

June 8, 2023

Mendham Township
2 West Main Street
P.O. Box 520
Brookside, NJ 07926

**RE: Abbreviated Environmental Impact Statement
 Mosle Preserve and Recreation Area
 Block 100, Lot 17.02
 Mendham Township, Morris County, New Jersey**

INTRODUCTION

The Mendham Township Recreation Advisory Committee proposes to replace ten existing, portable, diesel-powered light towers currently used at the active recreational fields within the Mosle Preserve and Recreation Area (Preserve) with four permanent light-emitting diode (LED) light poles around the football field. Additionally, six permanent LED light poles are proposed adjacent to the existing gravel parking lot located north of the active recreational fields. The focus of this abbreviated Environmental Impact Statement (EIS) is on potential wildlife impacts. Specifically, Princeton Hydro has prepared this abbreviated EIS to assess, if applicable, potential wildlife impacts associated with the installation and operation of the proposed LED lighting system when compared to the existing diesel-powered lighting system.

EXISTING CONDITIONS

GENERAL SITE CHARACTERISTICS

The Preserve is located at Block 100, Lot 17.02 in Mendham Township, Morris County, New Jersey (Site). The approximately 112-acre parcel is co-owned and co-managed by the Schiff Natural Lands Trust, Inc. (Schiff), Mendham Township, and the New Jersey Water Supply Authority (NJWSA) for the preservation of open space and recreational sporting opportunities. The Site contains steep slopes, dense mixed coniferous and deciduous forest, three active recreational fields, and a trail network (**Exhibit 1**). The active recreational fields, which consist of two multipurpose fields and a baseball diamond, are located within a cleared area in the center of the Site. The fields, which are henceforth collectively referred to as Mosle Field, are game quality and have been used consistently for baseball/softball and football since 2019. In addition, an access drive bisects the Site, and a gravel parking lot is located north of Mosle Field. The gravel parking lot is surrounded by mature forest to the north and west and by a successional young forest to the east and south. The Site is surrounded largely by undeveloped forest; however, a few residential properties abut the property, and a newly constructed townhouse development is located southwest of Mosle Field.

According to New Jersey Department of Environmental Protection's (NJDEP) GeoWeb (2023), the Site contains palustrine forested (PFO) wetlands and an unnamed tributary to the North Branch of the Raritan River within the northeastern portion of the Site and the headwaters of the Gladstone Brook within the southwestern portion of the Site. Both streams are classified as Freshwater Water 2-Trout Production, Category One (FW2-TPC1) waters according to NJDEP's Surface Water Quality Standards (N.J.A.C. 7:9B).



Although wildlife surveys have not been conducted in support of this abbreviated EIS, the property likely supports a variety of generalist species, including white-tailed deer (*Odocoileus virginianus*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), groundhog (*Marmota monax*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), occasional black bear (*Ursus americanus*), and additional mammal, avian, lepidopteran, reptile, and amphibian species. Additionally, according to the U.S. Fish and Wildlife Service's Information for Planning and Consultation (IPaC) tool (**Exhibit 2**) and the NJDEP's GeoWeb, the Site is mapped for the following Federally and State threatened and endangered (T&E) species and species of special concern (SOSC):

- Indiana bat (*Myotis sodalist*) active season sighting, maternity colony, roost site (Federally Endangered)
- Northern long-eared bat (*Myotis septentrionalis*) active season sighting (Federally Endangered)
- Tricolored bat (*Perimyotis subflavus*) (Proposed Federally Endangered)
- Bog turtle (*Glyptemys muhlenbergii*) (Federally Threatened)
- Monarch butterfly (*Danaus plexippus*) (Federal Candidate for Listing)
- Bobcat (*Lynx rufus*) on road (State Endangered)
- Barred owl (*Strix varia*) non-breeding (State Threatened)
- Wood turtle (*Glyptemys insculpta*) occupied habitat (State Threatened)
- Veery (*Catharus fuscescens*) breeding (SOSC)
- Wood thrush (*Hylocichla mustelina*) breeding (SOSC)

ARTIFICIAL LIGHTING CONDITIONS

Currently, ten portable, diesel-powered, twenty-five-foot-tall, light towers are used up to three times per week at Mosle Field for football practice between September and November. No lighting is currently provided at the gravel parking lot on-Site. For the purposes of this EIS, Princeton Hydro has assumed that the existing light towers on-Site power high-intensity discharge (HID) lamps, such as metal halide or high-pressure sodium. It is Princeton Hydro's understanding that the Mendham Township Recreation Advisory Committee (Committee) has long-standing concerns with the existing lighting program, primarily related to the existing diesel-powered lights resulting in both noise and air pollution while also creating a safety hazard as they run very hot. Additionally, the parking lot does not presently have any lighting, which is a safety concern for all users of Mosle Field and the Preserve due to potential tripping and falling hazards. A well-lit space would help maintain a safe environment. Additional concerns expressed by the Committee include that the existing diesel-powered light towers are near the end of their life, are not environmentally friendly or labor efficient, and do not provide downlighting. The 2014 Five Year Vision for Mosle Field identified that low wattage, downward type lighting should be utilized on-Site.

PROPOSED CONDITIONS

The Committee proposes to implement the Mosle Recreation Area Lighting Improvement Project (Project) to improve the Mosle Field active recreational facilities. This Project involves installing permanent LED light poles around the parking lot and Mosle Field to increase the usability and safety of the Site. Specifically, the Committee proposes to install six new twenty-five-foot-tall, ninety-degree downstream, permanent LED light poles around the parking lot to eliminate any safety concerns related to the low-light/dark conditions currently experienced within the parking lot (**Exhibit 3**). Additionally, the existing portable diesel-powered HID light towers around the athletic fields will be replaced with four new seventy-foot-tall, ninety-degree downstream facing, permanent LED light poles around Mosle Field. LEDs produce more directional light, preventing the horizontal or upward emissions which contribute most to light pollution. Additionally, LED lamps benefit from lower running costs; low energy consumption; controllability of spectral, temporal and intensity of emissions; reduced CO2 emissions; and smart lighting capabilities that enable dimming.

The differences between existing and proposed conditions were considered during the preparation of this abbreviated EIS as it relates to potential wildlife impacts. First, six permanent LED light poles are proposed around the existing gravel parking lot where no lights currently exist and, second, four permanent LED light poles are



proposed around Mosle Field in place of the ten existing portable diesel-powered HID light towers. In accordance with the April 3, 2023, Mosle Field Presentation (Slide 6), this abbreviated EIS assumes that no increased use of Mosle Field is proposed during time frames when lighting is required.

POTENTIAL IMPACTS OF ARTIFICIAL LIGHT ON WILDLIFE

To understand the effects of artificial light on wildlife, it is important to understand the difference between diurnal and nocturnal species. Diurnal species are primarily active during daylight hours (dawn to dusk) while nocturnal species are primarily active at night (dusk and dawn). Common diurnal species include the majority of songbirds, eastern gray squirrel, groundhog, and white-tailed deer. Common nocturnal species include bats, owls, opossum, raccoon, and coyote.

Artificial lighting attracts and repels different wildlife in different ways, and some wildlife are able to capitalize on the effects of artificial lighting while others are adversely impacted¹. Artificial lighting attracts some organisms, such as moths and frogs, through a 'vacuum effect', concentrating them as a food source to be preyed upon, or resulting in a trap which exhausts and kills them. Several spiders, amphibians, reptiles, bats, and birds benefit from this 'vacuum effect' and focus their foraging on insects accumulated at streetlights. For other species, artificial light acts as a deterrent, excluding them from habitat they might otherwise utilize. In this manner, artificial light can result in habitat loss for certain species.

Artificial light can also disturb the natural circadian and circannual cycles of other wildlife, which in turn can affect a whole range of species interactions, physiological processes, and behaviors². For example, artificial light can affect niche partitioning by extending the activity of diurnal species and bringing them into competition with nocturnal species. Diurnal species may catch insects at streetlights after sunset, thus increasing exploitation and interference competition with nocturnal species.

LIGHT SPECTRUM

The electromagnetic spectrum encompasses radiation with wavelengths ranging from less than a nanometer (gamma rays) to a kilometer (radio waves). While humans perceive wavelengths between 400 and 700 nm as 'visible light', birds, fish and invertebrates can detect light in the ultraviolet (UV) range (10-400 nm). Different types of streetlights have distinct spectral signatures (**Exhibit 4**). Again, for the purposes of this EIS, Princeton Hydro assumed that the existing light towers on-Site power HID lamps, such as metal halide or high-pressure sodium. High-pressure sodium lamps produce a virtually monochromatic light averaging at a 589 nm wavelength, whereas metal halide lamps have a broader spectral range from 365-579 nm. Both types of HID lamps emit an abundance of UV light. With pressure to reduce energy use and CO₂ emissions, the lighting industry is now turning to LEDs. LEDs have broad spectral signatures, typically 400-700 nm, with very few emissions in the UV range.

Impacts on animals and their prey depend on the light spectra produced by streetlights; UV wavelengths attract more insects and consequently more light-tolerant predators. HID lamps, for instance, generally attract more insects than all other commonly used street light types, including LEDs, since they emit relatively more energy in the UV range³. LED lights emit little energy in the UV range, therefore attracting fewer insects than the high UV-emitting HID lights. Also, several bat species have UV-sensitive photoreceptors and might therefore be more strongly affected by lights that also emit in the UV range. Thus, the conversion from HID to LED lights would reduce

¹ Zachary Cravens, et. al. (2018), Illuminating prey selection in an insectivorous bat community exposed to artificial light at night. *J Appl Ecol*, 55:705-713. <https://doi.org/10.1111/1395-2664.13036>

² E.G. Rowse, et. al. (2016), Bats in the Anthropocene: Conservation of Bats in a Changing World, Chapter 7: Dark Matters: The Effects of Artificial Lighting on Bats. DOI 10.1007/978030319-25220-9_7.

³ Lewanzik, D. and Voigt, C.C. (2017), Transition from conventional to light-emitting diode street lighting changes activity of urban bats. *J Appl Ecol*, 54: 264-271. <https://doi.org/10.1111/1365-2664.12758>



the aforementioned potential impacts of artificial light on wildlife while also reducing both light and noise pollution when compared to existing conditions.

POTENTIAL IMPACTS

Specific to the aforementioned Federally and State-listed wildlife species, only Indiana bat, northern long-eared bat, and tri-colored bat have the potential to be impacted by the proposed Project. While barred owl is a nocturnal species that may opportunistically feed along forest edges, their primary foraging occurs within dense woodlands⁴. Similarly, bobcats prefer to hunt and move about during the day or during bright nights, likely to compensate for poor night vision⁵. Thus, modifying the lighting on-Site is not anticipated to adversely impact the foraging patterns of barred owl or primarily diurnal activities of bobcat. Bog turtle, monarch butterfly, and wood turtles are diurnal and thus would not be impacted by the proposed Project. Veery and wood thrush are also diurnal, although they migrate primarily at night. Although migratory birds can be attracted to lights during migration, the downward facing nature of the proposed LED lights eliminates this concern for both these species and all other migratory avian species.

The Site has the potential to provide suitable habitat for northern long-eared bat, Indiana bat and tricolored bat, as well as other bat species commonly found in New Jersey. Northern long-eared bat forages solely within the understory of forested areas feeding on prey which they catch while in flight using echolocation or by gleaning motionless insects from vegetation⁶. They have a diverse diet including moths, flies, leafhoppers, caddisflies, beetles and arachnids. They use forested areas not only for foraging, but for roosting and commuting between summer and winter habitat and require a dense growth of trees and underbrush covering a large tract.

Indiana bats typically forage in semi-open to closed forested habitats with open understory, forest edges, and riparian areas⁷. Indiana bats are nocturnal insectivores. They emerge shortly after sunset and begin feeding on a variety of insects that are captured and consumed while flying. This species feeds almost exclusively on flying insects.

Tricolored bats require a dense growth of trees and underbrush covering a large tract. They are opportunistic feeders and consume small insects including caddisflies, moths, beetles, wasps, flying ants and flies⁸. They emerge early in the evening and forage at treetop level or above but may forage closer to ground later in the evening. This species of bat exhibits slow, erratic, fluttery flight while foraging and are known to forage most commonly over waterways and forest edges.

At Mosle Field, the active recreational fields are already illuminated by ten portable diesel-powered HID light towers. Therefore, the type and quantity of light which is being produced around the football field is critical to examine, as the wildlife surrounding the athletic fields are already adapted to the impacts of artificial light. The ten diesel-powered light towers will be replaced with four permanent LED light poles that are positioned to be ninety-degrees downward facing. Additionally, six permanent, ninety-degree downward facing, LED light poles will be installed around the parking lot.

Light intensity has a significant effect on bat activity. For example, many bats are light-averse, including many *Myotis* species (e.g., the northern long-eared bat and the Indiana bat), and cannot use areas that are illuminated

⁴ The Cornell Lab. 2023. Barred Owl. Accessed via: https://www.allaboutbirds.org/guide/Barred_Owl/lifehistory.

⁵ Rockhill AP, DePerno CS, Powell RA. The effect of illumination and time of day on movements of bobcats (*Lynx rufus*). PLoS One. 2013 Jul 8;8(7):e69213. doi: 10.1371/journal.pone.0069213. PMID: 23861963; PMCID: PMC3704646.

⁶ U.S. Fish and Wildlife Service. 2023. Northern Long-eared Bat. Accessed via: <https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis>.

⁷ U.S. Fish and Wildlife Service. 2023. Indiana Bat. Accessed via: <https://www.fws.gov/species/indiana-bat-myotis-sodalis>.

⁸ U.S. Fish and Wildlife Service. 2023. Tricolored Bat. Accessed via: <https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus>.



for foraging, resting, commuting, or roosting. Replacing the existing HID's with LED's will significantly reduce the glare of light coming off Mosle Field and emanating into the surrounding forest. This condition may increase the habitat range of light-averse bat species within the forest. Although new lights will be installed around the parking lot where no lights currently exist, the ninety-degree downward facing LED lights will minimize light trespass into the surrounding forest and towards the sky. Overall, replacing ten HID light towers with ten LED light poles on-Site will reduce the trespass of artificial light into the surrounding forest and potentially increase the habitat range of light-averse species on-Site.

As noted above, LED lights that emit little energy in the UV range attract fewer insects than the high UV-emitting HID lights that are currently on-Site. Thus, replacing HID's with LED's also has the potential to reduce the quantity of insects congregating exclusively at lights around Mosle Field, resulting in a more even distribution of insects throughout the entire Site. In this manner, the replacement of ten HID light towers with ten LED light poles may increase insect availability in the general community and thus decrease competition for food among light-averse species in remaining dark habitats.

Artificial light falling on or close to a bat roost can cause many problems for bats. A bat roost is any place that a bat uses for shelter or protection, such as in trees, built structures or underground sites. Illumination of bat roosts can delay or prevent emergence from roosts, resulting in reduced foraging time and missing the peak time of insect abundance (just after dusk). By reducing the amount of glare emanating from lights on-Site as a result of replacing HID's with LED's, the proposed Project has the potential to benefit bats by expanding their range of suitable roosting habitat and improving the quality (i.e., darkness) of roosting habitat on-Site.

In summary, replacing the ten existing HID light towers on-Site with the ten proposed LED light poles has the potential to benefit bats, including the Federally Endangered northern long-eared bat and Indiana bat, as well as the Proposed Federally Endangered tricolor bat. By reducing the glare of light trespassing into the surrounding forest and reducing the UV energy emitted from lighting on-Site, the proposed Project has the potential to increase the habitat range of light-averse species, facilitate a more even distribution of insects throughout the entire community, and expand suitable roosting habitat for bats. As such, the proposed Project is not anticipated to have any long-term deleterious impacts on any of the aforementioned Federally and/or State-listed species identified as potentially present on-Site.

Further, no adverse impacts are anticipated to general wildlife as a result of the proposed Project. It is important to note that the hours of light operation will not change under proposed conditions. Further, the lights will continue to only be employed between September and November. Currently, wildlife likely avoids Mosle Field and the parking area during lighting hours due to increased human and vehicle activity. When people leave the Site and the existing diesel-powered lights turn off, wildlife likely return to Mosle Field and the surrounding areas. These circumstances would not change under proposed conditions since the hours and dates of light operation would not change.

Although no adverse impacts are anticipated, the proposed Project would result in minor, positive impacts to the local wildlife community. Specifically, general wildlife would benefit from the elimination of the diesel-powered generators which currently power the HID light towers on-Site. Noise and air pollution associated with this energy source will be eliminated in their entirety. Noise pollution can interfere with animal communication, mating behavior and spatial orientation on land. Additionally, diesel generators are extremely inefficient. Diesel exhaust contains more than 40 toxic air contaminants and other harmful environmental pollutants, including nitrogen oxide, currently the most important ozone-depleting emission. Eliminating the noise pollution and air contaminants associated with the diesel-powered generators currently employed on-Site would benefit local wildlife, as well as the community at large.

Long-term positive impacts to safety are also anticipated as a result of the project. A well-lit space helps people feel safe and makes it easier for them to navigate without tripping or falling. Due to the relatively rural nature of



the surrounding area, run-ins with wildlife are not out of the question. In the event that there is a bear or other wildlife within the vicinity of the parking lot, visitors would be able to see them under the proposed lighting condition and keep a safe distance. Thus, lighting the existing parking lot would keep users of Mosle Field and wildlife safer by limiting the potential for these types of interactions.

There may be short-term, temporary displacement of general wildlife during the installation of the proposed Project. Species such as white-tailed deer, eastern grey squirrel, and groundhog may have to alter their activities during construction due to increased traffic and noise, however, these impacts would be minimal and temporary in nature. Once the construction of the Project is complete, it is anticipated that prior utilization of the Site by these species would return to pre-construction conditions.

In summary, the proposed Project would not have a long-term, adverse impact on wildlife species on-Site. Rather, by reducing the glare of light trespassing into the surrounding forest and reducing the UV energy emitted from lighting on-Site, the proposed Project has the potential to increase the habitat range of light-averse species, facilitate a more even distribution of insects throughout the entire community, and expand suitable roosting habitat for bats. Additionally, eliminating the noise pollution and air contaminants associated with the diesel-powered generators currently employed on-Site would benefit local wildlife, as well as the community at large. Long-term, positive impacts to safety are also anticipated as a result of illuminating the gravel parking lot. Finally, any wildlife temporarily displaced during construction is anticipated to return to their preferred habitats following completion of installation activities.

If you have any questions regarding the findings presented herein, please contact me directly at ebjorhus@princetonhydro.com or 908-237-5660 (ext. 130).

Sincerely,

A handwritten signature in blue ink that reads "Emily Bjorhus". The signature is fluid and cursive, with the first name "Emily" and last name "Bjorhus" clearly legible.

Emily Bjorhus, PWS
Project Manager / Environmental Scientist II
Princeton Hydro, LLC

cc: Michael Rehman, CERP, PWS - Director of Ecological Services, Princeton Hydro

Exhibits


- Exhibit 1 – Aerial Overview Map
- Exhibit 2 – USFWS IPaC Results
- Exhibit 3 – Musco Lighting Plan and Budget Estimate for the Mosle Field Complex
- Exhibit 4 – Spectral Content of Different Light Types

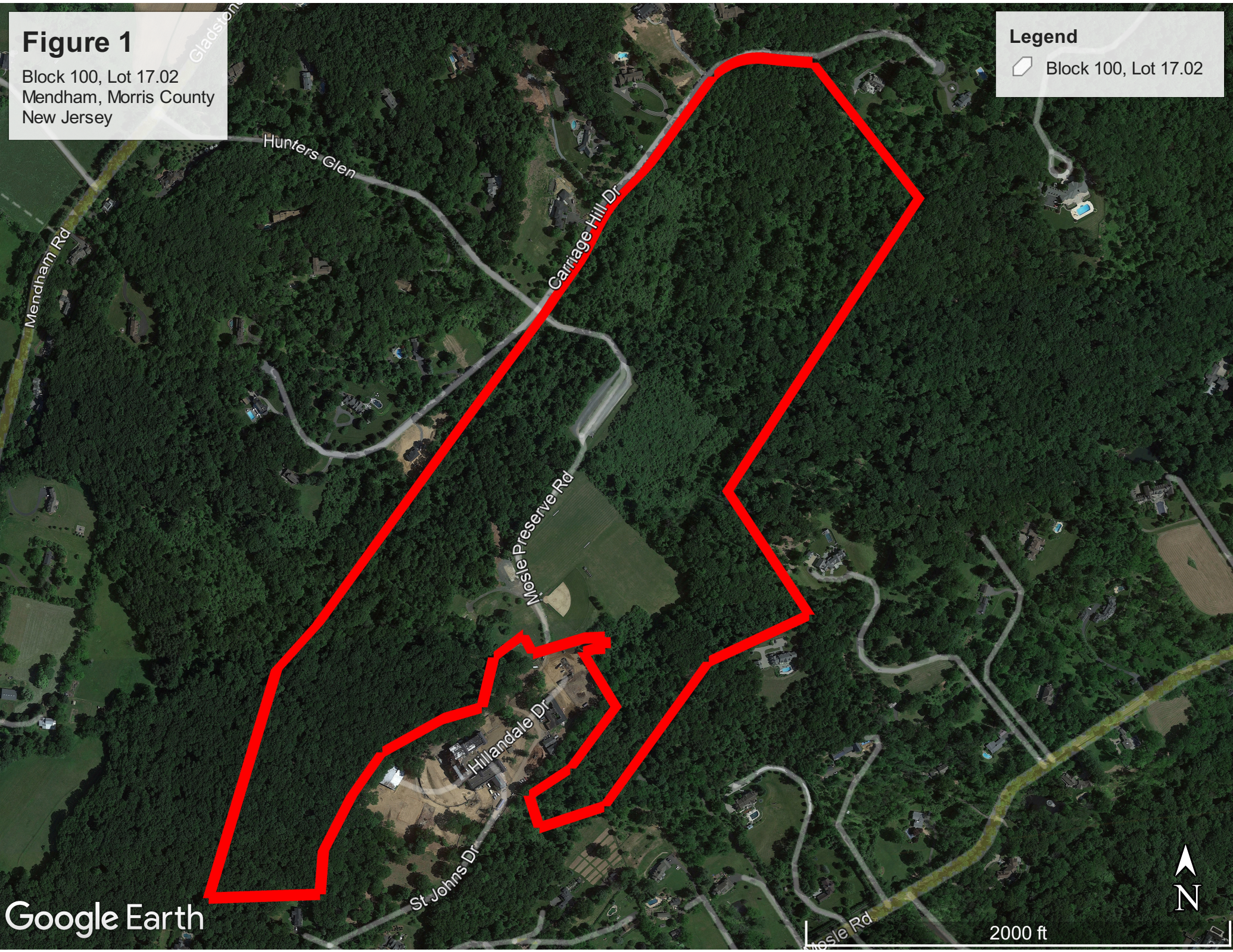
EXHIBIT 1
AERIAL OVERVIEW MAP

Figure 1

Block 100, Lot 17.02
Mendham, Morris County
New Jersey

Legend

 Block 100, Lot 17.02



Google Earth



2000 ft



EXHIBIT 2

USFWS IPAC RESULTS

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



Local office

New Jersey Ecological Services Field Office

☎ (609) 646-9310

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

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 species¹ 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 Fisheries²).

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. IPaC only shows species that are regulated by USFWS (see FAQ).

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
<p>Indiana Bat <i>Myotis sodalis</i></p> <p>Wherever found</p> <p>There is final critical habitat for this species. Your location does not overlap the critical habitat.</p> <p>https://ecos.fws.gov/ecp/species/5949</p>	Endangered
<p>Northern Long-eared Bat <i>Myotis septentrionalis</i></p> <p>Wherever found</p> <p>No critical habitat has been designated for this species.</p> <p>https://ecos.fws.gov/ecp/species/9045</p>	Endangered
<p>Tricolored Bat <i>Perimyotis subflavus</i></p> <p>Wherever found</p> <p>No critical habitat has been designated for this species.</p> <p>https://ecos.fws.gov/ecp/species/10515</p>	Proposed Endangered

Reptiles

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

Insects

NAME	STATUS
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Monarch Butterfly *Danaus plexippus*

Candidate

Wherever found

This species only needs to be considered if the following condition applies:

- The monarch is a candidate species and not yet listed or proposed for listing. There are generally no section 7 requirements for candidate species (FAQ found here: <https://www.fws.gov/savethemonarch/FAQ-Section7.html>).

No critical habitat has been designated for this species.

<https://ecos.fws.gov/ecp/species/9743>

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.

You are still required to determine if your project(s) may have effects on all above listed species.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

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 <https://www.fws.gov/program/migratory-birds/species>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>

- Nationwide conservation measures for birds

<https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.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.

NAME	BREEDING SEASON
<p>Bald Eagle <i>Haliaeetus leucocephalus</i></p> <p>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.</p>	Breeds Sep 1 to Aug 31
<p>Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p> <p>https://ecos.fws.gov/ecp/species/9399</p>	Breeds May 15 to Oct 10
<p>Black-capped Chickadee <i>Poecile atricapillus praticus</i></p> <p>This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p>	Breeds Apr 10 to Jul 31
<p>Bobolink <i>Dolichonyx oryzivorus</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds May 20 to Jul 31

Canada Warbler <i>Cardellina canadensis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Cerulean Warbler <i>Dendroica cerulea</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 27 to Jul 20
Chimney Swift <i>Chaetura pelagica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Golden Eagle <i>Aquila chrysaetos</i> 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
Kentucky Warbler <i>Oporornis formosus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Northern Saw-whet Owl <i>Aegolius acadicus acadicus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Jul 31
Prairie Warbler <i>Dendroica discolor</i> 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 <i>Protonotaria citrea</i> 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 <i>Melanerpes erythrocephalus</i> 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*

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Wood Thrush *Hylocichla mustelina*

Breeds May 10 to Aug 31

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

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.

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 (I)

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.





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](#) 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 list of migratory birds that potentially occur 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 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 [Rapid Avian Information Locator \(RAIL\) 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 to 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 or migrating in my 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 query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. 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

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

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 (NWI)

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](#).

Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the [NWI map](#) to view wetlands at this location.

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 tubercid 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



EXHIBIT 3

MUSCO LIGHTING PLAN AND

BUDGET ESTIMATE FOR THE MOSLE FIELD COMPLEX

Mosle Field Complex Mendham, NJ

EQUIPMENT LAYOUT

INCLUDES:

- Multipurpose - Field 1
- Parking 1

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

Installation Requirements: Results assume $\pm 3\%$ nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

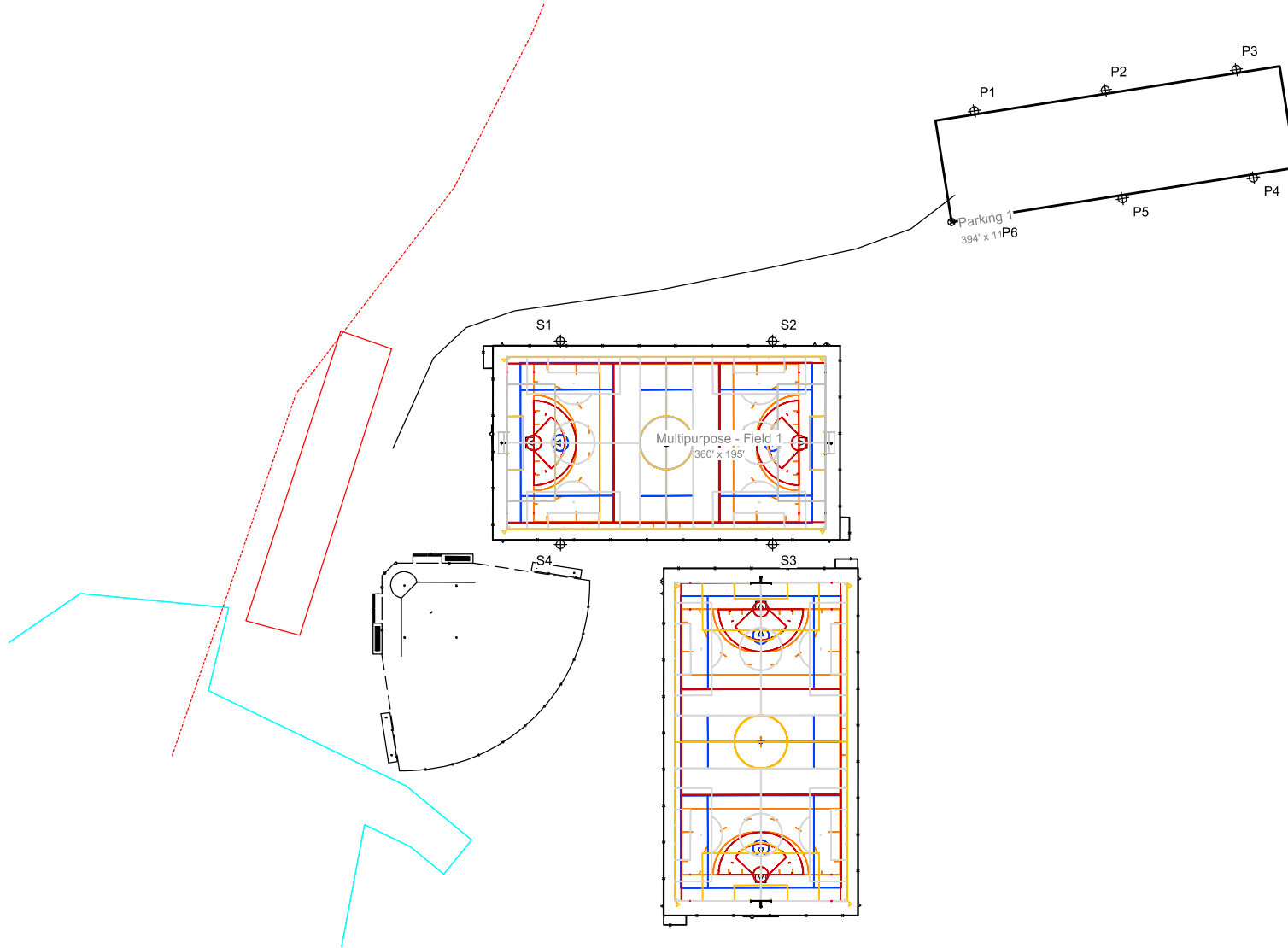
EQUIPMENT LIST FOR AREAS SHOWN

QTY	LOCATION	Pole		Luminaires			QTY / POLE
		SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE		
6	P1-P6	30'	-	30'	CREE OSQ	1	
2	S1-S2	60'	-	60'	TLC-LED-900	3	
				60'	TLC-LED-1200	1	
				60'	TLC-LED-550	1*	
				60'	TLC-LED-1500	4	
2	S3-S4	60'	-	60'	TLC-LED-900	3	
				60'	TLC-LED-1200	1	
				60'	TLC-LED-1500	4	
10	TOTALS						40

* This structure utilizes a back-to-back mounting configuration

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Driver (.90 min power factor)	Line Amperage Per Luminaire (max draw)					
	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	480 (60)
TLC-LED-1500	8.4	7.9	7.3	6.3	5.0	4.6
TLC-LED-900	5.2	4.9	4.5	3.9	3.1	2.9
Cree OSQ	-	-	-	-	0.3	0.2
TLC-LED-550	3.2	3.0	2.8	2.4	1.9	1.4
TLC-LED-1200	6.9	6.5	6.0	5.2	4.2	3.8



SCALE IN FEET 1 : 120
0' 120' 240'

Pole location(s) Ⓧ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: Matt Sullivan · File #156497F · 24-Apr-23



We Make It Happen.™

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EQUIPMENT LAYOUT

Budget Estimate

Mosle Field Complex – Mendham, NJ

5/3/23

Budget Estimate – Materials and installation

Multipurpose Field and Parking lot \$375,000.00-\$400,000.00

Sales tax and bonding are not included.

Light-Structure System™ with Total Light Control – TLC for LED™ technology

System Description – Light-Structure System™ complete from foundation to poletop in 5 Easy Pieces™

Factory-built, wired, aimed, and tested lighting system includes:

- Pre-cast concrete bases
- Galvanized steel poles
- Factory-wired and tested remote electrical component enclosures
- Pole length factory-assembled wire harnesses
- Factory-aimed and assembled luminaires
- UL listed as a complete system
- Guaranteed light levels of 50 footcandles.
- Control-Link® control and monitoring system to provide remote on/off and dimming (high/medium/low) control and performance monitoring with 24/7 customer support
- Product assurance and warranty program that includes materials and onsite labor, eliminating 100% of your maintenance costs for 25 years.

Supplemental Lighting

- OSQ area luminaires
- 30' height square steel pole with base plate
- 10-year materials and onsite labor warranty.

Estimate is based on:

- International Dark Skies Association
- Structural code and wind speed = 2021 IBC, 115 mi/h, and exposure: C, Importance Factor 2.
- Owner is responsible for getting electrical power to the site, coordination with the utility, and any power company fees
- Standard soil conditions – rock, bottomless, wet, or unsuitable soil may require additional engineering, special installation methods and additional cost.
- Installation estimate includes off-loading, installation of foundations, poles, and lighting equipment by a licensed contractor and installation of distribution panel, contactor cabinet, underground wiring and associated electrical work and materials by a licensed electrical contractor.
- Pricing is based on May, 2023 pricing and is subject to change.

Thank you for considering our Team for your sports lighting needs. Please contact me with any questions.

Dan Shaloo
Sales Executive
Musco Sports Lighting, LLC
Phone: 732-539-4329
Email: dan.shaloo@musco.com
Project # 156497





EXHIBIT 4

SPECTRAL CONTENT OF DIFFERENT LIGHT TYPES

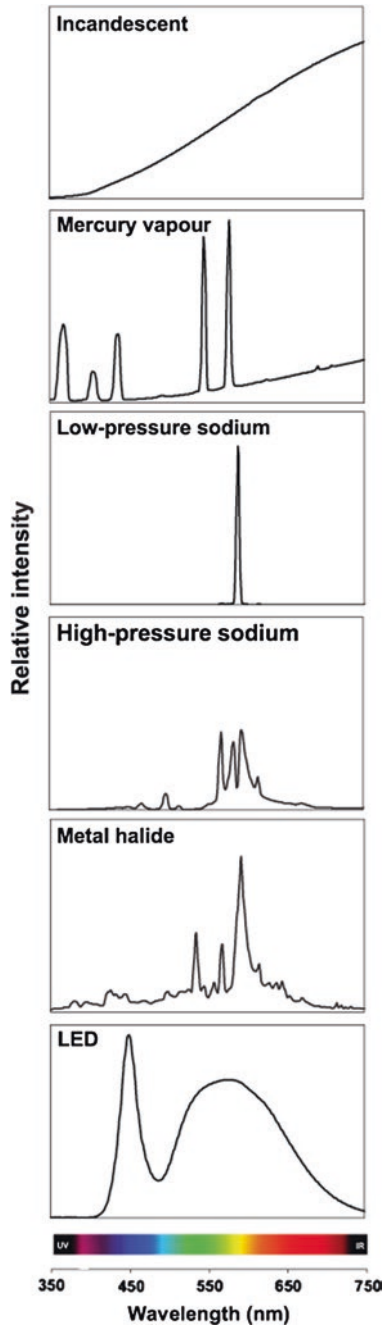


Fig. 7.1 The spectral content of different light types varies considerably. The spectral composition of common lighting technologies is shown. From Gaston et al. (2013)