each species has a link to its own webpage.**

| Common Name | Scientific Name | Status |
|---|---|---|
| **BROAD-WINGED DAMSELS** | **CALOPTERYGIDAE** | N/A |
| Sparkling Jewelwing | Calopteryx dimidiata | None |
| Ebony Jewelwing | Calopteryx maculata | None |
| American Rubyspot | Hetaerina americana | None |
| **SPREADWINGS** | **LESTIDAE** | N/A |
| Great Spreadwing | Archilestes grandis | None |
| Slender Spreadwing | Lestes rectangularis | None |
| Swamp Spreadwing | Lestes vigilax | None |
| **POND DAMSELS** | **COENAGRIONIDAE** | N/A |
| Blue-fronted Dancer | Argia apicalis | None |
| Violet Dancer | Argia fumipennis violacea | None |
| Powdered Dancer | Argia moesta | None |
| Blue-ringed Dancer | Argia sedula | None |
| Blue-tipped Dancer | Argia tibialis | None |
| Dusky Dancer | Argia translata | None |
| Azure Bluet | Enallagma aspersum | None |
| Familiar Bluet | Enallagma civile | None |
| Stream Bluet | Enallagma exsulans | None |
| Skimming Bluet | Enallagma geminatum | None |
| Orange Bluet | Enallagma signatum | None |
| Slender Bluet | Enallagma traviatum | None |
| Blackwater Bluet | Enallagma weewa | None |
| Fragile Forktail | Ischnura posita | None |
| Eastern Forktail | Ischnura verticalis | None |
| **DARNERS** | **AESHNIDAE** | N/A |
| Shadow Darner | Aeshna umbrosa | None |
| Common Green Darner | Anax junius | None |
| Springtime Darner | Basiaeschna janata | None |
| Fawn Darner | Boyeria vinosa | None |
| Swamp Darner | Epiaeschna heros | None |
| **CLUBTAILS** | **GOMPHIDAE** | N/A |
| Black-shouldered Spinyleg | Dromogomphus spinosus | None |
| Septima's Clubtail | Gomphus (Gomphurus) septima | SC |
| Cobra Clubtail | Gomphus (Gomphurus) vastus | None |
| Lancet Clubtail | Gomphus (Gomphus) exilis | None |
| Ashy Clubtail | Gomphus (Gomphus) lividus | None |
| Spine-crowned Clubtail | Gomphus (Hylogomphus) abbreviatus | None |
| Eastern Least Clubtail | Stylogomphus albistylus | None |
| Russet-tipped Clubtail | Stylurus plagiatus | None |
| Arrow Clubtail | Stylurus spiniceps | None |
| **CRUISERS** | **MACROMIIDAE** | N/A |
| Stream Cruiser | Didymops transversa | None |
| "Georgia" Swift River Cruiser | Macromia illinoiensis georgina | None |
| **EMERALDS** | **FAMILY CORDULIIDAE** | N/A |

## Appendix O. Dragonflies & Damselflies of Mercer County
## Mount Rose Stewardship Plan

**Source: www.njodes.com**

**Note: Each species has a link to its own webpage.**

| Common Name | Scientific Name | Status |
|---|---|---|
| Prince Baskettail | Epitheca (Epicordulia) princeps | None |
| Common Baskettail | Epitheca (Tetragoneuria) cynosura | None |
| **SKIMMERS** | **LIBELLULIDAE** | N/A |
| Calico Pennant | Celithemis elisa | None |
| Halloween Pennant | Celithemis eponina | None |
| Eastern Pondhawk | Erythemis simplicicollis | None |
| Bar-winged Skimmer | Libellula axilena | None |
| Slaty Skimmer | Libellula incesta | None |
| Widow Skimmer | Libellula luctuosa | None |
| Twelve-spotted Skimmer | Libellula pulchella | None |
| Painted Skimmer | Libellula semifasciata | None |
| Great Blue Skimmer | Libellula vibrans | None |
| Blue Dasher | Pachydiplax longipennis | None |
| Wandering Glider | Pantala flavescens | None |
| Eastern Amberwing | Perithemis tenera | None |
| Common Whitetail | Plathemis lydia | None |
| "Western" Cherry-faced Meadowhawk | Sympetrum internum | None |
| "Eastern" Cherry-faced Meadowhawk | Sympetrum internum(janae?) | None |
| Band-winged Meadowhawk | Sympetrum semicinctum | None |
| Autumn Meadowhawk | Sympetrum vicinum | None |
| Black Saddlebags | Tramea lacerata | None |

*Wildlife Action Plan priority species are highlighted

Species Status:

E - Endangered
T - Threatened
D - Decreasing
SC - Special Concern
S - Stable
U - Undertermined
I - Introduced
GS - Game Species