

Ecological Master Plan

Haddon Township

Environmental and Historical Center

March 2014



Prepared by:
Carol Maxwell
John Nystedt, RLA, LEED BD+C

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Acknowledgements

The Delaware Riverkeeper Network appreciates the input received from the following groups during planning process:

- Haddon Township Environmental Commission
- Saddlers Woods Conservation Association
- Haddon Township Department of Public Works
- Haddon Township Historical Society

Goals and Objectives

Create a natural environment worthy of an Environmental and Historical Center

1. Create a beautiful and ecologically appropriate landscape

- "Heal" the site from the damage caused by the previous utility work

2. Improve circulation

- Highlight the connection between Newton Lake Park, the Environmental and Historical Center and the surrounding neighborhood.
- Create connecting pathways to the adjacent Newton Lake Park walkways. These pathways will lead from the Newton Lake walkway through the environmental center landscape, highlighting the various ecological zones featured en route to the neighborhoods.
- Improve the quality of these trails to withstand common storm events. Increasing appropriate plantings to stabilize banks, and managing stormwater flows to minimize erosion of the trail.

3. Improve storm water management and water quality

- Clean and infiltrate runoff from building and parking lot in designed rain gardens on site.
- Provide swales to the rain gardens that move water away from the building to prevent water damage of the building.

4. Increase native plant diversity throughout the woodland

- *Remove plants that can stifle native diversity and habitat for native species, and replace with native species.
- *Repair the disturbed area around the Center with diverse native species

5. Increase learning opportunities

- *Create an outdoor classroom area.
- *Highlight the connection between the restoration of the woodlands surrounding the Environmental and Historical Center and Saddler's Woods as an older "reference plant community." Document and publish restoration activities.
- *Utilize signage, tours and classes for environmental education of visitors.

Existing Conditions

The Township's property is approximately 2.7 acres and located adjacent to Camden County's Newton Lake Park in the Bettlewood neighborhood of Haddon Township.



The building is located on the upland portion of the site at 143 Ormond Ave. There is approximately a 15% slope down to the park from the Center.



The soil, trails and plant life closest to the building were recently severely disturbed due to the installation of sanitary sewer piping.



Next to the highly disturbed area shown above, the slope down to the stream was also disturbed due to pipe installation and construction traffic. The slope has a low quantity of desirable vegetation, and some trees are dying due to root impacts from construction (photo below show the disturbed slope and the creek).



The riparian area west of the Center is ecologically compromised. A combination of runoff coming from an adjacent storm drain along with a natural seep on the property creates a small creek and riparian area. The small creek area is unstable due to storm surges and a general lack of vegetation. Invasive species are common. The small creek flows under the path around Newton Lake Park, and into the lake.



Further to the northwest, there is an upland woodland area that is also highly impacted by invasive species. Trails exist in this area connecting East Oakland Ave to Newton Lake Park. Volunteers have been maintaining some of the vegetation and building trail steps in this area.

Hydrology

The area is located in the Newton Creek sub watershed, which drains into the Delaware River. According to FEMA, the portion of the site indicated as Riparian Corridor in the Vegetation and Trails Plan is located in the 100-year flood zone in hazard area AE. This indicates that this area must be kept free of encroachment due to the existence of determined Base Flood Elevations.

Soils

According to the USDA's Web Soil Survey, the soil type is HowC-Howell-Urban land complex that is classified as being well drained. The depth to the water table is usually 36 inches and it has a high water capacity. In terms of soil horizons, 0 to 15 inches is expected to be loam, 15 to 32 inches clay loam and 32 to 60 inches silty. However, the soil around the building is highly disturbed and compacted. Additionally, the soils in the riparian corridor are wetland soils with a shallow water table.

According to soil tests taken on July 17, 2013, the soil closest to the building is Sandy Clay Loam. . The composition of the soil is 46% sand, 24% silt, 30% clay and the gravel content is 21.1% with low organic matter and carbon. This indicates soil amendments are necessary to grow most plants well. The gravel content is very high, probably from blending of leftover gravel from the utility repair project's staging area; in summary, the soil is low quality, heavily compacted from construction equipment, and has little infiltration as indicated by a previous attempt at a rain garden.



Infiltration testing was conducted just west of sanitary easement near the corner of the county property indicates moderate infiltration. This means infiltration via a rain garden is feasible.

See soil and infiltration test results in appendix i.



Existing Vegetation

On the site, there is a significant elevation change. There are both Upper Woodlands, that is dryer, and a Riparian Corridor, that runs along a stream in the woods. The Riparian Corridor has a fairly healthy mix of native plants including Elderberry and Viburnum. However there is Japanese Knotweed, a non-native invasive plant common to stream banks. In the Upper Woodlands, non-native species are fairly present and are stifling native biodiversity.

The area around the Center is highly disturbed due to utility construction. Vegetation was removed, cut trees were left on site, and re-seeding was minimally successful. Significant work is needed here to re-establish a diverse native landscape.

The following is a list of native plants found on site.

EXISTING NATIVE VEGETATION HADDONTOWNSHIP ENVIRONMENTAL AND HISTORICAL CENTER	
Scientific Name	Common Name
Acer rubrum	Red Maple
Acer saccharinum	Silver Maple
Carya ovata	Shagbark Hickory
Fraxinus pennsylvanica	Green Ash
Impatiens capensis	Jewelweed
Liquidambar styraciflua	Sweet Gum
Prunus serotina	Black Cherry
Quercus rubra	Red Oak
Robinia pseudoacacia	Black Locust
Rubus fruticosus	Black Berry
Sambucus nigra	Elderberry
Sassafras albidum	Sassafras
Smilax rotundifolia	Green Briar
Symplocarpus foetidus	Skunk Cabbage
Toxicodendron radicans	Poison Ivy
Viburnum dentatum	Arrowwood Viburnum

Recommendations

Stormwater Management

Around the Center, re-grading is needed to help water flow away from the building. Currently it puddles around the building in a few locations because the land around it is higher, which is undesirable for the health of the building. Swales are recommended to guide water away from the building.

There is an opportunity for using the runoff as a resource - using it to naturally irrigate landscape plantings; and there is an opportunity to clean the runoff through use of vegetated swales and rain gardens. The proposed design includes two vegetated swales and two rain gardens. The runoff from the parking lot is included in the swale and rain garden design, helping to clean pollutants coming from the parked cars. The rain gardens are located in areas where infiltration is feasible. One of the rain gardens will require an overflow pipe to a nearby stormwater manhole.

Trails

The trails closest to the Center should be made of a fine crushed stone so that wheelchairs may access the site. Further from the building, where trails become steeper, the trails may be made of the fine crushed stone, or mulch. The steps are proposed to be wood, filled with crushed stone and mimic the existing steps along the trails.

Along vehicular maintenance routes that lead to the sanitary sewer manholes, a particular type of trail is proposed. The interior path, approximately 5 feet wide, shall have a trail made of 3" of fine crushed stone. Underneath this will be "well-graded" crushed stone such as NJDOT I5. The outer 3.5' on either side of the trail will be a "reinforced meadow" with a soil mix made of 70% clean crushed stone and 30% soil; this mix supports vehicles and allows vegetation to grow; it will be planted with low meadow species.. This 12-foot wide access lane is designed to allow the passage of trucks to the sanitary sewer manholes when needed.



Vegetative Zones

This site is divided into three vegetative zones for restoration purposes; *Learning Landscape* (ZONE-1), *Upper Woodlands* (ZONE-2), and *Riparian Corridor* (ZONE-3). Please see Appendix ii.

ZONE-1 Learning Landscape (surrounding the building)

Within the Learning Landscape, there are a number of different plant communities; a low growing meadow that serves as a visual and practical landscape for truck access to sanitary drains, a programmed landscape with specimen plants to beautify the building, and rain gardens to absorb runoff created by impervious surfaces and building. All of these areas contain canopy trees, shade trees, shrubs and a herbaceous plant layer. Additionally there is an area designated as an outdoor classroom that provides enclosure through means of designed vegetation and fence, and a seating area for study and discussion.

Within the plan, all native vegetation will be conserved and/or salvaged. Invasive plants will be removed based on expert oversight and information in Appendix vi. Contingent upon the funding stream, the meadow and the rain gardens should be the first areas within the learning landscape to be planted.

The two rain gardens designed to collect runoff from the parking lot and roof of the building will be planted with species tolerant of wet and dry conditions. These rain garden will be mulched and then planted with plants located in Appendix v.

The learning landscape is in need of soil remediation. This should be done during the re-grading process. In areas where there is an excessive amount of rocky soil, blend compost into the top 6 inches of soil. In areas where soil is impaired, add 2-4 inches of quality topsoil where needed. Export of degraded soil may be likely needed. For mulch, in planting beds within the Learning Landscape and along the edge of this area, 2 inches of leaf compost or wood chip compost shall be on top of the soil. Nearest the building, surrounding new plantings and grading, there is a potential of unwanted growth in this area. Three inches of mulch should be applied in these places.

In other portions of the Learning Landscape, details concerning placement of shade trees, shrubs, and herbaceous plants can be found on the Layout Plan appendix iii. Once plants are put into the ground, the areas surrounding the plantings should be weeded regularly. In fall mulch and or leaf layer should be put over the plant root area to keep plants healthy over the winter months (supplement existing mulch).

ZONE 2- Upper Woodland

Behind the Center exists the next area of interest - the Upper Woodland. In this dryer area, first steps should include the removal of invasive plants according to chart V. After the areas have been managed by non-native plant removal, plantings should be revegetated according to the planting plan and plants on the plant list in Appendix v. These plant lists are based upon the forest composition for from the reference site at Saddler's Woods. When vegetation is planted, it should be placed in "clump and gap" arrangement, mimicking the natural dispersal process of each plant. No raking or leaf blowing should be taking place in either of these areas. Natural leaf litter serves as proper insulation and habitat for these plants and animals.

ZONE-3 Riparian Corridor

The Riparian Corridor is found nearest the lowest areas of the property where a small creek runs though the property. Again, non-native plants should be removed according to the directions on chart V. They should then be replaced with a sampling of plants from list F. These plants are based upon wetter areas within the reference site of Saddler's Woods. Live cuttings (trees and shrubs that sprout from live branches) can be placed on the stream bank and steep slopes to provide bank stabilization.

Implementation Sequence

This plan includes a strategic process for implementation.

Phase 1: Establishment of the vehicular access to the sanitary sewer manholes, grading of the soil around the Center, and establishment of trails, is the first step to the improvement of the landscape. (See appendix ii)

Phase II: Vegetation management/planting of the "Learning Landscape" (Zone 1), i.e., the area around the building, to the existing woods edge. This zone will be planted according to the planting plan (see appendix iii). Learning Landscape includes the rain gardens which will be graded and planted during this second phase of implementation.

Phase III: Finally the plan for non-native plant removal, and replanting, within the Upper Woodlands and Riparian Corridor will be implemented. Please see the notes below.

Sequence outline as of March 2014, for Phase I and Phase II

1. Move mulch from on-site stockpile
2. Temporary erosion and sedimentation control
3. Build access lanes to sanitary sewer manholes (including trail, see detail)
4. Swale grading; rain garden grading; soil ammendments
5. Temporary seeding, summer 2014
6. Planting fall 2014+
7. Meadow seeding spring 2015

Establishment of trails may begin any time after step 4 above.

Invasive Management

Wherever possible, avoid herbicide treatment if other options are viable. Some non-native invasive species require herbicide treatment to kill root systems and prevent re-growth. Other species may be managed with vigilant and periodic manual removal.

When herbicides are required, utilize herbicide application methods that apply the least herbicide necessary. Do not overspray onto native species; use “paint” technique where invasive plants are among native species. Utilize certified and experienced applicators; consult with the applicators to refine the management regime for each species; consider non-herbicide alternatives rather than the easy route of herbicide application. Use herbicide mixes that are approved for riparian locations.

Follow regulations. For non-native invasive trees, treatment with an herbicide and oil mixture (painted on the trunk) is typically effective at causing tree death; girdling the tree trunk is also effective for many tree species and preferred because it avoids herbicide. It is desirable to let the treated/girdled trees decline and die in place, allowing the root systems to hold soil for the future as other tree root systems take over, providing habitat in the dead “stag” trees. However near trails it is best to cut off the tree branches and/or trunks that may potentially fall on trails; this can be done after tree death occurs, before branches/trunks are weakened. Trained volunteers should be monitored carefully during this process to prevent any mishaps. Root removal is critical when pulling invasive species such as invasive shrubs and perennials. Always replant with native species to fill in the ecological niche, soon after managing the non-native plants. See Appendix v for details.

Future Management and Non-Native Species

Budgetary provisions should be made for management, combined with volunteer efforts. After initial invasive removal and plantings, areas should be maintained by monitoring and removal of any non-native species, and re-planting native species where needed.

Appendix i: Infiltration Report

Delaware Riverkeeper Network

John Nystedt and intern Carol Maxwell

Infiltration Testing

Testing Date: 7/16/2013

Report Date: 7/17/2013

CRI 2013 Project Name: Riparian Buffer Restoration and Stormwater BMP's at the Environmental Center

Haddon Township Environmental and Historical Center

Weather: 90 degrees, sunny; no rain in recent days

Pit 1

Location: 10' west of sanitary easement near corner of county property

12" depth, clayey subsoil at the bottom of the pit

Extremely Variable, not good data results, started to stabilize at the end of testing

Variable infiltration probably due to odd soil conditions / recent construction

RATE PER HALF HOUR	RATE PER HOUR
1.8	Anomaly, not used
0	Anomaly, not used
0.1	0.2
0.45	0.9
0.3	0.6
AVERAGE INFILTRATION RATE PER HOUR	0.6

A stabilized infiltration rate was not achieved, but the data suggests infiltration is above the 0.5" per hour threshold

Design Recommendations: infiltration is likely feasible, soil amendments would help

Bottom of proposed rain garden should not be driven over or compacted.

Pit 2

Location: 10' west of sanitary easement near corner of county property

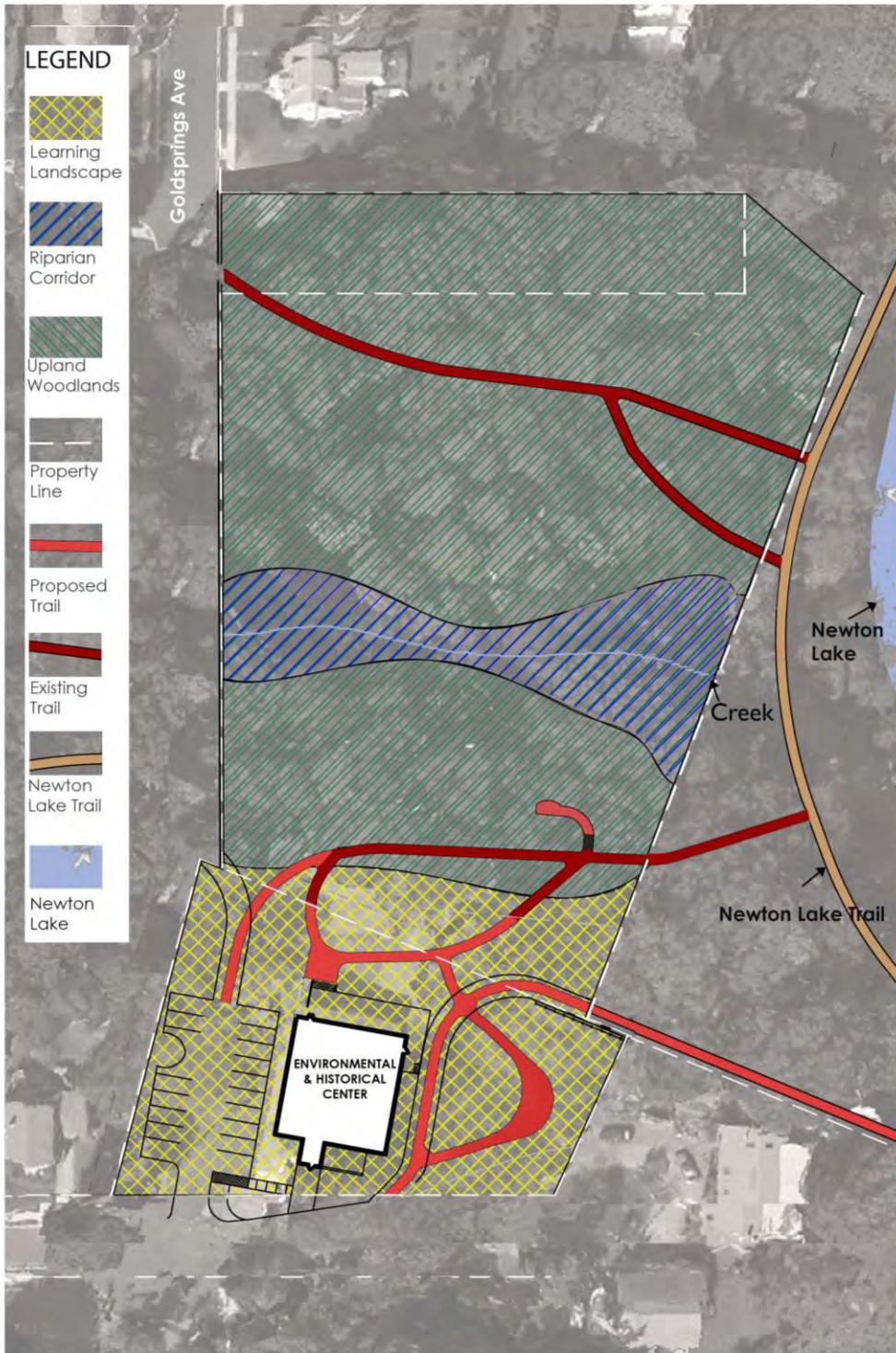
3" depth (in organic soil)

RATE PER 15 MINUTES	RATE PER HOUR
0.7	2.8
0.75	3
0.45	1.8
0.7	2.8
0.6	2.4
0.5	2
AVERAGE INFILTRATION RATE PER HOUR	2.4

Design Recommendations: infiltration is feasible in this layer, though capacity for large storms is based on underlying soil (pit 1)

Leaving existing soil in the bottom of the infiltration basin makes a lot of sense, building up on the downhill side with soil from other location

Appendix ii: Vegetation and Trails Map



Vegetation and Trails Plan
 Haddon Township Environmental and Historical Center
 October 2013

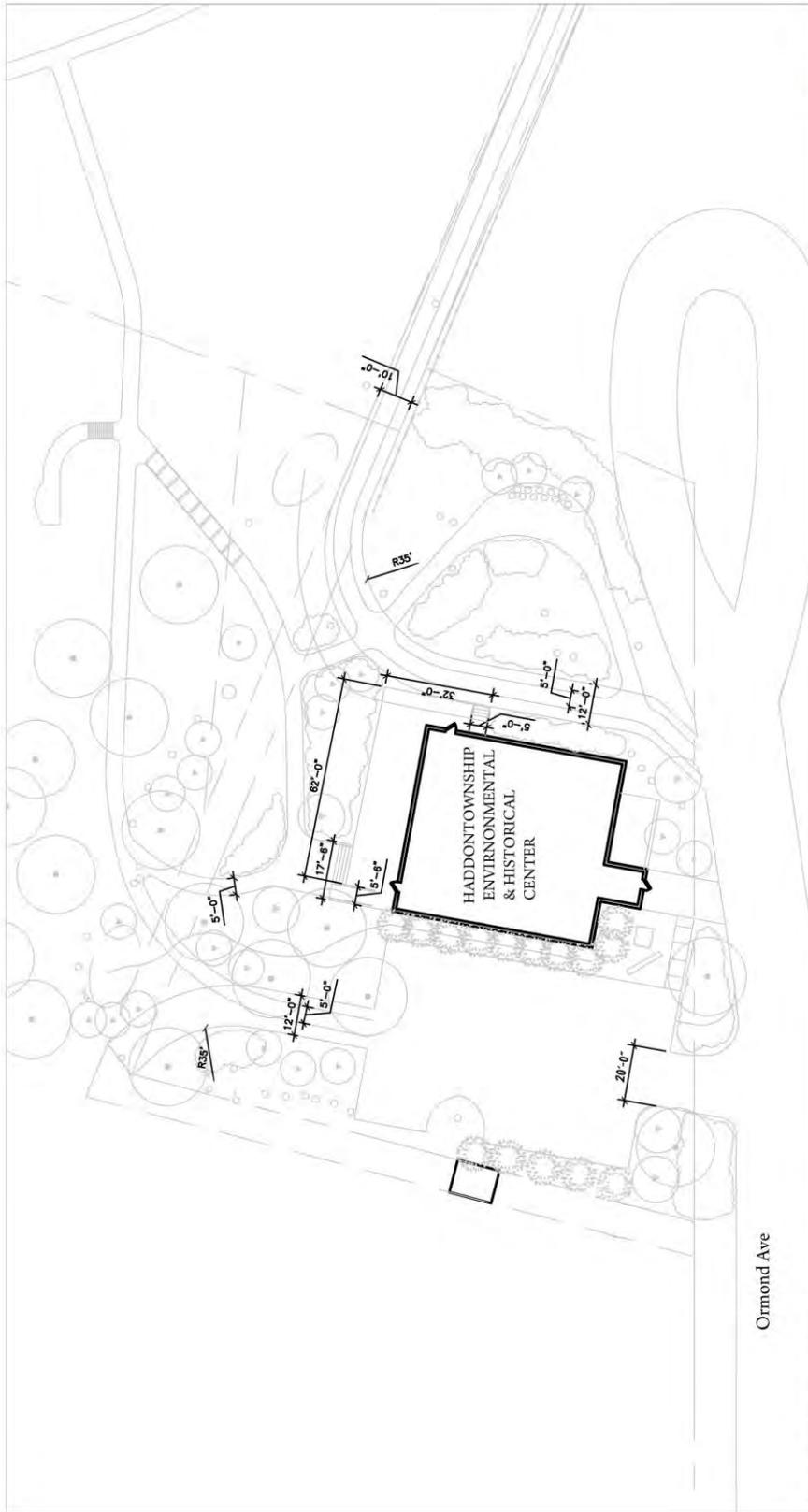


Appendix iii: Layout Plan



Layout Plan
 Haddon Township Environmental and Historical Center
 October 2013

Appendix iv: Dimension Plan



Ormond Ave

Dimensions Plan
 Haddon Township Environmental and Historical Center
 Nov 2013

0 15 30 60 feet

N

Appendix v: Proposed Planting by Zone

Learning Landscape : ZONE 1

Botanical Name	Common Name	Family	Wetland Status	Upland Woodland	Upland Successional Woodland
Trees					
<i>Betula populifolia</i>	Gray birch	Betulaceae	FAC	X	X
<i>Cornus florida</i>	Flowering dogwood	Cornaceae	FACU-FAC	X	X
<i>Juniperus virginiana</i>	Red cedar	Cupressaceae	FACU-, FACU	X	X
<i>Liriodendron tulipifera</i>	Tuliptree	Magnoliaceae	FACU, FAC	X	X
<i>Pinus strobus</i>	White pine	Pinaceae	FACU	X	X
<i>Rhus copallina</i>	Winged sumac	Anacardiaceae	UPL, NI	X	X
<i>Rhus typhina</i>	Staghorn sumac	Anacardiaceae	UPL		X
<i>Sassafras albidum</i>	Sassafras	Lauraceae	FACU-, FACU	X	X
<i>Viburnum prunifolium</i>	Blackhaw	Caprifoliaceae	FACU, FACU+	X	X
Shrubs					
<i>Cercis canadensis</i> *	Redbud	Fabaceae	UPL, FACU	X	X
<i>Cornus amomum</i>	Black huckleberry	Ericaceae	FACU	X	X
<i>Gaylussacia frondosa</i>	Blue huckleberry	Ericaceae	FAC	X	X
<i>Rubus allegheniensis</i>	Allegheny blackberry	Rosaceae	UPL, FACW	X	X
<i>Rubus flagellaris</i>	Common dewberry	Rosaceae	UPL, FACU-	X	X
<i>Rubus occidentalis</i>	Black raspberry	Rosaceae	UPL	X	X
<i>Smilax glauca</i>	Cat greenbrier	Smilacaceae	UPL, FAC	X	X
<i>Vitis aestivalis</i>	Summer grape	Vitaceae	UPL, FAC	X	X
<i>Cornus amomum</i>	Silky dogwood	Cornaceae	FACW, FACW+		X
Grasses					
<i>Carex swanii</i>	Swan's sedge	Cyperaceae	UPL, FACU	X	X
<i>Juncus tenuis</i>	Path rush	Juncaceae	FAC-, OBL	X	X
<i>Schizachyrium scoparium</i>	Little bluestem	Poaceae	FACU-, FACU+	X	X
<i>Agrostis perennans</i>	Upland bent grass	Poaceae	FACU, FACW		X
<i>Carex abscondita</i>	Thicket sedge	Cyperaceae	FACU, FACW		X
<i>Carex scoparia</i>	Pointed broom sedge	Cyperaceae	Meadow, FACW		X
<i>Danthonia compressa</i>	Flattened oatgrass	Poaceae	FACU-		X
<i>Dichanthelium acuminat</i>	Western panic grass	Poaceae	Meadow, FACU-, FACW		X
<i>Dichanthelium clandest</i>	Deertongue grass	Poaceae	FAC+, FACW		X
<i>Dichanthelium dichotom</i>	Cypress panic grass	Poaceae	Meadow, FAC-, FAC		X
<i>Eragrostis pectinacea</i>	Carolina lovegrass	Poaceae	Meadow, FACU, FAC		X
<i>Muhlenbergia schreberi</i>	Nimble-will	Poaceae	FACU, FAC		X
<i>Panicum dichotomifloru</i>	Fall panic grass	Poaceae	FACU, FACW		X
<i>Panicum virgatum</i>	Switchgrass	Poaceae	UPL, FACW		X
Ferns					
<i>Dennstaedtia punctilobu</i>	Hay-scented fern		open woods meadows and slopes		X
<i>Botrychium virginianum</i>	Rattlesnake fern	Ophioglossaceae	FACU	X	X
Herbaceous					
<i>Acalypha virginica</i>	Virginia threeseed mercu	Euphorbiaceae	Disturbed areas, UPL, F	X	X
<i>Ageratina altissima</i>	White snakeroot	Asteraceae	UPL, FAC	X	X
<i>Apocynum cannabinum</i>	Dogbane	Apocynaceae	Meadow, FACU, FAC+	X	X

(continued next page)

Learning Landscape : ZONE 1

Botanical Name	Common Name	Family	Wetland Status	Upland Woodland	Upland Successional Woodland
<i>Eclipta prostrata</i> *	False daisy	Asteraceae	Meadow	X	X
<i>Lysimachia quadrifolia</i>	Whorled loosestrife	Primulaceae	UPL, FACU	X	x
<i>Polygonatum pubescens</i>	Hairy Solomon's seal		wooded slopes, stream bank	X	X
<i>Sanicula canadensis</i>	Canada black snakeroot	Apiaceae	UPL, FACU+	X	X
<i>Asclepias syriaca</i>	Common milkweed	Asclepiadaceae	Meadow		X
<i>Chamaesyce maculata</i>	Milk purslane	Euphorbiaceae	Disturbed areas		X
<i>Conyza canadensis</i>	Horseweed	Asteraceae	Meadow, UPL, FAC		X
<i>Cryptotaenia canadensis</i>	Canadian honewort	Apiaceae	FACU, FAC+		X
<i>Cuscuta gronovii</i>	Dodder	Cuscutaceae	Meadow		X
<i>Desmodium glabellum</i>	Dillenius' tick trefoil	Fabaceae			X
<i>Echinacea purpurea</i> *	Purple coneflower	Asteraceae			X
<i>Erigeron annuus</i>	Daisy fleabane	Asteraceae	Disturbed areas, FACU, FAC		X
<i>Euthamia graminifolia</i>	Grass-leaved goldenrod	Asteraceae	Meadow, FAC, FACW		X
<i>Geranium carolinianum</i>	Carolina geranium	Geraniaceae	Disturbed areas		X
<i>Monarda fistulosa</i>	Wild bergamot	Lamiaceae	UPL, FAC+		X
<i>Oxalis dillenii</i>	Wood sorrel	Oxalidaceae	Disturbed areas		X
<i>Prenanthes trifoliolata</i>	Gall of the earth	Asteraceae	UPL		X
<i>Solidago canadensis</i>	Canada goldenrod	Asteraceae	FACU, FACU+		X
<i>Solidago rugosa</i>	Rough-stemmed goldenrod	Asteraceae	FAC, FAC+		X
<i>Symphotrichum novi-belgii</i>	New York aster	Asteraceae	UPL		X
<i>Symphotrichum pilosum</i>	Heath aster	Asteraceae	Meadow		X
<i>Verbena urticifolia</i>	White vervain	Verbenaceae	UPL, FAC+		X

Upland Woodland: ZONE 2

Botanical Name	Common Name	Family	Wetland Status	Upland Woodland
Trees				
<i>Acer rubrum</i>	Red maple	Aceraceae	FAC	X
<i>Betula populifolia</i>	Gray birch	Betulaceae	FAC	X
<i>Carya glabra</i>	Pignut	Juglandaceae	FACU-, FACU	X
<i>Carya tomentosa</i>	Mockernut	Juglandaceae	FAC	X
<i>Cornus florida</i>	Flowering dogwood	Cornaceae	FACU-FAC	X
<i>Fagus grandifolia</i>	American beech	Fagaceae	FACU	X
<i>Gleditsia triacanthos</i> *	Honey locust	Fabaceae	FACU, FAC	X
<i>Juniperus virginiana</i>	Red cedar	Cupressaceae	FACU-, FACU	X
<i>Liriodendron tulipifera</i>	Tuliptree	Magnoliaceae	FACU, FAC	X
<i>Magnolia tripetala</i> *	Umbrella magnolia	Magnoliaceae	FACU, FAC	X
<i>Nyssa sylvatica</i>	Black gum	Cornaceae	FAC	X
<i>Pinus strobus</i>	White pine	Pinaceae	FACU	X
<i>Populus grandidentata</i>	Bigtooth aspen	Salicaceae	FACU-, FACU	X
<i>Prunus serotina</i>	Black cherry	Rosaceae	FACU	X
<i>Quercus alba</i>	White oak	Fagaceae	FACU-, FACU+	X
<i>Quercus coccinea</i>	Scarlet oak	Fagaceae	UPL	X
<i>Quercus falcata</i>	Southern red oak	Fagaceae	FACU-, FACU	X
<i>Quercus prinus</i>	Chestnut oak	Fagaceae	UPL, FACU-	X
<i>Quercus rubra</i>	Northern red oak	Fagaceae	FACU-, FACU+	X
<i>Quercus velutina</i>	Black oak	Fagaceae	UPL, FACU	X
<i>Rhus copallina</i>	Winged sumac	Anacardiaceae	UPL, NI	X
<i>Robinia pseudoacacia</i> *	Black locust	Fabaceae	UPL, FAC	X
<i>Sassafras albidum</i>	Sassafras	Lauraceae	FACU-, FACU	X
<i>Tilia americana</i>	Basswood	Tiliaceae	FACU	X
<i>Viburnum lentago</i>	Nannyberry	Caprifoliaceae	FACU, FAC+	X
<i>Viburnum prunifolium</i>	Blackhaw	Caprifoliaceae	FACU, FACU+	X
Shrubs				
<i>Cercis canadensis</i> *	Redbud	Fabaceae	UPL, FACU	X
<i>Cornus amomum</i>	Black huckleberry	Ericaceae	FACU	X
<i>Gaylussacia frondosa</i>	Blue huckleberry	Ericaceae	FAC	X
<i>Hamamelis virginiana</i>	Witch hazel	Hamamelidaceae	FACU, FAC-	X
<i>Kalmia latifolia</i>	Mountain laurel	Ericaceae	FACU-, FACU	X
<i>Myrica pensylvanica</i>	Northern bayberry	Myricaceae	UPL	X
<i>Parthenocissus quinquefolia</i>	Virginia creeper	Vitaceae	FACU, FAC	X
<i>Rhododendron periclymenon</i>	Pink azalea	Ericaceae	FAC	X
<i>Rubus allegheniensis</i>	Allegheny blackberry	Rosaceae	UPL, FACW	X
<i>Rubus flagellaris</i>	Common dewberry	Rosaceae	UPL, FACU-	X
<i>Rubus occidentalis</i>	Black raspberry	Rosaceae	UPL	X
<i>Smilax glauca</i>	Cat greenbrier	Smilacaceae	UPL, FAC	X
<i>Smilax rotundifolia</i>	Roundleaf greenbrier	Smilacaceae	FAC	X
<i>Viburnum acerifolium</i>	Mapleleaf viburnum	Caprifoliaceae	UPL, FACU	X
<i>Vitis aestivalis</i>	Summer grape	Vitaceae	UPL, FAC	X
<i>Vitis labrusca</i>	Fox grape	Vitaceae	FACU, FAC+	X
Grasses				
<i>Carex pensylvanica</i>	Pennsylvania sedge	Cyperaceae	UPL	X
<i>Carex swanii</i>	Swan's sedge	Cyperaceae	UPL, FACU	X
<i>Juncus tenuis</i>	Path rush	Juncaceae	FAC-, OBL	X
<i>Schizachyrium scoparium</i>	Little bluestem	Poaceae	FACU-, FACU+	X

Upland Woodland: ZONE 2

Botanical Name	Common Name	Family	Wetland Status	Upland Woodland
Ferns				
<i>Botrychium virginianum</i>	Rattlesnake fern	Ophioglossaceae	FACU	X
<i>Pteridium aquilinum</i>	Bracken	Dennstaedtiaceae	FACU-, FAC-	X
<i>Thelypteris noveboracensis</i>	New York fern	Thelypteridaceae	FAC, FAC+	X
Herbs				
<i>Acalypha virginica</i>	Virginia threeseed mercury	Euphorbiaceae	Disturbed areas, UPL, FAC	X
<i>Ageratina altissima</i>	White snakeroot	Asteraceae	UPL, FAC	X
<i>Anemone quinquefolia</i>	Wood anemone	Ranunculaceae	FACU, FAC	X
<i>Apocynum cannabinum</i>	Dogbane	Apocynaceae	Meadow, FACU, FAC+	X
<i>Aralia nudicaulis</i>	Wild sarsaparilla	Araliaceae	FACU, FAC	X
<i>Chimaphila maculata</i>	Striped prince's pine	Pyrolaceae		X
<i>Dioscorea villosa</i>	Wild yam	Dioscoreaceae	FACU, FAC+	X
<i>Eclipta prostrata</i> *	False daisy	Asteraceae	Meadow	X
<i>Erythronium americanum</i>	Yellow trout lily	Liliaceae		X
<i>Eurybia divaricata</i>	White wood aster	Asteraceae		X
<i>Galium aparine</i>	Sticky willy	Rubiaceae	FACU, FAC-	X
<i>Geum canadense</i>	White avens	Rosaceae	FACU, FAC	X
<i>Lactuca biennis</i>	Tall blue lettuce	Asteraceae	FACU, FAC+	X
<i>Lactuca canadensis</i>	Yellow wild lettuce	Asteraceae	FACU-, FAC+	X
<i>Lysimachia quadrifolia</i>	Whorled loosestrife	Primulaceae	UPL, FACU	X
<i>Maianthemum racemosum</i>	False Solomon's seal	Liliaceae		X
<i>Mitchella repens</i>	Partridgeberry	Rubiaceae	FACU, FAC	X
<i>Monotropa uniflora</i>	Indian pipe	Monotropaceae	UPL, FACU	X
<i>Phytolacca americana</i>	Pokeweed	Phytolaccaceae	FACU+, FAC	X
<i>Polygonatum biflorum</i>	Smooth Solomon's seal	Liliaceae	UPL, FAC-	X
<i>Polygonatum pubescens</i>	Hairy Solomon's seal		wooded slopes, stream banks	X
<i>Sanguinaria canadensis</i>	Bloodroot	Papaveraceae	UPL, FACU-	X
<i>Sanicula canadensis</i>	Canada black snakeroot	Apiaceae	UPL, FACU+	X
<i>Sisyrinchium angustifolium</i>	Stout blue-eyed grass	Iridaceae	FACU, FACW-	X
<i>Uvularia sessilifolia</i>	Sessileleaf bellwort	Liliaceae	FACU-, FAC+	X
<i>Viola sororia</i>	Common blue violet	Violaceae	FAC-, FAC	X

Riparian Corridor: ZONE 3

Botanical Name	Common Name	Family	Wetland Status	Wetlands & Stream Edge	Stream Slopes
Trees					
<i>Acer negundo</i>	Box elder	Aceraceae	FAC+, FAC, FAC, FACW	X	X
<i>Acer rubrum</i>	Red maple	Aceraceae	FAC	X	X
<i>Acer saccharum</i>	Sugar maple	Some planted	UPL, FACU	X	X
<i>Fraxinus pennsylvanica</i>	Green ash	Oleaceae	FAC FACW	X	X
<i>Liquidambar styraciflua</i>	Sweet gum	Hamamelidaceae	FAC, FACW	X	X
<i>Magnolia virginiana</i>	Sweetbay	Magnoliaceae	FACW+, OBL	X	X
<i>Quercus phellos</i>	Willow oak	Fagaceae	FAC+, FACW	X	X
<i>Salix nigra</i>	Black willow	Salicaceae	UPL, OBL	X	X
<i>Carpinus caroliniana</i>	Ironwood	Betulaceae	FAC	X	
<i>Quercus bicolor</i>	Swamp white oak	Fagaceae	FACW+, OBL	X	
<i>Salix discolor</i>	Pussy willow	Salicaceae	FACW	X	
<i>Carya tomentosa</i>	Mockernut	Juglandaceae	FAC		X
<i>Celtis occidentalis</i>	Hackberry	Ulmaceae	FACU, FAC		X
<i>Nyssa sylvatica</i>	Black gum	Cornaceae	FAC		X
<i>Platanus occidentalis</i>	American sycamore	Platanaceae	FAC, FACW		X
<i>Ulmus americana</i>	American elm	Ulmaceae	FAC, FACW		X
Shrubs					
<i>Amorpha fruticosa</i> *	False indigo	Fabaceae	Meadow, FAC, OBL	X	
<i>Cephalanthus occidentalis</i>	Buttonbush	Rubiaceae	Meadow, OBL	X	X
<i>Clethra alnifolia</i>	Coastal sweetpepperbush	Clethraceae	FAC+, FACW	X	X
<i>Cornus amomum</i>	Silky dogwood	Cornaceae	FACW, FACW+	X	
<i>Ilex glabra</i>	Inkberry	Aquifoliaceae	FACW-, FACW	X	
<i>Ilex verticillata</i>	Common winterberry	Aquifoliaceae	FACW, OBL	X	
<i>Lindera benzoin</i>	Spicebush	Lauraceae	FACW-, FACW		X
<i>Vaccinium corymbosum</i>	Highbush blueberry	Ericaceae	FACW-, FACW	X	
Grasses					
<i>Carex tribuloides</i>	Blunt broom sedge	Cyperaceae	Meadow, FACW, OBL	X	X
<i>Cyperus strigosus</i>	Straw-colored flatsedge	Cyperaceae	Meadow, FACW	X	X
<i>Glyceria striata</i>	Fowl manna-grass	Poaceae	Stream corridor, OBL	X	X
<i>Juncus effusus</i>	Common rush	Juncaceae	Meadow, FACW+, OBL	X	X
<i>Juncus tenuis</i>	Path rush	Juncaceae	FAC-, OBL	X	
<i>Carex debilis</i>	White-edged sedge	Cyperaceae	FAC, OBL	X	
<i>Carex stricta</i>	Tussock sedge	Cyperaceae	Meadow, OBL	X	
<i>Carex vulpinoidea</i>	Fox sedge	Cyperaceae	Meadow, OBL	X	
<i>Cinna arundinacea</i>	Wood reed	Poaceae	FACW, FACW+	X	
<i>Eleocharis ovata</i>	Ovate spikerush	Cyperaceae	Meadow, OBL	X	
<i>Juncus acuminatus</i>	Tapertip rush	Juncaceae	Meadow, OBL	X	
<i>Leersia oryzoides</i>	Rice cutgrass	Poaceae	Meadow, OBL	X	
<i>Elymus virginicus</i>	Virginia wild rye	Poaceae	Meadow, FAC, FACW		X
Ferns					
<i>Athyrium filix-femina</i>	Lady fern	Dryopteridaceae	FAC, FAC+	X	X
<i>Osmunda cinnamomea</i>	Cinnamon fern	Osmundaceae	FACW, OBL	X	X
<i>Osmunda regalis</i>	Royal fern	Osmundaceae	OBL	X	X
<i>Woodwardia areolata</i>	Netted chain fern	Blechnaceae	FACW+, OBL	X	X
<i>Dryopteris x triploidea</i>	Triploid hybrid wood fern		moist woods swamps and t	X	
<i>Equisetum arvense</i>	Field horsetail	Equisetaceae	FACU, FACW-	X	
<i>Dennstaedtia punctilobula</i>	Hay-scented fern		open woods meadows and slopes		X
<i>Dryopteris carthusiana</i>	Spinulose wood fern	Dryopteridaceae	UPL		X
<i>Onoclea sensibilis</i>	Sensitive fern	Dryopteridaceae	FACW		X

(continued next page)

Riparian Corridor: ZONE 3

Botanical Name	Common Name	Family	Wetland Status	Wetlands & Stream Edge	Stream Slopes
Herbaceous					
<i>Asclepias incarnata</i>	Swamp milkweed	Planted	Meadow, FACW+, OBL	X	X
<i>Bidens frondosa</i>	Devil's beggarticks	Asteraceae	Meadow, FACW, FACW+	X	X
<i>Boehmeria cylindrica</i>	False nettle	Urticaceae	FACW, OBL	X	X
<i>Epilobium coloratum</i>	Purpleleaf willowherb	Onagraceae	Disturbed areas, OBL	X	X
<i>Eupatorium perfoliatum</i>	Boneset	Asteraceae	Meadow, FACW+, OBL	X	X
<i>Iris versicolor</i>	Blue flag	Iridaceae	Meadow, OBL	X	X
<i>Lobelia siphilitica</i>	Great lobelia	Campanulaceae	FACW+, OBL	X	X
<i>Ludwigia alternifolia</i>	Seedbox	Onagraceae	FACW+, OBL	X	X
<i>Polygonum pennsylvanicum</i>	Pennsylvania smartweed	Polygonaceae	FACW-, OBL	X	X
<i>Polygonum punctatum</i>	Dotted smartweed	Polygonaceae	FACW, OBL	X	X
<i>Rudbeckia fulgida</i>	Orange coneflower	Asteraceae	FAC, OBL	X	X
<i>Rudbeckia laciniata</i>	Cut-leaf coneflower	Asteraceae	FACU, FACW+	X	X
<i>Symphotrichum racemosum</i>	Smooth white oldfield aster	Asteraceae	UPL	X	X
<i>Arisaema triphyllum</i>	Jack in the pulpit	Araceae	FAC, FACW	X	
<i>Bidens cernua</i>	Nodding beggarticks	Asteraceae	Meadow, FACW+, OBL	X	
<i>Callitriche heterophylla</i>	Water starwort	Callitricaceae	Stream corridor, OBL	X	
<i>Geum laciniatum</i>	Rough avens	Rosaceae	FAC+, FACW	X	
<i>Ludwigia palustris</i>	Marsh seedbox	Onagraceae	OBL	X	
<i>Lycopus virginicus</i>	Bugleweed	Lamiaceae	OBL	X	
<i>Mimulus ringens</i>	Monkeyflower	Scrophulariaceae	OBL	X	
<i>Polygonum arifolium</i>	Halberd-leaved tearthumb	Polygonaceae	OBL	X	
<i>Symplocarpus foetidus</i>	Skunk cabbage	Araceae	OBL	X	
<i>Viola cucullata</i>	Marsh blue violet	Violaceae	FACW+, OBL	X	

Appendix vi: Non Native Species and Management Recommendations

DOCUMENTED INVASIVE SPECIES					
SCIENTIFIC NAME	COMMON NAME	FRUITS & SEEDS	LEAF	FLOWERING	RECOMMENDED TREATMENT
<i>Paulownia tomentosa</i>	Princess Tree	January through the beginning of February		Mid March through June	Cut tree and paint Cambium with 20% glyphosate *do not cut while seed bearing, treat after cutting
<i>Rosa mutiflora</i>	Multiflora Rose	Mid June (unripe) till end of December (some fruit still present on stems)	Mid April till frost	May- June	Remove plants and roots. Weed wrench recommended
<i>Lonicera japonica</i>	Japanese Honeysuckle	Mid July through Sept	Leaves green all year	May through Sept	Cut and paint
<i>Polygonum cuspidatum</i>	Knot Weed	Fruit present on stems through the year, fruiting from July through November.	Mid March until Frost	Begins to bud Mid March and in full flower till October	Cut back in spring. use glyphosate, spot treatment when flowering
<i>Hendera Helix</i>	English Ivy	Fruits on plant in May	Leaves green all year	Mid August through October	Cut and paint. Additionally pull by hand.
<i>Vinca Minor</i>	Periwinkle	Spreads by rhizomes	Leaves green all year	May to June	Can be pulled, raked or dug. Can also cut back in early spring and spray with glyphosate on the resprouts. It should be resprayed July to October for successive years.
<i>Acer platanoides</i>	Norway Maple	Seeds June till mid August. Seeds are wind dispersed.	May through the beginning of December	mid to late april	Seedlings are easy to pull when the soil is moist. Larger plants, make sure to get all the roots for large trees, girdle the tree in spring.
<i>Alanthus Altissima</i>	Tree of Heaven	Seeds are produced from late summer through early fall. In flat winged fruits called samaras. Seedlings establish a taproot 3 months after germination.	Mid April to Mid November	from May to early June	Seedlings are easy to pull when the soil is moist. Scrape and paint.
<i>Morus Alba</i>	White Mulberry	Flowers and fruits produced in spring	May through the beginning of December	late spring	Cut and paint, younger sprouts can be pulled out by hand.
<i>Artemisia vulgaris</i>	Mugwort	August to October	April to December	Flowers July through to September	Spray and pull

Appendix vii: Definitions

Invasive Species:

Federal Executive Order 13112 of 1999 defined an “invasive species” 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. This definition covers all organisms, including vascular plants, animals (including invertebrates), fungi, bacteria and viruses. For the purposes of this report, “non-native” refers to plants not indigenous to our area prior to European settlement.

End of Report