

# Golf Course Habitat Restoration Pilot Program: A Pilot Project between the U.S. Golf Association and The Nature Conservancy

Technical Interim Report:  
November, 2016

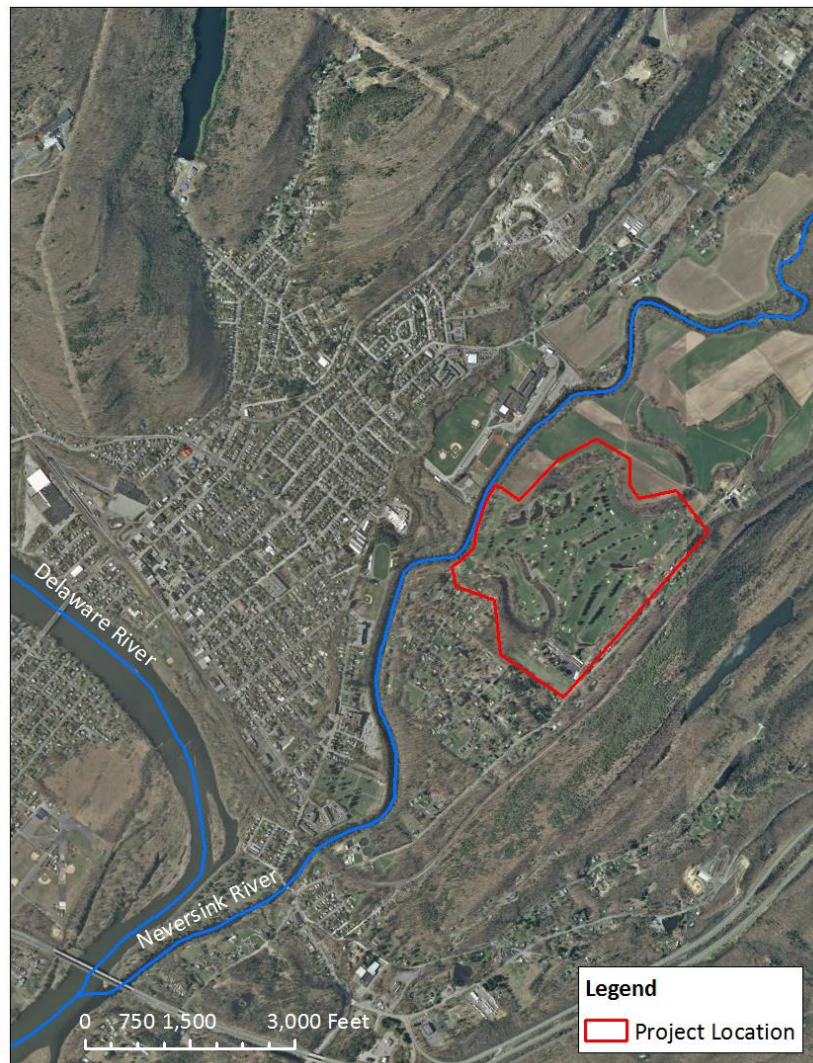


Submitted by:  
Andrew J. Peck, Ph.D.  
Freshwater Project Manager  
The Nature Conservancy

## Background

The Delaware River, the jewel of Mid-Atlantic river systems, is a largely intact and highly productive watershed that supports abundant and diverse freshwater mussel populations, annual shad and eel runs, and naturally reproducing populations of brook, rainbow and brown trout. The Neversink River, a major tributary to the Delaware, also supports similar species diversity because of its high water quality and largely intact floodplains. The Lynx at Riverbend Golf Club is located in the floodplain of the Neversink River, just upstream of the confluence with the Delaware River in Port Jervis, New York (Exhibit I). Though much of the Neversink floodplain is intact, floodplain development does increase in the vicinity of Port Jervis. The golf club and the area high school, both are located in floodplain and across the river from each other, are susceptible to inundation by floodwaters. The latest inundation event was in the fall of 2011 when Tropical Storm Irene was quickly followed by Tropical Depression Lee.

**Exhibit I.** Location of The Lynx at Riverbend Golf Club relative to the Village of Port Jervis, the Delaware River and the Neversink River.



The combination of these two storms caused catastrophic damage across the region. The Lynx at Riverbend Golf Club, also suffered extensive damages due to 6 -10 feet of inundation for more than a week. The flooding deposited fine sediment across all of the fairways and in the water features of the course. The sediment suffocated fairway turf, buckled cart paths, decimated actively managed out-of-play turf areas, and deposited unwanted and otherwise “weedy” seed. The damage caused by this single flooding event caused the course to close for much of the Fall of 2011, and it still has not fully recovered. The extent of damage to the course caused by this single flooding event was not avoidable (e.g. sediment deposition in fairways, bunkers and ponds, buckled cart paths, etc.). While the damage caused by such an extreme weather event may not be entirely preventable, the magnitude of impacts could be reduced in future events with the incorporation of nature-based solutions. For example, generally unused, out-of-play areas can be restored to native plant communities, or “naturalized,” as nature is often a first line of defense in extreme weather situations.

### **Project Overview**

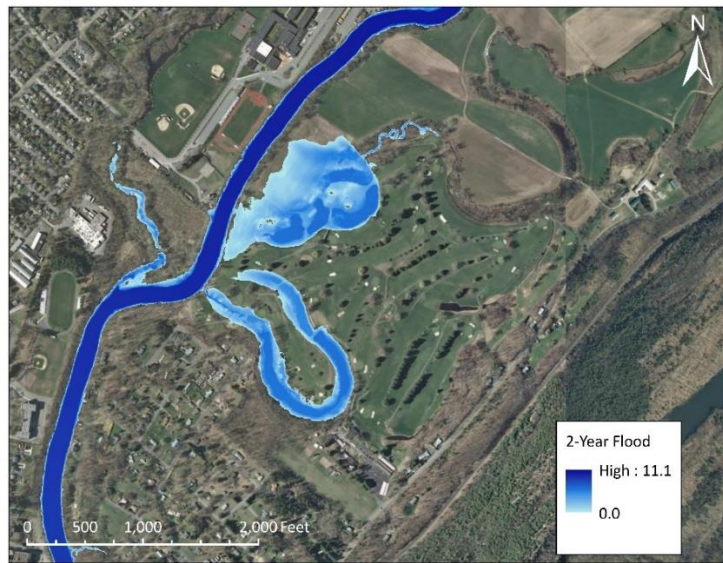
The U.S. Golf Association (USGA), The Nature Conservancy and The Lynx at Riverbend Golf Club are evaluating future management options by developing an understanding not only how to improve day-to-day operations and how course patrons use the course, but also how, when, and where floodwaters are likely to impact the course infrastructure. The objective is to reduce the acreage of managed areas to save resources in both day-to-day operations and also reduce the amount of effort needed to restore the course to pre-event conditions following the next flood event; naturalized areas are generally better suited to recover with little to no intervention.

### **Hydrologic Evaluation**

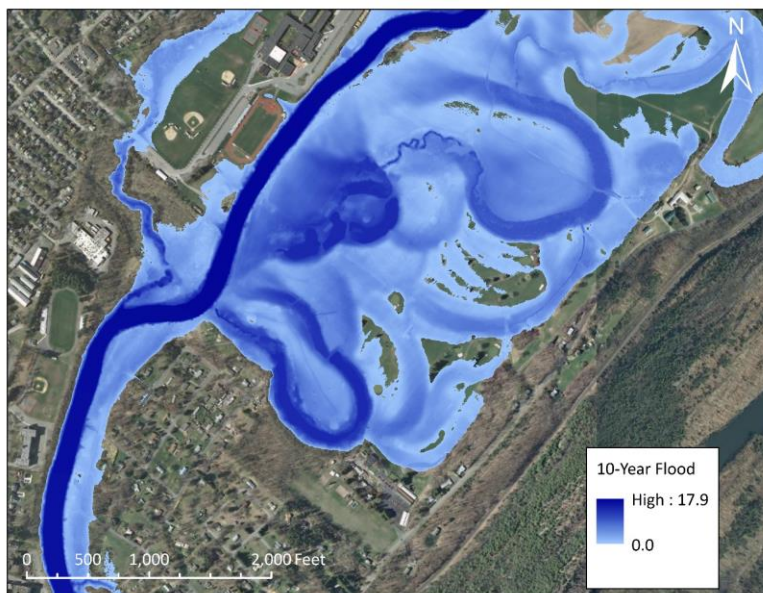
During the Spring of 2015, Milone and McBroom, Inc. a hydrologic consultant, conducted inundation modeling of the course to help determine the progression of inundation from river flooding at various stages. It was quickly determined that the entire course is likely to become inundated at relatively low river stage heights due to the design of the drainage system (Exhibit II). Because all of the stormwater drainage systems ultimately discharge into the Neversink River, the reverse is also true. As the water levels in the Neversink rise and overtop the drainage pipes, water then backs up throughout the entire system, ultimately flooding the entire course before the Neversink actually overtops its banks. This is exacerbated by run-off which drains off the ridge to the south of the course. Major investments into stormwater management strategies would ultimately prove ineffective, not mention cost-prohibitive. The decision was made to focus efforts more on being able to recover more quickly from flooding events rather than trying to stop flooding from occurring in the first place.

**Exhibit II.** Inundation mapping of The Lynx at Riverbend Golf Club. Darker areas represent the deepest points of inundation and lighter shading represents shallower levels of inundation. The flood event of 2011 produced a discharge of 28,800 cubic feet per second (cfs) which closely equates to a 30 year storm with a three percent chance of being experienced or exceeded in any given year. Precipitation and hydrologic analysis indicates that storms of this magnitude could be expected to increase in frequency/likelihood with climate change.

1. Two-year flood frequency (conditions with a 50% likelihood of exceeded in a given year)



2. 10-year flood frequency (conditions with a 5% chance of being exceeded in a given year)



### Course User Mapping and Analysis

Using USGA's user tracking tool, we were able to track more than 120 rounds of golf across the entire course (Exhibit III). The mapping clearly showed usage patterns associated with cart paths and fairways as well as preferred pathways into out-of-bounds areas. 12 zones of little to no use by golfers were identified and these areas were further evaluated for feasibility of naturalization using course operations, likelihood of inundation, and likelihood of success as our selection criteria.

**Exhibit III.** Individual user track (red lines) mapping, using GPS technology, identified several areas of low-use by patrons, which are candidates for naturalization (area inside green lines).



### Restoration Plan Development

Initial restoration plans included the excavation of two new pond areas and an extension of another existing water feature (see accompanying project design plans). Around these new water features and in the selected naturalization areas, we would plan to remove remaining turf grasses and plant a wide variety of native grasses, sedges, shrubs, and trees in these areas. An additional three acres, across three separate low-use locations, would also be prepped and planted with native vegetation. In total, approximately five acres would be improved to reduce the necessary day-to-day management and flood event recovery costs, while providing improved aesthetics for course patrons and both resident and migratory wildlife such as turtles, salamanders, pollunators, rabbits and birds. Deer and other mammals are omnipresent in the region and will not be a focus of restoration efforts.

### Permitting Considerations

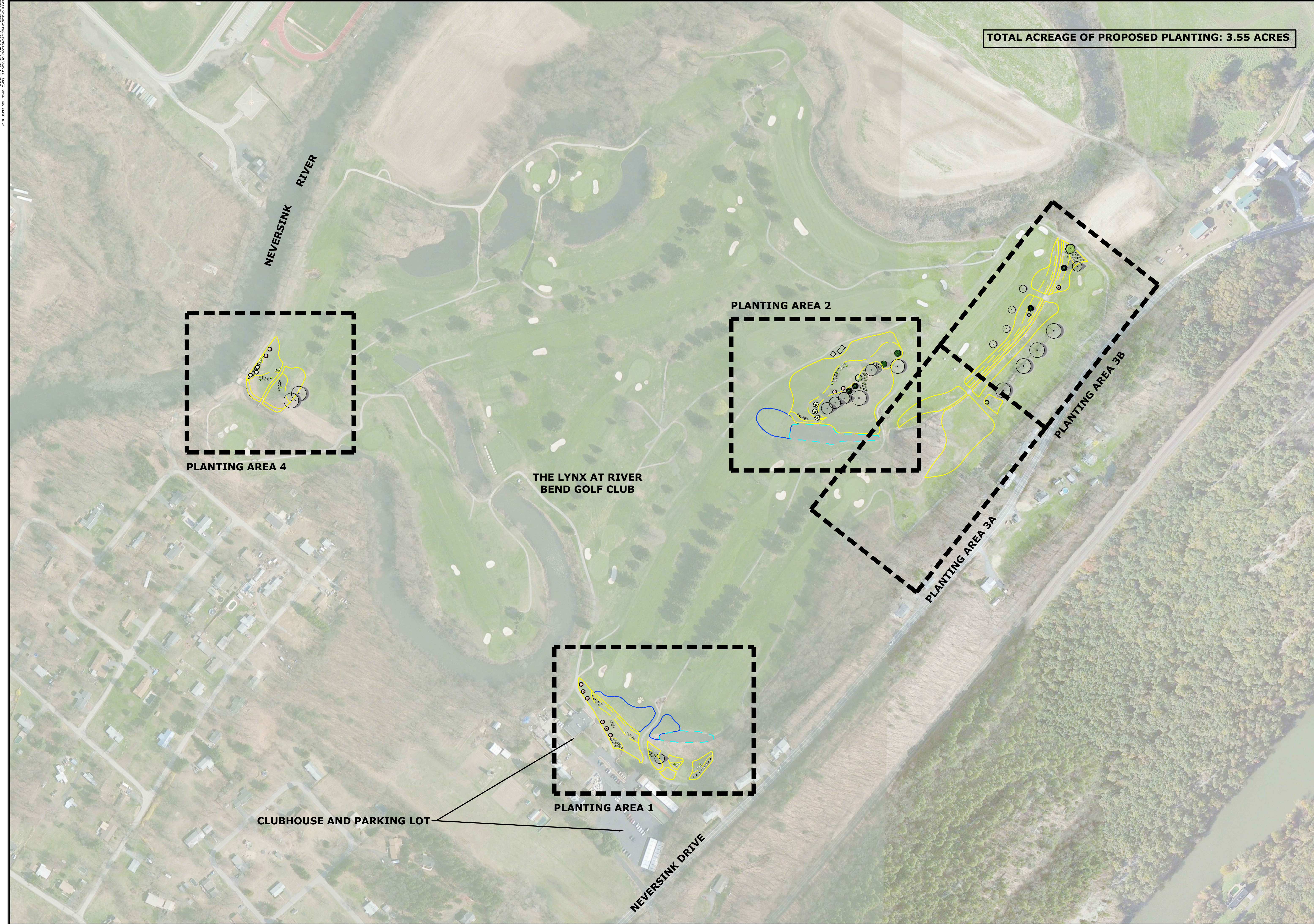
The full project was required to be evaluated through a state and federal permit review process because the course is located in a floodplain and USGA funds are being leveraged with funds from the New York Governor’s Office of Storm Recovery (NYS GOSR) funds (mix of federal and state resources). This

process accounts for necessary Clean Water Act and Endangered Species Act reviews as well as New York's State Environmental Quality Review (SEQR), which includes an assessment of historical significance. The Upper Delaware is also renowned for artifacts pre-dating European settlement. On or near the footprint of the The Lynx at Riverbend, a conflict between Native Americans and European Settlers is known to have occurred. Under regulations of the New York State Historic Preservation Office, the creation of new water bodies on the course would require the execution of extensive artifact assessments, because of the likely presence of artifacts and burial grounds. These required assessments, totaling more than \$80,000 and coupled with the likelihood of additional high costs if artifacts were discovered, have recently caused us to re-evaluate our restoration plan.

Rather than create and excavate new pond structures, we will leave them as super-saturated areas and simply plant appropriate low-growing, inundation-tolerant plant and shrub species. Opting not to excavate the proposed ponds releases more than \$80,000 dollars of state funding that can now be invested in plant species to naturalize additional acreage throughout the course. We will be reformulating our planting scheme to most effectively utilize these additional funds and naturalize low-use, out-of-bounds areas from active management and reduce the implications of future flooding events.

### **Revised Timeline**

We are in the process of reformulating our planting design and our permit application to showcase the new scope of work. We expect this process to be completed in the January/February timeframe which will allow for a staggered implementation schedule. The revised schedule calls for an initial planting of super-saturated areas in late-May or June 2017, well after the first frost, followed by more intensive site preparation and planting in currently managed areas in September or October, 2017.

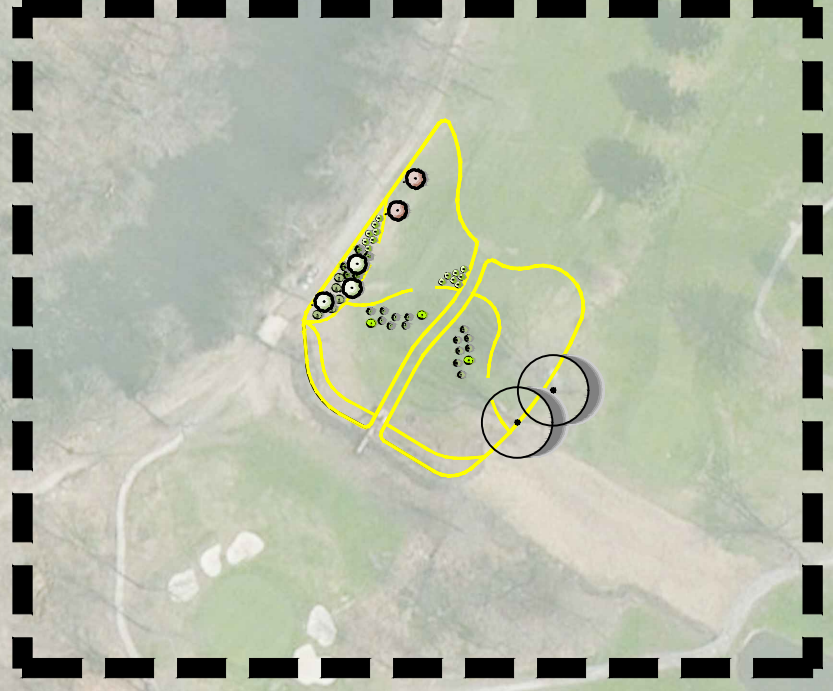


TOTAL ACREAGE OF PROPOSED PLANTING: 3.55 ACRES

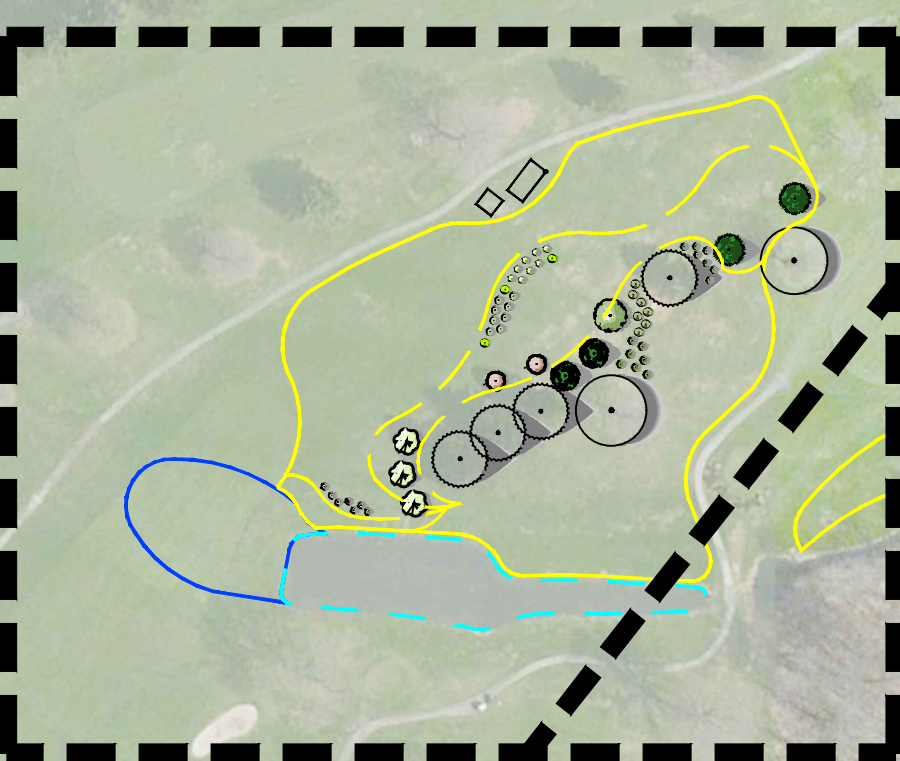
NEVERSINK RIVER

THE LYNX AT RIVER BEND GOLF CLUB

NEVERSINK DRIVE



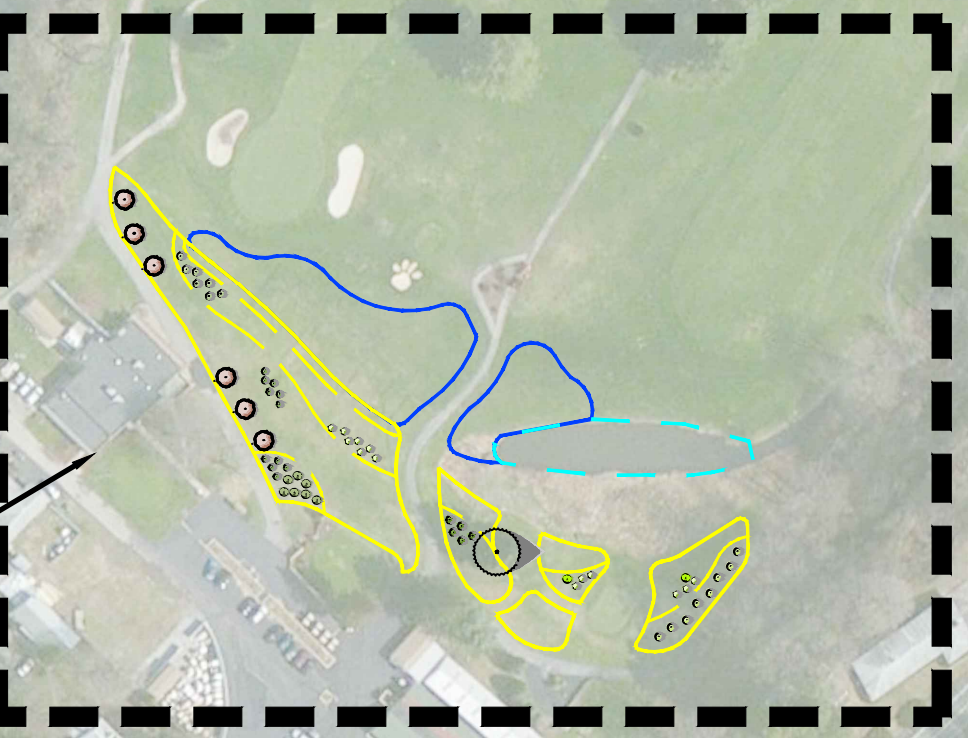
PLANTING AREA 4



PLANTING AREA 2

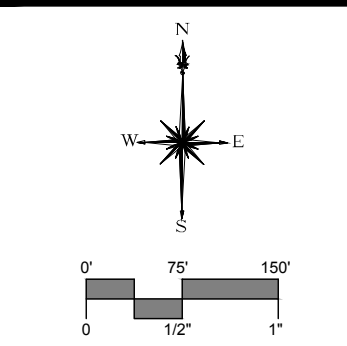


PLANTING AREA 3A  
PLANTING AREA 3B



PLANTING AREA 1

CLUBHOUSE AND PARKING LOT



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 99 Realty Drive  
 Cheshire, Connecticut 06410  
 (203) 271-1773 Fax (203) 272-9733  
 www.miloneandmcbroom.com

DESCRIPTION	DATE	BY

CONCEPTUAL PLANTING PLAN - OVERALL  
 USGA NATURALIZATION PROJECT  
 THE LYNX AT RIVER BEND GOLF CLUB  
 PORT JERVIS  
 ORANGE COUNTY, NEW YORK

DESIGNED	BDK	MTD
SCALE		
1"=150'		
DATE		
JULY 18, 2016		
PROJECT NO.		
1967-21		

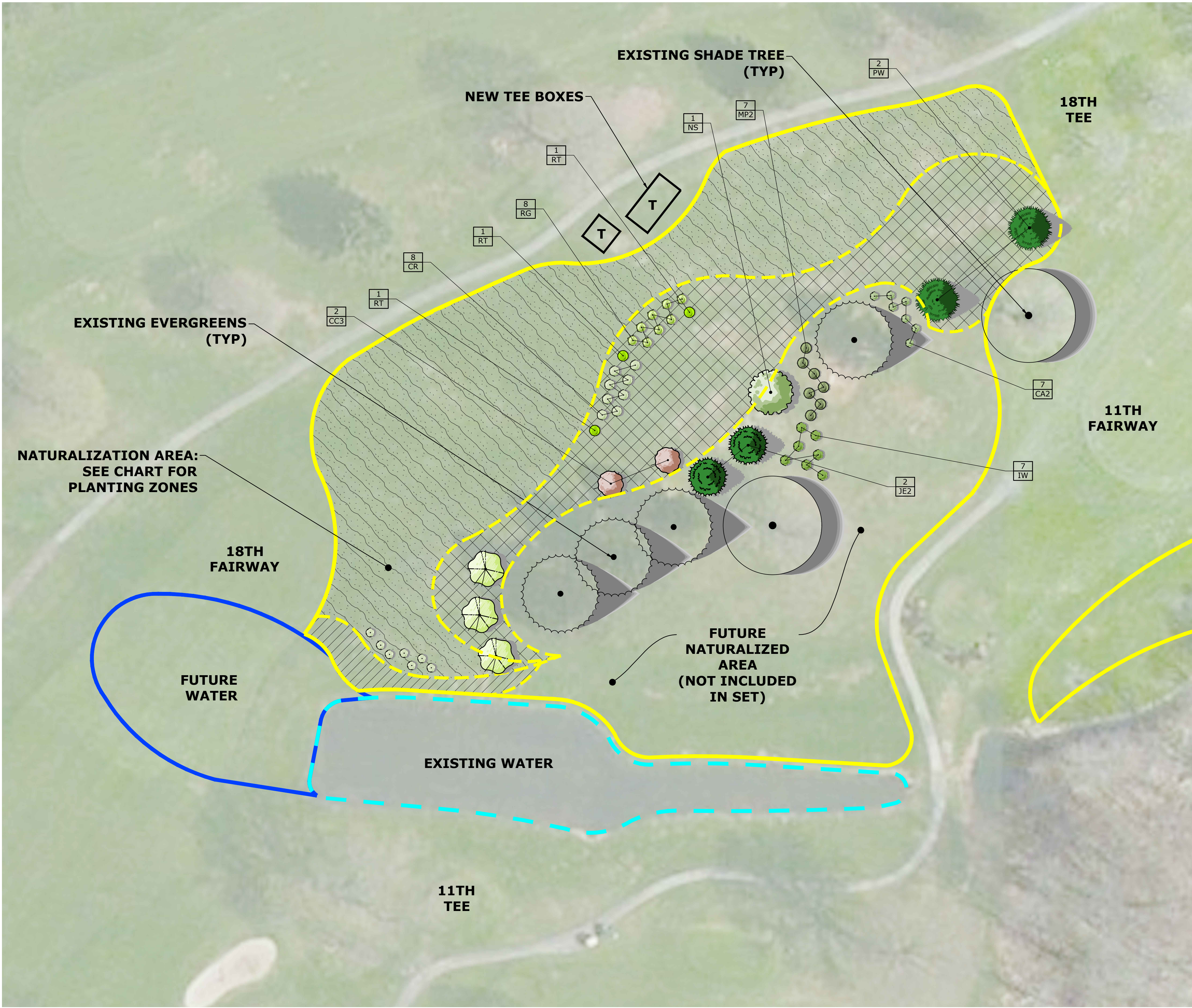
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DATE PLOTTED: 06/09/2016 10:58:10 AM



**SITE PREPARATION / CONSTRUCTION SCHEDULE**

1. HERBICIDE APPLICATION TO REMOVE DIFFICULT SPECIES.
2. MECHANICALLY REMOVE UNDESIRABLE LARGER WOODY SPECIES.
3. DEEP TINE AERATION AND LAWN SCALPING.
4. SMOTHER TURF WITH CLEAN TOPSOIL AND MULCH FOR PLANTS.

**TOTAL ACREAGE OF PROPOSED PLANTING:  
1.35 ACRES (THIS SHEET ONLY)**

**PLANT SCHEDULE AREA 2**

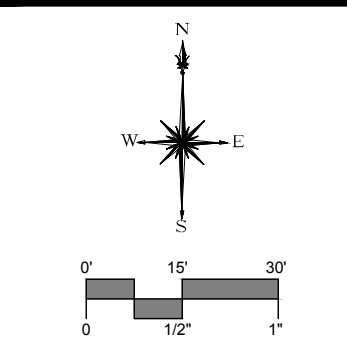
TREES	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONT.	COMMENTS
BR	3	Betula nigra	River Birch	2.5" Cal.	B & B	FULL & DENSE
CC3	2	Cornus florida 'Cherokee Brave'	Cherokee Brave Dogwood	2.5" Cal.	B & B	SINGLESTEM
JE2	2	Juniperus virginiana	Eastern Red Cedar	7' / 8" HT.	B & B	FULL & DENSE
NS	1	Nyssa sylvatica	Sour Gum	2.5" Cal.	B & B	FULL & DENSE
PW	2	Pinus alba	White Pine	7' / 8" HT.	B & B	FULL & DENSE

SHRUBS	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONT.	COMMENTS
CO	7	Cephalanthus occidentalis	Buttonbush	---	#3	FULL & DENSE
CA2	7	Clethra alnifolia	Summersweet Clethra	---	#3	FULL & DENSE
CR	8	Cornus sericea	Red Twig Dogwood	---	#3	FULL & DENSE
IW	7	Ilex verticillata	Winterberry	---	#3	FULL & DENSE
MP2	7	Myrica pensylvanica	Northern Bayberry	---	#3	FULL & DENSE
RG	8	Rhus aromatica 'Gro-Low'	Gro-Low Fragrant Sumac	---	#3	FULL & DENSE
RT	3	Rhus typhina 'Tiger Eyes'	Tiger Eyes Sumac	---	#3	FULL & DENSE

**NATURALIZED PLANT SCHEDULE AREA 2**

	<b>WET EDGE</b> Carex crinita / CaterpillarSedge Eupatorium dubium / Joe-Pye Weed Iris versicolor / Blue Flag Juncus effusus / Soft Rush Lobelia cardinalis / Cardinal Flower Matteuccia struthiopteris / Ostrich Fern Onoclea sensibilis / Sensitive Fern Osmunda cinnamomea / Cinnamon Fern Senecio aureus / Golden Ragwort Vernonia lettermannii 'Iron Butterfly' / Iron Butterfly Ironweed Vernonia noveboracensis / Common Ironweed	1,738 sf
	<b>TRANSITION</b> Asclepias tuberosa / Butterfly Milkweed Carex pensylvanica / Pennsylvania Sedge Dennstaedtia punctilobula / Hay-scented Fern Echinacea purpurea / Purple Coneflower Lobelia cardinalis / Cardinal Flower Onoclea sensibilis / Sensitive Fern Osmunda cinnamomea / Cinnamon Fern Schizachyrium scoparium / Little Bluestem Grass Vernonia lettermannii 'Iron Butterfly' / Iron Butterfly Ironweed Vernonia noveboracensis / Common Ironweed	35,569 sf
	<b>MEADOW</b> Andropogon gerardii / Big Blue Stem Carex pensylvanica / Pennsylvania Sedge Chasmanthium latifolium / Wood Oats Deschampsia flexuosa / Wavy Hair Grass Echinacea purpurea / Purple Coneflower Erigeron philadelphicus / Philadelphia Fleabane Geranium maculatum / Spotted Geranium Liatris spicata / Spike Gayfeather Lupinus perennis / Wild Lupine Panicum virgatum / Switch Grass Phlox paniculata / Garden Phlox Rudbeckia laciniata / Cutleaf Coneflower Schizachyrium scoparium / Little Bluestem Grass Sorghastrum nutans / Indian Grass Sporobolus heterolepis / Prairie Dropseed Symphyotrichum novae-angliae / New England Aster Waldsteinia fragarioides / Appalachian Barren Strawberry	21,522 sf



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DESCRIPTION	DATE	BY

**CONCEPTUAL PLANTING PLAN - AREA 2**  
 USGA NATURALIZATION PROJECT  
 THE LYNX AT RIVER BEND GOLF CLUB  
 PORT JERVIS  
 ORANGE COUNTY, NEW YORK

MTD DESIGNED	BDK DRAWN	MTD CHECKED
SCALE 1"=30'		
DATE JUNE 9, 2016		
PROJECT NO. 1967-21		

SHEET NAME  
**2**

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**SITE PREPARATION / CONSTRUCTION SCHEDULE**

1. HERBICIDE APPLICATION TO REMOVE DIFFICULT SPECIES.
2. MECHANICALLY REMOVE UNDESIRABLE LARGER WOODY SPECIES.
3. DEEP TINE AERATION AND LAWN SCALPING.
4. SMOTHER TURF WITH CLEAN TOPSOIL AND MULCH FOR PLANTS.

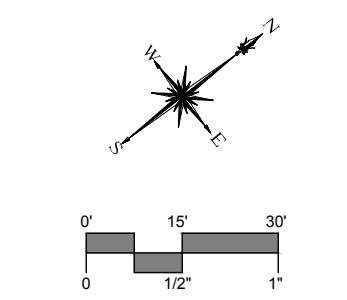
**TOTAL ACREAGE OF PROPOSED PLANTING:  
0.07 ACRES (THIS SHEET ONLY)**

**PLANT SCHEDULE AREA 3A**

TREES	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONT.	COMMENTS
AL	1	Ameianchier laevis	Allegheny Serviceberry	2.5" Cal.	B & B	FULL & DENSE

**NATURALIZED PLANT SCHEDULE AREA 3A**

DESCRIPTION	QTY
MEADOW Andropogon gerardii / Big Blue Stem Carex pensylvanica / Pennsylvania Sedge Chasmanthium latifolium / Wood Oats Deschampsia flexuosa / Wavy Hair Grass Echinacea purpurea / Purple Coneflower Erigeron philadelphicus / Philadelphia Fleabane Geranium maculatum / Spotted Geranium Liatris spicata / Spike Gayfeather Lupinus perennis / Wild Lupine Panicum virgatum / Switch Grass Phlox paniculata / Garden Phlox Rudbeckia laciniata / Cutleaf Coneflower Schizachyrium scoparium / Little Bluestem Grass Sorghastrum nutans / Indian Grass Sporobolus heterolepis / Prairie Dropseed Symphyotrichum novae-angliae / New England Aster Waldsteinia fragarioides / Appalachian Barren Strawberry	2,750 sf



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**CONCEPTUAL PLANTING PLAN - AREA 3A**  
 USGA NATURALIZATION PROJECT  
 THE LYNX AT RIVER BEND GOLF CLUB  
 PORT JERVIS  
 ORANGE COUNTY, NEW YORK

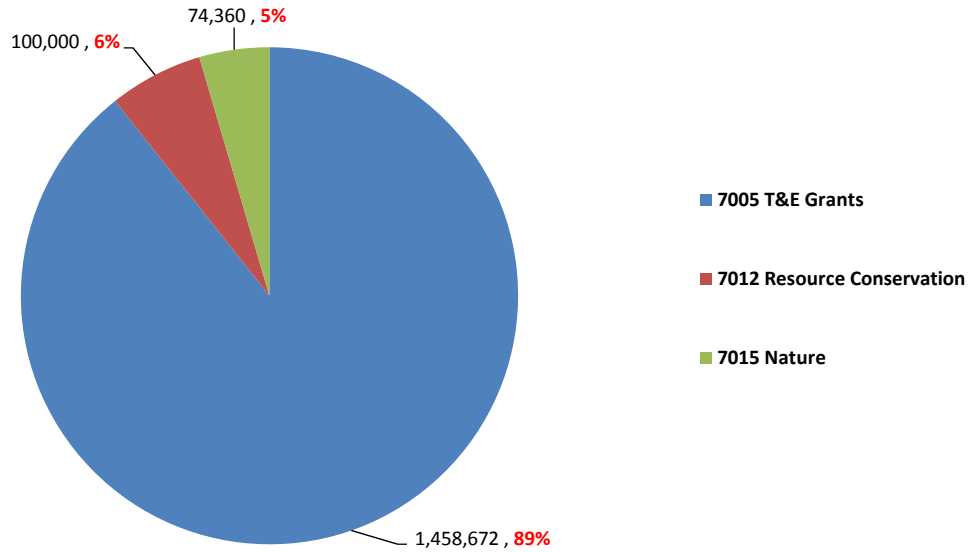
MTD DESIGNED	BDK DRAWN	MTD CHECKED
SCALE 1"=30'		
DATE JUNE 9, 2016		
PROJECT NO. 1967-21		

**3A**

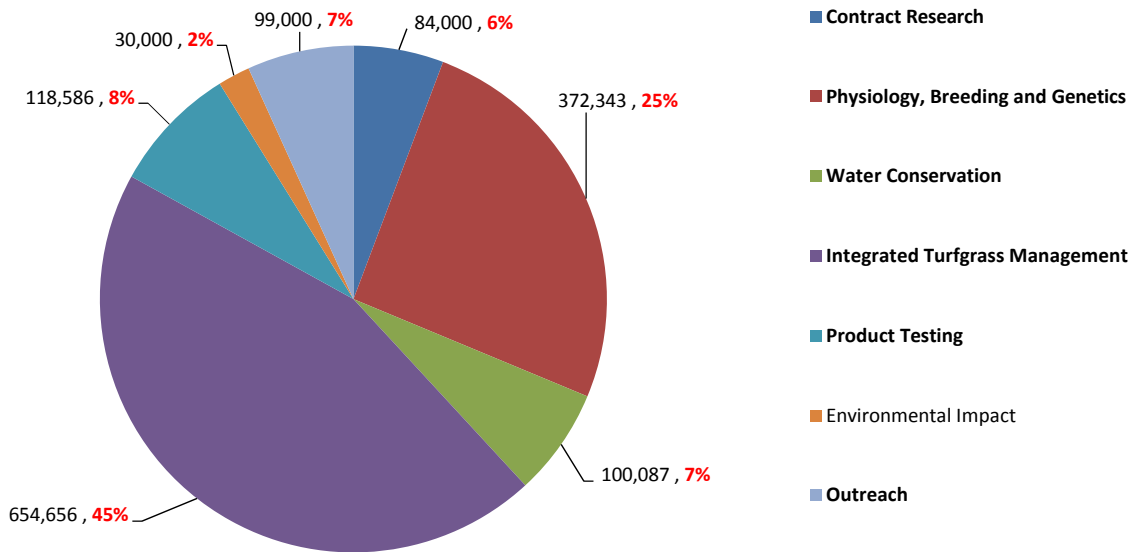




## Green Section Research Grants



## Turfgrass and Environmental Grants



### Turfgrass & Environmental Research

	2016	2017
Contract Research	84,000	159,800
Physiology, Breeding and Genetics	372,343	366,179
Water Conservation	100,087	169,196
Integrated Turfgrass Management	654,656	632,261
Product Testing	118,586	112,451
Environmental Impact	30,000	12,600
Outreach	99,000	74,500
<b>7005 T&amp;E Grants</b>	<b>1,458,672</b>	<b>1,526,987</b>
<b>7012 Resource Conservation</b>	<b>100,000</b>	<b>100,000</b>
<b>7015 Nature</b>	<b>74,360</b>	<b>54,329</b>
<b>7000 Grant Accounts</b>	<b>1,558,672</b>	<b>1,626,987</b>