Sugar's Bridge Nature Area

NATURAL AREA STEWARDSHIP REPORT

July 2014

East Bradford Township, Chester County
(Tax parcels 51-4-1-E; 51-4-3-E; 51-4-4-E)
33.7 acres

Natural Lands Trust
land for life

Sugar's Bridge Nature Area

East Bradford Township, Chester County, PA

NATURAL AREA STEWARDSHIP REPORT

July 2014

Natural Lands Trust

Hildacy Farm Preserve
1031 Palmers Mill Road
Media, PA 19063

610-353-5587
www.natlands.org

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GENERAL PROPERTY DESCRIPTION

The 33.7-acre Sugar's Bridge Nature Area (Nature Area) is located in East Bradford Township, Chester County between Harmony Hill Road to the north and Downingtown Pike (Route 322) to the south (see *Location* and *2010 Aerial Photography* maps). The Nature Area is accessible from a parking lot on Harmony Hill Road, a pull-off area on Downingtown Pike, and a parking lot on Skelp Level Road with trail access through the M. John Johnson Nature Center. The Nature Area is comprised of three sections—northern and southern sections owned by East Bradford Township and a central section owned by PECO between them. In addition to being owned by East Bradford Township, the Nature Area is protected by a conservation easement held by North American Land Trust. Many of the properties surrounding the Nature Area are protected through East Bradford Township ownership, conservation easements, and homeowner association open space covenants.

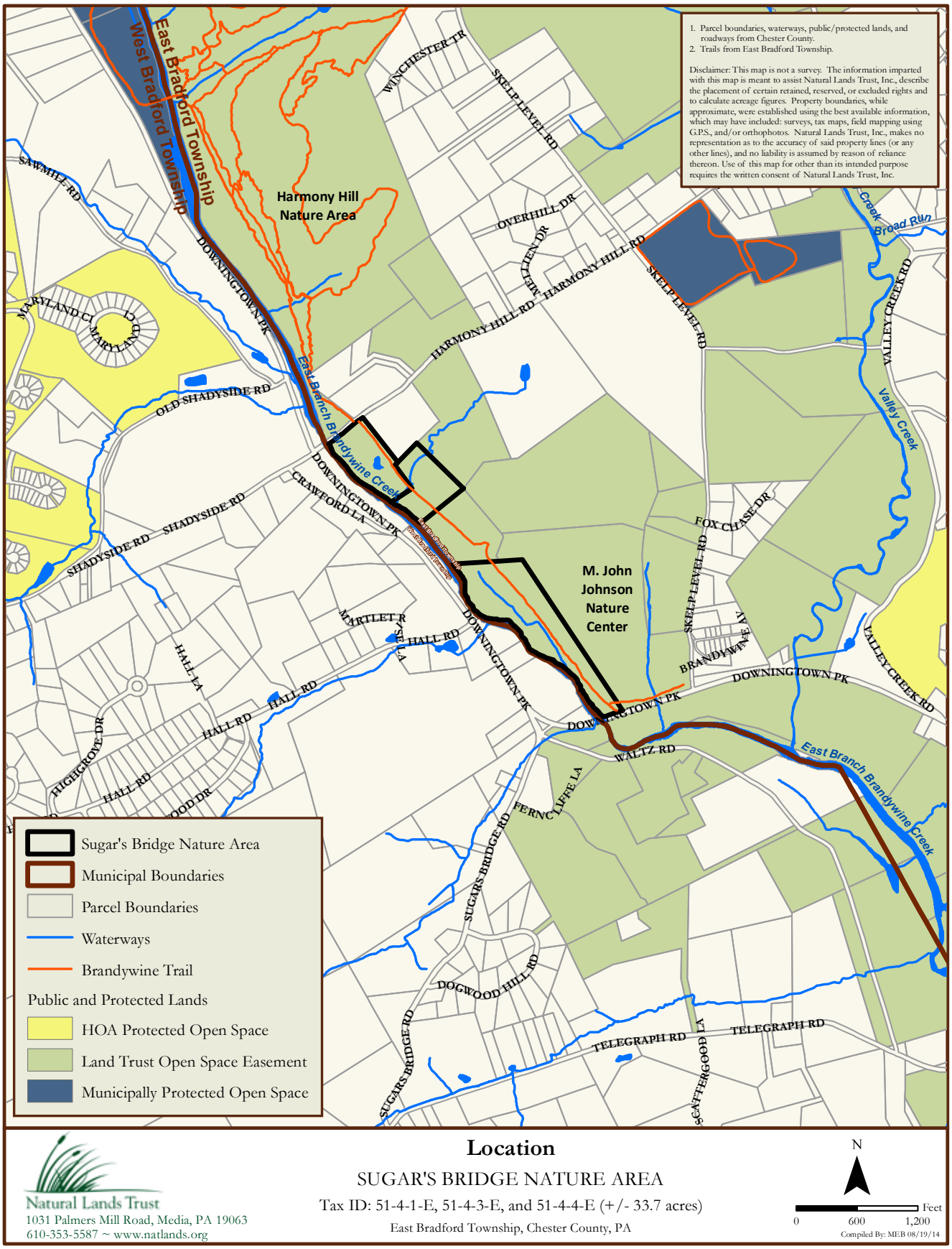
Natural Lands Trust staff accompanied by Mandie Cantlin, Assistant Township Manager, conducted a field inspection of the property on April 3, 2014. The Nature Area's natural resources were assessed and documented by field notes and photographs.

Kiosk

Parking area along Harmony Hill Road

TOPOGRAPHY

The topography of the property ranges from about 200 feet to 320 feet above mean sea level (see *Hydrologic and Topographic Features* map). Both the highest and lowest elevations are located in the southern section of the Nature Area. The higher elevations are along the eastern boundary toward the northern portion of the parcel. The lowest elevation is located in the southwest corner of the Nature Area along the East Branch Brandywine Creek. The western portion of the Nature Area is mostly flat floodplain along the Creek, while the eastern portion lies largely on steep slopes (15–25% and greater than 25%).


1. Parcel boundaries, waterways, public/protected lands, and roadways from Chester County.
2. Trails from East Bradford Township.
Disclaimer: This map is not a survey. The information imparted with this map is meant to assist Natural Lands Trust, Inc., describe the placement of certain retained, reserved, or excluded rights and to calculate acreage figures. Property boundaries, while approximate, were established using the best available information, which may have included: surveys, tax maps, field mapping using G.P.S., and/or orthophotos. Natural Lands Trust, Inc., makes no representation as to the accuracy of said property lines (or any other lines), and no liability is assumed by reason of reliance thereon. Use of this map for other than its intended purpose requires the written consent of Natural Lands Trust, Inc.
West Bradford Township
East Bradford Township
Harmony Hill Nature Area
M. John Johnson Nature Center
East Branch Brandywine Creek
Broad Run
Valley Creek
WINCHESTER TR
SKELP LEVEL RD
SAWMILL RD
OVERHILL DR
MELLEN DR
HARMONY HILL RD
DOWNINGTOWN PK
MARYLAND CI
OLD SHADYSIDE RD
CRAWFORD LA
SHADYSIDE RD
FOX CHASE DR
VALLEY CREEK RD
MARTLET R
HALL RD
HALL LA
BRANDYWINE AV
WALTZ RD
HIGHGROVE DR
FERNCLIFFE LA
SUGARS BRIDGE RD
DOGWOOD HILL RD
TELEGRAPH RD
SCATTERGOOD LA
Sugar's Bridge Nature Area
Municipal Boundaries
Parcel Boundaries
Waterways
Brandywine Trail
Public and Protected Lands
HOA Protected Open Space
Land Trust Open Space Easement
Municipally Protected Open Space
Natural Lands Trust
1031 Palmers Mill Road, Media, PA 19063
610-353-5587 ~ www.natlands.org
Location
SUGAR'S BRIDGE NATURE AREA
Tax ID: 51-4-1-E, 51-4-3-E, and 51-4-4-E (+/- 33.7 acres)
East Bradford Township, Chester County, PA
N
Feet
0
600
1,200
Compiled By: MEB 08/19/14


Sugar's Bridge Nature Area
Municipal Boundaries
Parcel Boundaries
Waterways
Brandywine Trail
HARMONY HILL RD
DOWNINGTOWN PK
CRAWFORD LA
East Bradford Township
West Bradford Township
MARTLET RISE LA
HALL RD
East Branch Brandywine Creek
M. John Johnson
Nature Center
DOWNINGTOWN PK
SUGARS BRIDGE RD
WALTZ RD
1. Aerial photography from DVRPC.
2. Parcel boundaries and roadways from Chester County.
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Natural Lands Trust
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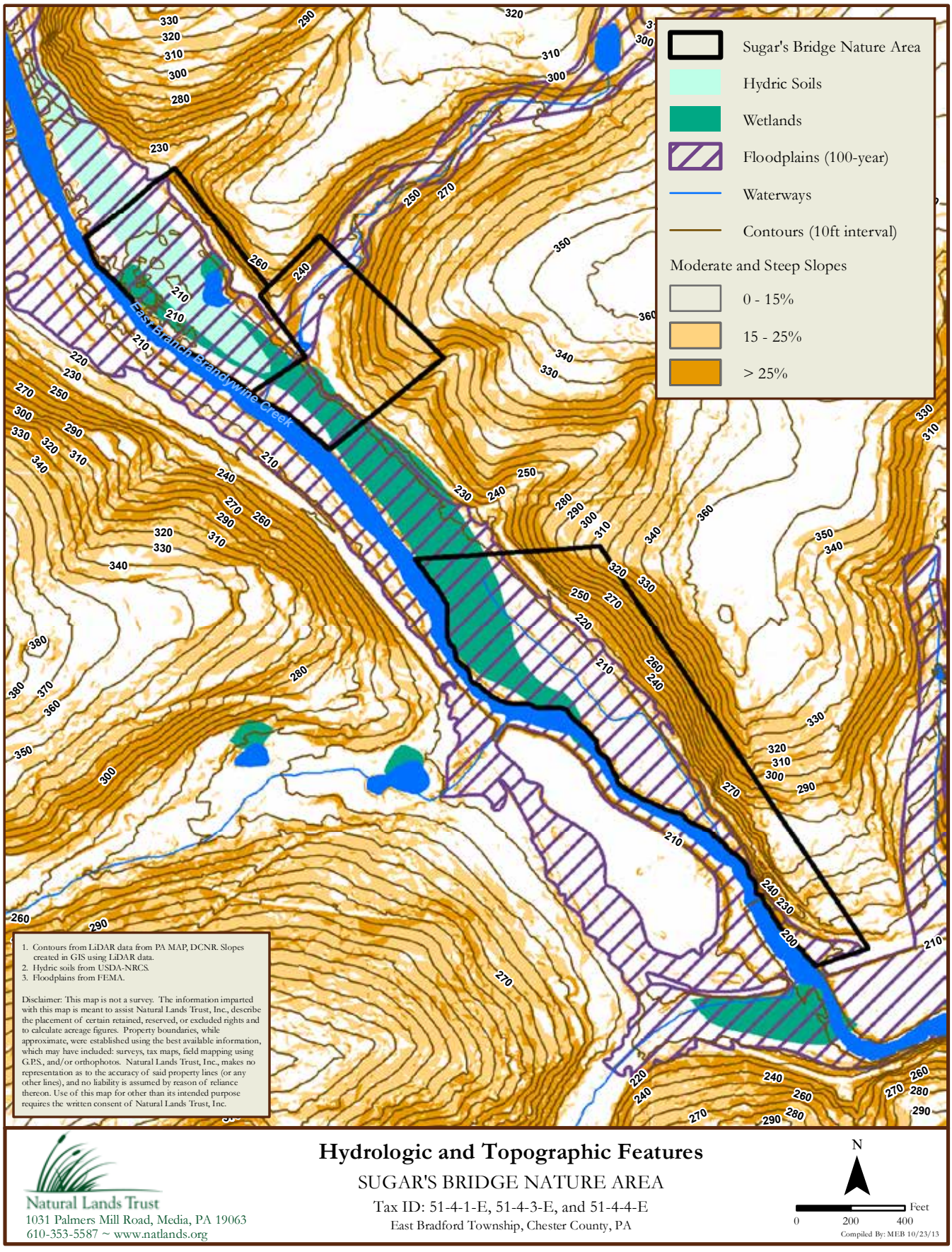
2010 Aerial Photography
SUGAR'S BRIDGE NATURE AREA
Tax ID: 51-4-1-E, 51-4-3-E, and 51-4-4-E (+/- 33.7 acres)
East Bradford Township, Chester County, PA
N
0
225
450
Feet
Compiled By: MEB 08/19/14


Sugar's Bridge Nature Area
Hydric Soils
Wetlands
Floodplains (100-year)
Waterways
Contours (10ft interval)
Moderate and Steep Slopes
0 - 15%
15 - 25%
> 25%
East Branch Brandywine Creek
1. Contours from LiDAR data from PA MAP, DCNR. Slopes created in GIS using LiDAR data.
2. Hydric soils from USDA-NRCS.
3. Floodplains from FEMA.
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Hydrologic and Topographic Features
SUGAR'S BRIDGE NATURE AREA
Tax ID: 51-4-1-E, 51-4-3-E, and 51-4-4-E
East Bradford Township, Chester County, PA
N
Feet
0
200
400
Compiled By: MEB 10/23/13

WATER RESOURCES

The property is located within the East Branch Brandywine Creek watershed. The East Branch Brandywine Creek flows from north to south along the Nature Area's western boundary for approximately 1,225 feet in the northern section and 2,333 feet in the southern section. The East Branch Brandywine Creek is a tributary to the Brandywine Creek which flows into the Christina River and continues into the Delaware River.

The Nature Area contains waterways, wetlands, hydric soils, floodplains, seasonal pools, an old earthen pond, and concrete pools that are remnants of a former trout hatchery (see *Hydrologic and Topographic Features* map). Two tributaries flow through the Nature Area into the East Branch Brandywine Creek. One tributary, beginning as outflow from a pond on a neighboring property, enters the northern section of the Nature Area from the east. This headwater stream flows through the old trout hatchery structures before entering the Brandywine floodplain and eventually the Creek. The second tributary flows almost parallel to the East Branch Brandywine Creek in the southern section of the Nature

Brandywine Creek

Seasonal pool

Old pond

Tributary in northern section

Trout hatchery remnants

Tributary in southern section

Skunk cabbage seep

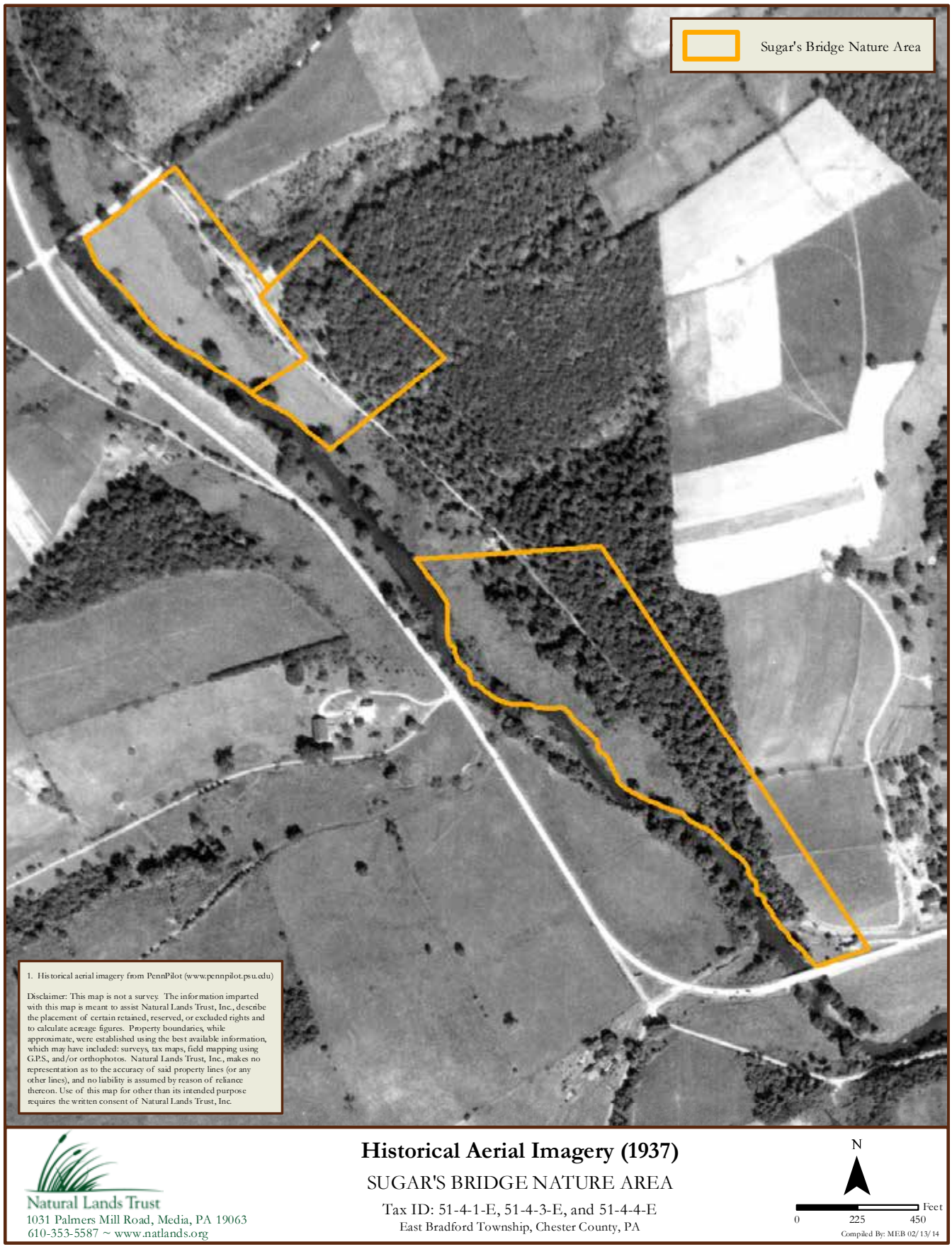
Area before entering the Creek. Wetlands and hydric soils are contained within the flat floodplain which comprises approximately half of the Nature Area. The man-made pond is located in the northern section of the Nature Area north of the first tributary. Water from the tributary was previously diverted from the stream channel by pipes into the pond area. At the time a new culvert was installed to carry the stream under the old trolley bed, the pipes were broken and the pond is now fed solely by stormwater and functions as a seasonal pool. Much of the year, the area is a wet depression and does not contain standing water.

PLANT RESOURCES

Historically, most of the floodplain and the flat upland area in the southeast corner of the southern section were kept open through agriculture. The steep slopes and a portion of the floodplain in the southern section have been forested for over a century as seen in the 1937 aerial. By 1971, more of the floodplain had begun its succession to scrub/shrub and forest, particularly along the East Branch Brandywine Creek in the northern section and across most of the southern section. Additionally, between 1937 and 1971, a portion of the forest in the northern section was cut to accommodate the trout hatchery. As a result of these past disturbances, Sugar's Bridge Nature Area currently contains five plant communities as described below with invasive species highlighted in bold type (see *Vegetation Communities* map). They include terrestrial meadow, skunk cabbage seep, floodplain forest, old pine plantation, and red oak–mixed hardwood forest. An improvement area contains the earthen pond, fish hatchery and former estate area.

Skunk Cabbage Seep

At the base of the steep slope to the south of the trout hatchery lies a large skunk cabbage seep. The only species observed during the April site visit was skunk cabbage (*Symplocarpus foetidus*).


Sugar's Bridge Nature Area
1. Historical aerial imagery from PennPilot (www.pennpilot.psu.edu)
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Natural Lands Trust
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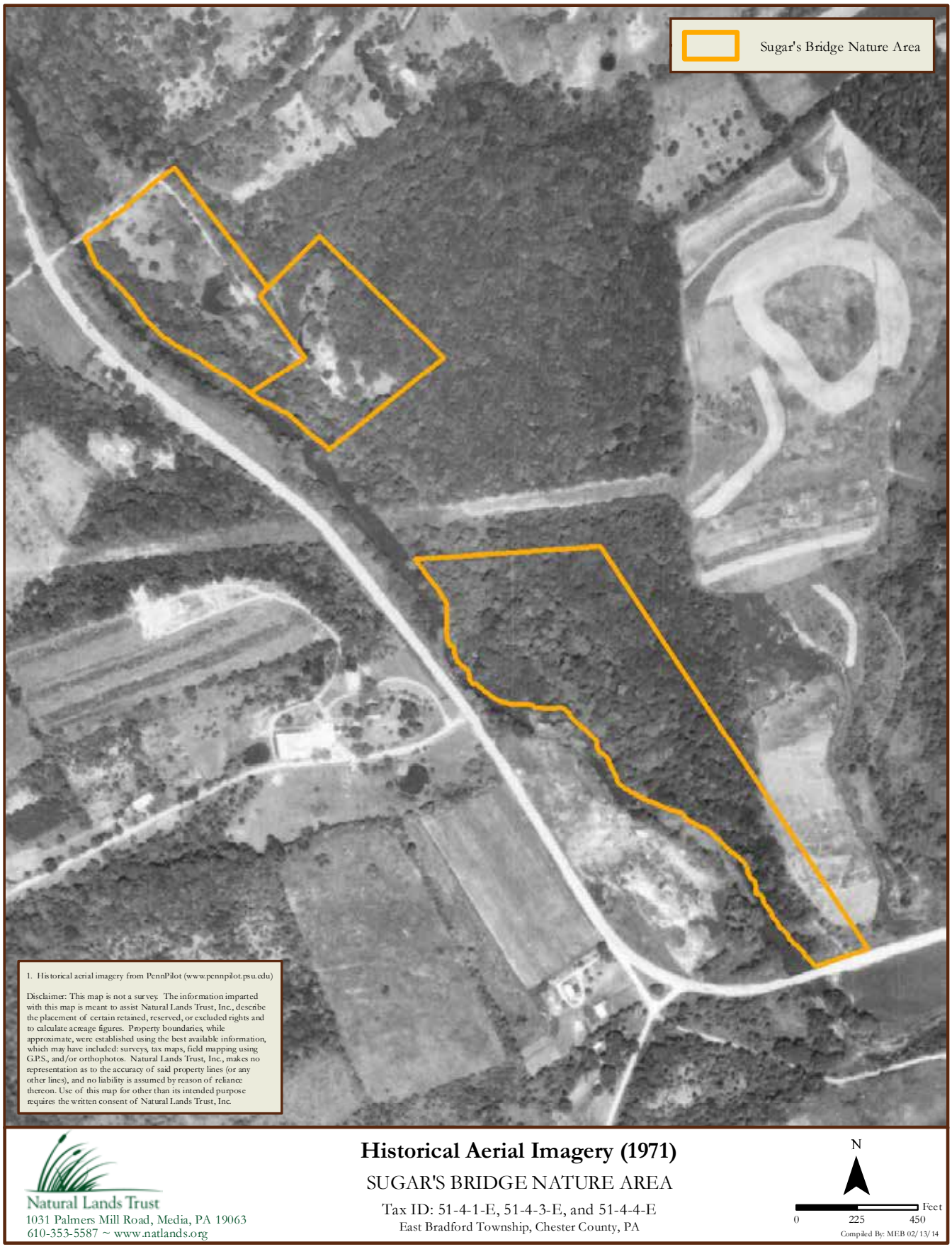
Historical Aerial Imagery (1937)
SUGAR'S BRIDGE NATURE AREA
Tax ID: 51-4-1-E, 51-4-3-E, and 51-4-4-E
East Bradford Township, Chester County, PA
N
Feet
0
225
450
Compiled By: MEB 02/13/14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Natural Lands Trust
1031 Palmers Mill Road, Media, PA 19063
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Historical Aerial Imagery (1971)
SUGAR'S BRIDGE NATURE AREA
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East Bradford Township, Chester County, PA
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Feet
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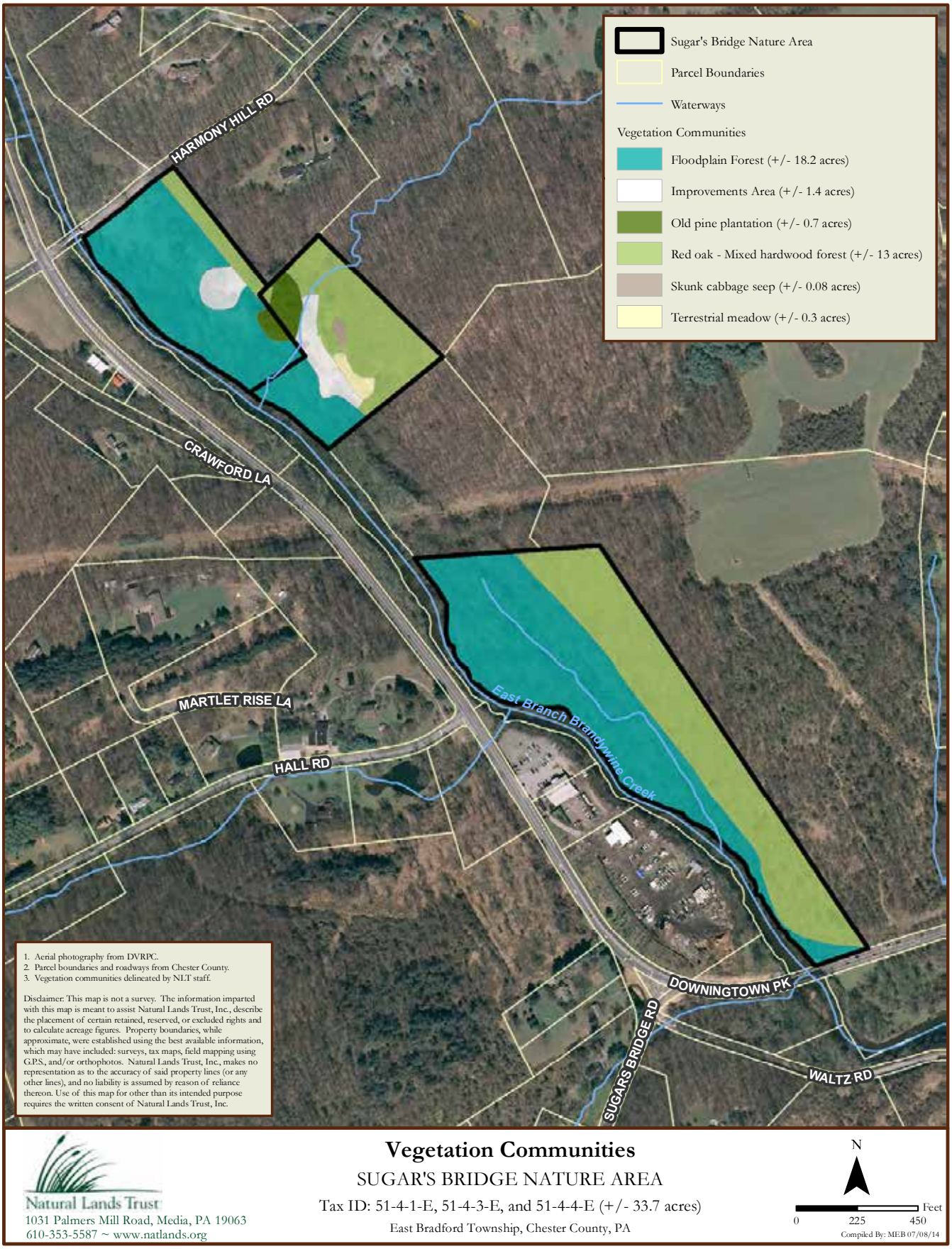
Compiled By: MEB 02/13/14


Sugar's Bridge Nature Area
Parcel Boundaries
Waterways
Vegetation Communities
Floodplain Forest (+/- 18.2 acres)
Improvements Area (+/- 1.4 acres)
Old pine plantation (+/- 0.7 acres)
Red oak - Mixed hardwood forest (+/- 13 acres)
Skunk cabbage seep (+/- 0.08 acres)
Terrestrial meadow (+/- 0.3 acres)
HARMONY HILL RD
CRAWFORD LA
MARTLET RISE LA
HALL RD
East Branch Brandywine Creek
DOWNINGTOWN PK
SUGARS BRIDGE RD
WALTZ RD
1. Aerial photography from DVRPC.
2. Parcel boundaries and roadways from Chester County.
3. Vegetation communities delineated by NLT staff.
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0
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450
Feet
Compiled By: MEB 07/08/14

Floodplain Forest

A broad maturing floodplain forest covers the western half of the Nature Area. The forest canopy is dominated by ash (*Fraxinus* sp.) and American sycamore (*Platanus occidentalis*). Other canopy trees include box-elder (*Acer negundo*), silver maple (*A. saccharinum*), red maple (*A. rubrum*), pin oak (*Quercus palustris*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), tuliptree (*Liriodendron tulipifera*), and **tree-of-heaven** (*Ailanthus altissima*). Understory trees, shrubs, and vines include sugar maple (*A. saccharum*), Norway maple (*A. platanoides*), sweet cherry (*Prunus avium*), mulberry (*Morus* sp.), blackhaw (*Viburnum prunifolium*), spicebush (*Lindera benzoin*), **grape** (*Vitis* spp.), **privet** (*Ligustrum* sp.), **oriental bittersweet** (*Celastrus orbiculatus*), and **shrub honeysuckle** (*Lonicera* sp.). **Lesser celandine** (*Ranunculus fiscaria*) formed an almost continuous carpet on the forest floor at the time of the site visit. The herbaceous layer also included **mile-a-minute** weed (*Persicaria perfoliatum*), **garlic mustard** (*Alliaria petiolata*), and **Japanese stiltgrass** (*Microstegium vimineum*).

Floodplain forest

Red Oak–Mixed Hardwood Forest

This forest primarily covers the steep slopes of the northern and southern sections. In the northern expression, canopy trees include tuliptree, white oak (*Quecus alba*), chestnut oak (*Q. montana*), black oak (*Q. veluntina*), and beech (*Fagus grandifolia*). The understory is dominated by beech, and also contains red maple, sugar maple, Norway spruce (*Picea abies*), and hornbeam (*Carpinus caroliniana*). The sparse shrub layer included mountain laurel (*Kalmia latifolia*), **autumn-olive** (*Eleagnus umbellata*), and spicebush; **garlic mustard** and Pennsylvania sedge (*Carex pensylvanica*) were the only herbs present at the time of the site visit.

The forest in the southern section has a younger canopy that has a greater tuliptree component. Beech again dominates the understory and includes **tree-of-heaven** and black-gum (*Nyssa sylvatica*). The shrub layer in this forest is also sparse and includes spicebush and **Japanese honeysuckle** (*Lonicera japonica*).

Red oak–mixed hardwood forest in northern section

Red oak–mixed hardwood forest in southern section

Old Pine Plantation

An old pine plantation rests on the southeast-facing slopes of the northern section on the north side of the old hatchery structures. The canopy is primarily white pine (*Pinus strobus*). The area has been invaded by black cherry (*Prunus serotina*) and red ash (*Fraxinus pennsylvanica*). Poison ivy (*Toxicodendron radicans*) is also present.

Old pine plantation

Terrestrial Meadow

A small terrestrial meadow lies next to the storage garage. It contains a good component of broom-sedge (*Andropogon virginicus*), a native warm-season grass. **Autumn-olive** is invading the meadow.

Terrestrial meadow

CURRENT USE

The Sugar's Bridge Nature Area is used for passive and semi-active recreation. A parking lot provides access to the property and the Brandywine Trail for picnicking, hiking, biking, dog walking, and nature exploration. The Brandywine Trail allows park users to explore the Nature Area and adjoining properties and provides views to the Creek. It enters the Nature Area in the north from Harmony Hill Nature Area, extends for 0.23 miles through the northern section of Sugar's Bridge Nature Area, continues 0.16 miles through the PECO lands, re-enters the Sugar's Bridge Nature Area, extending another 0.37 miles, and continues east to the M. John Johnson Nature Center. The Brandywine Trail traverses a total of 0.76 miles through Sugar's Bridge Nature Area and the PECO land.

Oriental bittersweet vine on edge tree

Lesser celandine in floodplain

STEWARDSHIP ISSUES, OPPORTUNITIES, AND RECOMMENDATIONS

The following stewardship issues and opportunities were observed during the site visit to the Nature Area on April 3, 2014. They are described in the context of two overall stewardship goals for the natural areas on the property: (1) to provide a safe and enjoyable environment for passive and semi-active recreation and educational opportunities; and (2) to protect and enhance plant communities that support resident and migratory wildlife. Each stewardship issue and opportunity is followed by general recommendations to address the issue or fulfill the opportunity.

Invasive Plants

A ubiquitous problem encountered in the stewardship of natural lands in southeastern Pennsylvania—and increasingly recognized as a threat worldwide—is the presence of invasive plant species. An invasive species is one that rapidly spreads and out-competes multiple native species, chiefly because of the absence of predators, pathogens, and herbivores that keep it in check in its native range. Most invasive plants are particularly well adapted to colonize disturbed areas. In southeastern Pennsylvania, disturbance from human activities, particularly sprawl, coupled with the rich horticultural history of the southeastern counties, has afforded numerous invasive species the opportunity to become well established throughout the region. Even though the occasional immigration of new species into plant communities is a normal process, the current high rate of introduction—fueled by the planting of exotic (non-native) species for horticulture, wildlife management, and erosion control—is threatening the integrity of native plant communities and lowering native biodiversity. Not only do invasive plants alter the makeup of the plant communities on a site, but they also may affect soil chemistry and hydrology and are usually less beneficial to wildlife than the native plants they replace, contributing further to the loss of biodiversity. Additionally, vines on trees increase the likelihood

of downed trees. This is particularly important near roads, trails, recreational facilities, and structures where damages and injuries may occur from falling trees. Some invasive species—such as **poison hemlock**—are highly toxic to humans and pets.

In general, the Sugar's Bridge Nature Area is moderately impacted by invasive plants. Of most concern are vines, such as **oriental bittersweet, grape, mile-a-minute,** and **Japanese honeysuckle** that are moderately heavy in a few locations in the floodplain and upland forests. Aggressive vines can greatly raise a tree's vulnerability to blowdown through the increased weight (that elevates the tree's center of gravity) and by the vast increase in surface area (that acts to collect wind, ice, and snow). Vines can also smother tree seedlings and prevent them from reaching the canopy to replace trees felled by old age, windthrow, or pathogens. Other invasives of concern include **privet**, **shrub honeysuckle**, and **lesser celandine** in the floodplain; **autumn-olive**, **tree-of-heaven,** and **Norway maple** in the mature upland forest and old pine plantation; and **garlic mustard** in all forested areas.

Privet hedge along trail

RECOMMENDATIONS

Since the diversity of native species in a system is vital to providing suitable habitat for resident and migratory wildlife, as well as providing an enjoyable environment for community residents, we suggest the following measures to control invasive plant species at Sugar's Bridge Nature Area. In general, it is best to address invasive plant control with a *top-down* (starting in the canopy and working down through understory, shrub, and groundcover layers), *least-first strategy* (starting in the least impacted areas).

When considering invasive plant control, it is important to keep in mind that effective control of invasive plants, especially in the understory, shrub, and groundcover layers of the forest, will only be possible if implemented in conjunction with a deer management program (see "Forest Sustainability" section below). It is also important to note that the extensive edge area and seed sources in the region and the prolific nature of these plants guarantee that even with complete eradication on the property, invasive species can quickly reestablish themselves as a serious stewardship problem if not monitored and addressed on a regular basis.

The following invasive management recommendations for the Sugar's Bridge Nature Area are listed in general order of priority. The "Invasive Vegetation Management" section of Natural Lands Trust's *Land for Life: A Handbook on Caring for Natural Lands* (2014) also provides guidelines for monitoring and controlling invasive plants typical of the southeastern Pennsylvania landscape.

Any volunteer or contractor used for invasive plant control should be able to distinguish native species from invasive species (e.g., **Norway maple** from native maples). In sensitive wetland areas in the Nature Area (the headwater stream, seeps, pond), only herbicides approved for aquatic use (e.g., Rodeo) should be applied.

- Cut vines that are climbing into canopy trees, starting in the interior more intact area of the forest and moving to the forest edges. All **oriental bittersweet** and **Japanese honeysuckle** vines should be cut and the cut stump treated with a systemic herbicide, if possible. Because the native grape vine is beneficial for native wildlife, only cut grape vines that are climbing into the canopy of the forests and compromising the structural integrity of native trees.

Cut stumps of grape vines can be left to re-sprout. Care should be taken not to cut any Virginia creeper or poison ivy vines (unless the poison ivy impacts areas of high public use). These are native species that benefit wildlife and rarely become large enough to compromise canopy trees.

- Manage **Norway maple** with a basal bark application of triclopyr ester (e.g., Garlon 4) herbicide and basal oil. We recommend using a 20–30% mix of triclopyr in basal oil applied in a band around the base of the trunk, avoiding runoff. Depending on the season, it may take time for this treatment to work; for example, a winter application may result in leaf out in spring, followed by defoliation. Once the trees are dead, they can be cut down (if they create a potential hazard for visitors) without stimulating suckering or left as snags for wildlife habitat. Young **tree-of-heaven** (up to 1–2 feet) can be pulled by hand, as long as roots are not broken.
- Control **garlic mustard** in the forested areas. This is best done in early spring when the plant is in flower. Plants should be pulled, bagged, and removed from the site. This is a great activity for volunteers of all ages.
- Prevent **lesser celandine** from invading the red oak–mixed hardwood forest. The trail provides a good barrier to the spread of this herbaceous invasive. Given the extent of coverage already in the floodplain forest and the potential for this species to re-colonize from floodwaters, it is probably futile to try to control it there. Monitoring and quickly removing any on the east side of the trail will prevent a similar fate for the upland forest herb layer.
- Control **mile-a-minute** growing on native shrubs. Plants should be pulled (with gloves!) before they flower in the summer.
- Manage **privet, shrub honeysuckle,** and **autumn-olive** by cutting to the stump and applying a glyphosate herbicide to the cut stump. Alternatively, after cutting, the shrub can be left to resprout and the young foliage treated with a glyphosate herbicide. In areas near water resources, a glyphosate herbicide (e.g., Rodeo) suitable for wetland habitats should be used.
- Plant trees in gaps in the floodplain forest to reduce edge. In gaps where invasive shrubs have been removed, replant with native species to improve wildlife value and protect exposed slopes from erosion. Development of a forest management strategy that identifies phases for the removal of tree and shrub invasives over several years will help to spread out costs and to maintain nesting sites for resident and migratory birds until native replacements are established. The "Native Plant Materials" section of Natural Lands Trust's *Land for Life: A Handbook on Caring for Natural Lands* (2014) also provides a list of native species that are appropriate for the natural areas in the preserve.
- New plantings should be monitored for deer browsing. If needed, protect newly planted trees from deer browse using tree shelters for plants less than 6 feet in height. For trees over 6 feet in height, tree wraps limit damage from buck rubbing. Newly planted shrubs should be protected with wire fencing.

Dense ash regeneration in floodplain forest

Dead canopy tree in upland forest

FOREST SUSTAINABILITY

In addition to exotic invasive plants, forest sustainability is threatened by overabundant deer populations and the imminent threat of the emerald ash borer. Deer overabundance is a problem that affects most natural areas in our region. The habitat value of forests is greatest where there is an extensive unbroken canopy of mature trees with a diversity of native understory species that includes trees, shrubs, and herbaceous plants. Deer impact forest health by consuming seeds (particularly acorns) and browsing on seedlings, shrubs, and herbaceous plants. As deer population density increases, this activity can adversely affect populations of other wildlife species, especially songbirds, through a decrease in plant species and structural diversity within the forest.

Another method for determining the level of deer impact that is gaining favor with natural resource professionals (gathering accurate, useful deer density information is often complicated and expensive) is the condition of forest vegetation. A healthy mature forest has structural diversity with well developed herb, shrub, understory, and canopy layers that create a dense curtain of foliage during the growing season. There should be abundant natural regeneration (seedlings and saplings), particularly in forest gaps.

The sustainability of the forests within the Nature Area is in jeopardy from invasive plants and insects, and moderate deer overbrowsing. The floodplain forest has scattered patches of dense tree regeneration, but most of it is ash. The seedlings and saplings within the old pine plantation are similarly mostly ash. The red oak–mixed hardwood forest is in good condition, with good structural diversity, but lacks tree seedlings, which will be needed to replace canopy trees that die or are blown over.

Because much of the floodplain forest canopy and understory is composed of ash species, the Nature Area is highly vulnerable to the emerald ash borer (EAB)—an insect that is spreading into southeastern Pennsylvania and will likely infest the entire region over the next decade. The EAB attacks all species of ash and can eliminate all ash trees within an infested area. Although trees can be treated to prevent attack by the EAB, it would be cost prohibitive to treat the entire Nature Area. The township will need to decide on a strategy

for addressing EAB. Options include treating a limited number of specimen trees (trees with high aesthetic value), conducting a timber sale to preemptively remove ash from the site (trees killed by EAB lose most of their timber value), and allowing nature to take its course. The last option will need to be combined with increased monitoring for hazard trees and removing them from high target areas.

RECOMMENDATIONS

The recommended deer density to allow for adequate tree regeneration is 20 deer per forested square mile (one deer per 32 acres). However, to perpetuate a healthy native forest with a diversity of native shrubs and wildflowers, the recommended deer density is 10 deer per forested square mile (one deer per 64 acres). With approximately 32 acres of forest cover, the property can only sustainably support one deer.

Our recommendations for addressing the impact of deer overbrowsing are provided below. Additional information about Natural Lands Trust's deer management program and deer management opportunities are included in the "Deer Management Options" section of Natural Lands Trust's *Land for Life: A Handbook on Caring for Natural Lands* (2014).

- Continue the deer management program at Sugar's Bridge Nature Area.
- Monitoring the effects of deer browsing and educating the public about the effects of overabundant deer will be critical to the success of any future deer management program in the Township. One option to visually demonstrate and monitor the impact of deer browsing is the installation of small (10 meters square) exclosures. The growth of vegetation within these exclosures is often dramatically different than in surrounding areas with unrestricted access by deer. Ideally, exclosures (with accompanying interpretive signage to educate the public about the importance of reducing the deer population to maintain forest health) should be erected in forested areas on relatively flat ground and near public trails. The setup and monitoring of deer exclosures is a valuable educational exercise that could be undertaken by local schools and colleges.
- Determine strategy for management effects of emerald ash borer infestation. When planting trees care should be taken to plant trees other than ash that are appropriate for a floodplain forest, such as sycamore, silver maple, and box-elder.

WATER QUALITY AND ECOLOGY

Sugar's Bridge Nature Area provides a large riparian buffer for most of the length of the East Branch Brandywine Creek and its tributaries. The exception to this is where the northern tributary was converted to a fish hatchery in the past and the remnant concrete structures still exist. Riparian buffers help to safeguard water quality, stabilize stream channels, and maximize infiltration and groundwater recharge that feed the stream. The riparian vegetation also benefits the aquatic ecology by shading the stream and adding organic matter (leaves, branches) that provide structure and nutrients for aquatic organisms. Preserving this cover by addressing the issues above will maintain these benefits.

In addition to the fish hatchery, the man-made pond (historically used for fishing and ice-skating by the residents of the property) diverted water from the northern tributary channel and an outflow released the water onto the floodplain and into the East Branch Brandywine Creek. Despite the aesthetic benefits of ponds, the mostly exposed water surface increases the water temperature of pond outflow, which could degrade the habitat for aquatic organisms downstream.

The relatively high elevation of the Brandywine Trail limits its susceptibility to flooding. However, stormwater from the adjacent steep slopes may flow across the trail. Therefore, the trails should be monitored regularly to quickly correct any erosion and prevent degradation of natural resources. When trails are constructed the natural surface drainage patterns are interrupted which can intercept more surface water, and lead to soil erosion. Not only does the trail itself endure irreversible changes, the soil transported off of the trails can cause problems elsewhere as it may smother vegetation, provide a place for invasive plants to thrive, or be washed into waterways where it can change the

drainage patterns of the streams and harm aquatic organisms and vegetation.

RECOMMENDATIONS

The property should be carefully managed to protect and enhance the water quality of on-site and downstream water resources associated with the East Branch Brandywine Creek and to realize the many wildlife benefits and ecosystem services these resources provide.

- Remove the fish hatchery structures and reestablish the stream channel bordered by wet meadow or forest. Contact the Chester County Conservation District and Pennsylvania Department of Environmental Protection for technical assistance and potential funding sources.
- Determine whether the man-made pond will be a permanent feature of the Nature Area. Alternatives include converting the pond to a wetland/wet meadow or restoring the pond for recreational fishing.
- Monitor trail system regularly to correct any erosion and natural features degradation.
- Install signage about the importance of picking up trash and dog waste to protect water quality.

WILDLIFE ENHANCEMENT

Additional opportunities for enhancing wildlife habitat on the property are described below:

- Provide educational signage for Nature Area users related to the effects of leaving their dogs off-leash —including disturbance of wildlife and concerns of other users.
- Determine the future management of the man-made ephemeral pond area. Converting the area to a wet meadow, scrub/shrub, or forest will provide specialized habitat for plants and animals. Habitat diversity could be enhanced under either scenario.
- Determine if the area adjoining the storage garage to the south should be converted to a meadow. Please see "Meadow Reclamation and Recommendations" section below for more information.
- Leave dead down wood within the forests as it serves as the base of the forest food web and a nutrient reservoir for living trees. Dead standing trees (snags) should also be left if they are located in areas that are not heavily used by the public. Snags benefit wildlife by providing cavities and loose bark for nesting and shelter, perching sites, and decaying wood for numerous insects that provide food for woodpeckers and nuthatches. See attached article "Critter Condos-Managing Dead Wood for Wildlife" for more information about these wildlife enhancements.
- Consider installing nest boxes for Wood Ducks along the East Branch Brandywine Creek. See attached article about Wood Ducks published by the Natural Resources Conservation Service and the Wildlife Habitat Council.
- Consider installing nesting boxes for Eastern Bluebirds along the forest/meadow edge. Bluebirds nest in tree cavities, but in the absence of these natural niches, these species readily adopt nest boxes to raise their young and reduce competition for cavities with other birds. See attached article for more information: "Artificial Nesting Structures" published by the Natural Resources Conservation Service Wildlife Habitat Management Institute and the Wildlife Habitat Council.
- Support pollinator (bees, butterflies, and other insects) habitat by mowing current and future meadows in late winter and by including a good component of forbs (non-grass perennial herbs) in the seed mix for the meadows.

MEADOW RECLAMATION AND MANAGEMENT

Native meadows are characterized by a diverse structure and composition of short and tall grasses and native wildflowers that provide feeding and nesting habitat for declining grassland birds (e.g., Eastern Meadowlark, Bobolink) and small mammals, as well as nectar sources for numerous butterflies and other insects. Native meadow species are naturally adapted to the soils and climate of our region and can, if necessary, survive on very little rain (and no irrigation). Once established, native meadows usually require just one mowing each year to limit encroachment by trees and shrubs. Such low maintenance requirements (one mowing, no fertilizer or irrigation) significantly reduce the costs of upkeep in comparison to the traditional suburban lawn.

The small terrestrial meadow could be enhanced to provide educational and wildlife benefits. The small upland meadow near the storage garage offers an opportunity to support the national effort to improve and expand habitat for pollinators (bees, butterflies). In addition, there is opportunity to establish a wet meadow/marsh (fed by the skunk cabbage seep) adjacent to the old hatchery structures if the structures are removed the natural stream channel restored.

RECOMMENDATIONS

Consider expanding and enhancing the terrestrial meadow in the open area near the storage garage. Contact the Xerces Society for Invertebrate Conservation for technical assistance and educational materials. The existing meadow could be expanded down to the trail by removing the debris pile, removing the shrubs and grading the bank. Adding more forbs (non-grass herbs) will provide more nectar plants for pollinators. Mow the meadows on a once-yearly schedule in March. Mowing at this time of year minimizes impact on the nesting and foraging activities of native wildlife (birds, small mammals, butterflies) and often allows for easy equipment access if the ground is still frozen. An alternative management strategy—given the small size of the meadow—is to monitor the meadow for tree and shrub seedlings annually and manually remove as needed, along with any invasive herbs. Enhance the wildlife habitat value of the Nature Area by expanding the wet meadow/marsh after removing the fish hatchery structures. Monitor for invasive plants and manually remove or spot treat with herbicide as necessary.

HAZARDS AND DEBRIS

A few hazards exist at Sugar's Bridge Nature Area, including an open well (now filled), a pier, and possible hazard trees. Additionally, various types of debris and streamside trash are scattered within the Nature Area, particularly along the creek and in the floodplain.

An open well is located near the historic fish hatchery. At the time of the field inspection the above-ground structure has been boarded, but a board has been removed and the well has not been closed. Since the field inspection, the Township has filled the well with stone. A pier is located at the site of the man-made pond. While the pier appears to be in good condition, it lacks safety structures and users could potentially fall from the pier. The remains of an old tree stand were also observed during the site visit.

Potential hazard tree along Harmony Hill Road

There is a potential for hazard trees along roadways, trails and other locations where the public might pause for any extended time—such as a sign, bench, or picnic table. As a landowner, East Bradford Township is responsible for preventing trees and branches from falling into the adjacent right-of-way on the bordering roads through the monitoring and removal of hazard trees (trees that due to structural defects could fall in part or whole on a "target" such as a road, residence, or person). At the field inspection on April 3, 2014, potential hazard trees were noted on Harmony Hill Road and along the trail near the PECO boundary with the southern section of Sugar's Bridge Nature Area.

Debris and trash is scattered throughout the Nature Area, particularly within the floodplain, along the creek, and near the old homestead where the storage garage is located. Some of the debris and trash noted at the field inspection included old fence posts and trolley ties, plastic and metal pipes, concrete and cinder blocks, glass bottles, a cast iron tub, a concrete and wood trash pile, metal pipe structure (possibly fish hatchery canopy) and electricity box structure (electrical wires have been removed), and a large metal box.

Remains of old tree stand

Old well

Missing board on old well

Debris and Trash pile near storage garage

RECOMMENDATIONS

- At the site visit NLT staff recommended to Mandie Cantlin to close the well near the historic fish hatchery suggesting an option of leaving the above ground structure in place for historical reference and interpretation and fill the well with stone and concrete from the fish hatchery. Since the field inspection, the Township has filled the well with stone to a height to prevent people and wildlife from becoming trapped inside.
- Determine if the pier should be retained or removed. If retaining it, check the pier for structural integrity and safety. Perform required maintenance and repair or replace to meet safety standards.
- Monitor potential hazard tree areas along public roads, trails, lawn areas, and places where people may linger—such as benches, picnic tables, or interpretive signs—by foot once each year and following severe storms, and address potential hazard trees (pruned or removed) as needed. Ideally, a certified arborist should be hired to complete this task and address any identified hazards through pruning or removal. See the "Hazard Tree Monitoring Program" section of the Natural Lands Trust's *Land for Life: A Handbook on Caring for Natural Lands* (2014) for information about procedures for hazard tree monitoring. In addition, Morris Arboretum in Philadelphia offers courses on identifying hazard trees.
- Remove scattered debris and streamside trash.

BOUNDARY ENCROACHMENT

Proper maintenance of property boundaries is an important stewardship priority on open space parcels. These undeveloped properties are often subject to unwarranted (and frequently unintentional) use by neighbors (e.g., dumping of yard waste) due to poorly marked boundaries.

RECOMMENDATION

- Where needed, survey and post the boundaries of the Sugar's Bridge Nature Area to assist in preventing encroachment issues and to inform passing motorists about the location of the public open space. Signs could be small (3 ¾" x 3 ¾", 0.12 gauge aluminum diamond shape signs) and should indicate East Bradford Township ownership. Posting every 50–100 feet is adequate and particularly important where the property abuts private land.

ENVIRONMENTAL EDUCATION AND VOLUNTEERS

The natural communities, water resources, and scenic landscape within the Sugar's Bridge Nature Area provide good opportunities to connect the community to their natural surroundings and provide meaningful volunteer and educational experiences. The following suggestions could further enhance community educational opportunities on the property.

RECOMMENDATIONS

- Install interpretive signs in key areas along the future trail that describe the natural resources (e.g., vegetation communities, wildlife habitat, floodplains, water quality) or stewardship initiatives (e.g., deer management, invasive plant management).
- Label healthy examples of native trees along the future trail with scientific and common names in a manner that will not harm the trees.
- Invite Township residents to participate in natural areas stewardship projects. Schedule "workdays" on environmentally friendly days such as Earth Day or Arbor Day. Volunteers, including local scout troops, hiking clubs, birding groups, schools, and businesses could be recruited to assist with projects recommended in this report, including:
    - Cutting vines from trees
    - Pulling **garlic mustard**
    - Planting the riparian buffer with native tree, shrub, and herbaceous plant species
    - Building, installing, and maintaining a kiosk
    - Building and installing nest boxes
    - Maintaining trails
    - Removing debris and streamside trash
    - Providing a presence at the Nature Area
- Encourage local schools, environmental groups, and birding groups to schedule educational walks on the property including water studies (chemistry, aquatic invertebrates), native plant and tree identification, and bird identification.

STEWARDSHIP PRIORITIES AND IMPLEMENTATION SCHEDULE

PRIORITY[1]	STEWARDSHIP RECOMMENDATIONS	SEASON	WHO COULD IMPLEMENT?
Invasive Plants			
1	Cut vines on canopy trees	Anytime	Volunteers
1	Manage **tree-of-heaven**	Fall	Municipal staff[2] or contractor
1	Manage **mile-a minute**	Spring	Volunteers
1	Manage invasive shrubs in meadow	Fall	Municipal staff or contractor
2	Manage invasive shrubs in forest	Fall	Municipal staff or contractor
2	Monitor **lesser celandine**	Spring	Municipal staff or volunteer
Forest Sustainability			
1	Continue Deer Management Program	Winter	Permitted hunters
2	Educate public about the effects of overabundant deer	Anytime	Municipal staff, contractor, or volunteers
Water Quality and Ecology			
2	Remove the concrete walls and structures of the historic fish hatchery	As permitted	Municipal staff or contractor
2	Convert the fish hatchery pool area to wet meadows or wetlands	As permitted	Municipal staff or contractor
2	Determine if the earthen pond will be permanent or if it will be converted to wetlands	Anytime	Municipal staff
1	Monitor trail system regularly for erosion	Anytime	Volunteers or municipal staff
2	Install signage about picking up trash and dog waste using Leave No Trace messaging	Anytime	Municipal staff

Wildlife Enhancement			
2	Install signage about the effects of having dogs off-leash using Leave No Trace messaging	Anytime	Municipal staff
2	Consider converting the area to the south of the storage garage to a native meadow	Anytime	Municipal staff or contractor
1	Install nesting boxes for Bluebirds and Wood Ducks	Late Winter	Volunteers
Meadow Reclamation and Management			
1	Monitor meadow for trees and shrubs and mow the meadow or pull seedlings annually	Early Spring (March)	Contractor or volunteers
1	Monitor for invasive vegetation and spot treat, as needed	Anytime	Contractor or volunteers
2	Augment meadow with forbs to improve pollinator habitat	Spring	Contractor or volunteers
2	Contact Xerces Society for technical assistance and educational materials	Anytime	Municipal staff
Hazards			
	Since the site visit the well near the old fish hatchery has been filled and closed		
1	Check the pier near the man-made pond for structural integrity and safety and determine if it should be removed or maintained	Anytime	Municipal staff or contractor
1	Monitor roadside boundaries and high use areas for hazard trees	Late Winter–Early Spring	Municipal staff
2	Remove scattered debris and streamside trash	Anytime	Municipal staff and volunteers

continued

Boundaries			
2	Post boundaries to assist in preventing encroachment	Anytime	Municipal Staff
Public Access and Environmental Education			
3	Install interpretive signs in key areas	Spring–Fall	Municipal Staff
3	Label healthy examples of native trees	Spring–Fall	Municipal Staff and Volunteers
2	Invite residents to participate in stewardship projects	Spring–Fall	Municipal Staff (oversees)
2	Encourage local groups to schedule nature walks	Spring–Fall	Municipal Staff (oversees)

[1] 1 = high priority (implemented within 1–3 years);
2 = mid-priority (implemented within 3–5 years);
3 = low priority (implemented within 5–10 years)

[2] Must have PA Pesticide Applicator Certification to apply herbicides on public property

APPENDICES

Natural Lands Trust

Bluebird Nesting Boxes

INSTALLATION GUIDELINES

Time: It is best to erect the box by the first week of March. Male bluebirds will begin box selection as early as mid-March.

Location: Open mowed fields
120 feet from wooded edge
Boxes 100 yards apart
One box per acre

Placement: Face hole away from prevailing wind
Entrance hole 4–6 feet above the ground
Place within 50 feet of a perch (natural or manmade)

POTENTIAL COMPETITORS

Several other bird species may attempt to utilize your bluebird nesting box. The following will assist you in identifying the species.

Tree Swallow
nesting material: dry grass with feathers
eggs: pure white

Chickadee
nesting material: moss and hair
eggs: dull white with brown spots

House Wren
nesting material: small twigs
eggs: red and brown spots

House Sparrow
nesting material: dried plants with feathers
eggs: dull white with olive spots

NESTING INFORMATION

Dry grasses are the materials most commonly used by bluebirds. Although when made near evergreens, pine needles may be used. Nest building begins in early April. It takes five to fourteen days for bluebirds to complete a nest.

A single egg is laid each day. The eggs are approximately ¾" by ⅔" and are normally clear blue. The female incubates the eggs for about 14 days. After hatching, the young will leave the nest in approximately 17 days.

After the young have fledged, remove the used nesting material. Bluebirds nest two to three times a season, building a new nest each time.

Monitor the nesting boxes once a week, between early April and late August.

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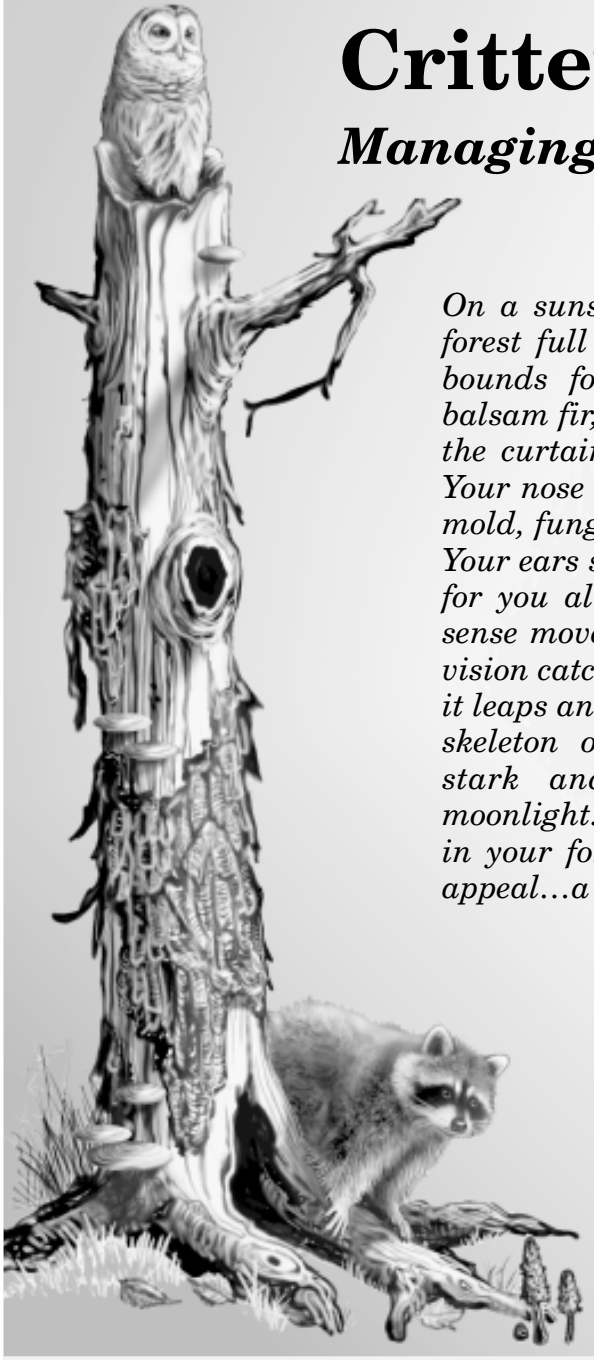
Natural Lands Trust ~ Hildacy Farm ~ 1031 Palmers Mill Road ~ Media, PA 19063 ~ 610-353-5587 ~ www.natlands.org

01/2007

Critter Condos

Managing Dead Wood for Wildlife



On a sunset stroll through your woods, you find a forest full of activity...full of life…a snowshoe hare bounds for cover, a red squirrel scampers up a balsam fir, a blue jay scolds from a branch above. As the curtain of darkness falls, your senses heighten. Your nose intercepts the pungent, earthy odor of leaf mold, fungi, and rotting wood drifting on the breeze. Your ears snatch a few "who cooks for you, who cooks for you all?" notes of a barred owl. Suddenly, you sense movement overhead! Turning, your peripheral vision catches the floating form of a flying squirrel as it leaps and glides from a snag. The smooth, barkless skeleton of this dead tree stands stark and whitewashed in the moonlight. It's then you realize that in your forest, even dead things have appeal…a life of their own….

Snags. By night, they look ghostly in the misty, moonlit darkness. In reality they teem with life. Over 70 kinds of Wisconsin mammals, birds, reptiles and amphibians, not to mention swarms of insects, spiders, millipedes and other invertebrates use snags…dead or dying trees. These critter condos provide den, nest and feeding sites, as well as sites for food storage, perching, preening and courtship rituals. This publication illustrates the variety of dead wood that benefit wildlife and the ways you can manage for it.

USDA NRCS Natural Resources Conservation Service

Wildlife Habitat Management Institute

WILDLIFE HABITAT COUNCIL℠

Wood Duck
(Aix sponsa)

Fish and Wildlife Habitat Management Leaflet

General Information

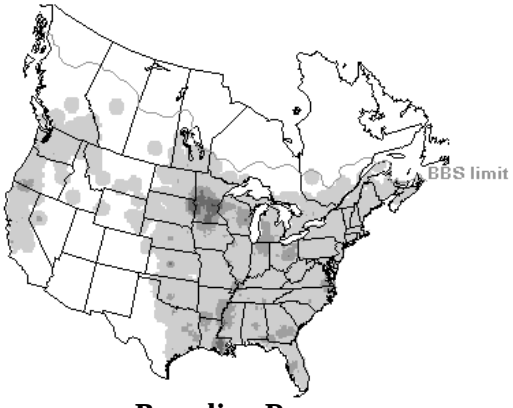
The wood duck is considered by many bird watchers to be North America's most colorful waterfowl species. Its scientific name, Aix sponsa, translates into "waterbird in bridal dress." Today the wood duck is one of the most common waterfowl species breeding in the United States. However, this was not always the case. Writings from the early 19th century indicate that wood ducks were in abundant supply and very popular for their tasty meat and bright decorative feathers. By the late 1880's, unregulated hunting and destruction of woodland and wetland habitat had caused the wood duck population to decline to alarmingly low levels. By the beginning of the 20th century, wood ducks had virtually disappeared from much of their former range.

In response to the Migratory Bird Treaty established in 1916 and enactment of the Federal Migratory Bird Treaty Act in 1918, wood duck populations began to slowly recover. By ending unregulated hunting and taking measures to protect remaining habitat, wood duck populations began to rebound in the 1920's. The development of the artificial nesting box in the 1930's gave an additional boost to wood duck production. Wood ducks eagerly accepted boxes as suitable nesting sites, and over the following fifty years, conservation groups and individuals helped increase numbers of wood ducks by preserving habitat and erecting nest boxes. The combination of hunting restrictions and habitat conservation and management measures enabled wood duck populations to rebound enough to support conservative hunting in the 1940's. The story of the wood duck is an example of how active wildlife management techniques can have a tremendous effect on the overall success of an individual species.

This pamphlet is designed to serve as an introduction to the habitat requirements of the wood duck and to assist in the development of a comprehensive wood duck management plan. The success of any individual species management plan depends on targeting the specific needs of the species and analyzing the designated habitat areas as a whole to ensure that all habitat requirements are present. This guide also provides recommendations for monitoring the program to ensure successes are documented and problems are addressed before they impact the success of the overall management plan.

Range

The wood ducks' range extends on the east coast from Nova Scotia west to the north central U.S. and south to Florida and the Gulf of Mexico. Birds nesting in New England winter in the Atlantic states from the Carolinas southward. Midwestern wood ducks winter in the area extending from Georgia west to Texas. On the west coast, the wood ducks' range extends from British Columbia



Breeding Range