

Ecological Impacts of Lighting Watertown-Cambridge Greenway City of Cambridge, Massachusetts

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Summary

A proposal to introduce artificial lighting to the proposed Watertown-Cambridge Greenway will illuminate what is currently a relatively dark patch of urban woodland habitat. Within this urban setting, species that would regularly use this treed habitat, either as primary habitat or as a travel corridor, are species that can thrive under or at least tolerate urban conditions, including artificial lighting. This slice of habitat is small enough that it is unlikely to support any individuals or populations of species that do not tolerate urban conditions.

The lighting plan proposes to minimize the amount of new light introduced to the environment by both limiting light trespass and recommending lighting for only part of the night. Based on the lighting plan design and the urban setting of the project, the ecological impacts of the lighting are expected to be minimal.

1.0 Project Overview

The City of Cambridge, Massachusetts is considering adding lighting to the proposed Watertown-Cambridge Greenway. The proposed Greenway is a rail-to-trail project along the former Boston & Maine rail corridor from Arlington Street in Watertown to the entrance of the Cambridge Water Treatment Plant at Fresh Pond Parkway. One of the factors the City is weighing in the decision to add lighting to the Greenway is the ecological consequence of introducing additional light to this relatively narrow segment of vegetated urban land.

2.0 Project Specific Considerations

2.1 Ecological Resources in Project Area

The habitat and wildlife resources present with the portion of the Fresh Pond Reservation where the Greenway is proposed were evaluated through an on-site visit on May 27, 2017, and a review of existing data sources. A walk of the abandoned rail bed from the Fresh Pond Parkway entrance to the Cambridge Water Department building to the Watertown-Cambridge town line revealed that within the Reservation, overstory trees are dominated by native oaks (*Quercus rubra*, *Q. alba*) and white pine (*Pinus strobus*), while outside the reservation mature trees consist almost exclusively of non-native, invasive species, including Norway maple (*Acer platanoides*) and black locust (*Robinia pseudoacacia*). The understory throughout the project area is dominated by non-native, invasive species, including Japanese knotweed (*Fallopia japonica*), and oriental bittersweet (*Celastrus orbiculatus*). In some locations, particularly the pine-dominated areas, the understory is sparse, apparently in part due to the network of well-used foot trails present as well as natural shading.

In general, as described in the 2000 Fresh Pond Master Plan, the natural habitats present within the Reservation present unique and valuable habitats within an urban setting. Further, the Reservation and specifically the abandoned rail line help to provide a connection between the

Mount Auburn Cemetery and the Alewife Brook Reservation, creating a travel corridor for wildlife that eventually links to the Mystic River. However, based on the observations made during the site visit, although the habitat surrounding the abandoned rail line provides value for resident wildlife that are adapted to urban settings and as a stopover for migrating birds, its overall quality is impacted by the lack of plant diversity and its relatively small size. This portion of the Reservation has only a very limited potential to support unique or rare species. The review of rare species known to be present in the City of Cambridge, described below, also supports this assumption.

The New England Field office of the US Fish and Wildlife Service provides information about the distribution of federally listed species in Massachusetts by county and town on its website (https://www.fws.gov/newengland/EndangeredSpec-Consultation_Project_Review.htm). The only species listed as present county-wide for Middlesex County is the federally threatened northern long-eared bat (*Myotis septentrionalis*). This tree-roosting species forages primarily under the tree canopy and has limited potential to use the urban forested habitats in the Fresh Pond Reservation, including the area proposed for the Greenway.

The Massachusetts Natural Heritage and Endangered Species Program compiles data on the distribution of state-designated rare species by town (<http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/town-species-viewer.html>) and lists only one species, the State threatened peregrine falcon (*Falco peregrinus*), as recently observed in the City. The peregrine falcon was last reported in Cambridge in 2016; the most recent records for the other 14 rare wildlife species recorded in Cambridge range from 1890 to 1941. Peregrine falcons are strictly diurnal and eat other birds, which they capture on the wing. They may hunt over the Reservation, but would not otherwise spend time there as they perch and nest on high ledges, a habitat type that is not available at the Reservation.

The most abundant species of vertebrates at the reservation are birds. The 2012 check list of birds produced by the Friends of Fresh Pond notes that 149 species of birds are seen regularly at the Reservation. Chapter 6 of the 2000 Fresh Pond Master Plan notes that more than 230 species of birds have been identified in the Reservation since 1984, while currently 220 species have been reported at the Reservation to e-bird (<http://ebird.org/ebird>), the real-time, online checklist program supported by the Cornell Lab of Ornithology and National Audubon Society. The species listed in the Friends of Fresh Pond checklist and by e-bird include year-round and seasonal residents as well as migrants which make only brief stop overs in the Reservation. While the proposed Greenway area does offer suitable habitat for a variety of bird species, as noted above, the lack of plant diversity and its relatively small size, as well as understory characteristics limit its habitat value for many species. The Master Plan's list of five most important bird habitat areas (Chapter 6, p.51) does not include the proposed Greenway location.

2.2 Proposed Lighting Plan

In their April 28, 2017 report, Lam Partners describe a lighting plan designed to illuminate the Greenway while minimizing light trespass to the surrounding area. To minimize light spilling

beyond the pathway, while still providing sufficient light levels and enough uniformity to create a sense of safety for trail users, they recommend lighting the Greenway using the Cree Edge Round Type 2 fixture, with a backlight shield, on a pole height of 11 feet, with poles spaced 100-105 feet apart. Further, they recommend LED fixtures specified with a color temperature of 3000K (“warm” white) to minimize shorter wavelength blue spectrum light and eliminate ultraviolet (UV) emissions. Lam Partners also recommends using the same wireless dimming control module that the City uses to control other street and park lights. For the Greenway, Lam Partners suggests programming the fixtures to turn on at dusk, to a minimum output that introduces a level of safety, dimming at 9:30 pm to 10% as a warning that the lights will soon be shut off completely, and then shutting lights off completely at 10:00 pm.

3.0 General Impacts of Outdoor Lighting and Mitigation

3.1 Impacts on Wildlife

Artificial outdoor lighting at night adds light to the immediate area where it is placed, and also creates sky glow, which leads to a more generalized loss of darkness across the region where outdoor lighting is used. Both effects of outdoor lighting can interrupt natural behavior patterns for many species, most notable moths and other insects, amphibians, reptiles, bats, and migratory birds. In addition to altering day and night activity patterns, artificial lighting can also cause biological clock disruption. Both these effects may change breeding behavior, predator avoidance, and foraging behavior. Lighting can disrupt the behavior of certain species so severely, it essentially results in habitat loss as these species can no longer successfully use the available habitat to meet their shelter, feeding, and breeding needs. In addition, lighting is known to cause navigation errors. In particular, migrating birds are known to become “trapped in light” by certain types of lighting placed on tall structures (e.g., communication towers, tall buildings), circling these structures until they hit them or drop from exhaustion.

In addition to the amount and duration of light added to the environment, the type (i.e., the color or wave length) of light has an effect. Insects are attracted by ultraviolet light and blue spectrum light, and can become “trapped” in those lights, leading to mortality. Blue spectrum lights also create more sky glow, creating a greater increase in the extent of light pollution beyond the local source than light from other parts of the spectrum. Blue spectrum light may also have other effects. As summarized in a 2010 white paper (*Visibility, Environmental, and Astronomical Issues Associated with Blue-Rich White Outdoor Lighting*, International Dark Sky Association) research indicates that the blue portion of the spectrum interferes with parts of the human endocrine system mediated by photoperiod, leading to reduction in the production of melatonin, a hormone shown to effect health and mood. Similar effects may be expected on other species.

3.2 Mitigating Impacts of Light

The best approach to minimizing the impacts of light on the natural environment is to minimize the amount of light added to the natural landscape. If outdoor lighting is being used:

- Direct light to only where it is needed and minimize intrusion into areas where light is not needed.
- Use only the minimum level of light required.
- Turn off lights when they are not needed.
- Choose light sources that minimize the amount of shorter wavelength (“blue”) light emitted.
- Choose light sources that do not emit ultra-violet wavelengths.

4.0 Effects of Lighting the Project - Conclusions

As proposed, the lighting plan appears to add a relatively low amount of new light to the environment both by limiting the lighted area and recommending lighting for only part of the night. The recommended design will minimize both light trespass in the immediate area of the Greenway and the project’s contribution to sky glow. Use of LED light fixtures that emit only limited amounts of blue spectrum light will further reduce the contribution to sky glow and may have other benefits as well. LED technology has evolved rapidly over the past few years and is expected to continue to do so. If lighting is installed on the Greenway, when choosing replacement fixtures in the future, the lighting spectrum of available fixtures should always be considered.

Adding lighting to the proposed Watertown-Cambridge Greenway will introduce light to what is currently a relatively dark slice of urban woodland habitat. As described above, because of the urban setting, most of the species that would regularly use this treed habitat, either as their primary habitat or as travel corridor, are species that can thrive under or at least tolerate urban conditions, including artificial lighting. Additionally, this slice of habitat is small enough that it is unlikely to support any individuals or populations of species that do not tolerate urban conditions, and the project does not involve tall lighting structures that could affect migrating birds. Based on the lighting plan design and the urban setting of the project, the ecological impact of the proposed lighting plan is expected to be minimal.