Natural Heritage Program Survey Report of the Wandendale Regional Wastewater Treatment and Disposal Project

Tax Parcels: 234-7.00-127.00, 234-7.00-130.00,
234-11.00-48.00 and 234-11.00-50.00
Midway, DE (Sussex County)
Rehoboth Bay Watershed

Submitted to:
Kenneth L. Davis, P.E.
CABE Associates, Inc.
144 South Governors Ave.
Dover DE 19903

Completed by:
Robert Coxe, Environmental Scientist – Ecology
Anthony Gonzon, Environmental Scientist – Wildlife
William A. McAvoy, Environmental Scientist – Botany

Delaware Natural Heritage and Endangered Species Program
Wildlife Section, Delaware Division of Fish and Wildlife
Department of Natural Resources and Environmental Control
4876 Hay Point Landing Road
Smyrna, DE 19977

Report Submitted:
September 11, 2009

Introduction

The Wandendale Regional Wastewater Treatment and Disposal Project, located in Sussex County, Delaware, was visited by Delaware Natural Heritage and Endangered Species Program (DNHESP) Environmental Scientists[1] within the Delaware Division of Fish and Wildlife, Department of Natural Resources and Environmental Control (DNREC).

The purpose of the site visit was to classify and map vegetation communities on site and to survey and assess habitat conditions for plants and birds of conservation concern. The site was initially evaluated for vegetation communities and for habitat that could support bird species of conservation concern on July 16th 2009. A rare plant survey was conducted on a small portion of the site on July 21st, 2009.

This report summarizes the vegetation communities, plants and birds observed on July 16 and 25, 2009 on Tax Parcel #s 234-7.00-127.00, 234-7.00-130.00, 234-11.00-48.00 and 34-11.00-50.00 (Figure 1). The vegetation characterization, observations of plants and birds, and associated qualitative assessment of habitats provided in this report are intended to assist the project applicant with current and future plans for expanding spray irrigation operations.

The area surveyed totaled 154.6 acres and was comprised of a mixture of agricultural fields, tidal marsh, wooded area and small amount of developed area (Figure 1). All of the marsh communities located by Love Creek were aerially interpreted using 2002 imagery due to the thickness of the eastern reed grass on the edge of the marsh. In general the marsh communities can be better mapped from aerial photos than by ground observation. All of the communities surveyed at Wandendale can be described as being in good condition and most are very mature. The southernmost stands appear to be receiving deer browse pressure (Figure 11) and some standing snags are present (Figure 12).

Summary of Findings

1. Vegetation Communities: The Wandendale site was classified and mapped for vegetation communities and is composed of fifteen vegetation communities and three land covers. Agricultural Field (180 acres) is the largest land cover. Northeastern Dry Oak-Hickory Forest (37 acres), Southern Red Oak/Heath Forest (31 acres), and Successional Tuliptree Forest (24 acres) are the largest vegetation communities at the site. The forests found on the Wandendale Property are good mature examples of the community types.

2. Avian Survey: Other than Black Vulture (state-rare), no state-rare or federally listed species were observed at this site. Although Osprey aren't state or federally listed, they are a Species of

[1] DNHESP scientists participating in the field survey included Robert Coxe (vegetation ecologist), Bill McAvoy (botanist) and Anthony Gonzon (wildlife scientist).

Greatest Conservation Need (SGCN[2]) and their nests are federally protected when containing eggs or chicks. No direct impacts to Osprey are anticipated as this species is most likely to nest immediately adjacent to open water or on structures above the open water. Several additional SGCN were observed during the survey (Table 1). It is important to note that this survey was conducted near the end of the peak breeding period for most species in Delaware and is not the best time to assess area use by the avian community. To further address concerns about rare, threatened or endangered species and to accurately access habitat use, additional surveys should be conducted during the peak breeding period, April 15 through July 31, particularly during June. Additionally, any tree clearing that might occur should be conducted outside the above window.

- **Nesting Habitat Quality**: Multiple standing snags, downed trees, and excavated tree holes were observed at this site. These cavities and the snags they are located in are important for a suite of cavity-nesting species that are often limited by available nest and roost site. Care should be taken to minimize reducing the number of snags and other potential cavity locations during construction.

3. Rare Plants: Six state rare and uncommon plants were discovered during surveys of this property (Fig. 13): *Juncus subcaudatus,* woodland rush, S1 (extremely rare, known from 1 to 5 populations statewide); *Dryopteris celsa*, log fern, S2 (very rare, known from 6 to 10 populations statewide); *Isoetes engelmannii*, Engelmann's quillwort, S2; *Agrimonia gryposepala*, tall hairy agrimony, S3 (uncommon, known from 21 to 50 populations statewide); *Alnus maritima,* seaside alder, S3; and *Carex typhina*, cattail sedge, S3. More detailed population data and management recommendations can be found in the descriptions of the vegetation communities in which they were found.

Recommendations

1) The forests found on the Wandendale Property are generally good mature examples of the community types. There are concerns regarding the long-term impact of spray irrigation on ground water due to increased run-off and on soil salinity. Please refer to our original letter dated June 22, 2009 for concerns about potential impacts of wastewater on wildlife that inhabit forested areas, specifically ground nesting birds and amphibians. Recommendations provided in this letter should still be considered.

2) Rare plants were found within the Red Maple-Seaside Alder Woodland community and the Red Maple-Sweetgum Swamp (described below). In order to maintain these state rare species, it

[2] Species of greatest conservation need (SGCN) are indicative of the overall diversity and health of the State's wildlife resources. Some may be rare or declining, others may be vital components of certain habitats, and still others may have a significant portion of their population in Delaware. SGCN are identified in the Delaware Wildlife Action Plan (DEWAP) which is a comprehensive strategy for conserving the full array of native wildlife and habitats-common and uncommon- as vital components of the state's natural resources. This document can be viewed via our program website at http://www.dnrec.state.de.us/nhp. This document also contains a list of species of greatest conservation need, species-habitat associations, and maps of key wildlife habitat.

is recommended that the upland buffer be expanded to avoid or minimize runoff and nutrient enrichment.

3) Rare plants were found within the Successional Tuliptree Forest and the Northeastern Dry Oak-Hickory Forest. In order to maintain these rare plant populations, it is recommended that the tree canopy remain intact, and soil disturbance and nutrient enrichment be avoided. Nutrient enrichment to these sites will likely result in the explosion of non-native invasive plants that could overrun the communities.

4) If tree clearing is unavoidable, it should not occur during the nesting season, April 15 to July 31st, to minimize impacts to breeding birds. Care should be taken to protect any standing snags or trees with natural cavities as these will support multiple avian species and other vertebrates throughout the entire year.

5) To further address concerns about rare, threatened or endangered species and to accurately access habitat use, additional surveys should be conducted during the peak breeding period, April 15 through July 31, particularly during June.

6) Surveys weren't conducted specifically for amphibians and reptiles, so species distribution and habitat use are unknown. However, a box turtle was observed within the transition zone between the Southern Red Maple-Black Gum Swamp and Southern Red Oak/Heath Forest. Because box turtles have relatively small home ranges, we recommend impacts to this forest be avoided or minimized.

Survey Findings

Historical Analysis of the Site

An examination of 1937 photos (Figure 2) reveals little change in the overall character of the properties associated with this site. All of the wooded areas are wooded and the agricultural areas are the same in 1937 as they are in 2007 (Figure 3).

Soils and Geology

Most of the site is underlain by the sediments of the Omar Formation. The far northern parcel (234-7.00-130.00) is underlain by more recent Holocene deposits. All of the sites have a ground water table that is less than 10 feet below the surface. Elevations at the site range from sea level at Love Creek on the north end of the property to 12 feet at the southwestern end of the property. Soil types present at Wandendale include Downer Sandy Loam, Downer Loamy Sand, Greenwich Loam and Broadkill Mucky Peat. Other minor soils include Fallsington Loam, Evesboro Loamy Sand, Askecksy Loamy Sand and Fort Mott-Henlopen Complex.

Descriptions of the Vegetation Communities

Vegetation communities were determined by qualitative analysis, observations made in the field on July 16, 2009 and aerial-photo interpretation using both 2002 and 2007 imagery.

Fifteen vegetation communities and three land covers were noted in the survey (Figure 1). Vegetation communities are named according to the *Guide to Delaware Vegetation Communities*[3] which follows the National Vegetation Classification (NVC) System[4]. The NVC classifies vegetation on a national scale for the United States and is linked to the international vegetation classification. The NVC helps provide a uniform name and description of vegetation communities found throughout the country and helps determine relative rarity.

The NVC association number is given with the vegetation community and their approximate acreage in the project area. Names of communities correspond with the common names as given in the NVC and the *Guide to Delaware Vegetation Communities.*

Ecological Integrity Assessments (EIAs) were done on the Northeastern Dry Oak-Hickory Forest north of Sarah Run, the Southern Red Oak/Heath Forest north of Sarah Run and the Northern Coastal Plain/Piedmont Basic Mesic Hardwood Forest that is near Love Creek. EIAs help to determine rank of the vegetation communities. Vegetation communities are given a grade of A to D depending on the amount of wooded buffer, maturity and others. The results are below:

1. Northeastern Dry Oak-Hickory Forest (3.41 rating for a C)
2. Southern Red Oak/Heath Forest (4.05 rating for a B)
3. Northern Coastal Plain/Piedmont Basic Mesic Hardwood Forest (4.16 rating for a B)

Vegetation Community Descriptions

The vegetation communities include:

1. Cultivated Lawn (CEGL008462)—3 acres
2. Mid-Atlantic Coastal Plain Loblolly Pine Forest (CEGL006040)—3 acres
3. North Atlantic High Salt Marsh (CEGL006606)—1 acre
4. North Atlantic Low Salt Marsh (CEGL004192)—15 acres
5. Northeastern Dry Oak-Hickory Forest (CEGL006336)—37 acres
6. Northeastern Old Field (CEGL006107)—7 acres
7. Northeastern Successional Shrubland (CEGL006451)—0.2 acres
8. Northern Coastal Plain/Piedmont Basic Mesic Hardwood Forest (CEGL006055)—6 acres
9. Red Maple-Seaside Alder Woodland (CEGL006317)—1 acre
10. Red Maple-Sweetgum Swamp (CEGL006110)—3 acres
11. Reed Tidal Marsh (CEGL006187)—2 acres
12. Southern Red Maple-Black Gum Swamp (CEGL006238)—7 acres
13. Southern Red Oak/Heath Forest (CEGL006299)—31 acres
14. Successional Tuliptree Forest (CEGL007220)—24 acres

---

[3] Coxe, Robert. 2009. Guide to Delaware Vegetation Communities - Summer 2009 version. Delaware Division of Fish and Wildlife. 451pp.Unpublished Report.

[4] Anderson, M., P. Bourgeron, M. T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D. H. Grossman, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A. S. Weakley. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: list of types. The Nature Conservancy, Arlington, Virginia, USA. 502 pp.

15. Pennsylvania Smartweed, Barnyard Grass, Devil's Beggar's Tick Wetland—5 acres

The land covers include:

1. Agricultural Field—180 acres
2. Impervious Surface—2 acres (mainly at the Wandendale Hunting Club)
3. Water—0.5 acres (edge of Love Creek)

***Cultivated Lawn* (11.0 acres)**

This community is composed of grasses that are mowed more than once a year and planted ornamental plants. At the Wandendale site it occurs mainly on roadsides.

***Mid-Atlantic Coastal Plain Loblolly Pine Forest* (3 acres)(Figure 4)**

This community is located on a low elevation bluff on the south-side of Love Creek. Mature loblolly pine (*Pinus taeda*) and willow oak (*Quercus phellos*) compose the canopy and overtop an understory of wild black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), black gum (*Nyssa sylvatica*), American holly (*Ilex opaca*) and southern red oak (*Quercus falcata*). There is a high amount of black cherry in the understory, a trait which this stand shares with a Maritime Successional Forest and is indicative of its exposure to saline influence. Common greenbrier (*Smilax rotundifolia*) is common in the shrub and woody vine layer and is associated by wisteria (*Wisteria sinensis*) and blackberry (*Rubus* sp.). Only two herbs were noted from this community perhaps owing to the high acidity of the pine needles and the maritime location. The herbs included Virginia creeper (*Parthenocissus quinquefolia*) and pokeweed (*Phytolacca americana*).

***North Atlantic High Salt Marsh* (1 acre)**

This community is found scattered in the marshes of Love Creek in the northernmost parcel. Salt meadow cordgrass (*Spartina patens*) is the prominent species and may be joined by salt marsh cordgrass (*S. alterniflora*).

***North Atlantic Low Salt Marsh* (15 acres)**

This community is the most common marsh community at the site and is dominated almost exclusively by salt marsh cordgrass (*Spartina alterniflora*). Comparison with the 1937 aerial photos (Figure 2) to 2007 (Figure 3) aerial photos shows some widening the guts in the marsh perhaps due to the presence of more water.

***Northeastern Dry Oak-Hickory Forest* (37 acres) (Figure 5)**

This community is one of the rarer communities in the state and it is not yet known whether it is because they have not been found if they are actually rare. Other places where it is found include Bombay Hook National Wildlife Refuge and Woodland Beach Wildlife Area. The example at Wandendale contains a mixture of oaks and high amount of hickory. Southern red oak (*Quercus falcata*) and mockernut hickory (*Carya alba*) co-dominate the canopy and are associated by black oak (*Quercus velutina*), loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), tuliptree (*Liriodendron tulipifera*) and blackgum (*Nyssa sylvatica*). A few willow oak

(*Quercus phellos*), black walnut (*Juglans nigra*) and pond pine (*Pinus serotina*) are also present. The understory is composed of smaller members of the canopy plus a dominance of American holly (*Ilex opaca*) and smaller amounts of sweetbay (*Magnolia virginiana*) and sassafras (*Sassafras albidum*). The shrub and woody vine layer is composed of common greenbrier (*Smilax rotundifolia*), summer grape (*Vitis aestivalis*), strawberry bush (*Euonymus americanus*) and smaller and local amounts of Japanese honeysuckle (*Lonicera japonica*), privet (*Ligustrum vulgare*) and poison ivy (*Toxicodendron radicans*). Herbs are consistent and common throughout the stand. Some of the more common species include Virginia creeper (*Parthenocissus quinquefolia*), snakeroot (*Sanicula marilandica*), enchanter's nightshade (*Circaea lutetiana*), jack-in-the-pulpit (*Arisaema triphyllum*) and a local population of Christmas fern (*Polystichum acrostichoides*).

The example here appears to be present in the 1937 (Figure 2) although with a lower stature. It may have been cut in the early 1900s and has grown to the mature state that is presents today.

Rare Plants Found (Figure 13): *Agrimonia gryposepala*, tall hairy agrimony, S3 (uncommon, known from 21 to 50 populations statewide); about 25 plants were found scattered throughout a small area (ca. 20 x 20 meters square) on rich, loamy soil.
In order to maintain this population, it is recommended that the tree canopy remain intact, and soil disturbance and nutrient enrichment be avoided. Nutrient enrichment to this site could result in the explosion of non-native invasive plants that could overrun the site.

***Northeastern Old Field* (7 acres) (Figure 6)**

Part of the agricultural has been left fallow this season and is presently a Northeastern Old Field. Plant species in the field include Canada Horseweed (*Conyza canadensis*), dock (*Rumex crispus*), dandelion (*Taraxacum officinale*) and chinese clover (*Lespedeza stipulacea*).

***Northeastern Successional Shrubland* (0.2 acres)**

A small area of Northeastern Successional Shrubland is located on the edge of an agricultural field in the middle parcel. Species here include blackberry (*Rubus* sp.), multiflora rose (*Rosa multiflora*) and summer grape (*Vitis aestivalis*).

***Northern Coastal Plain/Piedmont Basic Mesic Mixed Hardwood Forest* (6 acres)**

This community is to the east of the gut jutting south from Love Creek on a rise. While not typical of the National Vegetation Classification (NVC) definition of this community, a similar example occurs at Prime Hook Wildlife Area. Like this one, the example at Prime Hook contains an understory of American holly and a minimum amount of herbs. This variant has been noted in the NVC as occurring in Delaware and at Prime Hook WA and the Wandendale example is apparently yet another example. In time this community may be separated out from the others.

Tuliptree (*Liriodendron tulipifera*) dominates the community and is associated by white oak (*Quercus alba*), mockernut hickory (*Carya alba*), southern red oak (*Quercus falcata*), red maple (*Acer rubrum*), and loblolly pine (*Pinus taeda*). The understory is composed of American holly (*Ilex opaca*) associated by red maple and tuliptree. No shrubs were documented from the

community and Japanese honeysuckle (*Lonicera japonica*) and poison ivy (*Toxicodendron radicans*) were documented from the woody vine layer. Other than the vine surprisingly few herbs were noted including Virginia creeper (*Parthenocissus quinquefolia*), cinnamon fern (*Osmunda cinnamomea*) and partridge-berry (*Mitchella repens*).

***Red Maple-Seaside Alder Woodland* (1 acre)**

This swamp community contains a scattered canopy of red maple (*Acer rubrum*) that overtops a shrub layer of seaside alder (*Alnus maritima*), sweet-pepper bush (*Clethra alnifolia*), sweetbay (*Magnolia virginiana*), highbush blueberry (*Vaccinium corymbosum*) and common greenbrier (*Smilax rotundifolia*). Herbs present include eastern reed grass (*Phragmites australis*), netted chainfern (*Woodwardia areolata*), cinnamon fern (*Osmunda cinnamomea*), jack-in-the-pulpit (*Arisaema triphyllum*), poison hemlock (*Conium maculatum*) and pennywort (*Hydrocotyle* sp.).

Rare Plants Found (Figure 13): *Juncus subcaudatus,*woodland rush, S1 (extremely rare, known from 1 to 5 populations statewide); 10 plants were found in a canopy gap within the swamp. *Alnus maritima,* seaside alder, S3 (uncommon, known from 21 to 50 populations statewide); many individuals observed scattered throughout the swamp.

In order to maintain these state rare species, it is recommended that the upland buffer be expanded to avoid or minimize runoff and nutrient enrichment.

***Red Maple-Sweetgum Swamp* (3 acres) (Figure 10)**

This community is located on Sarah Run and has a canopy heavily dominated by red maple (*Acer rubrum*) that is associated by a few sweetgum (*Liquidambar styraciflua*) and blackgum (*Nyssa sylvatica*). The understory is composed of sweetgum, American holly (*Ilex opaca*) and in the lower parts, sweetbay (*Magnolia virginiana*). The shrub and woody vine layer is scattered throughout the site and is composed of arrow-wood (*Viburnum dentatum*), common greenbrier (*Smilax rotundifolia*), poison ivy (*Toxicodendron radicans*). Some exotic invasive species, such as Japanese honeysuckle (*Lonicera japonica*) and privet (*Ligustrum vulgare*) are also present in this layer and are located primarily in the upper reaches of Sarah Run. The herb layer is rich in this example and one plant species of greatest conservation need and another possible one were located along the stream. Other more common herbs include netted chain fern (*Woodwardia areolata*), orange-spotted jewelweed (*Impatiens capensis*), wetland blue violet (*Viola cucullata*), rice cut-grass (*Leersia virginica*), three-way sedge (*Dulichium arundinaceum*) and poison hemlock (*Conium maculatum*). Asiatic dayflower (*Commelina communis*) was also noted to be growing in the floodplain.

Rare Plants Found (Figure 13): *Isoetes engelmannii*, Engelmann's quillwort, S2 (very rare, known from 6 to 10 populations statewide); 100's of plants found scattered on bare, saturated soil of Sarah Run, which appears to be an intermittent stream as there was no flowing water on this date. *Carex typhina*, cattail sedge, S3 (uncommon, known from 21 to 50 populations statewide); about 50 plants found scattered along the edges of Sarah Run.

In order to maintain these populations, it is recommended that the upland buffer be expanded to minimize soil runoff and sedimentation.

***Reed Tidal Marsh* (2 acres)**

This community is found on the edges of the North Atlantic Low Salt Marshes in the northernmost parcel by Love Creek. It dominated nearly completely by eastern reed grass (*Phragmites australis*).

***Southern Red Maple-Black Gum Swamp* (7 acres) (Figure 7)**

This community is located at the headwaters of a tributary to Love Creek near the intersection of DE Route 24 and Camp Arrowhead Road. The canopy is dominated by red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*) with an understory of black gum. Sweet pepperbush (*Clethra alnifolia*) is the primary shrub. Herbaceous plants are located in the soft mud areas on the edges of the stream and on the streambanks and include skunk cabbage (*Symplocarpus foetidus*), cinnamon fern (*Osmunda cinnamomea*), netted chain fern (*Woodwardia areolata*), hay-scented fern (*Dennsteadtia punctilobula*) and jack-in-the-pulpit (*Arisaema triphyllum*).

***Southern Red Oak/Heath Forest* (31 acres) (Figure 8)**

This community is located at the eastern end of the parcel that is located near the church and north of Sarah Run and on the north side of the middle parcel. White oak (*Quercus alba*), southern red oak (*Quercus falcata*), loblolly pine (*Pinus taeda*), Virginia pine (*Pinus virginiana*) and a few black oak (*Quercus velutina*) are found in the canopy. The understory is composed of persimmon (*Diospyros virginiana*), sassafras (*Sassafras albidum*), mockernut hickory (*Carya alba*), sand hickory (*Carya pallida*), flowering dogwood (*Cornus florida*) and a few eastern red cedar (*Juniperus virginiana*) and serviceberry (*Amelanchier canadensis*). Shrubs noted include lowbush blueberry (*Vaccinium pallidum*) and a few scattered highbush blueberry (*Vaccinium corymbosum*). Summer grape (*Vitis aestivalis*) and poison ivy (*Toxicodendron radicans*) are both woody vines in this community. Herbs are exceedingly few, which is typical for this community, and include deer-tongue grass (*Dichanthelium clandestinum*), false solomon's seal (*Maianthemum racemosum*) and partridge-berry (*Mitchella repens*).

This community appears to be mature (about 80 years old) judging by the low stature of the trees in the 1937 photos (Figure 2).

***Successional Tuliptree Forest* (24 acres) (Figure 9)**

This community is located in two locations within the parcels, one near the church and the other near the tributary to Love Creek. Tuliptree (*Liriodendron tulipifera*) dominates the canopy and is associated by white oak (*Quercus alba*) and pignut hickory (*Carya glabra*). Understory species appear to reflect the adjacent communities and include sassafras (*Sassafras albidum*), pignut hickory, American holly (*Ilex opaca*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), white oak and a few hercules-club (*Aralia spinosa*). Strawberry bush (*Euonymus americana*) was the only shrub noted. Japanese honeysuckle (*Lonicera japonica*) is found in dense quantities in the woody vine layer along with common greenbrier (*Smilax rotundifolia*) and blackberry (*Rubus* sp.). Indian pipes (*Monotropa uniflora*), Virginia creeper

(*Parthenocissus quinquefolia*), deer-tongue (*Dichanthelium clandestinum*), and snakeroot (*Sanicula marilandica*) are among some of the herbs seen.

The example in the middle parcel shows a thinner canopy in 1937 photos perhaps indicating that is had been recently cut. The example in the south parcel is present at about the same stature and the community present today appears to possibly succeeding to a Northern Coastal Plain/Piedmont Basic Mesic Hardwood Forest or a Northern Dry Oak-Hickory Forest.

Rare Plants Found (Figure 13): *Dryopteris celsa*, log fern, S2 (very rare, known from 6 to 10 populations statewide); 12 plants were found, consisting of about 25 fronds.

In order to maintain this population, it is recommended that the tree canopy remain intact, and soil disturbance and nutrient enrichment be avoided. Nutrient enrichment to this site will likely result in the explosion of non-native invasive plants that could overrun the site.

Wetland of Pennsylvania Smartweed, Barnyard Grass* and *Devil's Beggar's Ticks

A wetland dominated by Pennsylvania Smartweed (*Polygonum pensylvanicum*), barnyard grass (*Echinochloa crus-galli*) and devil's beggar's ticks (*Bidens frondosa*) is located just north of the Wandendale Hunt club in the northernmost parcel. This community does not match anything in the Guide to Delaware Vegetation Communities. This particular wetland is out of the area of impact for the spray irrigation field.

Avian Community Survey

All parcels were surveyed for birds on July 16, 2009. In total, 37 species were identified (Table 1) and with the exception of Black Vulture (state-rare), no rare, threatened, or endangered species were detected.

Given the survey was conducted late during the breeding season for many neotropical songbird species known to breed in Delaware, additional species are likely to occur annually within these parcels. Of the species detected, thirty-one species are very likely to breed on these parcels. In addition, habitat or potential nesting structures were observed that may support breeding for four additional species. Two observed species should be unlikely to breed at this site, but suitable foraging habitat exists.

Several snags, downed logs, and tree cavities were observed throughout the wooded parcels. Snags and cavities provide nesting and roosting habitat for multiple species detected within the project area. Ten species known to utilize cavities for either breeding or roosting were detected. Of these, the Northern flicker and great crested flycatcher are identified as Species of Greatest Conservation Need

Ovenbird was the only ground-nesting species observed during the survey, and an Ovenbird nest was discovered along the edge of the eastern parcel bordering Love Creek. Although this species was not detected on other parcels, adequate leaf litter was present and the habitat is suitable for nesting throughout the site. Since this is strictly a ground-nesting species, it is most likely to be directly impacted by any changes in the groundcover structure or other changes on the forest floor.

Reptile Occurrence

Surveys were not conducted for amphibians or reptiles, but a single Eastern box turtle (*Terrapene carolina carolina*) was observed during Avian surveys. It was found within the transition zone between the Southern Red Maple-Black Gum Swamp and Southern Red Oak/Heath Forest (Figure 14.) Eastern box turtles are upland turtles that use forests, forest edges and wetlands as primary habitat. Females use open, sunny areas from May until late June to lay eggs and both males and females often use open areas along or near woodlands for basking.

Although box turtles receive no legal protection in the state of Delaware (other than laws restricting collection and possession), they are listed as a SGCN[2] in the Delaware Wildlife Action Plan due to regional collection pressure and loss of habitat. Although box turtles are generally considered a common species, they are recognized by many herpetologist as a species highly susceptible to extirpation (local extinctions) due to a variety of factors. These factors include:

High mobility: Although their normal home range is only about the size of a football field, they need a variety of habitat types to complete their life cycle. In developing areas, these habitat types are often bisected by roads and box turtles are hit by cars while trying to reach different parts of their home range.

Pet Trade: Many box turtles are permanently removed from the wild by both individuals wishing to keep one or two for pets and by whole-salers wishing to make a profit by selling wild box turtles to pet stores and foreign markets. An estimated 27,000 box turtles were exported to foreign countries from the United States alone in 1992.

Life History Traits. Box turtles have both low reproductive rates (produce few viable eggs/year and most nests and hatchlings are quickly lost to predation) and a late age of first reproduction (box turtles do not start reproducing until they are between 7-10 years old). The mixture of these two factors along with the longevity of adults can cause failing populations to appear healthy. Populations can be experiencing no effective reproduction and still maintain a relatively large number of adults. Therefore, because adults can be seen long after recruitment has been eliminated, failing populations can be perceived as viable.

Reproductive Needs: Box turtles have only been found to locate mates visually. They do not appear to smell or otherwise sense mates. Because mate-finding is so opportunistic, box turtle densities within a given habitat need to be high in order to maintain consistent breeding opportunities. As individuals are removed from populations, the chance of encountering mates is diminished, resulting in reduced mating, and therefore reduced genetic exchange.

Table 1. Bird species detected at the site of the proposed Wandendale Spray Irrigation Site.

Common Name	Species Name	DE SGCN[1]	Breeding Likely?	Cavity User
Great Blue Heron	*Ardea herodias*		UNLIKELY	
Black Vulture	*Coragyps atratus*	Tier 2	POSSIBLE	
Turkey Vulture	*Cathartes aura*		POSSIBLE	
Osprey	*Pandion haliaetus*	Tier 1	POSSIBLE	
Red-tailed Hawk	*Buteo jamaicensis*		POSSIBLE	
Mourning Dove	*Zenaida macroura*		YES	
Eastern Screech-owl	*Megascops asio*		YES	X
Red-bellied Woodpecker	*Melanerpes carolinus*		YES	X
Downy Woodpecker	*Picoides pubescens*		YES	X
Northern Flicker	*Colaptes auratus*	Tier 2	YES	X
Pileated Woodpecker	*Dryocopus pileatus*		YES	X
Eastern Wood-pewee	*Contopus virens*		YES	
Acadian Flycatcher	*Empidonax virescens*		YES	
Great Crested Flycatcher	*Myiarchus crinitus*	Tier 2	YES	X
Red-eyed Vireo	*Vireo olivaceus*		YES	
Blue Jay	*Cyanocitta cristata*		YES	
Purple Martin	*Progne subis*		UNLIKELY	
Tree Swallow	*Tachycineta bicolor*		YES	X
Barn Swallow	*Hirundo rustica*		YES	
Carolina Chickadee	*Poecile carolinensis*		YES	X
Tufted Titmouse	*Baeolophus bicolor*		YES	X
Carolina Wren	*Thyrothorus ludovicianus*		YES	X
Blue-gray Gnatcatcher	*Polioptila caerulea*		YES	
Wood Thrush	*Hylocichla mustelina*	Tier 1	YES	
American Robin	*Turdus migratorius*		YES	
Gray Catbird	*Dumetella carolinensis*		YES	
Brown Thrasher	*Toxostoma rufum*	Tier 2	YES	
Ovenbird	*Seiurus aurocapilla*		YES	
Summer Tanager	*Piranga rubra*		YES	
Scarlet Tanager	*Piranga olivacea*	Tier 2	YES	
Northern Cardinal	*Cardinalis cardinalis*		YES	
Blue Grosbeak	*Passerina caerulea*		YES	
Indigo Bunting	*Passerina cyanea*		YES	
Red-winged Blackbird	*Aeglaius phoeniceus*		YES	
Common Grackle	*Quiscalus quiscula*		YES	
Brown-headed Cowbird	*Molothrus ater*		YES	
American Goldfinch	*Carduelis tristis*		YES	

[1]Delaware Species of Greatest Conservation Need, as identified by the Delaware Wildlife Action Plan.

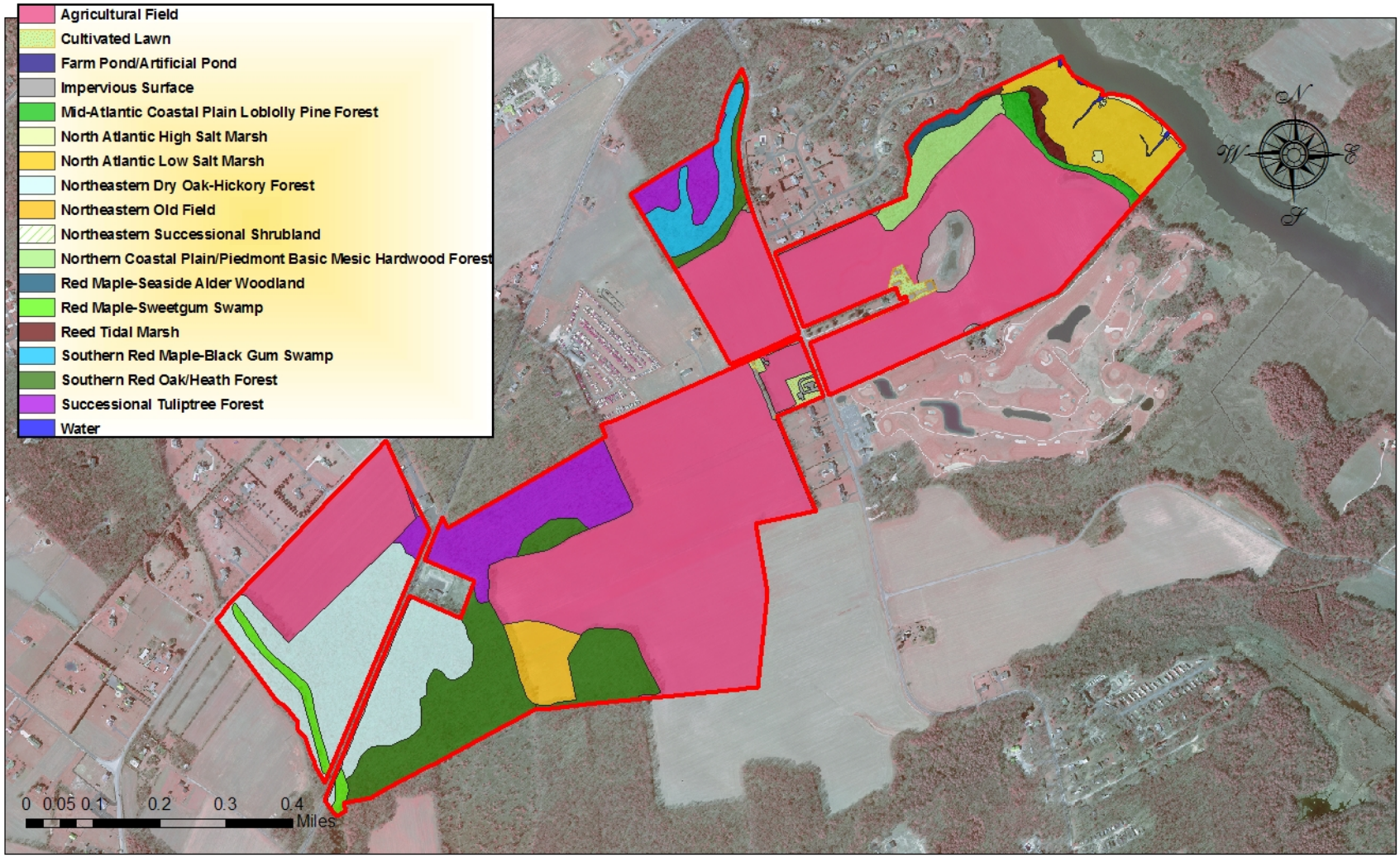

Figure 1. Vegetation Communities and Land Covers at Wandendale Spray Irrigation Site, Sussex County, Delaware

Figure 2. 1937 Aerial View of the Wandendale Site

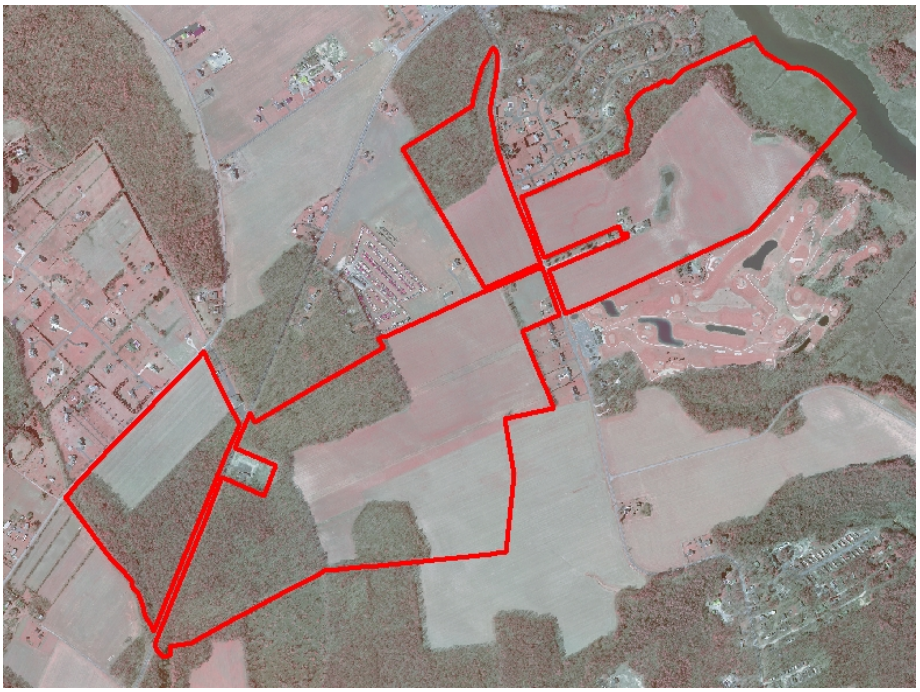

Figure 3. 2007 Aerial View of the Wandendale Site

Figure 4. Mid-Atlantic Coastal Plain Loblolly Pine Forest

Figure 5. Northeastern Dry Oak-Hickory Forest

Figure 6. Northeastern Old Field

Figure 7. Southern Red Maple-Black Gum Swamp

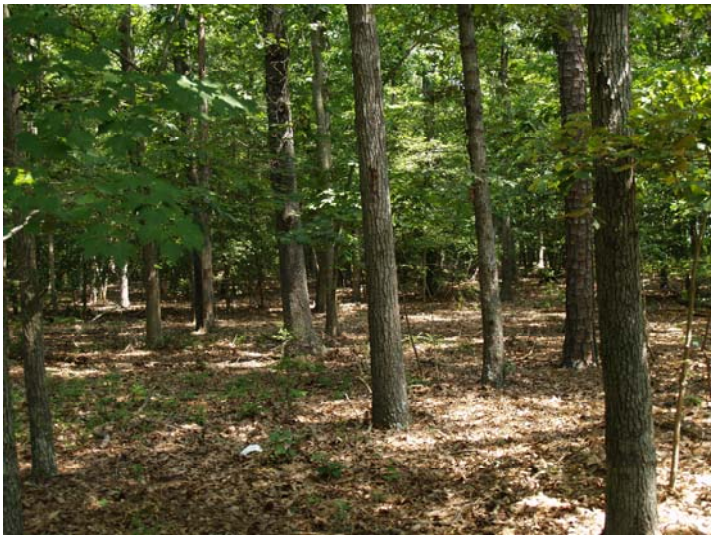

Figure 8. Southern Red Oak-Heath Forest

Figure 9. Successional Tuliptree Forest

Figure 10. Red Maple-Sweetgum Swamp

Figure 11. Evidence of Deer Browsing

Figure 12. Picture of Standing Snag

State Rare and Uncommon Plants

Agrimonia gryposepala, tall hairy agrimony, S3

Dryopteris celsa, log fern, S2

Isoetes engelmannii, Engelmann's quillwort, S2
Carex typhina, cattail sedge, S3

Juncus subcaudatus, woodland rush, S1
Alnus maritima, seaside alder, S3

Figure 13.

State Rare and Uncommon plants found during surveys of the Wandendale spray irrigation site.

Figure 14. Approximate location of Eastern box turtle.