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Ecological Evaluation

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DRAFT

ECOLOGICAL EVALUATION
For

BOONTON RESERVOIR
PROPOSED RECREATION TRAIL PROJECT

Town of Boonton and Parsippany-Troy Hills Township
Morris County, NJ

August 27, 2019

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1.0 INTRODUCTION

At the request of Open Space Institute (OSI), Amy S. Greene Environmental Consultants, Inc. (ASGECI) is conducting an Ecological Inventory and Floristic Quality Assessment of a proposed project site located in the town of Boonton and Parsippany-Troy Hills Township, Morris County, New Jersey (see Appendix A, Figures). The investigation was conducted on multiple visits between May and August, 2019. The property is located east of I-287 and south of the Town of Boonton (see Section 2, Figure 1). The investigation was conducted in preparation for the design of an approximate 7.5-mile public recreational trail around the existing Boonton Reservoir and associated amenities.

The project study area shown in the figures represents the existing limits of the Boonton Reservoir of approximately 1,200 acres (including open water); however, the actual footprint and potential direct impact of the project is expected to be substantially smaller than what is shown.

2.0 METHODOLOGY

ASGECI reviewed existing mapping and data including NJDEP Landscape Mapping v 3.3; SSURGO soils mapping; NJDEP wetlands mapping; NJDEP Land Use and Land Cover Mapping; NJDEP Floodplain Mapping; NJDEP Natural Heritage Project Data; and US Fish and Wildlife Service (USFWS) Information, Planning and Consultation (IPaC) System for data on Federally protected species. This information collectively provides a basic understanding of the ecological characteristics and limitations of the Boonton Reservoir that may be further developed through field evaluations.

ASGECI has conducted several field studies at Boonton Reservoir to date, each of which as added to the preparation of the Ecological Evaluation Report. Field investigations have focused on general site orientation, drainage evaluation, wetland identification and delineation, wildlife and ecological evaluation, and Floristic Quality Index (FQI) data collection. To increase efficiency and effectiveness of field visits, biologists collected target data and also recorded anecdotal ecological observations of significance during each field visit. The following are summaries of the data collection events:

2.1 Floristic Quality Index (FQI)

The FQI (Swink and Wilhelm 1979, 1994) is a bioassessment method estimates the quality and diversity of vegetation communities based on a set value for each identified plant species. The values are based on the sensitivity of the plant species to disturbance. FQI plots consist of a 10M X 10 m square in which all plant species are identified (to species level) and recorded. Cover or density data is not taken in the plot. Site visits will occur throughout the remaining growing season of 2019 and will continue into the spring and early summer of 2020 so a complete growing season of data is collected. A total of seven plot sampling events will occur. Upon completion of vegetation data collection, an FQI score for the reservoir property vegetation communities will be calculated using the data from each sample plot.

The first FQI visit was conducted on 6-26-18 to characterize and facilitate mapping of general vegetation communities to be studied, establish (flag and GPS locate) vegetation sampling plots for each community, familiarize biologists with the general ecological conditions onsite, and finalize data collection logistics. FQI plots 1 through 6 were created and evaluated on this date. A seventh plot was created and evaluated on 8-1-19. Plots were semi-randomly selected in the most common vegetation communities onsite including PFO and PEM wetlands, secondary successional upland, and mature upland forest. To better evaluate floristic quality in all

communities throughout the site, ASGECI is developing a general list of all plants identified during all field assessments, and has collected additional vegetation community data at various locations throughout the reservoir (see Appendix D).

Collection of baseline FQI data will help evaluate the existing ecological value and function of the various communities onsite, determine potential impacts of future projects, and assist in developing future ecological management initiatives for the site. To assist in the description of plant communities, *Classification of Vegetation Communities of NJ* (Breden et al) was utilized. The approximate boundaries of each vegetation community identified within the study area have been mapped based on the habitat field survey.

2.2 Wetland Delineation

To assist with determining wetland project impacts for future permitting and determining methodologies needed for trail development and drainage improvements; ASGECI conducted a wetland delineation of all wetlands within 150 feet of the proposed trail (see Wetland Report under separate cover). The wetlands on the project site were delineated and documented between July 23, 2019 and August 2, 2019, and on August 7, 2019. The wetland flags were recorded by VS Land Data during August, 2019. This delineation was performed in accordance with methodology outlined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation, 1989).

2.3 Drainage Investigation

ASGECI and the project engineer from Rippled Waters, Inc. conducted visits on two occasions to evaluate draining conditions onsite, specifically along the northern and western shores of the reservoir where significant washout, erosion, sedimentation and accumulations of debris have occurred. These visits occurred to help inform and develop solutions to (runoff volume and quality) drainage issues associated with these locations. These solutions include use of bio-retention logs and/or biofilter cells planted with native vegetation (see Stormwater Management Report under separate cover).

2.4 Wildlife and Habitat Investigation

During all surveys, ASGECI conducted wildlife evaluations that involved habitat assessment, as well as documentation of observed terrestrial wildlife (see Table 4). This data was collected to better determine how wildlife is utilizing onsite communities and resources, to determine ecological function and value of the site, to determine potential impacts associated with trail development and increased human presence onsite, to aid in project permitting compliance, and to aid in the development of site-specific wildlife management recommendations. Specific wildlife ecological conditions that were evaluated include threatened and endangered species habitat and potential presence (based on agency documentation and data); migratory, wintering and nesting forest bird species and use; common wildlife usage; and invasive or nuisance wildlife presence.

3.0 SITE DESCRIPTION

3.1 Introduction

Boonton Reservoir consists of a mix of vegetation communities with deciduous forests of varying types being the most widespread. A total of approximately 400 acres of forest are established along the eastern, western and northern shores or the reservoir. Wetland forests are generally situated in lower portions of the site and along stream corridors. Significant open species exist 1.3 miles to the west (opposite of Rt. 287) and 1.4 miles to the southeast of the reservoir. These open species are separated from the reservoir by major roadways (Interstate 287); suburban

neighborhoods; and Route 46. The Rockaway River flows into the reservoir from the northwest under Parsippany Boulevard/Route 511 (see Appendix A, Figures).

3.2 Soils and Topography

Topography at the site is generally flat within the wetlands and slopes downward to the reservoir from surrounding upland forest and residential development. The eastern western portions of the study area contain upland peaks with elevations of 360 to 370 feet above mean sea level (AMSL). These areas slope downward to elevations of 300 feet AMSL along the reservoir shoreline. The associated slopes range 8 to 25 percent based on Soil Survey Geographic (SSURGO) slopes data. Elevations as low as 280 feet AMSL exist within wetlands along the southeastern portion of the site (See wetland Report, Wetland Q). Wetlands fringing the reservoir shore and in most lowland areas are found at elevations between 320 to 305 feet AMSL. Soil types onsite are generally loams or sandy loams and often contain large amounts of cobble and boulder sized stones, particularly in sloping upland areas.

3.3 Surface Water

The nearest surface waters include the Boonton Reservoir, Troy Brook located south of Route 46, and the main stem and tributaries of the Rockaway River, which flows into the study area in the northwest corner of the reservoir and exits over the outfall spillway (Boonton Dam) on the northeastern end of the site. In addition to the Rockaway River, there are several unnamed stream tributaries or intermittent stream channels onsite. These streams and associated wetlands drain to the reservoir and Troy Brook via culverts under Route 46. The 100-year floodplains in the study area are primarily contained within the corridor of the Rockaway River, the reservoir itself, and some wetlands adjacent to reservoir coves (see Appendix A, FEMA Floodplain Map and NJDEP Wetlands and Streams Map).

Nearly all onsite wetlands and waters are within the Rockaway River (Boonton Dam to Stony Brook) subdrainage basin (HUC 14 # 02030103030150) which has a surface water quality classification of Freshwater 2, Trout Maintenance, Category 1 (FW2- TM-C1). This includes all waters upstream of the reservoir outfall including the upstream Rockaway River and the reservoir itself. The Rockaway River below the outfall is classified as Freshwater 2, Non-Trout, Category 2 FW2 NT- C2 by the NJDEP. No trout-production waters were identified within the vicinity of the site.

3.4 Vegetation Communities

The following dominant vegetation communities were identified by ASGECI within Boonton Reservoir. Variation of species dominance exists within these communities.

TABLE 1: MAJOR VEGETATION COMMUNITIES AT BOONTON RESERVOIR

Community Type	Dominant Species Observed	Approx. Acres	Notes
Upland Deciduous Forest	red oak, white oak, sugar maple, Norway Maple, American beech, tulip poplar, Ashes	TBD	More established upland forest often with larger DBH trees, more common on larger slopes and hills onsite

TABLE 1: MAJOR VEGETATION COMMUNITIES AT BOONTON RESERVOIR			
Secondary Successional Forest	black locust, Norway maple, black cherry, black walnut	**TBD**	Characterized by clearing or ground disturbance in more recent decades. Early colonizer or exotic tree species.
Mixed Deciduous Forest	Upland deciduous forest with a white pine component	**TBD**	Important for potential bald eagle nesting and perching.
Early/Mid-Successional Uplands (Old Field)	Goldenrods, milkweed, Autumn olive, spotted knapweed, blackberries (*Rubus* spp.)	**TBD**	Highly variable – Primarily occurs on ecotonal edges of more dominant communities.
Maintained Lawn Uplands	Cool season grasses (*Festuca* and *Poa* spp.), yellow nutsedge, crab grass, Virginia buttonweed, plantain	**TBD**	Mowed areas near reservoir entrance, north shore and south shore. Lower ecological value.
Palustrine Forested Wetlands	Red maple, pin oak, green ash, American elm	**TBD**	Most common wetland community - in forest depressions, along streams corridors, low flat areas.
Palustrine Emergent Wetlands	Sedges (*Carex* spp,) woolgrass, green bulrush, soft rush, Cattails (*Typha* spp.), common reed	**TBD**	Periodically occurs as a lake fringe, edges or breaks of PFO, open portions of Wetland Q and II.

Upland Deciduous Forest

Upland forest communities of mixed age are common along both the central, eastern, and western shores of the reservoir. Although most locations include a similar diversity of species, there is significant variation in species dominance. Forests are typically range from 60% to 80% canopy cover and are mixed age. Upland forest tree diameters at breast height (DBH) generally range from 6" to 35" with most trees between 10 and 20". Periodic large "super canopy" trees were regularly observed in forests. Typically, the site's upland forests occur on gradual slopes and often contain areas with well drained soils that are interspersed cobble and boulders.

Sugar maple (*Acer saccharum*) dominant forest is common along both the eastern and western shores. Sugar maple areas may be co-dominated by oaks, particularly red oak (*Quercus rubra*) and white oak (*Quercus alba*), American beech (*Fagus grandiflora*) and bitternut hickory (*Carya cordiformis*). Other frequently observed upland forest canopy species include tulip poplar (*Liriodendron tulipifera*), red maple (*Quercus rubra*) black oak (*Quercus velutina*), white ash (*Fraxinus americana*), black birch (*Betula lenta*) and occasional shagbark hickory (*Carya ovata*). Portions of this forest, particularly along the western property boundary, contain the non-native Norway maple (*Acer platanoides*) as a co-dominant (see Appendix B, Photos D and E).

The subcanopy of the upland forests contains small, scattered populations of musclewood (*Carpinus caroliniana*), sassafras (*sassafras albidum*), and black cherry (*Prunus serotina*). Much of the understory of the mature forest on both the eastern and western shores is open with occasional non-native shrubs including Japanese barberry (*Berberis vulgaris*) and multiflora rose (Rosa multiflora). Composition of the understory (including the general absence of native vegetation) appears to be the result of intensive deer browsing. The herbaceous layer occasionally includes patches of graminoids such as poverty oats (*Danthonia spicata*) or Pennsylvania sedge (*Carex pennsylvanica*), and a variety of forbs including wood asters (*Aster* spp.), hawkweeds (*Hieracium* spp.), and striped wintergreen (*Chimaphila maculata*). Saplings such as young tulip poplar, maples or oaks were generally uncommon in the understory.

Secondary Successional Forest

Secondary successional forests are younger forests areas (indicating more recent disturbance) typically dominated by pioneer or other opportunistic woody species and often contain greater amounts of understory and herbaceous vegetation (see Appendix B, Photo D) . This community may also result as a product of fallen trees from blowdown or diseased trees (such as from emerald ash borer). The general DBH size of trees in these forested areas may be smaller than more mature forest areas and breaks in canopy coverage (< 50%) frequently occur. Dominant canopy trees vary by location onsite. The southern portion of the western shore is primarily dominated by larger black walnut (*Juglans nigra*) while some areas immediately south of the Rockaway River are dominated by stands of non-native black locust (*Robina pseudoacacia*). Other tree species that occur in these areas include black cherry, Norway maple, sassafras and the non-native tree-of-heaven (*Ailanthus altissima*) and occasional Eastern cottonwood (*Populus deltoides*).

Due to increased light penetration and deer avoidance/selection, the understory and herbaceous layers of these uplands may be dense with exotic species that are less palatable to deer. The most dominant of these species onsite is Japanese stiltgrass (*Microstegium vimineum*), which grows as dense monoculture mats in both wetlands and uplands. White snakeroot (*Ageratina altissima*) is also very common in the herbaceous layer. This native member of the aster family is not consumed by deer and subsequently is one of the most dominant herbaceous understory species in these communities onsite. The non-native smartweed, lady's thumb (*Persicaria maculosa*), was often observed interspersed with other herbaceous species. Other common species include the invasive garlic mustard (*Alliaria petiolata*), and occasional Jack -in-the-pulpit (*Arisaema triphyllum*). Common non-native shrub and vine species include dense stands of Japanese barberry (particularly along the northeastern shoreline) privet (*Privet* sp.), honeysuckles (*Lonicera* spp.), fox grape (*Vitis labrusca),* and wineberry (*Rubus phoenicolasius*). Common vines include the non-native oriental bittersweet (*Celastrus orbicularis*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*). A large open portion of successional forest adjacent to Wetland GG is dominated in the herbaceous layer by the highly invasive mile-a-minute vine (*Persicaria perfoliata*).

Mixed Deciduous/Coniferous Forest

A limited amount of forest onsite is mixed forest deciduous/coniferous forest onsite that primarily consists of the native white pine (*Pinus strobus*) interspersed with native deciduous trees including oaks, and tulip poplar. In these areas, the forest was generally dense and contained minimal understory species. Several larches (*Larix* sp. - likely planted) were observed interspersed among the pine in one location the western shore. These stands of pine, which are sheltered and often contain large trees, are particularly important for eagle nesting onsite (see Appendix B, Photos I and J).

Early or Mid-Successional Uplands

Ecotonal areas including forest edges, rocky shorelines, and semi-maintained locations onsite contain a mix of early (herbaceous dominant) or mid-successional (woody dominant) communities (see Appendix B, Photos G, H and K). These communities, when containing a woody cover component greater than 25% , are often referred to as "old field". These areas typically have a mix of native and exotic species and can vary greatly in composition. Monocultures of non-native mugwort (*Artemisia vulgaris*) are common along disturbed upland shorelines, forest edges, building edges and other disturbed areas. Other common successional species observed include non-native Autumn olive (*Elaeagnus umbellata*), non-native spotted knapweed (*Centaurea maculosa*), dogbane (*Apocynum cannabinum*), goldenrods (*Solidago* spp.) including rough goldenrod (*Solidago rugosa*), Canada goldenrod (*S. canadensis*), and sweet

goldenrod (*S. odora*); common milkweed (*Asclepias syriaca*); white snakeroot; late-flowering boneset (*Eupatorium serotinum*), daisy fleabane (*Erigeron annuus*), and Canada thistle (*Cirsium arvense*). Vines commonly observed in these communities include poison ivy (*Toxicodendron radicans*), Virginia creeper, wild strawberry (*Fragaria virginiana*) Japanese honeysuckle (*Lonicera japonica*), and field cinquefoil (*Potentilla simplex*) and wineberry or blackberries (*Rubus* spp).

Maintained Uplands

Heavily maintained (mowed) uplands are common along the reservoir on the northern and southern shores, and near the main entrance gate. These areas are dominated by common cool season grasses (*Poa* and *Festuca* spp.) as well as lesser amounts of smooth crabgrass (*Digitaria ischaemum*), small carpgrass (*Arthraxon hispidus*) and a variety of native and exotic forbs including white clover, (*Trifolium repens*), Virginia buttonweed (*Diodia virginiana*), blackseed plantain (*Plantago rugelli*), English plantain (*Plantago lanceolata*), heal-all (*Prunella vulgaris*), butter and eggs (*Linaria vulgaris*) and birdsfoot trefoil (*Lotus corniculatus*).

Palustrine Forested Wetland

Broad leaved deciduous forested wetlands are common and interspersed with forested uplands throughout the reservoir's eastern and western shores (see Appendix B, Photos A and C). These larger lowland forest wetlands often occur on level ground with small stream tributaries and contain open areas of bare mud, patches of standing water, or buttressed trees indicating extended periods of partial inundation. Examples of these include wetlands the central and southern part of the eastern shore (Wetlands I and Q) as well as wetlands along unnamed tributary corridors on the western shores (Wetlands HH and II). Some PFO wetlands, such as Wetland T and Wetland X on the northwestern portion of the site, occur on gentle rocky slopes where a small amount of drainage or seeping water can be observed. Other PFO wetlands occur as small forest depressions surrounded up upland slopes.

The most widespread wetland forest type onsite is the red maple swamp forest. Red maple is the dominant canopy species and the trees generally range from 10 to 20" DBH with 60-80% canopy closure. Common associate species in these wetlands include green ash (*Fraxinus pennsylvanica*), pin oak (*Quercus palustris*), and American elm (*Ulmus americana*). Other species observed include bitternut hickory, American Sycamore (*Platanus occidentalis*), swamp white oak (*Quercus bicolor*), black gum (*Nyssa sylvatica*) and occasionally silver maple (*Acer saccharinum*).

The PFO forest herbaceous layers vary in density. Some areas contain 100% cover of Japanese stiltgrass; as well as lady's thumb, water pepper and other *Persicaria* species. Other species commonly observed, (particularly in the most hydric locations) include skunk cabbage (*Symplocarpus foetidus*), fowl mannagrass (*Glyceria striata*), clearweed (*Pilea pumila*), spotted jewelweed (*Impatiens capensis*), and false nettle (*Boehmeria cylindrica*). Wetland shrubs were generally uncommon in forests with occasional highbush blueberry (*Vaccinium corymbosum*), or southern arrowwood (*Viburnum dentatum*) being observed.

Palustrine Emergent Wetland

These wetlands are herbaceous dominant and may occur onsite as a modified drainage feature or ditch (such as Wetlands P and R see Appendix B, Photo E), as an open component of a larger wetland complex (Wetlands Q and II – see Appendix B, Photo B), or as a shoreline fringe consisting of an interspersion of muddy and rocky areas (Wetlands G, Y, EE, and portions of FF). These wetlands tend to have higher plant diversity compared to other plant communities onsite. Common species observed include broadleaf cattail (*Typha latifolia*) and narrowleaf cattail

(*Typha angustifolia*), arrow-leaved tearthumb (*Persicaria sagittata*), green bulrush (*Scirpus atrovirens*), soft rush (*Juncus effusus*), tussock sedge (*Carex stricta*), lurid sedge (*Carex lurida*), fringed sedge (*Carex crinita*), hop sedge (*Carex lupulina*), yellow nut sedge (*Cyperus esculentus*), woolgrass (*Scirpus cyperinus*) smartweeds (*Persicaria* spp.), clearweed, false nettle, deer tongue grass (*Dichanthelium clandestinum*), spotted jewelweed, and monkeyflower (*Mimulus ringens*). Some PEM wetland areas with less inundation (such as portions of the roadside edge of Wetland Q) contain common wet meadow species such as Virginia mountain mint (*Pycnanthemum virginianum*), rough goldenrod (*Solidago rugosa*), blue vervain (*Verbena histata*) and grass-leaved goldenrod (*Euthamia graminifolia*).

In addition to species noted above, fringe wetlands along the reservoir edges occasionally contain some isolated trees including black willow (*Salix nigra*) and river birch (*Betula alleghensis*), as well as some highly aquatic wetland plants including Iris sp. and a few isolated examples of pickerelweed (*Pontederia cordata*) and arrow arum (*Peltandra virginica*). PEM wetland fringe communities tend to not to be extensive (under 1/10 acre), which limits their ecological significance relative to the larger the reservoir landscape.

3.5 Invasive Plants

Background

Increases in global commerce and transportation throughout over the twentieth century have created opportunities for exotic (non-native) species to be transported into new ecosystems where natural controls on their populations may not occur. These introductions may be intentional or incidental. As a result of the modern global economy, infestations of non-native species have become extremely common locally and throughout the world. While many introduced exotic species do not naturalize or appear to be ecologically benign, a percentage of these species become extremely harmful to ecosystems and are termed "invasive."

The New Jersey Invasive Species Council (NJISC) definition originally developed by the National Invasive Species Council defines an invasive species as "a species that is 1) nonnative to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health". Invasive species may be any introduced plant, fungus, animal, or microorganism that fits this definition.

Invasive species often have a set of common characteristics, including the tendency to be hearty and adaptable, the ability to reproduce rapidly, and the ability to outcompete other, often native, species. Compounding environmental issues, such as forest fragmentation, hydrological changes from development, and pollution, and browse impacts of native species from deer, livestock or other species will often exacerbate the introduction and impact of invasive species. In addition, there are many examples of the spread of various invasive species being linked to global climate change. The presence of invasive plants often results in a drop of overall species diversity, and a reduction ecological functions and values of a natural community. An interesting and problematic characteristic of many invasive plant species, such as garlic mustard, is allelopathy: their ability to utilize various chemical and structural methodologies for outcompeting native species.

Invasive Plant Species Onsite

All vegetation communities at Boonton Reservoir are affected by invasive species to varying degrees; however upland forests appear to be the communities most affected by invasive plants. The most common forest community invasive species include Japanese stiltgrass, Japanese barberry, Norway Maple, and mile-a-minute vine. Dense monocultures of Japanese stiltgrass are common in both upland and wetlands forests onsite and are often the dominant plant of the

herbaceous layer. Japanese stiltgrass tends to occur mostly in disturbed forest uplands and along the edges of wetlands. This plant has allelopathic properties (it can suppress the growth of native seedlings through chemical means). Barberry can reduce competition and forest regeneration by changing the pH of the surrounding soil. The presence of these species is exacerbated by deer selection. Deer avoid eating these species and prefer consuming native competitor plants. Mile-a-minute vine is an aggressive vine that grows in dense mats in forest breaks in several locations along the western shore. Norway maple is also an allelopathic plant and a common component of the sugar maple and oak upland forests along the western shore. Table 2 below identifies the most common exotic invasive plant species identified at Boonton Reservoir.

TABLE 2: COMMON INVASIVE PLANT SPECIES OBSERVED AT BOONTON RESERVOIR

Common Name	Latin/origin	Associated Communities Onsite	Environmental Concerns
Autumn Olive	*Elaeagnus umbellata* Asia	Occurs in successional areas - limited observations	Impacts natural plant succession alters soil nitrogen cycling.
Japanese Knotweed	*Polygonum cuspidatum* Asia	Periodically identified along the artificial rock water edges	Reduces plant and wildlife diversity. Alters water flow along streams.
Garlic Mustard	*Alliaria petiolata* Europe	Occurs in woodlands, floodplains, along trails and forest edges onsite.	Reduces native herbaceous diversity/lowers habitat quality. Displaces many native spring wildflower species of woodland habitats (allelopathic). Not consumed by deer.
Multiflora Rose	*Rosa multiflora* Asia	Forest edges/gaps and along edges of wetlands.	Produces dense thickets impenetrable to humans and wildlife. Outcompetes native species and reduces overall native species diversity.
Common Reed	*Phragmites australis* Europe (native var. exist)	Component of larger wetlands with open areas (particularly along south shore and along 287 near Wetland II.	Grows in dense monocultures that limit plant and wildlife diversity. May impact wetland hydrology through evapotranspiration.
Purple Loosestrife	*Lythrum salicaria* Eurasia	Very small amounts along wetland and open water edges	Dries wetlands, Reduces native plant diversity, impacts sensitive wildlife. Declines overall functions and values of the wetland.
Japanese Stiltgrass	*Microstegium vimineum* Asia	Extremely common and widespread. Monocultures occur in site floodplains, forested uplands, forested and open wetlands,	Grows rapidly in dense patches. Forms monocultures that smother forest understories. Reduces overall diversity and decreases native plant production.
Wineberry	*Rubus phoenicolasius* Asia	Common along wooded edges, secondary successional woods, and successional fields.	Forms impenetrable thickets that threaten certain rare plant communities.
Tree-of-Heaven	*Ailanthus altissima* China	Forest edges and gaps. Generally not a major forest component onsite.	Suppresses growth of native species (alleopahthic). Plant is somewhat toxic to humans. .
Honeysuckle spp.	*Lonicera* spp. Eurasia	Relatively common in secondary successional forest understories and early successional fields.	Forms dense monocultures that smother and collapse native plants resulting in a loss of plant regeneration.
Asiatic Bittersweet	*Celastrus orbiculatus*	Forest edges, open woodlands, fields, hedgerows and other	Smothers native trees/vegetation and kills them by shading, girdling and ultimately

TABLE 2: COMMON INVASIVE PLANT SPECIES OBSERVED AT BOONTON RESERVOIR			
Common Name	**Latin/origin**	**Associated Communities Onsite**	**Environmental Concerns**
	E. Asia	disturbed lands.	uprooting them..
Spotted Knapweed	*Centaurea stoebe* Europe	Small amounts observed in successional areas along reservoir shoreline.	Suppresses growth of native species through chemical (allelopathic) methods. Displaces native species with its taproot and increases erosion..
Norway Maple	*Acer platanoides* Europe, W Asia	Alluvial fields, disturbed sites, floodplain forests, planted species common in yards	Species can form dense monocultures that shade out native species.
Canada thistle	*Cirsium arvense* North America	Maintained areas, yards, agricultural areas, fields, grasslands	Canada thistle grows in dense patches through an aggressive root system and reduces quality of grasslands and riparian habitats for wildlife.
Mile-a-Minute weed	*Persicaria perfoliata* Asia	Very common along forest breaks on the western shore	Can grow up to 6 inches a day. Smothers native vegetation and penetrates the tree canopy, shading out the understory.

3.6 Floristic Quality Index Data

Floristic Quality Index data will be continually taken onsite throughout the growing season of 2019 and will continue into the early summer of 2020. Up to six sampling events will occur for each 10 x 10 M plot. Upon completion of data collection in June 2020, ASGECI will determine scores for each plot and the entire site collectively based on both plot data and the running plant list. ASGECI will prepare a conclusion and analysis of FQI scores at that time and incorporate it into the final report. A list of plant species identified in FQI plots is included in Appendix D. General FQI Plot Descriptions are included in Table 3.

TABLE 3: FLORISTIC QUALITY INDEX PLOT DESCRIPTIONS			
Name	**Community Type**	**Location Characteristics**	**Lat/Long**
Plot 1	Secondary Successional Forest –dense herbaceous understory	Narrow portion of southwest shore adjacent to Rt 287. Mix of pin oak, silver maple, sassafras, white oak	40.874804, -74.419825
Plot 2	Palustrine Emergent Wetland	Relatively diverse sedge and grass dominant portion of Wetland Q on southeastern portion of site.	40.868741,-74.409849
Plot 3	Palustrine Forested Wetland	Flooded red maple/pin oak forest adjacent to shoreline near forest access along northeastern shore. (Wetland C)	40.888983,-74.396489
Plot 4	Upland Deciduous Forest	Beech oak forest immediately west of roadway on eastern shore. Sparse understory	40.879956,-74.402035

TABLE 3: FLORISTIC QUALITY INDEX PLOT DESCRIPTIONS			
Plot 5	Secondary Successional Forest – dense herbaceous and shrub understory	Secondary successional forest with a mix of native and exotic species on northeastern portion of the site. Dense barberry.	40.887170,-74.398592
Plot 6	Palustrine Forested Wetland	Red maple dominant forested depression affected by a road berm and receiving offsite runoff from offsite impervious surfaces. Sparse understory.	40.875596,-74.403884
Plot 7	Upland Deciduous Forest	Mixed oak forest with red and white oak. Sparse understory with several forbs and grasses observed.	40.893103,-74.404511

3.6 Vegetation and Reforestation Recommendations and Considerations

Invasive Species Control

- Invasive species presence is a fundamental ecological problem within all Boonton Reservoir vegetation communities and control of any individual species is complex due to the persistence of seed banks or root material in the soil, compounding effects of deer population, and reintroduction from adjacent development. Therefore, any proposed control of invasive plants, particularly understory or herbaceous layer species, must carefully consider long-term maintenance including deer exclusion or control (see White-tailed deer Section).

- For long-term invasive species management (including full development of goals, objectives and strategies), an invasive species/deer management plan may be considered for the reservoir with cooperation from Morris County personnel. It is likely that a County-wide invasive species and/or deer control management plan is already developed. Such an existing plan or other local plans may serve as a template for developing a site-specific plan.

- Based on the urban location of Boonton Reservoir, it would be expected that other invasive species may occur onsite and not yet observed. It is important that reservoir managers develop a protocol to monitor for and identify new invasive species or new areas of establishment onsite. This could be established in conjunction with an education program that allows regular reservoir visitors to help identify and report observed invasive species. Quick identification and immediate action may result in the cost-effective elimination of a species before it fully establishes onsite.

- Prior to enacting any smaller scale habitat enhancement plantings associated with the proposed project, invasive species control and monitoring must be considered and implemented in the discrete location where the plantings are to occur. If any native plantings are not carefully planned and monitored, the vegetation community is likely to revert back to an invasive-dominant community.

- The species that currently appear to be the most problematic in terrestrial reservoir habitats include several forest understory/herbaceous layer species including Japanese stiltgrass, Japanese barberry, honeysuckles, and mile-minute vine. These species should be considered priority species for control. Other allelopathic species, including Norway maple and garlic mustard may also be impacting forest regeneration by suppressing native sapling growth (in combination with deer presence).

- Typical invasive species controls often include the careful and appropriate use of herbicides such as glyphosate applied by a State licensed and appropriately trained individual. Herbicides are typically applied by a licensed applicator by discretely spraying, injecting, or stem or cambium cutting and "paint" application (for shrubs or trees). It is understood that the use of herbicides may not be a feasible option as the site is a public water supply.

- Other methods that are utilized include removal by hand or mechanical means in discrete and manageable locations. Hand removal is the most habitat sensitive method but is labor intensive, time consuming, and likely less effective as seed stock and root fragments are more likely to remain. Mechanical removal may require multiple growing seasons to assure effective removal of remnant plants.

- Consultation with the Morris County Park system and/or expert foresters or ecological restoration specialists may result in the development of a feasible and practical approach to managing invasive species onsite.

Reforestation

- As discussed above, reforestation on any scale must be planned in conjunction with invasive species and deer control. The presence of these variables and the difficulty of their control presents a significant obstacle to reforestation. As a result, the ecological and economic cost vs. the benefit of significant reforestation must be carefully considered before planning and implementation.

- Assuming that the variables discussed could be controlled, ASGECI identified two forested areas currently overrun with invasive species that may be further evaluated for future invasive plant control and reforestation.

- One west shore location currently consists of a portion of open flat wetland and low upland woodland partially opened by the loss of ashes to emerald ash borer (see Appendix A, Vegetation Community Figure). Light penetration from the forest opening has led to the dense colonization of exotic herbaceous species including Japanese stiltgrass, lady's thumb, and mile-a-minute vine. Planted canopy recolonization species may include red maple, elms, or pin oak. Examples of understory species that may provide sufficient forage and shelter to passerines include dogwoods (*Cornus* spp), Viburnums (*Viburnum* spp.), or highbush blueberry.

- A second location to consider for reforestation consists of highly disturbed lowland and secondary successional forest along the northern portion of the west shore in the vicinity of Wetland F (see Appendix A, Vegetation Community Figure). This area has been historically disturbed by regular trail use, earth movement, and other factors. As a result,

this area has become densely colonized with Japanese barberry, Japanese microstegium and some exotic trees including Norway maple.

- Removal and control of barberry in the understory and replacement with native understory shrubs (see species identified in above bullet) would be a consideration in this location. The canopy is partially closed; however, replanting in discrete openings with pin oak, swamp white oak, or elms may be considered. Individual tree protection to avoid deer consumption would be required.

Stormwater Improvement Planting

- Several of the culverted drainage features along the west shore run from the property boundary to the western shore waterfront (see Wetland Report). These areas tend to be steep banked and lack native wetland vegetation due to the high velocity of runoff from adjacent Route 287 and urban areas. These features are degraded, subject to erosion and sedimentation from silt and sand as well as pollution from floatable plastics and roadside chemicals.

- As part of the proposed project, a combination of engineering solutions and native hydrophytic vegetation plantings are proposed to improve ecological conditions and potentially improve local water quality at these locations.

- Wildlife benefits resulting from the improvement to the drainage areas and local water quality may include increased or improved foraging areas for small fish such as dace or minnow species, native insects such as dragonflies, frogs, and reptiles such as water snakes. Some passerine birdlife may increase utilization of these areas for plant or insect foraging.

- A diversity of native plant species may be used depending on the hydric regime and light penetration. Native graminoids (sedge and grasses) that may be considered include (*Carex* spp.) sedges, grasses such as (*Panicum* spp.), rushes, (*Juncus* spp.) or bulrushes (*Scirpus* spp.). Aquatic forbs such as pickerel weed may also be considered. Shrubs that may be considered include dogwoods (*Cornus* spp) or viburnums (*Viburnum* spp.). These stormwater improvement strategies are further discussed in the Stormwater Report prepared for the project by Rippled Waters, Inc.

- Planting areas will be limited in scale and must be periodically monitored to assure long-term success. Invasive species control and deer exclusion must be incorporated.

Early-Successional Pollinator Planting

- It is understood that most maintained areas such as the reservoir berms and lawns near facility areas are required to be maintained with cool season grasses and regular mowing. However, some areas such a portion of the maintained field adjacent near the entrance to facility and around the north access gate present potential for pollinator planting based on the openness of the location and existing land uses.

- These areas are generally easy to maintain (occasional mowing during appropriate season – no lower than 6 inches) and relatively inexpensive to establish. The development of

such fields would require less regular maintenance than current cool season dominant areas and may be a more feasible alternative to reforestation projects in the short term.

- As with all managed plantings, deer and invasive species control would need to be carefully considered. This may include the need for high exclusion around discrete wildflower/grassland locations, and quick identification and hand removal of any colonizing invasive species monocultures.

- Plantings of warm season clump grasses such as *Andropogon* or *Panicum* spp. combined with various native wildflowers including milkweeds (*Asclepia*s spp.), asters (*Aster* spp), goldenrods (*Solidago* or *Euthamia* spp.), coneflower, field thistle, bee balm and cut plant (*Silphium perfoliatum*) would drastically improve the ecological value and function of currently maintained uplands.

- Native early successional grasslands have ecological value by providing nectaring and larval host plants to insects (including butterflies and honeybees). In addition, even small grasslands may be utilized by migratory or foraging grassland bird species such as the savannah sparrow or (*Passerculus sandwichensis* - State-threatened (breeding)) and many other passerines (songbirds). Installation of appropriately sized and maintained bird boxes in this location may attract highly observable and popular songbird species such as Eastern bluebird (*Sialia sialis*) or tree swallows. A purple martin (*Progne subis*) colony may also be established by providing a group of nest boxes or hollowed gourds.

- Educational signage explaining pollinator relationships could be effectively utilized in conjunction with these areas and provide a significant aesthetic and ecological focal point to reservoir visitors.

- Any conversion of maintained uplands to grassland adjacent to streams or stream channels (such as the channeled tributaries along the north shore) would potentially reduce velocity and potential pollutants associated with stormwater runoff.

4.0 WILDLIFE SPECIES AND HABITATS

4.1 Common Wildlife

Boonton Reservoir, while somewhat degraded from fragmentation, surrounding urbanization, and deer overpopulation; remains a significant wildlife habitat resource for terrestrial and aquatic species. During the ASGECI field investigations of the Boonton Reservoir study area, biologists documented a variety of wildlife species, including mammals, birds, snakes, turtles, amphibians, and insects. Species identified to date, as well as the habitats each species were found in or expected to occupy, are presented in the Table 4 below. Appendix D contains a checklist of vertebrate wildlife documented or potentially occurring onsite. Potential threatened and endangered species are discussed in Section 4.2.

Particularly extensive observations of breeding, wintering and migrating birds, have been collected within or near the reservoir property. Based on eBird submissions, 180 bird species have been identified onsite over the last five decades. The reservoir is of particular importance to wintering or migratory waterfowl and waterbirds such as American black duck (*Anas rubripes*), Northern pintail (*Anas acuta*), green-winged teal (*Anas carolinensis*), ring-necked duck **(***Aythya collaris*), scaup, *Aythya* spp. common merganser (*Mergus merganser*), and many others.

Significant migratory waterbird sightings (identified on eBird) include common loon (*Gavia immer*) red-throated loon (*Gavia stellata*), pied-billed grebe (*Podilymbus podiceps*) and horned grebe (*Podiceps auratus*). The reservoir is an extremely important resource to nesting waterbirds, particularly the State Special Concern (breeding) great blue heron (*Ardea herodias* - see Section 4.2 below) and the double-crested cormorant, both of which are documented reproducing on the reservoir's island rookery. Other heron species including great egret (*Ardea alba*) and the State - threatened black crowned night-heron (*Nycticorax nycticorax*) have been identified as potential breeders in the rookery; however, this has not been confirmed (Jonathan Klizas per com. to Bob Canace).

The wetland and upland forest complexes of remain important natural areas for both migratory and nesting forest interior Neotropical migrant songbirds. These species include warblers, thrushes, flycatchers, tanagers and other species sensitive to forest fragmentation. Typically forest patches need to be a minimum of 10 hectares (ha) of contiguous forest to be successfully utilized by a forest interior species; however, many species require much larger tracts for successful breeding.

There are three relatively large tracts of forest within and partially adjacent to the reservoir: 185 acres (75 ha) along the eastern shore, 110 acres (45 ha) along the western shore, and 42 acres (16 ha) along north shore. A variety of common forest interior nesting species have been observed utilizing these forests for breeding by ASGECI. Species observed include wood thrush (*Hylocichla mustelina*), red eyed vireo (*Vireo olivaceus*), scarlet tanager (*Piranga olivacea*), and Eastern wood pee-wee (*Contopus virens*). These forests also support a variety of migrating species such as warblers (*Dendroica* spp.) that use the reservoir forests as resting/stopover areas. These species can be regularly observed during spring (April-June) and fall (August-October) migratory periods and would be a potential reservoir draw for local birders and an activity to highlight through educational signage.

Common herptiles may be periodically observed onsite, particularly within or close to reservoir waters or wetlands; however, herptile diversity appears relatively low when compared to similar local forest and wetland communities. The lower diversity of herptiles is likely affected by the relative habitat isolation of the reservoir and forest floor degradation due to deer browse and invasive species presence.

Two species of frog were observed by ASGECI to date; however, it would be expected that some additional disturbance-tolerant amphibians, such as Northern gray treefrog (Hyla versicolor) or red-backed salamander (*Plethodon cinereus*) may occur in forest habitats. Pickerel frog (*Lithobates palustris*), bullfrog (*Lithobates catesbeianus*), and spring peeper (*Pseudacris crucifer*) may occur in wetlands or water edges. NJDEP Landscape Mapping maps a potential vernal pool in an adjacent forest just southeast of the site (see Appendix A). In addition, ASGECI observed several forested wetlands onsite that appear to seasonally hold water long enough to support vernal pool breeding amphibians. The surrounding urbanization does decrease the likelihood of obligate vernal pool breeding amphibian such as wood frog (*Lithobates sylvaticus*) or spotted salamander (*Ambystoma maculatum*) presence onsite. ASGECI will further investigate potential vernal pool locations onsite in the early spring of 2020 during FQI field evaluations.

Five common reptiles were observed to date during ASGECI field investigations. Examples of other species that could occur onsite include brown snake (*Storeria dekayi*), Eastern milk snake (*Lampropeltis triangulum)* or Northern ring-necked snake (*Diadophis punctatus*). Additional disturbance-tolerant pond turtles, particularly the introduced red-eared slider (*Trachemys scripta*)

would be expected to occur in the reservoir. The venomous Northern copperhead (*Agkistrodon contortrix*- State special Concern) is known to occur within the general region; however, the site isolation, disturbance, and lack of appropriate (basking and hibernacula) habitat effectively eliminates the possibility of occurrence onsite.

Five common mammals have been observed onsite by ASGECI to date; however, a number of other opportunistic mammal species are expected to occur. Common native species not yet observed during ASGECI field investigations include white-footed mouse (*Peromyscus leucopus*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), Virginia opossum (*Didelphis virginiana*), and big brown bat, (*Eptesicus fuscus*). Additional semi-aquatic mammals such as beaver (*Castor canadensis*) muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*) and American mink (Neovison vison) may all potentially occur onsite.

As with any typical terrestrial ecological community, insects represent the greatest observable animal diversity at Boonton Reservoir. Significant dragonfly (Odonata) and butterfly (Lepidoptera) diversity would be expected to occur onsite; particularly in open waters, successional fields and in emergent wetlands. A checklist in Appendix D provides a list of the most common butterflies and dragonflies that may be expected onsite.

TABLE 4: SPECIES OBSERVED DURING FIELD INVESTIGATIONS TO DATE-BOONTON RESERVOIR

Common Name	Scientific Name	Habitat*	Comments
Mammal Species			
White-tailed deer	*Odocoileus virginianus*	Throughout site	Small groups observed throughout site.
Raccoon	*Procyon lotor*	Throughout site	Tracks observed in streams and along edge of reservoir.
Eastern chipmunk	*Tamias striatus*	UDF, MDCF	Frequently observed or heard in forest areas.
Eastern gray squirrel	*Sciurus carolinensis*	UDF, MDCF	Frequently observed in all forest areas.
Woodchuck	*Marmota monax*	UDF, SSF, MDCF, EMSU, MU	Winter dens observed in upland wooded areas.
Birds			
American robin	*Turdus migratorius*	Throughout site	Common throughout site
Eastern wood-pewee	*Contopus virens*	UDF, MDCF, PFO	Frequently heard in mature forest on the eastern shore
Willow flycatcher	*Empidonax traillii*	SSF, EMSU, PEM	Heard in shrub and emergent wetland fringe near wetland I
Wood thrush	*Hylocichla mustelina*	UDF, MDCF	Frequently heard in mature forest eastern shore
Great crested flycatcher	*Myiarchus crinitus*	UDF, MDCF	Frequently heard in forest along eastern shore
Scarlet tanager	*Piranga olivacea*	UDF, MDCF	Heard in upland forest near north shore gate
Gray catbird	*Dumetella carolinensis*	Throughout site	Frequently heard in successional and forest areas

TABLE 4: SPECIES OBSERVED DURING FIELD INVESTIGATIONS TO DATE-BOONTON RESERVOIR			
Song sparrow	*Melospiza melodia*	SSF, EMSU	Frequently heard in edges and successional areas
American goldfinch	*Spinus tristis*	SSF, EMSU, MU	Heard and observed in early successional areas
Carolina wren	*Thryothorus ludovicianus*	Throughout site	Heard and observed in successional areas and maintained areas
House wren	*Troglodytes aedon*	SSF, EMSU, MU	Heard in developed areas
Black-capped chickadee	*Poecile atricapillus*	UDF, SSF, MDCF, PFO	Heard in secondary successional forest
Tufted titmouse	*Baeolophus bicolor*	UDF, SSF, MDCF, PFO	Heard in mature and successional forest
Baltimore oriole			
Yellow warbler	*Setohaga petechia*	SSF, EMSU, PFO	Heard in successional and wetland forest near north shore/
Mourning dove	*Zenaida macroura*	SSF, EMSU, MU	Observed in maintained areas.
Common grackle	*Quiscalus quiscula*	SSF, EMSU, MU	Observed in open areas
Fish crow	*Corvus ossifragus*	Throughout site	Observed over and around open waters and other open areas.
American crow	*Corvus brachyrhynchos*	Throughout site	Observed over and around open waters and other open areas.
Blue jay	*Cyanocitta cristata*	Throughout site	Frequently heard and observed throughout site.
White-breasted nuthatch	*Sitta carolinensis*	UDF, SSF, MDCF	Heard in forests on eastern shore.
Pileated woodpecker	*Dryocopus pileatus*	UDF, SSF, MDCF, PFO	Heard in forests on eastern shore.
Downy woodpecker	*Picoides pubescens*	UDF, SSF, MDCF, PFO	Heard and observed in all forests.
Northern flicker	*Colaptes auratus*	Throughout site	Heard and observed in all forests.
Red-bellied woodpecker	*Melanerpes carolinus*	UDF, SSF, MDCF, PFO	Heard and observed in all forests.
Turkey vulture	*Cathartes aura*	Throughout site	Frequent flyovers
Red-tailed hawk	*Buteo jamaicensis*	UDF, SSF, EMSU	Observed throughout site including flyovers
Great blue heron	*Ardea herodias*	PFO, PEM, OW	Several birds observed foraging and perching along edge of reservoir. Regularly observed on rookery.
Great egret	*Ardea alba*	PFO, PEM, OW	Observed flying over reservoir, towards rookery and in rookery.
Double-crested cormorant	*Phalacrocorax auritus*	OW	Foraging in reservoir water and regularly observed on rookery.
Common merganser	*Mergus merganser*	OW	Foraging in reservoir -eastern shore
Mallard	*Anas platyrhynchos*	OW	Foraging in reservoir

TABLE 4: SPECIES OBSERVED DURING FIELD INVESTIGATIONS TO DATE-BOONTON RESERVOIR			
Mute swan	*Cygnus olor*	OW	Foraging in reservoir observed in small groups (10 individuals).
Canada goose	*Branta canadensis*	OW, MU	Foraging in reservoir and on in maintained lawn areas about 50 observed possibly resident geese-very common.
Spotted sandpiper	*Actitis macularius*	OW, PEM	Observed in cove adjacent to wetland II.
Killdeer	*Charadrius vociferus*	OW, PEM	Observed in cove adjacent to wetland II.
Barn swallow	*Hirundo rustica*	EMSU, MU	Commonly observed over water particularly along the north and south shore.
Tree swallow	*Tachycineata bicolor*	EMSU, MU	Observed in open areas and over open water adjacent to south shore.
Northern rough-winged swallow	*Stelgidopteryx serripennis*	EMSU, MU	Observed in open areas and over water adjacent to south shore.
Eastern towhee	*Pipilo maculatus*	SSF, EMSU	Heard and observed in eastern forest near Wetland F.
Belted kingfisher	*Megaceryle alcyon*	OW, PEM	Possibly nesting on banks of reservoir near wetland FF and GG.
Blue-gray gnatcatcher	*Polioptila caerulea*	EMSU, PEM	Observed gleaning insects from trees near waterfront near Rockaway River shoreline.
Red-eyed vireo	*Vireo olivacea*	UDF, SSF, MDCF, EMSU	Frequently heard in eastern shore mature forests.
Ring-billed gull	*Larus delawarensis*	OW	Observed flying over reservoir
Reptiles			
Eastern painted turtle	*Chrysemys picta*	OW	Basking on edge of reservoir
Eastern box turtle	*Terrapene carolina*	UDF, SSF, MDCF, EMSU, PFO, PEM	Adult individual observed in uplands near mouth of Rockaway River
Common snapping turtle	*Chelydra serpentina*	UDF	Juvenile found on stream bank adjacent to the W feature.
Northern watersnake	*Nerodia sipedon*	OW, PEM	Observed on edge of reservoir
Garter snake	*Thamnophis sirtalis*	PEM, EMSU	Observed near edge of reservoir
Amphibians			
Green frog	*Lithobates clamitans*	PEM, PFO, OW	Periodically observed in Wetland Q
American toad	*Anaxyrus americanus*	PEM, PFO	Observed along stream within Wetland II.
Insects			
Tiger swallowtail	*Papilio glaucus*	PEM, EMSU, MU	Frequently observed in open areas

TABLE 4: SPECIES OBSERVED DURING FIELD INVESTIGATIONS TO DATE-BOONTON RESERVOIR			
Spicebush swallowtail	*Papilio troilus*	EMSU, UDF, MU	Frequently observed in open areas
Black swallowtail	*Papilio polyxenes*	PEM, EMSU	Frequently observed in open areas
Monarch	*Danaus plexippus*	PEM, EMSU	Frequently observed in open areas - successional habitats
Great Spangled Fritillary	*Speyeria cybele*	PEM, EMSU, MU	Observed in PEM fringe along the north shore.
Cabbage white	*Pieris rapae*	MU, EMSU, MU	Observed in maintained upland grass areas. Non-native.
Sulfur	*Colias philodice*	MU, EMSU	Observed in maintained upland grass areas.
Eastern tailed blue	*Cupido comyntas*	UDF, EMSU, MU	Observed along path
Luna moth	*Actias luna*	MDCF, MU	Observed in forest near Stream/Wetland JJ.
Annual cicada	*Neotibicen sp.*	MDCF	Heard in all forested areas.
Common whitetail	*Plathemis lydia*	PEM, OW	Observed over water onsite.
Ebony jewelwing	*Calopteryx maculata*	PFO, OW	Observed in forest stream along the western shore.
Green darner	*Anax junius*	PEM, OW	Observed over open water.
Black saddlebags	*Tramea lacerata*	PFO, PEM, OW	Observed in PEM wetland

*** Ecological Communities Key**
Upland Deciduous Forest (UDF) Secondary Successional Forest (SSF) Mixed Deciduous/Coniferous Forest (MDCF)
Maintained uplands (MU) Palustrine Emergent Wetland (PEM) Early or Mid-Successional Uplands (EMSU)

4.2 Threatened and Endangered Species

NJDEP Landscape Project mapping (v 3.3), NJ Natural Heritage Project and USFWS IPaC collectively identify eight species for which potentially suitable habitat may occur within or near the Boonton Reservoir. The Landscape Mapping identifies the site primarily as "Rank 4" habitat due to the presence of bald eagle, a State endangered species (see Landscape Map in Appendix A).

Of these identified species, three have been observed by ASGECI onsite. The State Special Concern wood thrush (*Hylocichla mustelina*) was identified calling in the upland forest habitat on the eastern shore. Great blue herons were frequently observed foraging, perching, and flying along the edge of the reservoir and bald eagles (juvenile and adult) were observed on multiple occasions. An additional Special Concern Species, the Eastern box turtle (*Terrapene carolina carolina*) was found during a stakeholder field meeting onsite in upland forest near the Rockaway River cove on the northwestern shore.

Table 5 identifies the rare, threatened and endangered species that were identified through the NJDEP Landscape Project and USFWS IPaC and were assessed during the field investigation. A brief description of each species, its habitat and potential to occur onsite, and proposed protections are included in this section.

Bald Eagle (*Haliaeetus leucocephalus* – State Endangered)

Bald Eagle Background

In general, breeding habitat for bald eagles consists of large nesting trees in forest patches or stands near open water areas suitable for (primarily fish) foraging (NJDEP 2013). Eagles nest in live or occasionally dead trees. Although rare, nesting on artificial structures is occurring with increasing frequency (USFWS 2007).

Bald Eagle foraging (resting and feeding) habitat consists of rivers, lakes and estuaries (typically over 20 AC) in size capable of holding suitable foraging fish populations. Water bodies are lined with one or more sufficient perches, such as live or dead trees. A wide range of forage fish may be eaten, including shad and herrings (Clupeidae), eels (Anguilliformes), white bass (*Morone chrysops*), suckers (Catostomidae), and catfish (Siluriformes). Eagles will also consume other prey such as mammals, waterfowl and other birds, reptiles or invertebrates (NJDEP 2013). Eagles may also feed on carrion. Wintering diets may be more opportunistic and include species other than fish with more frequency.

With reference to foraging, bald eagles typically perch in trees, but will use other objects such as partially submerged logs, boulders, or the ground. Wintering forage areas often consist of suitable perch vegetation adjacent to open, ice-free water. Studies have found that the distance from water and characteristic of bald eagle foraging and roosting sites varies greatly at different locations across the United States.

Trees may include deciduous or coniferous at variable distances (ranging from 0.15 to 2.3 mi. based on various studies) from appropriate foraging waterbodies (NJDEP 2013). NJDEP determines foraging habitat under Landscape Project v.3.3 by including contiguous forests/forested wetlands with dead and/or live trees with a DBH greater than 12 cm (8 in) and within 300 m (984 ft) of a suitable waterbody (greater than 20 acres and featuring appropriate prey items). Scrub-shrub or emergent freshwater wetland habitat quality are considered on a case-by-case basis (NJDEP 2013).

Bald Eagle Background Onsite Habitat

Onsite habitat for eagle foraging and nesting habitat is common throughout the reservoir. The reservoir and adjacent Rockaway River cove support populations of forage fish such as basses, perch, carp, and catfish. Over 85% of the reservoir is tree lined with trees generally ranging from 8 – 24" DBH with occasional "supercanopy" trees in excess of 30" DBH suitable for nesting occurring along the shoreline. Areas where trees are not present, such as along the northern and southern impoundment walls may still be utilized by foraging eagles; however, these areas would be considered generally less ecologically valuable. The general forest along the eastern shore is overall mixed in size and age. Much of the eastern shoreline itself is forested with trees generally suitable for foraging bald eagle; however, trees immediately adjacent to the water edge are often submature (typically 6-12" DBH). Forest along the size and quality varies significantly along the western shore. Southernmost areas of the western shore are narrow and consist of secondary successional forest. The forest quality improves in wider, central portion of the west shore where the bald eagle nest is located. The nest is in a relatively isolated location with mixed mature forest consisting of white pine, oak, and tulip poplar. The mixed age forests just north and south of the Rockaway River tend to be more degraded greater interspersions of secondary successional or exotic tree species.

Bald Eagle Proposed Protections

Disturbance or impacts to bald eagles resulting from the proposed action will be avoided by following the standard recommendations below. Similar recommendations are successfully utilized in natural areas within New Jersey and elsewhere to avoid and minimize impacts to bald eagles:

- Based on the myriad of existing foraging options onsite and the overall passive nature of proposed activities; there would be no significant advantage to bald eagles by relocating the trail along the eastern shore (from the existing maintenance road). Relocating the trail in this area would more likely result in additional forest impacts (potential tree removal and additional substrate disturbance) without a clear benefit to eagle foraging or populations in general.

- Based on recommendations with the NJDEP Endangered and Nongame Species Program (ENSP), the trail distance to the nest will be maximized to the greatest extent practicable (over 500 feet) in the vicinity of the nest.

- Signage restricting access within the bald eagle buffer (up to 660 feet) and adjacent shoreline may be utilized to minimize disturbance to nesting eagles. Signage may identify restricted "environmentally sensitive areas".

- Although nest disturbance is not expected, the section of the trail within 660 feet or (if determined to be required) may be seasonally closed for all or part of the breeding and nesting season (December through July) if there is high potential for disturbance. Closure locations may need to change if the eagle nest location changes in the future.

- An area that extends up to approximately 3,600 feet north of the nest includes an unnamed stream tributary and associated cove, emergent and forested wetlands, and mature upland shoreline forest. Eagles, multiple waterbirds, and shorebirds have been observed foraging in this location. As a result access to this location is limited.

- Once public access is allowed at the reservoir, eagles may be periodically monitored to determine if there are any changes in behavior, nest location changes, or development of juvenile wintering congregation areas. Any refinement to eagle protections based on observations may then be considered.

- A visual barrier such as an opaque fence along the trail areas closest to the nest (less than 660 feet) may be considered; however, this may not be necessary based on the density of the forest between the proposed trail route and the existing nest.

- Coordination and consultation with both ENSP and/or the US Fish and Wildlife Service will continue as needed during the design, permit, and implementation of the proposed trail to protect eagles and ensure compliance with both state law and the federal Bald and Golden Protection Act.

Great Blue Heron – Special Concern

Great Blue Heron Background

One of the most common wading birds in North America, great blue herons occur throughout New Jersey. Unlike most herons and egrets, this species may be found in the State year-round, though it is generally absent from the northwestern counties during the winter (Davenport 2011f).

Great blue herons typically nest in rookeries in trees or shrubs near an open waterbody, such as a river or lake (Kaufman 1996). The USFWS model for suitable great blue heron breeding habitat includes a variable defining a potential nest site as "a grove of trees at least 0.4 hectare in area located over water or within 250 meters of water" (Short & Cooper 1985). According to the USFWS model, potential nest sites may occur on an island within a river or lake, within a woodland swamp, or at the edge of an open water. In addition, the USFWS model suggests a disturbance-free buffer zone of 250 meters (land) or 150 meters (water) occurring around actual or potential nest sites (Short and Cooper 1985).

Trees used as nest sites are at least five (5) meters high and possess many branches at least 2.5 cm thick, capable of supporting nests; the trees may be alive or dead but typically possess an opening to allow herons to enter and leave the nest (Short & Cooper 1985). Tree selection varied in the Gibbs et al. (1987) study; no distinct requisites for nest site or colony site habitat were identified with regard to tree species, diameter, height, stand basal area, or stand density. However, analysis of forest habitat used for nesting versus those unused forest habitats found that colonies more often occurred in forests containing hardwoods and a noncontiguous canopy.

A study in coastal Maine (Gibbs et al. 1987) found that great blue herons are not limited by nest site availability. Foraging options (i.e., proximity to wetlands and open waters) within the vicinity of the nest colony may, however, affect nest colony size and location (Burger 1981; Werschkul et al. 1976; Custer & Osborn 1978; Thompson 1979a). The maximum observed flight distance from an active heronry to a foraging area was 29 kilometers in an Ohio study (Parris & Grau 1979). Other maximum flight distances were in the range of 4 to 5 kilometers (Thompson 1979b; Mathisen & Richards 1978).

Breeding populations are sensitive to human disturbance. Gibbs et al. (1987) suggests that avoidance of human disturbance takes precedence over proximity to foraging habitat with regard to colony site selection. Mathisen & Richards (1978) recorded all existing heronries in Minnesota as occurring at least 3.3 kilometers from human dwellings, and an average of 1.3 kilometer from the nearest paved road.

Great blue herons are generalists in the types of foraging areas they will utilize and can be found foraging on almost any waterbody or waterway, including fresh, brackish, and saline wetlands where they eat fish, small mammals, amphibians and reptiles (Kaufman 1996; McVey et al. 1993).

Great blue herons breed from early March to July. Within a rookery, each pair creates a large platform nest and incubates the eggs for 25 to 29 days. The young fledge approximately 60 days after hatching but remain dependent upon their parents for up to several weeks after. Sexual maturity is reached at two (2) years of age (Davenport 2011f).

Due to small, local occurrences of existing rookeries, the species' breeding population is listed as Special Concern in the State of New Jersey. The NJDEP ENSP monitors known rookeries

throughout the State. A 2009 survey performed by the ENSP found 31 active colonies in the State that year, containing a total of 586 individual nests (NJDEP 2009-2010; Davenport 2011f).

Great Blue Heron Onsite Habitat

The Boonton Reservoir is particularly important for great blue heron due to its island rookery in the central Part of the reservoir (approximately 3,700 feet from the southern shore of the reservoir). Its isolation in the reservoir allows the herons to nest in a relatively undisturbed environment without predation from terrestrial mammals. The rookery contains multiple (greater than 5) heron nests which are visible with binoculars. The rookery may also be shared with nesting double-crested cormorants (Phalacrocorax auratus) and great egret (*Ardea alba*) have also been observed utilizing the island. During the breeding season, great blue herons can regularly be seen flying from the rookery location to adjacent foraging areas on the reservoir. As herons are opportunistic and generalist foragers, most locations along the reservoir shoreline are suitable for foraging fish, frogs and other small animals. Both naturally vegetated areas as well as the rip-rap areas along the northern and southern shore are utilized by foraging blue herons. Streams, including the Rockway River upstream and downstream of the reservoir may also be used for foraging. The unnamed tributary cove and adjacent wetland identified in the central portion of the western shore appears to be a particularly important foraging location for great blue herons (as multiple birds were observed in this location), possibly due to its proximity to the rookery and the shallow edge conditions and wetland/mudflat edges that allow for relatively easy access to prey species.

As the rookery is a sufficient distance from the western and eastern shores (1,500 feet and 1,800 feet) respectively human activity along the shoreline would not be expected to affect rookery use or success.

Great Blue Heron Proposed Protections

- As no boating swimming or other water access is proposed, the proposed activity is not expected to impact or disturb the heron rookery. Discrete observation points may be developed along the trail without disruption to the species. Signage may be utilized from eastern and western shoreline points to educate visitors about great blue herons and other waterbirds utilizing the reservoir.

- As herons are generalist foragers with numerous foraging opportunities, it would not be expected that occasional displacement of foraging herons by visitors will impact significantly impact populations.

- Access to the sensitive the foraging area along the western shore will be limited and multiple shoreline locations are partially obscured or isolated from the proposed trail location, ensuring adequate heron foraging will continue.

<u>Wood Thrush (*Hylocichla mustelina* – State Special Concern)</u>

Wood Thrush Background

The wood thrush is a migratory songbird found throughout New Jersey. It breeds in the understories of woodlands, mostly deciduous, but sometimes mixed. Associated tree species include American beech, sweet gum, red maple, black gum, eastern hemlock (Tsuga canadensis), flowering dogwood (Cornus florida), and American hornbeam, as well as a variety of oaks (Quercus spp.) and pines (Pinus spp.). Ideal habitat includes trees at least fifty feet tall, with a moderate understory of saplings and shrubs, such as southern arrowwood (*Viburnum dentatum*), smooth blackhaw (*Viburnum prunifolium*), spicebush (*Lindera benzoin*), coastal sweet

pepperbush (Clethra alnifolia), rhododendrons (Rhododendron spp.), and blueberries (Vaccinium spp.). An open, moist forest floor with decaying leaf litter, in close proximity to water, is preferred (Roth, et. al, 1996; Cornell Lab of Ornithology, 2015).
In New Jersey, the wood thrush's breeding season lasts from early May to mid-August. Males arrive ahead of females and establish breeding territories, which are defended by singing. The female selects the nest site-usually within a small tree or shrub- and constructs the nest. The female incubates the eggs for about two weeks and both parents tend to the young. Fledging occurs at 12 to 13 days of age. Often, wood thrush pair produce two broods in a single season (Davenport 2011).

According to the North American Breeding Bird Survey Results and Analysis of 1966-2013, wood thrush populations have declined by 62% (Sauer, J.R., et. al, 2014) since the nation-wide survey began in 1966. Some of the most dramatic declines have taken place in the New England and Mid-Atlantic states, in which breeding and wintering habitats have been fragmented by human development. Fragmented forests result in a poorer food supply, exposure to predators, and nest parasitism by the brown-headed cowbird (*Molothrus ater*) (Roth et. al, 1996; Cornell Lab of Ornithology, 2015). Due to the decline of wood thrush populations in New Jersey, its breeding population has been designated as of special concern.

Wood Thrush Onsite Habitat
According to NJDEP Landscape Project mapping, suitable wood thrush habitat occurs within the study area, specifically within the forests along the northwestern shore. This portion of the study area contains both upland and wetland forests, with trees of varying species and size, including specimens well over fifty feet tall. However, the understory is limited to a few scattered, invasive shrub species, which may hold little value to wood thrush or other similar bird species. No wood thrushes were observed at this location.

During field investigations, wood thrushes were heard singing in deciduous and mixed-deciduous forests along the eastern shore of the reservoir. This area contained both upland and wetland forests with leaf litter and a few native shrub species, such as southern arrowwood. This area is not mapped as suitable habitat by the Landscape Project but appears suitable for breeding birds.

Wood Thrush Proposed Protections
It would not be expected that public access to the reservoir would result in any impacts to wood thrushes or other neotropical migrant songbirds utilizing the site. These species would not be expected to be displaced by visitors engaging in passive recreation and the habitat quality and foraging opportunities are not expected to be reduced as a result of human presence. However, the removal of trees and understory vegetation could not only reduce nesting, perching, roosting, and foraging habitat, but could also introduce new colonies of invasive plant species, which crowd out native plants and have little to no ecological value for birds and other wildlife. Tree and vegetation removal should therefore be performed to the minimum extent practicable and should be performed outside the timing restriction window established by the federal Migratory Bird Treaty Act (April 1 to August 31).

TABLE 5: LIST OF RARE, THREATENED AND ENDANGERED SPECIES – POTENTIAL HABITAT AS IDENTIFIED BY USFWS AND NJDEP LANDSCAPE PROJECT VERSION 3.3					
Common Name	**Scientific Name**	**Record Type**	**Status**	**Record Source**	**Potential Habitat in Study Area**
Birds					
Bald Eagle	*Haliaeetus leucocephalus*	Breeding, foraging, wintering	E	L - Onsite	Y*
Wood Thrush	*Hylocichla mustelina*	Breeding	SC	L -Onsite	Y*
Great Blue Heron	*Ardea herodias*	Nesting, Foraging	SC	L -Onsite	Y*
Reptiles					
Box turtle	*Terrapene carolina*	Observed in field	SC	n/a	Y
Wood turtle	*Glyptemys Insculpta*	Occupied habitat	T	L- adjacent to site	Y+
Bog turtle	*Glyptemys muhlenbergii*	Potentially occurring	LT, E	IpaC	Y+
Mammals					
Northern Long-eared bat (N. myotis)	*Myotis septentrionalis*	potentially occurring – non hibernation - roost site.	LT	IpaC - Onsite	Y
Indiana Bat	*Myotis sodalis*	potentially occurring – non hibernation - roost site.	LE, E	IPaC - Onsite	Y
Bobcat	*Lynx rufus*	observed on road	E	L -onsite	Y+

NOTES:
+ Severe limitations on habitat based on life histories and regional landscape (see species descriptions); * Observed onsite during surveys.

LT *Federally Threatened*
P *Federally Proposed /Candidate Species*
E *State Endangered*
T *State Threatened*
SC *State Special Concern*
IPaC - Species reported by USFWS Information and Conservation Planning (IPaC) System Official Species List,

Northern Long–Eared Bat (*Myotis septentrionalis* - Federally-Listed Threatened)

Northern Long–Eared Bat Background

The Northern long-eared bat is a medium-sized bat about 3 to 3.7 inches but with a wingspan of 9 to 10 inches. The range of the Northern long-eared bat includes much of the eastern and northcentral United States, and all Canadian provinces from the Atlantic Ocean west to the Southern Yukon Territory and Eastern British Columbia. Wintering habitat (hibernacula) is restricted to areas that support caves or underground cave-like structures. Hibernacula typically have large open areas with cracks or crevices for roosting. Hibernacula have consistent cool temperatures with very high humidity and minimal air currents (USFWS 2014).

During summer, roosting habitat includes live or dead trees of ≥3" dbh. Singular or groups of bats may roost under the bark, in cracks or hollows of these trees and select tree species based on the presence of flaking bark, cracks and holes. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. Over 30 species of trees have been identified as roosting trees for Northern long eared bat. The species also occasionally roosts under or within manmade structures such as barns. Isolated roost trees are considered suitable when they are within 1,000 feet of other suitable roost trees. Northern long eared bats feed exclusively on insects identified through echolocation. Insects may be captured on the wing or gleaned from water or vegetation surfaces. Foraging areas include forested wetlands and uplands woodlots and linear forested corridors. Adjacent emergent wetlands, old fields, and pastures may also be utilized. Summer habitat is typically occupied from mid-May through mid-August (USFWS 2014).

Indiana Bat (*Myotis sodalis* – State-Endangered and Federally Listed Endangered)

Indiana Bat Background

Indiana bats are a small brown to black colored bat with a wingspan of 9 to 11 inches. To untrained observers, they appear similar to many other common insect eating bats. These bats forage on flying aquatic and terrestrial insects. Foraging occurs primarily in and around forested habitats that include pole-stage mixed-oak forest, floodplain forest, upland forest, and forested wetlands (Butchkoski and Hassinger 2002, Gardner et al 1991, Humphrey et al. 1977, Murray and Kurta 2004, Romme et al. 2002, Sparks et al. 2005). Wooded foraging areas utilized may be dense or loose aggregates of trees with variable amounts of canopy closure and containing potential roosts (USFWS 2015).

Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures (USFWS 2015). Pregnant or lactating bats forage primarily within wooded corridors, streams, associated floodplain forests and impounded bodies of water, but will sometimes use hedgerows, upland forest, early successional fields and along croplands (Kitchell 2008).

Female summer roosts consist of live trees and/or snags ≥5 inches diameter at breast height (dbh) (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows, as well as linear features such as fencerows, riparian forests, and other wooded corridors (USFWS 2015). Primary roost trees may be of large diameter (>22" dbh) in open areas with high exposure to sunlight; alternate roosts are generally smaller in diameter within forest interior (Kitchell, 2008). These individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat (USFWS 2015). Optimal densities of roost trees (> 9 inches dbh) are 27 trees per acre in upland habitats and

17 trees per acre in floodplain habitats (NJDEP 2013). Indiana bats have been occasionally observed to utilize buildings or structures for roosting (Hassinger and Butchkoski 2001).

Tree species that have been identified as roost trees include American elm, slippery elm (*Ulmus rubra*), bitternut hickory, shagbark hickory, sweet pignut hickory (*Carya ovalis*), Northern red oak, post oak (*Quercus stellata*), white oak, silver maple, sugar maple, Eastern cottonwood, green ash, and sassafras USFWS 2013) . Characteristics of individual trees (e.g. crevices, location and light exposure) are considered more significant determinant roost suitability than tree species (USFWS 2013).

Onsite Habitat for Northern Long-Eared and Indiana Bats
Based on USFWS data, Northern long eared bat and Indiana bat hibernation and maternity roosts occur within the immediate vicinity of the reservoir. The closest known hibernation location is in Rockaway Township and hibernating bats of these species would not be expected on the reservoir property. There is; however, significant potential for roosting Northern long-eared and/or Indiana bats to occur onsite. Suitable roost trees, including a variety of large oaks, maples and hickories occur onsite. Large standing dead trees with flaking bark and light exposure are also common along the forested shores. The gradient between the forest and waterfront potentially provide ideal insect foraging opportunities for these species.

Proposed Protections for Northern Long-Eared and Indiana Bats
It would not be expected that public access to the reservoir would result in any impacts to Northern long-eared or Indiana bats. Bats would not be expected to be displaced by visitors engaging in passive recreation, and the habitat quality/options for bats are not expected to be reduced as a result of human presence. The following measures will be taken to prevent impacts to bats:

- For tree or limb removal associated with trail construction or maintenance, timing restrictions during the active bat roost season (potentially April through October) may be required. USFWS NJ Field Office would need to be contacted to determine the proximity of known maternal roost trees and the applicable timing restriction.

- It would be expected that with public presence, the emergency removal of unsafe trees may increase in public access areas. A protocol for any emergency tree removal (live or dead trees) and other onsite procedures to protect bats must be developed in coordination with Morris County Parks or other maintenance personnel, and the USFWS NJ Field Office.

- Habitat enhancements for bats may include the installation of bat roost boxes to potentially attract Northern long-eared bat or common bat species. These may be installed off the ground in an open area along the public access (such as along the North Shore). Educational signage explaining the natural history, biology or ecological benefits of bats may also be considered at any roost box location.

Bobcat (*Lynx rufus - State Endangered*)

Bobcat Background
Bobcats are a small (typically 35 inches in length) member of the Feline family of the Order Carnivora. They tend to have yellowish to grey brown fur streaked with dark spots or stripes that is more whitish on their underparts. Their black tipped tails are bobbed and typically 5-7 inches in length. In recent decades, most reports of bobcat have occurred in northern/northwestern New Jersey, but the species has been spreading in southern portion of the State including in Burlington and surrounding counties.

Bobcats are highly adaptable and versatile, and as a result their habitat is quite variable (NJDEP 2003). Habitats in the Northeast include forests, patchworks of forest and agriculture. Bobcats feed primarily on small mammals such as cottontail rabbits or chipmunks, as well as squirrels, mice and voles. They may also feed on carrion such as deer carcasses (NJDEP 2003). Bobcats are active year-round and do not hibernate. They may be active day or night depending on the time of the year. The home range varies and is affected by prey availability. Ranges have been to be as small as 0.2 q mi to 7 sq. mi. (NJDEP 2003).

Habitats are often a combination of areas in varying successional stages. They may be sensitive to intensive agricultural areas or heavily suburbanized areas. Bobcats prefer habitats with some dense cover and shelter from which they hunt. In northern New Jersey, they often use rocky outcrops, ledges or caves as shelter or to ambush prey from. In southern New Jersey and where outcrops do not occur, suitable cover may include shrub swamps, bogs, briars or conifer stands (NJDEP 2003).

Bobcat Onsite Habitat

NJDEP Landscape Mapping v 3.3 identifies habitat for bobcat throughout Boonton Reservoir shoreline, and along the adjacent Rockaway River stream corridor. The occurrence is a defined by Landscape Mapping as "on road" which may indicate observation of a road-killed individual outside the reservoir property. Bobcats are habitat generalists and the reservoir property does consist of a patchwork of wetland and upland forest habitat suitable in structure for the species. The property is, however, inherently limited by urban fragmentation and is isolated from larger contiguous (and more suitable) forest tracts.

Bobcat Proposed Protections

Bobcats are extremely mobile and their range in New Jersey appears to be expanding into more urban areas within the state. As with other medium or large predatory mammals (such as black bear and coyotes) there remains a possibility of transient individuals entering the reservoir property; however, it would be expected that encounters would be extremely rare and it appears that the reservoir property does not support a sustained reproductive population that would be displaced by human presence. As a result of this determination, specific required measures to protect bobcat populations or enhance onsite habitat are not proposed.

Bog Turtle (*Glyptemmys muhlenbergii*)

Bog Turtle Background

Bog turtles occur discontinuously in western, central and southern New York, adjacent Connecticut and Massachusetts, New Jersey, Pennsylvania, northern Delaware and Maryland, southwestern Virginia, and western North Carolina (Conant 1975). In New Jersey, bog turtles are documented in Sussex, Warren, Morris, Hunterdon, Somerset, Monmouth, Burlington, Ocean, Mercer, Gloucester and Salem Counties.

Habitat for bog turtles includes sunlit marshy meadows, spring seeps, bogs, and fens, usually with clear, shallow slow-moving rivulets or brooks (Conant 1975; Behler and King 1979; Ernst et al. 1994). Potential bog turtle habitat is recognized by the presence of suitable vegetation, hydrology and soils. Vegetation can include cattails (Typha latifolia, T. angustifolia), tussock sedge (Carex stricta), other sedge species (Carex spp., Cyperus spp., Dulichium spp.), rushes (Juncus spp.), bulrushes (Scirpus spp.), spikerushes (Eleocharis spp.), spotted jewelweed (Impatiens capensis), alders (Alnus spp.), skunk cabbage (Symplocarpus foetidus), arrow-leaved tearthumb (Polygonum sagittatum), rice cut-grass (Leersia oryzoides), and other open canopy wetland species (Cromartie, et al. 1982).

Other elements of suitable bog turtle habitat include soft mucky substrates for burrowing and hibernation; an interspersion of wet and dry areas within sites, often with the presence of muskrat and meadow vole runways for travel corridors and cryptic basking sites; a mosaic of habitats present such as uplands, shallow water and muck, and deeper water; and a predominantly open canopy, with scattered areas of shrubs and small trees (USFWS 1997).

Bog turtles are federally listed as threatened and State listed as endangered. Due to its highly specific habitat requirements, it is a sensitive species vulnerable to habitat loss, degradation, and fragmentation. It is also threatened by disease and collection for illegal wildlife trade.

Bog Turtle Onsite Habitat
No bog turtle habitat is mapped as occurring in the study area by NJDEP Landscape Mapping. However, the USFWS IPaC report identifies the species as one to consider in an impacts analysis for projects performed onsite. In addition, the study area is located in Parsippany Township, which is listed as supporting bog turtle populations.

During the field investigation, habitat that marginally meets the basic USFWS criteria for bog turtle was identified in one wetland within the study area (Wetland Q). This habitat appeared spring-fed and featured 6-8 inches of muck over approximately 30 percent of the wetland. Although the wetland was mostly forested, it contains areas of emergent vegetation typically associated with bog turtle habitat.

Bog Turtle Proposed Protections
Bog turtles are not expected to be present due to the disturbed, developed conditions surrounding both the wetland and the reservoir, as well as the lack of connectivity to other bog turtle habitats. Impacts to bog turtles or their habitat are not expected by the proposed project; nevertheless, if impacts (such as gravel placement) to the wetland or an area within 300 feet of the wetland are proposed, further coordination with the USFWS may be needed as part of the permitting process. A formal Phase I bog turtle habitat survey performed by a qualified surveyor may be required for the project – this will be determined in coordination with USFWS. The need for further studies or protections, such as a Phase II presence/absence survey or construction monitoring would be determined with USFWS coordination during the project permit application process.

Wood Turtle (*Glyptemmys insculpta* – State Threatened)

Wood Turtle Background
In New Jersey, wood turtle populations are generally restricted to the northern and central portions of the State; although the species has been documented in southern New Jersey, including within the Pinelands. The largest populations occur in Hunterdon, Morris, Sussex, Passaic, and Warren counties.

The species occupies both aquatic and terrestrial environments during different times of the year. Terrestrial habitats are used for nesting and foraging. To meet its survival needs, such as foraging and thermoregulation, wood turtles travel between different vegetation communities, including forests, forest edges, and open areas with less or little canopy cover (Compton et. al, 2002). The species is associated with thickets containing shrubs such as alder (*Alnus* spp.), green brier (*Smilax rotundifolia*), or multiflora rose (*Rosa multiflora*). Forests typically used by wood turtles are often dominated by oaks (*Quercus* spp.), black birch (*Betula lenta*), and red maple (*Acer rubrum*). The species may also utilize human-altered habitats, including abandoned railroad beds or agricultural fields and pastures.

Aquatic habitats include relatively remote, clean freshwater streams, which are typically associated with undisturbed uplands, such as fields, meadows, or forests. Wood turtles hibernate in the streams.

Hibernacula microhabitats include stream bottoms, stream banks, overhanging root systems, and abandoned muskrat holes. Wood turtles demonstrate strong multi-seasonal fidelity to specific streams and hibernacula (Davenport, 2010).

The species nests in elevated, well-drained, open areas with ample sunlight. Nest cavities are dug in loose soils unimpeded by rocks or dense vegetation and are typically 3.5 to 4.5 inches deep (Davenport, 2010). Females may utilize anthropogenic areas such as railroad beds, woodland roads, gravel pots, and the edges of agricultural fields for nesting (New Hampshire Division of Fish and Game, 2015), and may wander significant distances from hibernacula (marked females have been observed up to 0.56 miles from wintering habitat; Davenport, 2010).

During their summer movements, wood turtles are especially vulnerable to vehicular strikes. Once a fairly common species within suitable habitats in New Jersey, the species has declined since the 1970s, due to habitat loss and stream degradation. The wood turtle has since been listed as threatened in the State. Extensive monitoring and surveying continue for the species, but habitat loss, vehicle strikes, and illegal collection for the pet trade continue to pose significant challenges to its recovery.

Wood Turtle Onsite Habitat
No wood turtle habitat is mapped as occurring within the study area, although the NJDEP Landscape Project maps suitable habitat in the reservoir vicinity. While some streams and forested wetlands within the study area may contain elements of suitable habitat and while it is possible that transient wood turtles may reach the reservoir through the Rockaway River, it is unlikely that established, viable populations would occur onsite due to the surrounding development and the impounded nature of the reservoir waterbody.

Proposed Onsite Protections
Although proposed habitat enhancement activities such as drainage improvements or native plantings in wetlands and transition areas would potentially enhance wood turtle habitat, no specific onsite protections for wood turtle are proposed as there is very low likelihood of occurrence. It is possible that wood turtle construction monitoring and/seasonal timing restrictions may be required as part of state Flood Hazard Area or Wetland permitting conditions. This would involve inspection of the site and exclusion fence in and around wetlands by a qualified herpetologist immediately prior to construction and maintenance of silt fence by construction personnel during construction. Late fall and winter timing restrictions may apply to in-stream work (where wood turtles hibernate); and spring-summer in terrestrial areas that are not fenced (where they potentially travel, lay eggs, or forage). Terrestrial wood turtle protections would also incidentally protect other herptiles such as box turtle (see below).

<u>Eastern Box Turtle (*Terrapene carolina* – State Special Concern)</u>

Eastern Box Turtle Background
The eastern box turtle is the most terrestrial turtle found in New Jersey. It has been documented in all 21 counties within in State. The species inhabits a variety of habitats, including open woodlands, meadows, as well as rural and suburban yards- usually in close proximity to waterbodies (though it is not adapted for swimming). Box turtles hibernate in underground or underwater burrows from late fall to April.

In New Jersey, mating takes place shortly after emergence from hibernation. Two to seven eggs are laid in a shallow hole between June and July. These eggs hatch after approximately 90 days, after which some hatchlings remain underground, entering directly into hibernation. Sexual maturity is reached at four to five years of age.

Box turtles remain fairly common throughout their range, though their numbers are declining in New Jersey. Studies have shown that box turtles occupy small home ranges, often 250 square yards or less. When removed from these territories and placed in an unfamiliar environment, individuals may die in an effort to find their way back. As a result, the species is vulnerable to habitat destruction and fragmentation, which isolates individuals from finding mates and reduces food supply. Because many roadways transect suitable box turtle habitat, individuals are often struck by motor vehicles. The species has been listed as special concern in New Jersey (Carr, 1952; Schwartz & Golden, 2002).

Eastern Box Turtle Onsite Habitat

The NJDEP Landscape Project does not map suitable habitat for box turtle in the study area. However, one box turtle was identified in the secondary successional upland forest adjacent to the Rockaway River cove, near the western shore of the reservoir during a stakeholder field meeting. Suitable habitat was identified onsite during the field investigation. Various potential food sources, including insects, slugs, fungi, and fruit-bearing trees (i.e. black cherry) were found throughout the study area. The fallen logs and relatively open understories found throughout the site would be expected to support the species. In addition, suitable habitat for box turtle occurs adjacent to the study area, particularly to the east where development is sparse and tracts of floodplain forest remain relatively intact; this provides a corridor for which box turtle populations potentially travel into and out of the reservoir property.

Eastern Box Turtle Proposed Protections

It would not be expected that public access to the reservoir would result in any impacts to turtle species utilizing the site. The species described above would not be expected to be displaced by visitors engaging in passive recreation and the habitat quality and foraging opportunities are not expected to be reduced as a result of human presence. However, an increase in pedestrian traffic may increase the risk of turtles being collected as pets. Based on these findings, the following recommendations to protect turtle species are as follows:

- Incorporate best management practices during construction activities, particularly machinery use including the use of properly installed exclusion (silt) fence during construction activities.

- Install educational signage discouraging the collecting of wild turtles and other wildlife.

- To the greatest extent practicable, avoid disturbances to or removal of fallen logs, native vegetation, and other microhabitats that may be used as cover, nesting areas, and foraging by terrestrial turtle species.

- Any vegetation enhancements such as conversion of maintained upland to native successional field may potentially benefit this species, particularly if foraging options (such as native berry producing plants) are included in a planting design.

4.3 Invasive and Nuisance Wildlife Onsite

In addition to plant species, several invasive wildlife species responsible for overt ecological impacts have been observed onsite. The most significant of these exotic (nonnative) species currently appears to be the emerald ash borer (*Agrilus planipennis*). The beetle larvae kill native ash trees by feeding on the inner layers of the tree (phloem, cambium, and outer xylem). Evidence of dead or dying trees (assumed infected with emerald ash borer) were observed on the western shore and may be contributing to the establishment of invasive species in canopy gaps.

Ten to fifteen invasive mute swan (*Cygnus olor*) have been observed by ASGECI on Reservoir waters. This Eurasian species is aggressive and known to attack people, pets and native wildlife in defense of nests. They are particularly problematic for native waterfowl which may be chased off and displaced by their presence. The presence of these swans may have significant impacts for Boonton Reservoir which would be expected to support a diverse range of wintering waterfowl. Control of swans is typically done by culling; however, this is generally unpopular among the public. It is recommended that mute swans be observed in upcoming seasons to their affect on native waterfowl usage.

White-Tailed Deer

White -Tailed Deer Background

Although native to New Jersey, many ecologists consider white-tailed deer (*Odocoileus virginianus*) overpopulation to be among the greatest ecological threat to forests of New Jersey and southern New York. Often the species' ecological impact is clearly visible when manifested as a "browse line" within a forest understory. The deer browse line is a striation of heavy defoliation that typically extends from the forest floor to a height of around three to four feet (the typical maximum height that deer are capable of effectively browsing). The browse line is marked by drastic losses in vegetation density and diversity, even at relatively low deer densities. Ecological problems associated with deer over browse include increased vegetation exposure to wind, ice, insects and parasites; a lack of forest tree seedling regeneration from seed and shoot overconsumption; a lack of understory habitat structure (such as that required for ground nesting birds, salamanders and small mammals); and an increase in invasive species that deer avoid such as Japanese stiltgrass, garlic mustard and Japanese barberry.

The most common concern of deer presence is Lyme disease, a neurological disease with a wide variety of symptoms. Lyme disease is caused by a spirochete bacterium and typically transmitted to humans by deer ticks (*Ixodes scapularis*) and lone star ticks (*Amblyomma americanum*) in New Jersey. Although deer are not a reservoir for Lyme disease, deer are the preferred winter host for adult deer ticks. Correlations between superabundant deer tick populations and excessive densities of deer (greater than 100 deer/square mile) have been observed.

Potential Deer Effects and Control Onsite

The effect of super high densities of deer is evident at Boonton Reservoir. Male and female deer of all ages are regularly observed during daylight hours in all habitats onsite. The predominance of less palatable invasive herbaceous and understory species and the lack of native understory vegetation and seedling presence in many forest locations is the direct result of deer densities above carrying capacity. Deer overpopulation presents the greatest hurdle to invasive species control and native replanting onsite. The following considerations should be made with regard to deer control:

- In order to enhance onsite forests and other vegetation communities on a large scale, deer populations must be controlled. Deer control on a large scale would be difficult as the species are capable of jumping six-foot fences and can easily enter and exit the reservoir through cut fence holes, gate gaps, etc.

- To explore long term deer management solutions, a step-down deer management/invasive species management plan may be developed. Such a plan should accurately quantify deer densities and impacts onsite, determine rough control costs, evaluate cultural sensitivity and local support for deer control, and identify the reasonable and effective combination of controls for the reservoir.

- Similar deer management plans would be expected to be in place for other natural areas in Morris County and coordination with County personnel may facilitate plan and methodology development.

- In order to better quantify the effects of deer browse and determine the need of potential control methods, treatment (fenced) and control vegetation plots could be established and compared (in cover and native diversity) in various onsite communities to determine deer browse effects.

- Potential controls may require a combination of regular culling and exclusion (fencing) and individual protection of shrub, sapling or young tree plantings. Opening the site to recreational hunting does not appear feasible based reservoir property size and proximity to residences.

- For the purposes of smaller-scale planting projects associated with the proposed project (such as proposed non-structural drainage improvements utilizing vegetation), barriers such as appropriate deer exclusion fencing must be carefully planned, installed, monitored and maintained for long-term success in these areas. Invasive species control in conjunction with deer management must also be considered as part of the project design.

Canada Geese
Both resident and migratory Canada geese (*Branta canadensis*) occur onsite. Approximately 20 resident geese have been observed by ASGECI in the maintained areas onsite. The geese numbers observed are not sufficient to impact water quality but are likely to present an aesthetic issue with regard to visitors, particularly where visitors are most likely come into contact with goose feces (such as along the maintained southern shore).

As with deer, controlling resident geese is complicated and often involves multiple methodologies. Examples of control methods include use of deterrents such as chemical repellants or fencing, trained dogs, habitat alteration, addling of eggs, or culling of adults. As geese do not appear to present a major ecological issue onsite at this time, control is currently not recommended. As Canada geese prefer open maintained areas for foraging and to avoid predation; conversion of lawn areas to high grass or forbs will reduce goose usage and subsequent goose fecal accumulation in those areas.

5.0 CONCLUSIONS

Boonton Reservoir is an important and unique ecological resource to the region with high potential for passive recreational benefit. The reservoir itself is surrounded by urban development. While this contributes invasive species presence and limitations of wildlife recruitment; it also adds to the importance of the site as a “habitat island” for important species such as migratory birds.

Primary land cover in the reservoir includes varying types of deciduous upland forest ranging from mature oak-dominant forest typical of northern New Jersey to secondary successional forest with opportunistic colonizing canopy trees and evidence of previous disturbance. Other communities including palustrine forested and emergent wetlands, open waters and rocky shorelines, riparian habitats, early or mid-successional edges, and maintained uplands exist onsite.

Wetlands within 150 feet of the proposed trail have been delineated by ASGECI. Most of the proposed trail location is on the existing path where historic fill has been placed and is therefore

outside of wetlands. Tree removal for the proposed trail is expected to be minimal. NJDEP wetlands and Flood Hazard Area permitting will be required for the site (See Wetland Report).

Floristic Quality Index data is currently being collected and will continue to be collected during the growing season into June of 2020. Upon completion of data collection, an FQI index score will be calculated for each community plot and the site as a whole.

The reservoir supports a diversity of observable wildlife, particularly wintering, migratory and nesting birds and mobile insects such as dragonflies and butterflies. Key migratory bird species include various forest warblers and wintering waterfowl. Significant nesting bird species include bald eagles on the lower west shore, a great blue heron and double-crested cormorant island rookery, and forest interior bird nesting, particularly along the eastern shore. Common herptiles, including box turtle, have been observed onsite.

Agency databases identify several threatened and endangered species as potentially occurring onsite. Low mobility, habitat-sensitive terrestrial species such as wood turtle and bog turtle would not be expected to occur onsite due site degradation, historic hydrological manipulation, and a lack of habitat connectivity. Federally-listed bat species would be more likely to utilize the reservoir forests for foraging and roosting based on the proximity of known hibernacula and roost suitability.

The proposed project will be designed to assure the protection of rare, threatened and endangered species and protect wildlife habitat onsite. Considerations include a combination of area avoidance, seasonal timing restrictions as needed, limitations and enforcement of allowable activities, habitat enhancements, and stormwater control improvements. Educational signage should be incorporated into all habitat enhancement areas onsite.

Coordination with regulatory agencies, including the USFWS and the NJDEP (Land Use and Endangered and Nongame Species Program) will be ongoing and will be required as part of wetlands and flood hazard area permitting. This additional compliance review will assure that proposed activities will avoid and minimize ecological impact during and following construction, and once public access is permitted.

Deer overpopulation and invasive species control are the primary limiting factors to effective habitat enhancement and affect the type and scale of native plantings that can occur onsite. A site-specific deer and invasive species plan must be developed and implemented in coordination with Morris County and resource experts prior to larger-scale habitat enhancements such as reforestation. Deer and invasive species control and monitoring must be incorporated into the smaller-scale project planting plans (for stormwater enhancement or pollinator habitat development).

6.0 REFERENCES

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Davenport, M. 2010. *Wood Turtle.* Conserve Wildlife Foundation of New Jersey, Field Guide.http://www.conservewildlifenj.org/species/fieldguide/view/Glyptemys%20insculpta/. Accessed 4/19/2016.

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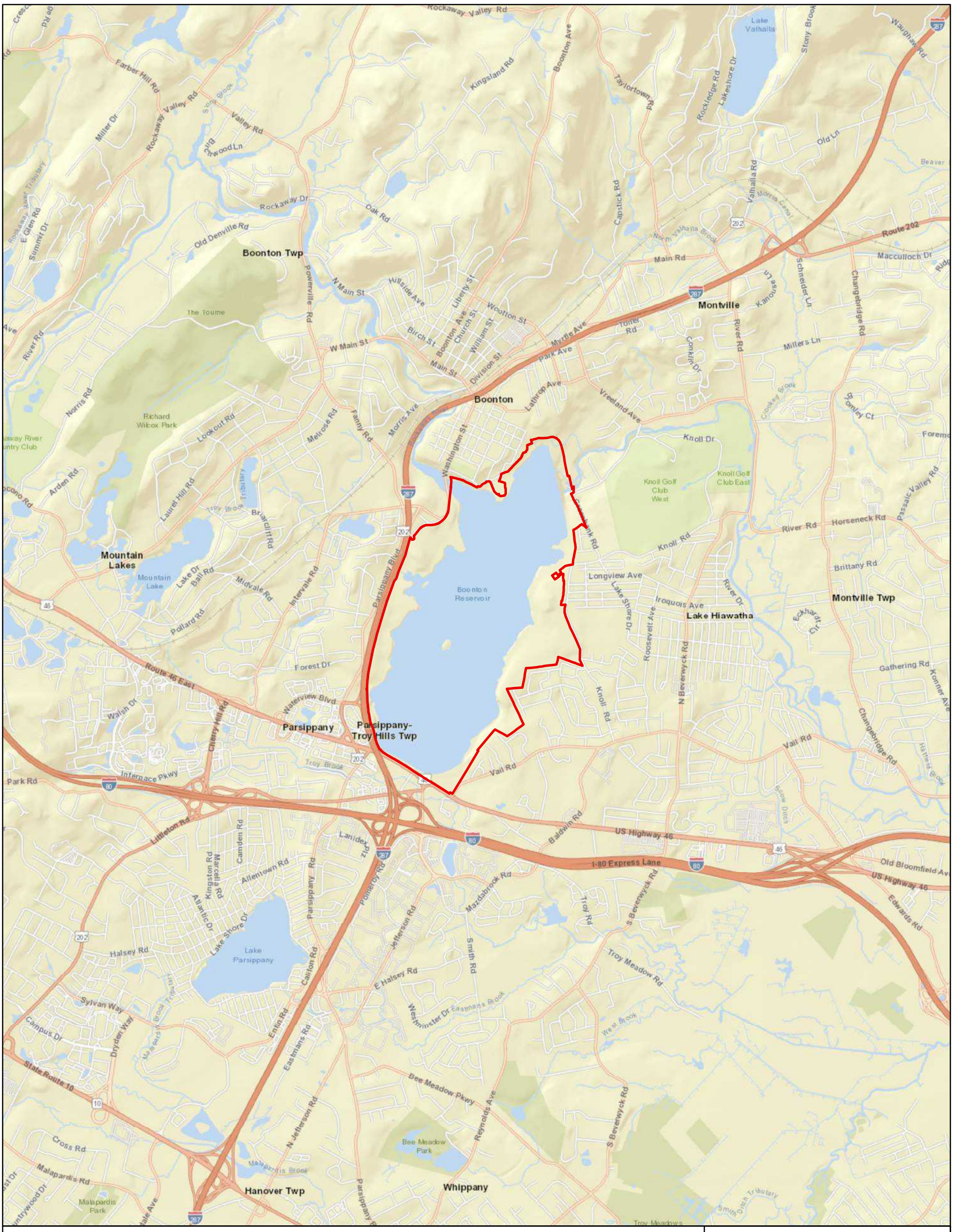
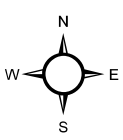
APPENDIX A FIGURES

County Road Map
SSURGO Soils Map
NJDEP Landscape Project Map
FEMA Floodplain Map
NJDEP Wetlands Map
Vegetation Community Map



Legend

Site Location



Source:
ESRI Street Map was developed using Esri basemap data, DeLorme basemap layers, U.S. Geological Survey elevation data, HERE data, and select data from the GIS user community, released by ESRI® Data & Maps, Redlands, California, 2019.

County Road Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429

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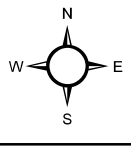
AMY S. GREENE ENVIRONMENTAL CONSULTANTS

Legend

Site Location

New Jersey State Plane Coordinates in NAD83 for the approximate center of site -
North: 746,462' // East: 517,744'

Latitude and Longitude Coordinates in NAD83 for the approximate center of site -
N: 40° 52' 57.57" / W: 74° 24' 26.44"



USGS Topographic Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429

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AMY S. GREENE ENVIRONMENTAL CONSULTANTS

Source:
National Geographic Society (NGS) USA Topographic Maps, seamless, scanned images of United States Geological Survey (USGS) paper topographic maps, Boonton, Caldwell, Morristown, and Pompton Plains NJ Quadrangles, copyright 2013, distributed as a web mapping service by ESRI® Data & Maps, Redlands, California, 2019.

Legend

Site Location

SOILS LIST:

BohB - Boonton moderately well drained gravelly loam, 3 to 8 percent slopes [NL]
FNAT - Fluvaquents and Udifluvents, 0 to 3 percent slopes, frequently flooded [HI]
HanB - Haledon silt loam, 3 to 8 percent slopes [NL]
HhmCa - Hibernia loam, 3 to 15 percent slopes, stony [HI]
MknB - Minoa silt loam, 3 to 8 percent slopes [NL]
OtsC - Otisville gravelly loamy sand, 3 to 15 percent slopes [NL]
PbphAt - Parsippany silt loam, sandy loam substratum, 0 to 3 percent slopes, frequently flooded [H]
PrkAt - Preakness sandy loam, 0 to 3 percent slopes, frequently flooded [H]
RkgBb - Ridgebury loam, 0 to 8 percent slopes, very stony [H]
RobCb - Rockaway sandy loam, 8 to 15 percent slopes, very stony [NL]
RobDc - Rockaway sandy loam, 15 to 25 percent slopes, extremely stony [NL]
RomE - Rockaway-Rock outcrop complex, 25 to 45 percent slopes [NL]
UR - Urban land [NL]
USRHVB - Urban land-Riverhead complex, 3 to 8 percent slopes [NL]
USROCC - Urban land-Rockaway complex, 3 to 15 percent slopes [NL]
USWHHB - Urban land-Whippany, occasionally flooded complex, 0 to 8 percent slopes [HI]
WhphB - Whippany silt loam, sandy loam substratum, 3 to 8 percent slopes [NL]

Sources:
Soil Survey Geographic (SSURGO) Database for Morris County, New Jersey,
U.S. Department of Agriculture, Natural Resources Conservation Service, Fort Worth, Texas, November 2013.
New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey -
Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

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AMY S. GREENE ENVIRONMENTAL CONSULTANTS

SSURGO Soils Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429

Legend

- Site Location
- Streams with Water Quality
- NJDEP Freshwater Wetlands
- NJDEP Linear Wetlands

WETLAND CLASSIFICATIONS:

MODD - Disturbed Areas (surface/vegetation disturbed, nature of activity not readily apparent)
PEM1C/PSS1C - Palustrine, Emergent, Persistent, Seasonally Flooded / Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded
PFO1A - Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded
PFO1B - Palustrine, Forested, Broad-Leaved Deciduous, Saturated
PFO1C - Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded
R4SB2 - Riverine, Intermittent, Streambed, Rubble

Sources:
NJDEP Wetlands of New Jersey by County, 1986, New Jersey Department of Environmental Protection (NJDEP), Office of Information Resources Management, Bureau of Geographic Information and Analysis, NJDEP, Trenton, November 1999.
NJDEP Surface Water Quality Standards of New Jersey, NJ Department of Environmental Protection (NJDEP), Water Monitoring & Standards (WMS), Bureau of Freshwater and Biological Monitoring (BFBM), Trenton, NJ, December 2010.
New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

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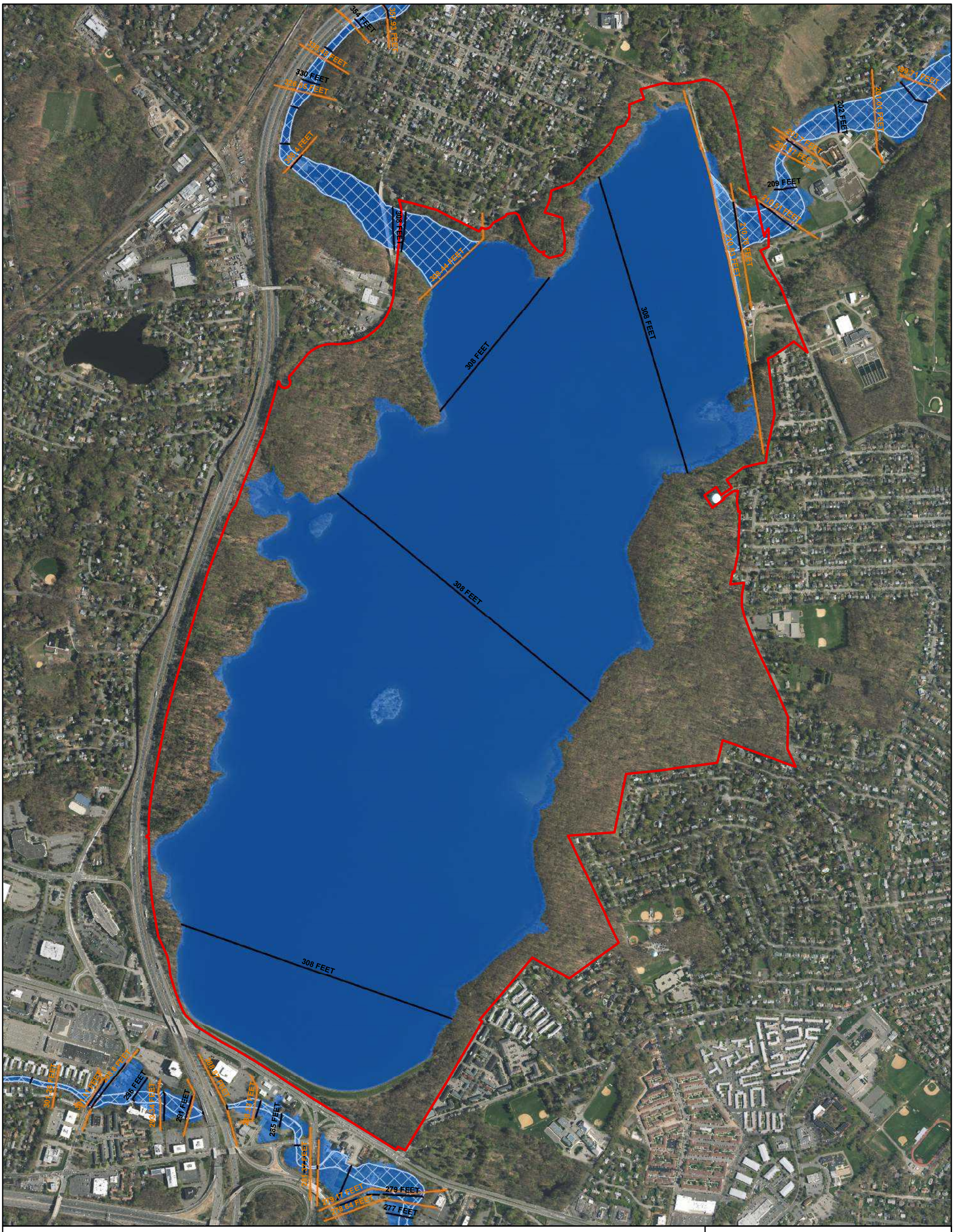
NJDEP Wetlands & Streams Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429



Legend

- Site Location
- 100-year FEMA Floodplain
- Floodway
- Base Flood Elevation
- Cross Section Elevation

Sources:
Preliminary Digital Flood Insurance Rate Map (DFIRM) Database, Morris County, New Jersey, Federal Emergency Management Agency, vector digital data, Federal Insurance and Mitigation Administration, Washington, DC, August 2017.
New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

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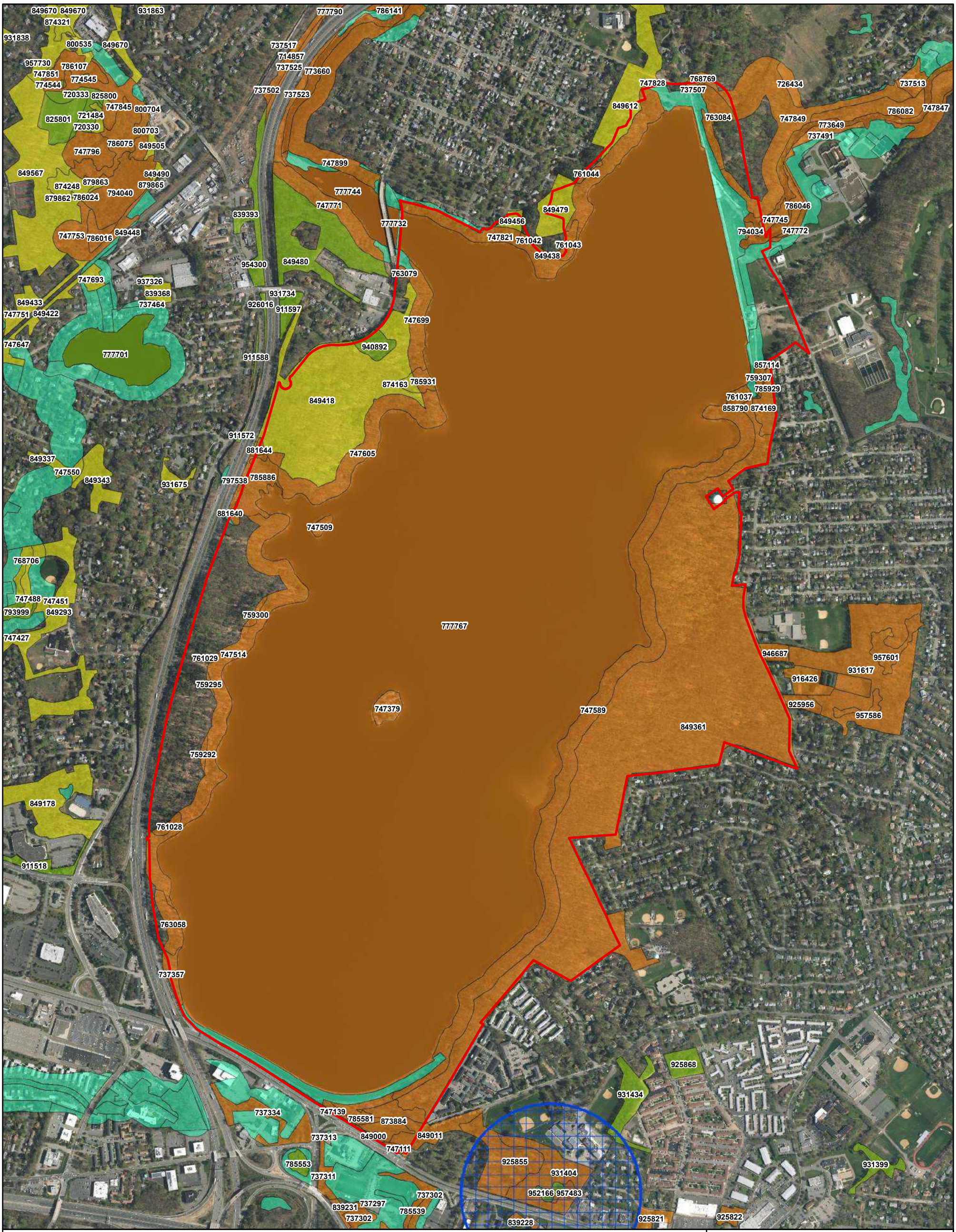
FEMA Floodplain Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429



Legend

- Site Location
- Rank 1 Habitat
- Rank 2 Habitat
- Rank 3 Habitat
- Rank 4 Habitat
- Rank 5 Habitat
- Potential vernal habitat area
- Vernal habitat area

SPECIES LIST:
737357, 737507, 747139, 747514, 747745, 747772, 747849, 759292, 759295, 759300, 759307, 761028, 761029, 761037, 761042, 761043, 761044, 763058, 763079, & 763084 - Bald Eagle (Foraging) & Bobcat (On Road)
747111, 768769, 849000, 849011, 857112, 857114, 858790, 873884, & 874169 - Bobcat (On Road)
747379 - Bald Eagle (Wintering & Foraging), Bobcat (On Road), & Great Blue Heron (Nesting Colony)
747509, 747589, & 747821 - Bald Eagle (Wintering & Foraging), & Bobcat (On Road)
747605 & 747699 - Bald Eagle (Wintering & Foraging), Bobcat (On Road), & Wood Thrush (Breeding Sighting)
773649, 881640, & 881644 - Bald Eagle (Foraging) & Great Blue Heron (Foraging)
777767 - Bald Eagle (Wintering), Bald Eagle (Foraging), & Great Blue Heron (Foraging)
785581, 785886, & 785929 - Bald Eagle (Foraging), Bobcat (On Road), & Great Blue Heron (Foraging)
785931 - Bald Eagle (Wintering & Foraging), Bobcat (On Road), & Great Blue Heron (Foraging)
794034 & 797538 - Bald Eagle (Foraging), Bobcat (On Road), & Great Blue Heron (Foraging)
849361 - Bald Eagle (Wintering) & Bobcat (On Road)
849418 - Bald Eagle (Wintering) & Wood Thrush (Breeding Sighting)
849438, 849456, 849479, 849612, & 874163 - Bald Eagle (Wintering)
940892 - Wood Thrush (Breeding Sighting)

Sources:
NJDEP Species Based Habitat by Landscape Region and Vernal Habitat (Version 3.3), New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered Non-Game Species Program, vector digital data, Division of Information Technology, Bureau of Geographic Information Systems, Trenton, NJ, May 2017.
New Jersey 2015 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles, State of New Jersey - Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), Trenton, NJ, February 2016.

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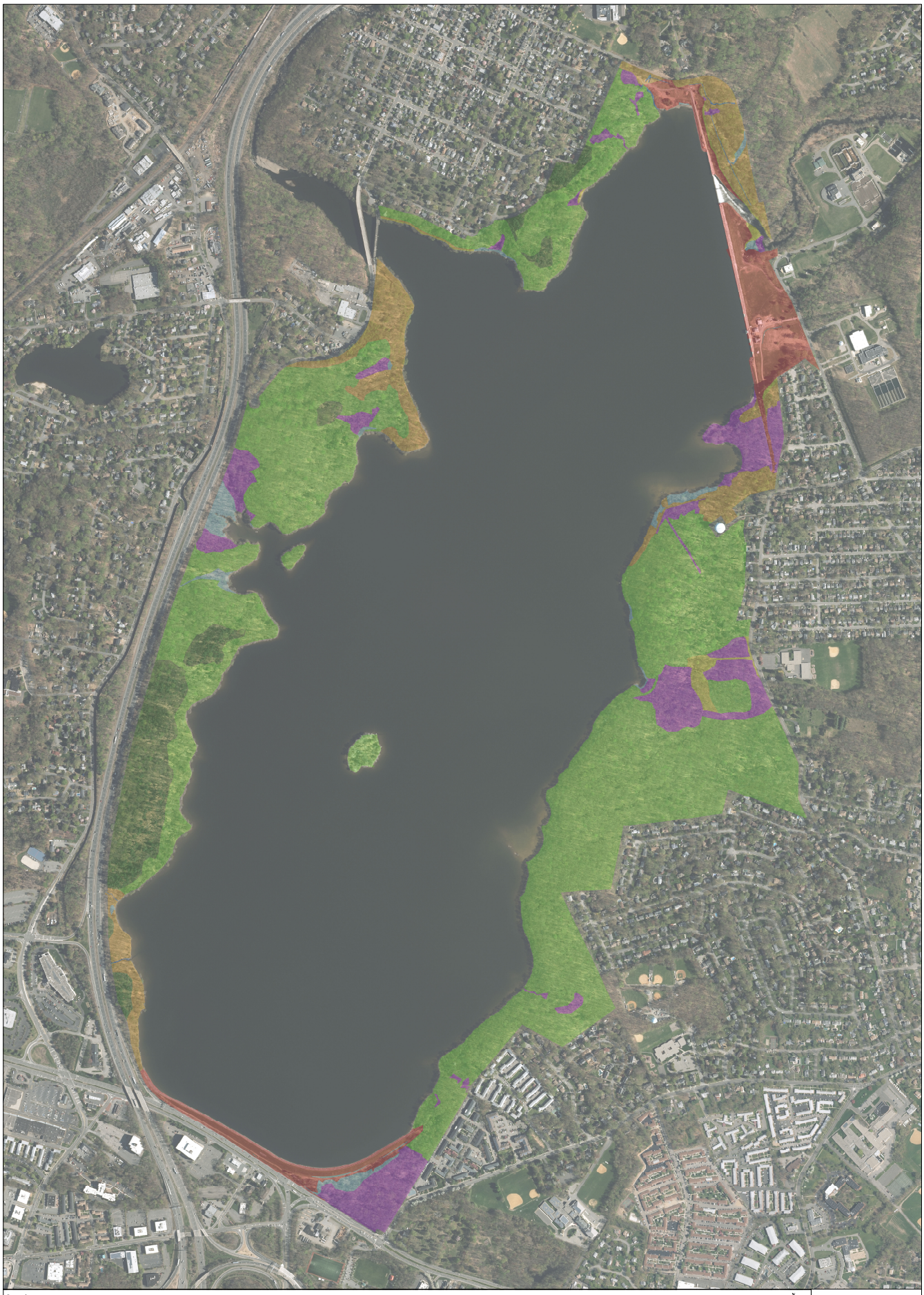
Landscape Project Map

Boonton Reservior Recreation Trail
Parsippany - Troy Hills Township
Block 400; Lot 1
and Town of Boonton
Block 90.01; Lot 2
Morris County, New Jersey

ASGECI Project # 4429

AMY S. GREENE ENVIRONMENTAL CONSULTANTS



Legend

- Deciduous Upland
- Mixed Coniferous Deciduous Upland
- Early or Mid Successional Upland
- Secondary Successional Upland
- Palustrine Emergent Wetland
- Palustrine Forested Wetland
- Open Water Channel
- Maintained Area

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DRAFT
DATE: 9/12/2019

Vegetation Communities Map

Boonton Reservoir Recreation Trail
Block 400, Lot 1
Parsippany - Troy Hills
Block 90.01, Lot 2
Town of Boonton
Morris County, New Jersey

ASGECI Project #4429

400 Feet

ARY S. GREENE ENVIRONMENTAL CONSULTANTS

APPENDIX B SITE PHOTOGRAPHS WITH DESCRIPTIONS

Photo A: View looking west across a forested wetland dominated by red maple along the east shore. Japanese stiltgrass can be seen in the herbaceous layer.

Photo B: View of a sedge-dominant emergent portion of Wetland Q. Root knees of an adjacent bald cypress (uncommon in New Jersey) can be observed in the photo.

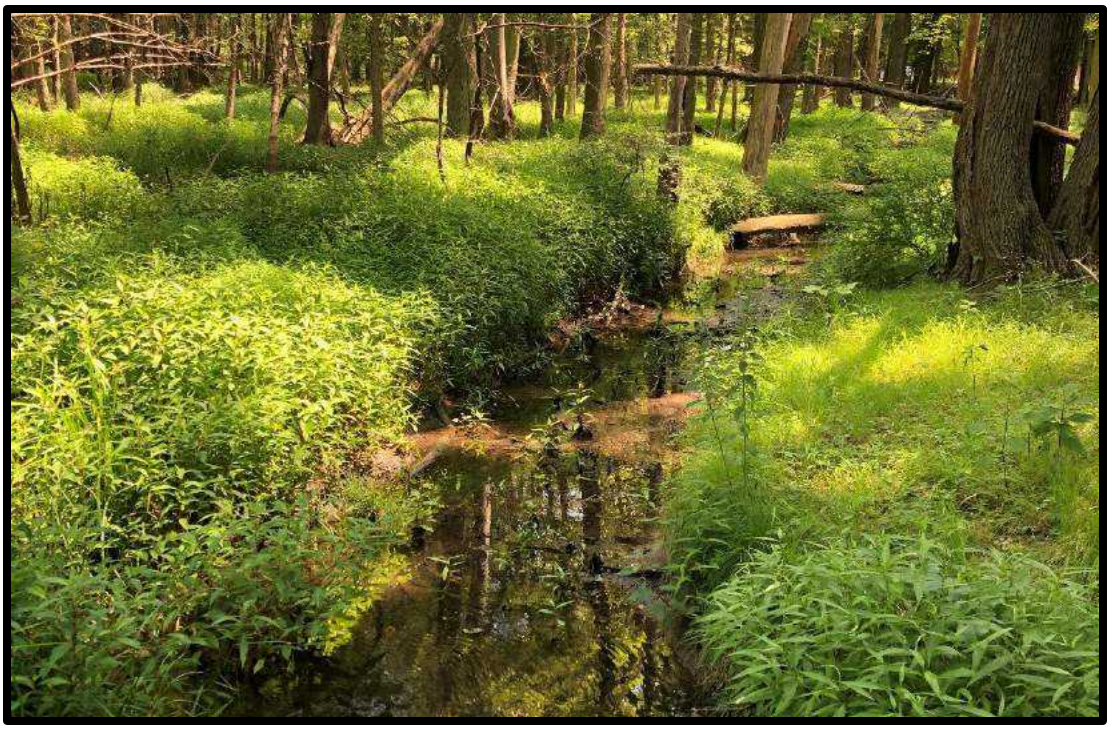


Photo C: View of a forested unnamed tributary of the Troy Brook in Wetland Q. Small tributaries or drainage channels exist along the all shores of the reservoir.

Photo D: View of secondary successional forest along the southwest shore. Light openings in these disturbed community results in high densities of exotic or opportunistic herbaceous species, shrubs and vines.

Photo E: View looking south at the reservoir berm that extends along the southeastern and southern shore. A wetland ditch exists along a portion of its base.

Photo D: View of boulder strewn sugar maple upland forest along the northwest shore. Rocky sloping upland areas are found on east and west both shores.

Photo E: Additional view of upland forest dominated by oaks and tulip poplar, with an understory of upland grasses.

Photo F: View looking east at maintained lawn near the main entrance to the reservoir. Lawns such as these may be converted to warm season wildflower/grassland areas to improve ecological value and function and provide a draw to visitors.

Photo G: View looking north at a mid-successional shrub and herb forest edge near Wetland Q. These upland areas develop onsite along ecotonal edges or where disturbance has recently occurred.

Photo H: View looking east along the southwestern shore at one of the eroded channels formed by runoff from an outfall near Route 287. Stormwater improvements to these locations will significantly improve localized ecological conditions and water quality.

Photo I: View looking north towards mixed forest along the central portion of the west shore.
This location is utilized by nesting eagles and the proposed trail alignment will avoid vital nest areas.

Photo J: View of dead trees in a white pine dominant area on the west shore.
Dead trees with flaking bark such as this have the potential to be utilized by listed bats.

Photo K: Winter view looking south across the reservoir from the northeast shore. The rocky upland successional shoreline is common throughout the reservoir. The heron rookery island can be seen in the back center of the photo.

Photo L: View looking north at oak-dominant uplands near FQI Plot 7 near the Rockaway River cove.

Photo M: View looking west at a wetland fringe along the north shore. The extent of wetland fringes along the reservoir waterfront tends to be limited due to the surrounding shoreline topography and geology.

Photo N: View looking north along the existing road (proposed trail alignment) in upland forest. Much of the roadway is well established and underlain with historic fill, which limits the amount new disturbance required to open it to public access.

APPENDIX C AGENCY CORRESPONDENCE

USFWS Information, Planning and Consultation System (IPaC) Species List,
Natural Heritage Project Letter – August 12, 2019

State of New Jersey
MAIL CODE 501-04
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF PARKS & FORESTRY
NEW JERSEY FOREST SERVICE
OFFICE OF NATURAL LANDS MANAGEMENT
P.O. BOX 420
TRENTON, NJ 08625-0420
Tel. (609) 984-1339 Fax (609) 984-0427

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

CATHERINE R. McCABE
Commissioner

August 12, 2019

Sean J. Ronan
Amy S. Greene Environmental Consultants, Inc.
4 Walter E. Foran Boulevard, Suite 209
Flemington, NJ 08822-4666

Re: Boonton Reservoir Recreation Trail ASGECI Project #4429
Block(s) - 400; 90.01, Lot(s) - 1; 2
Parsippany-Troy Hills Township and Boonton Town, Morris County

Dear Mr. Ronan:

Thank you for your data request regarding rare species information for the above referenced project site.

Searches of the Natural Heritage Database and the Landscape Project (Version 3.3) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Natural Heritage Data Request Form into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Landscape Project habitat mapping and the Biotics Database for occurrences of any rare wildlife species or wildlife habitat on the referenced site. The Natural Heritage Database was searched for occurrences of rare plant species or ecological communities that may be on the project site. Please refer to Table 1 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented on site. A detailed report is provided for each category coded as 'Yes' in Table 1.

We have also checked the Landscape Project habitat mapping and Biotics Database for occurrences of rare wildlife species or wildlife habitat in the immediate vicinity (within ¼ mile) of the referenced site. Additionally, the Natural Heritage Database was checked for occurrences of rare plant species or ecological communities within ¼ mile of the site. Please refer to Table 2 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented within the immediate vicinity of the site. Detailed reports are provided for all categories coded as 'Yes' in Table 2. These reports may include species that have also been documented on the project site.

We have also checked the Landscape Project habitat mapping and Biotics Database for all occurrences of rare wildlife species or wildlife habitat within one mile of the referenced site. Please refer to Table 3 (attached) to determine if any rare wildlife species or wildlife habitat is documented within one mile of the project site. Detailed reports are provided for each category coded as 'Yes' in Table 3. These reports may include species that have also been documented on the project site.

For requests submitted in order to make a riparian zone width determination as part of a Flood Hazard Area Control Act (FHACA) rule application, we report records for all rare plant species and ecological communities tracked by the Natural Heritage Program that may be on, or in the immediate vicinity of, your project site. A subset of these plant species are also covered by the FHACA rules when the records are located within one mile of the project site. One mile searches for FHACA plant species will only report precisely located occurrences for those wetland plant species identified under the FHACA regulations as being critically dependent on the watercourse. Please refer to Table 3 (attached) to determine if any precisely located rare wetland plant species covered by the FHACA rules have been documented. Detailed reports are

provided for each category coded as 'Yes' in Table 3. These reports may include species that have also been documented on, or in the immediate vicinity of, the project site.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. Please refer to Tables 1, 2 and 3 (attached) to determine if any priority sites are located on, in the immediate vicinity, or within one mile of the project site.

A list of rare plant species and ecological communities that have been documented from the county (or counties), referenced above, can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2010.pdf.

Beginning May 9, 2017, the Natural Heritage Program reports for wildlife species will utilize data from Landscape Project Version 3.3. If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive web application at the following URL, https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=0e6a44098c524ed99bf739953cb4d4c7, or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292-9400.

For additional information regarding any Federally listed plant or animal species, please contact the U.S. Fish & Wildlife Service, New Jersey Field Office at http://www.fws.gov/northeast/njfieldoffice/endangered/consultation.html.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Robert J. Cartica
Administrator

c: NHP File No. 19-4007484-17270

Table 1: On Site Data Request Search Results (6 Possible Reports)

Report Name	Included	Number of Pages
1. Possibly on Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	No	0 pages included
2. Natural Heritage Priority Sites On Site	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.3	No	0 pages included
5. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Stream Habitat File	No	0 pages included
6. Other Animal Species On the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Aves								
	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Bald Eagle	Haliaeetus leucocephalus	Wintering	3	NA	State Threatened	G5	S1B,S2N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Nesting Colony	2	NA	Special Concern	G5	S3B,S4N
	Wood Thrush	Hylocichla mustelina	Breeding Sighting	2	NA	Special Concern	G4	S3B,S4N
Mammalia								
	Bobcat	Lynx rufus	On Road	4	NA	State Endangered	G5	S2

Table 2: Vicinity Data Request Search Results (6 possible reports)

Report Name	Included	Number of Pages
1. Immediate Vicinity of the Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	No	0 pages included
2. Natural Heritage Priority Sites within the Immediate Vicinity	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat In the Immediate Vicinity of Project Site Based on Search of Landscape Project 3.3	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat In the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Stream Habitat File	No	0 pages included
6. Other Animal Species In the Immediate Vicinity of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Aves								
	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Bald Eagle	Haliaeetus leucocephalus	Wintering	3	NA	State Threatened	G5	S1B,S2N
	Cooper's Hawk	Accipiter cooperii	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Red-shouldered Hawk	Buteo lineatus	Nest	4	NA	State Endangered	G5	S1B,S3N
	Wood Thrush	Hylocichla mustelina	Breeding Sighting	2	NA	Special Concern	G4	S3B,S4N
Mammalia								
	Bobcat	Lynx rufus	On Road	4	NA	State Endangered	G5	S2
Reptilia								
	Wood Turtle	Glyptemys insculpta	Occupied Habitat	3	NA	State Threatened	G3	S2

Vernal Pool Habitat
In the Immediate Vicinity of
Project Site Based on Search of
Landscape Project 3.3

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Potential vernal habitat area	2077

Total number of records: 1

Monday, August 12, 2019

NHP File No.: 19-4007484-17270

Table 3: Within 1 Mile for Riparian Zone Width Determination
(6 possible reports)

Report Name	**Included**	**Number of Pages**
1. Rare Plant Species Occurrences for Riparian Zone Width Determination (Flood Hazard Area Control Act Rule Appplication) - Within One Mile of the Project Site Based on Search of Natural Heritage Database	No	0 pages included
2. Natural Heritage Priority Sites for Riparian Zone Width Determination - Within One Mile of the Project Site	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat for Riparian Zone Width Determination - Within One Mile of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches	Yes	2 page(s) included
4. Vernal Pool Habitat for Riparian Zone Width Determination - Within One Mile of the Project Site Based on Search of Landscape Project 3.3	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat for Riparian Zone Width Determination - Within One Mile of the Project Site Based on Search of Landscape Project 3.3 Stream Habitat File	No	0 pages included
6. Other Animal Species for Riparian Zone Width Determination - Within One Mile of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

Rare Wildlife Species or Wildlife Habitat for Riparian Zone Width Determination Within One Mile of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Amphibia								
	Blue-spotted Salamander	Ambystoma laterale	Occupied Habitat	4	NA	State Endangered	G5	S1
Aves								
	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Bald Eagle	Haliaeetus leucocephalus	Wintering	3	NA	State Threatened	G5	S1B,S2N
	Barred Owl	Strix varia	Breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Barred Owl	Strix varia	Non-breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Brown Thrasher	Toxostoma rufum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Cooper's Hawk	Accipiter cooperii	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Northern Goshawk	Accipiter gentilis	Breeding Sighting	4	NA	State Endangered	G5	S1B,S3N
	Red-shouldered Hawk	Buteo lineatus	Nest	4	NA	State Endangered	G5	S1B,S3N

Rare Wildlife Species or Wildlife Habitat for Riparian Zone Width Determination Within One Mile of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
	Red-shouldered Hawk	Buteo lineatus	Non-breeding Sighting	2	NA	Special Concern	G5	S1B,S3N
	Veery	Catharus fuscescens	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Wood Thrush	Hylocichla mustelina	Breeding Sighting	2	NA	Special Concern	G4	S3B,S4N
	Worm-eating Warbler	Helmitheros vermivorum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
Mammalia								
	Bobcat	Lynx rufus	Live Individual Sighting	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	On Road	4	NA	State Endangered	G5	S2
Reptilia								
	Northern Copperhead	Agkistrodon contortrix mokasen	Occupied Habitat	2	NA	Special Concern	G5T5	S3
	Wood Turtle	Glyptemys insculpta	Occupied Habitat	3	NA	State Threatened	G3	S2

Vernal Pool Habitat for Riparian Zone Width Determination Within One Mile of the Project Site Based on Search of Landscape Project 3.3

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Vernal habitat area	2957
Potential vernal habitat area	2077
Potential vernal habitat area	2088

Total number of records: 3

IPaC

U.S. Fish & Wildlife Service

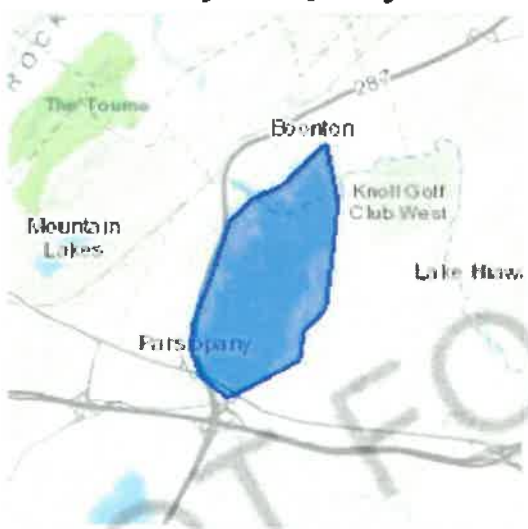
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Morris County, New Jersey



NOT FOR CONSULTATION

Local office

New Jersey Ecological Services Field Office

(609) 646-9310
(609) 646-0352

4 E. Jimmie Leeds Road, Suite 4
Galloway, NJ 08205

http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Reptiles

NAME	STATUS
Bog Turtle Clemmys muhlenbergii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6962	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

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Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

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NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	**Breeds Sep 1 to Jul 31**
Blue-winged Warbler Vermivora pinus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	**Breeds May 1 to Jun 30**
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	**Breeds elsewhere**
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	**Breeds elsewhere**

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Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler Protonotaria citrea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

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How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

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SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bald Eagle Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)												
Blue-winged Warbler BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)												
Golden Eagle Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)												
Long-eared Owl BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)												
Prairie Warbler BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)												

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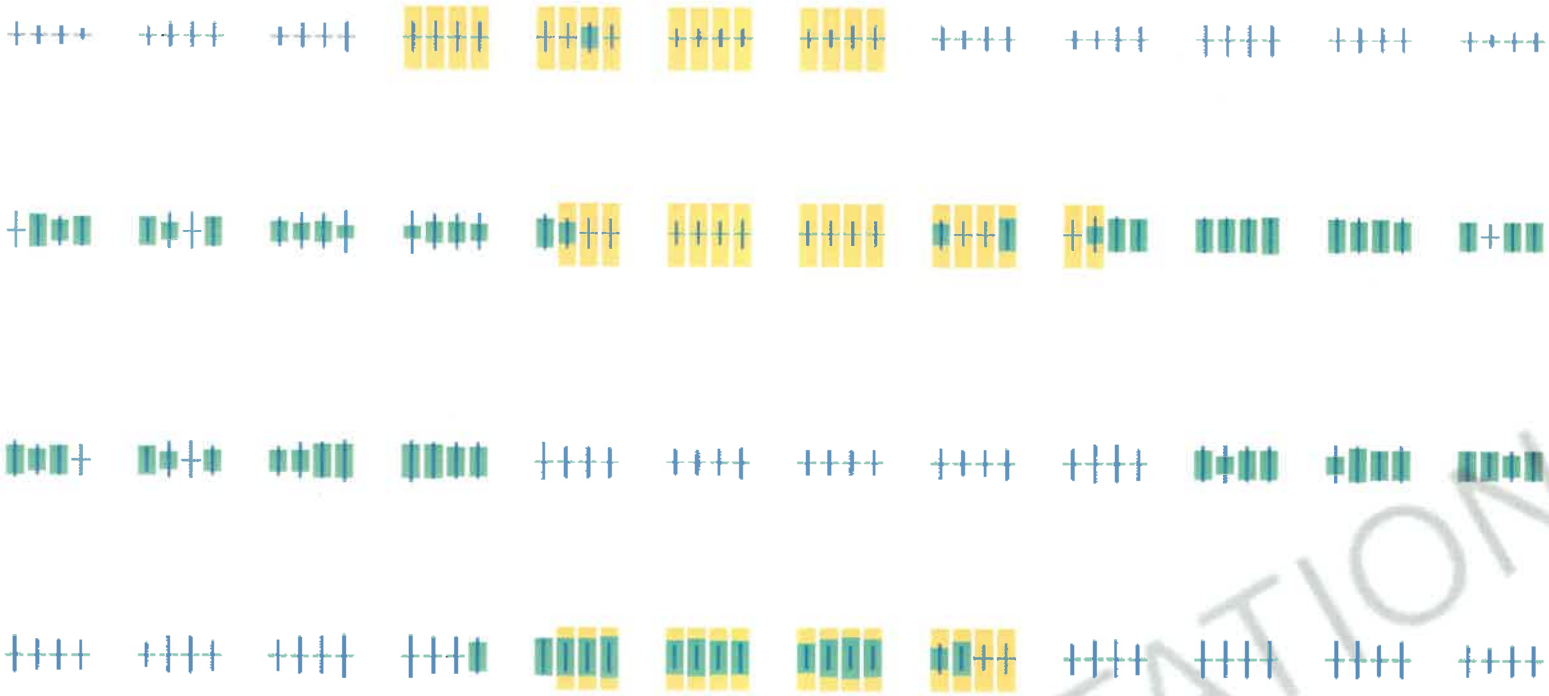
Prothonotary Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Red-headed Woodpecker
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Rusty Blackbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Wood Thrush
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a

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BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

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For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

NOT FOR CONSULTATION

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND
- PEM1/SS1C

FRESHWATER FORESTED/SHRUB WETLAND
- PFO1Ah
- PFO1C
- PFO1Ch

LAKE
- L1UBHh

NOT FOR CONSULTATION

RIVERINE

- R2UBH
- R2UBHx
- R5UBH

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Preliminary Floristic Quality Index (FQI) Plot Data/Plant List
Summer/Early fall Evaluation

FQI 1

Trees

Norway maple	*Acer platanoides*
Sugar maple	*Acer saccharum*
Silver maple	*Acer saccharinum*
Pin oak	*Quercus palustris*
Sassafras	*Sassafras albidum*
Green ash	*Fraxinus pennsylvanica*
Wineberry	*Rubus phoenicolasius*
White pine	*Pinus strobus*
Tulip poplar	*Liriodendron tulipifera*
Flowering dogwood	*Cornus florida*
Black walnut	*Juglans nigra*

Shrubs/Vines

Cinquefoil sp.	*Potentilla sp.*
Multiflora rose	*Rosa multiflora*
Virginia creeper	*Parthenocissus quinquefolia*
Poison ivy	*Toxicodendron radicans*
Japanese honeysuckle	*Lonicera japonica*
Riverbank grape	*Vitis riparia*

Herbaceous

Lady's thumb	*Persicaria maculosa*
White snakeroot	*Ageratina altissima*
Japanese stiltgrass	*Microstegium vimineum*
Wood sorrel	*Oxalis sp.*
Garlic mustard	*Alliaria petiolata*
Path rush	*Juncus tenuis*
Smartweed sp.	*Persicaria sp.*
Jack-in-the-pulpit	*Arisaema triphyllum*
Goldenrod sp.	*Solidago sp.*
Arrowleaf tearthumb	*Persicaria sagittata*
Virginia stickseed	*Hackelia virginiana*
Cinnamon fern	*Osmunda cinnemomea*
Pilewort	*Erechtites hieraciifolius*
Rosette grass sp.	*Dichanthelium sp.*

FQI 2

Trees

Pin oak	*Quercus palustris*
Green ash	*Fraxinus pennsylvanica*
Honey locust	*Gleditsia triacanthos*

Shrubs/Vines

Oriental bittersweet	*Celastrus orbiculatus*
Crown vetch	*Securigera varia*
Poison ivy	*Toxicodendron radicans*
Japanese honeysuckle	*Lonicera japonica*
Multiflora rose	*Rosa multiflora*
Allegheny blackberry	*Rubus alleghensis*
Privet	*Ligustrum sp.*

Herbaceous

NY Ironweed	*Vernonia noveboracensis*
Virgin's bower	*Clematis virginiana*
Spotted jewelweed	*Impatiens capensis*
Rough stemmed goldenrod	*Solidago rugosa*
Narrow leaved cattail	*Typha angustifolia*
Canada thistle	*Cirsium arvense*
Fringed sedge	*Carex crinita*
Horsetail sp.	*Equisetum sp.*
Cinnamon fern	*Osmunda cinnemomea*
Deer tongue grass	*Dichanthelium clandestinum*
Fowl mannagrass	*Glyceria striata*
Sensitive fern	*Onoclea sensibilis*
Arrow-leaved tearthumb	*Persicaria sagittata*
Lurid sedge	*Carex lurida*
False nettle	*Boehmeria cylindrica*
Marsh fern	*Thelypteris palustris*
Virginia mountain mint	*Pycnanthemum virginianum*
Soft rush	*Juncus effuses*
Blue vervain	*Verbena hastata*
Field cinquefoil	*Potentilla simplex*
Curly dock	*Rumex crispus*
Fox sedge	*Carex vulpinoidea*
Green bulrush	*Scirpus atrovirens*
Bedstraw sp.	*Gallium sp.*
Common teasel	*Dipsacus fullonum*
Arrowleaf tearthumb	*Persicaria sagittata*
Bugleweed sp.	*Lycopus* sp.

FQI 3

Trees

Red maple	*Acer rubrum*
Green ash	*Fraxinus pennsylvanica*
Slippery elm	*Ulmus rubra*

Shrubs/Vines

Multiflora rose	*Rosa multiflora*
Privet	*Ligustrum sp.*
Swamp dewberry	*Rubus hispidus*
Blackhaw viburnum	*Viburnum prunifolium*
Oriental bittersweet	*Celastrus orbiculatus*

Herbaceous

Fowl mannagrass	*Glyceria striata*
Japanese stiltgrass	*Microstegium vimineum*
Garlic mustard	*Alliaria petiolata*
Spotted jewelweed	*Impatiens capensis*
Soft rush	*Juncus effusus*
Stellate sedge	*Carex seorsa*
False nettle	*Bohemeria cylindrica*

FQI 4

Trees

American beech	*Fagus grandifolia*
Black birch	*Betula lenta*
White oak	*Quercus alba*
American elm	*Ulmus americana*

Shrubs/Vines

Oriental bittersweet	*Celastrus orbiculatus*
Japanese barberry	*Berberis thunbergii*
Poison ivy	*Toxicodendron radicans*
Virginia creeper	*Parthenocissus quinquefolia*

Herbaceous

Beech drops	*Epifagus virginiana*
Pennsylvania sedge	*Carex pennsylvanica*

FQI 5

Trees

American beech	*Fagus grandifolia*
Sugar maple	*Acer saccharum*
Tree of Heaven	*Ailanthus altissima*
Big tooth aspen	*Populus grandidentata*
Red maple	*Acer rubrum*
Tulip poplar	*Liriodendron tulipifera*

Norway maple	*Acer platanoides*
White Ash	*Fraxinus americana*
Black walnut	*Juglans nigra*
Hop hornbeam	*Ostrya virginiana*
Shrubs/Vines	
Virginia creeper	*Parthenocissus quinquefolia*
Oriental bittersweet	*Celastrus orbiculatus*
Fox grape	*Vitis labrusca*
Black cherry	*Prunus serotina*
Blackhaw viburnum	*Viburnum prunifolium*
Japanese barberry	*Berberis thunbergii*
Herbaceous	
Soft rush	*Juncus effuses*
Jack-in-the-pulpit	*Arisaema triphyllum*
Panicgrass sp.	*Panicum sp.*
Green bulrush	*Scirpus atrovirens*
Deertongue grass	Dichanthelium clandestinum
Hog peanut	*Amphicarpaea bracteata*
Reed canary grass	*Phalaris arudenacea*

FQI 6

Trees	
Red maple	*Acer rubrum*
Green ash	*Fraxinus pennsylvanica*
Tulip poplar	*Liriodendron tulipifera*
Shrubs/Vines	
Oriental bittersweet	*Celastrus orbiculatus*
Japanese barberry	*Berberis thunbergii*
Black cherry	*Prunus serotina*
Herbaceous	
Green bulrush	*Scirpus atrovirens*
Jack-in-the-pulpit	*Arisaema triphyllum*
Canada mayflower	*Maianthemum canadense*
Reed canarygrass	*Phalaris arudenacea*
Redshank	*Persicaria maculosa*
Mild waterpepper	*Persicaria hydropiperoides*
Intermediate wood fern	*Dryopterus intermedia*

FQI 7

Trees	
Red maple	*Acer rubrum*

Tulip poplar	*Liriodendron tulipifera*
White pine	*Pinus strobus*

Shrubs/Vines

Virginia creeper	*Parthenocissus quinquefolia*
Oriental bittersweet	*Celastrus orbiculatus*

Herbaceous

Wood aster	*Eurybia divaricata*
Striped wintergreen	*Chimaphila maculata*
Poverty grass	*Danthonia spicata*
Rosette grass	*Dichanthelium sp.*
White snakeroot	*Ageratina altissima*
Dwarf cinquefoil	*Potentilla canadensis*
Heart-leaved aster	*Aster cordifolius*
Hairy hawkweed	*Hieracium longipilum*
Violet bush clover	*Lespedeza frutescens*