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INTRODUCTION

The Wallingford Renewable Energy Project (WREP) is a proposed ground mounted photovoltaic project (the Project) located between Wilbur Cross Parkway and South Cherry Street in Wallingford, Connecticut. It is bounded to the south by industrial land owned by Allnex USA, Inc., and to the north by municipally owned and privately owned land. The Quinnipiac River borders the Site to the west and northwest. This report addresses an approximately 116 acre area (Study Area) that consists of three parcels owned by the Town of Wallingford and the Materials Innovation and Recycling Authority (MIRA), shown on Figure 1. The Town of Wallingford parcel includes a capped municipal landfill and electrical rights-of-way (ROWs). The MIRA parcels include paved and unpaved roadways; oil and natural gas ROWs; and areas formerly developed and abandoned for use as a trailer park and other residential use, reflecting a significant amount of anthropogenic manipulation and alteration. The residential uses on the MIRA parcels were discontinued so MIRA could acquire the parcels to manage leachate plumes that extend from the adjacent landfill. Undeveloped areas within the three parcels include mature upland deciduous forest, poor quality disturbed scrub lands, open marsh wetland, forested wetland, and forested floodplain.

Within the Study Area approximately 28 acres are mapped as Critical Habitat (Floodplain Forest) by the Connecticut Department of Energy and Environmental Protection - Natural Diversity Data Base (NDDDB), which collects information on and regulates critical biological resources (Figure 1). Preliminary Determination letters from NDDDB (letters issued April 7, 2017; Prelim. Determ. Nos. 201702359, 201702360) relative to the MIRA and Town of Wallingford properties attribute the local mapping to nine State-listed wildlife species. Eight additional State-listed species (four animals and four plants) were identified in the NDDDB correspondence as having the potential to occur in the vicinity (Table 1) of the properties. False mermaid weed is speculatively associated with the Town property in the NDDDB correspondence. Nearly all of the species and habitat types of concern are likely primarily associated with an intact Sand Barren habitat which is located 1,670 or more feet south of the Study Area.

Oxbow Associates, Inc. (OA) has performed habitat assessments for State-listed Species and Critical Habitat within the Study Area. The intent of the assessments was to determine the presence or absence of suitable habitats and insect host-plant species and, to the extent present, to delineate those areas. The following report is a summary of field assessments completed by OA staff between May and November, 2017.

METHODS

Prior to field assessments, OA staff conducted literature searches to gather information related to the Study Area as well as the targeted State-Listed Species and Critical Habitat anticipated to be present within the Study Area. In addition, OA examined available spatial geographic information system (GIS) data to evaluate the extent of potential suitable habitat areas based on aerial cover-types for target assessment in the field as well as anecdotal information from other sources.

On May 4, May 23, June 19, August 31, and November 28, 2017, OA staff (specifically Brian Butler-Principal Scientist, Amanda Weise-Field Botanist, Matthew Charpentier-Botanist, Scott Smyers-Senior Scientist, and Kyle Cormier-Environmental Scientist) visited the Study Area and surveyed suitable habitat areas for species listed in NDDDB correspondence throughout the Study Area (Figure 2). Search efforts were concentrated in mapped Critical Habitat areas as well as potential suitable habitat areas between developed and undeveloped lands (as identified with GIS data and aerial mapping). To ensure comprehensive coverage/assessment of target

habitat areas, the survey was completed using a meandering transect-sweep method. This loosely structured survey technique is commonly used as a method to assess species diversity and provides an effective and efficient strategy for large areas such as the Study Area. Later visits to the Study Area focused on targeted areas identified for additional consideration in the earlier surveys.

Spatial data were recorded by each staff person using hand-held Trimble Geo-XH or equivalent unit (capable of sub-meter accuracy). Notable locations were delineated with points, lines, or polygons in the field. Data were corrected using Pathfinder Software[®] and visualized using ArcGIS 10.5 (ESRI[®] 2011).

To characterize the plant communities, observed vascular plant species were documented, identified to species-level wherever possible, and recorded in the field; unknown or difficult to identify specimens, such as graminoids or members of the genus *Crocantthemum*, were collected for in-office inspection using microscopes or other applicable tools. Collections of rare plant species were made under a permit authorized by the Connecticut Department of Energy and Environmental Protection. All specimens collected during the assessment will be donated to the New England Botanical Club Herbarium maintained at the Gray Herbarium (GH), Harvard University, Cambridge, Massachusetts. Rare plants encountered in the field were assessed and recorded using NDDB Rare Plant Field Forms; data will be submitted to NDDB via electronic (PDF or similar format) submission.

Plant taxonomy follows nomenclature presented in Haines (2011); vegetation is classified according to Metzler and Barrett (2006).

HABITATS

The Study Area contains both natural and significantly degraded ecotypes attributable to prior land use history. This section describes the habitat types found within the Study Area, including those specifically identified by NDDB.

Developed/Ruderal Areas and Marginal Forests

More than half of the Study Area (71 acres) can be described as degraded, disturbed, marginal, or developed habitat. These areas include both upland and wetland habitats and generally have disturbed soil profiles. Areas can be generalized as having non-vegetated pervious or impervious surfaces (heavily used dirt or paved roads), or primarily vegetated with weedy non-native species (landfill cap, roads and scrub; Photos 1 – 4). Typical herbaceous species include orchard grass (*Dactylis glomerata*), vetch (*Vicia* sp.), crown-vetch (*Coronilla varia*), spotted knapweed (*Centaurea stoebe*), and fescue (*Festuca* spp.) Exceptions to the above include marginal forest areas that are transitional between more heavily disturbed areas and undisturbed/high quality habitat areas.

Floodplain Forest

NDDB has mapped approximately 28 acres of the westernmost portion of the Study Area as floodplain forest, designated as Critical Habitat (Figure 2). Field evaluations by REMA Ecological Services, LLC, and affirmed by OA, confirmed that a considerably smaller area (6.6+/- acres) than mapped by NDDB serves as forested floodplain habitat. Figure 3 illustrates the manner in which the area field-identified as floodplain forested habitat overlays with the NDDB-mapped area, as well as with the Federal Emergency Management Act (FEMA) floodplain (1% chance of annual flooding).

The floodplain communities (Photos 5, 6, 4) are associated with the Quinnipiac River - a medium-gradient river located at the southern edge of the Lower Connecticut River Valley (Ecoregion Subsection from Keys et al., 1995). This habitat includes seasonally flooded low elevation terraces on glacial outwash derived from sandstone, shale, and basalt parent material. Terraces are forested with a diversity of mature tree species including sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), maple (*Acer* spp.), ash (*Fraxinus* spp.), and tulip tree (*Liriodendron tulipifera*). Understory species include early spring ephemerals including, wild leek (*Allium tricoccum*), Virginia spring-beauty (*Claytonia virginica*), trout lily (*Erythronium americanum*), and dwarf ginseng (*Panax trifolius*), as well as colonies of Japanese stilt-grass (*Microstegium vimineum*), white-tinged sedge (*Carex albicans*), stinging nettle (*Urtica dioica*), and wood-nettle (*Laportea canadensis*). Common woody shrubs include sweet pepperbush (*Clethra alnifolia*) and a non-native shrub honeysuckle (*Lonicera* sp.).

While the vegetation varies within the habitat across the Study Area, sections can be classified as “American Sycamore – Box Elder and Pin Oak – Green Ash, temporarily flooded forests” according to Connecticut’s vegetation classification (Metzler & Barrett, 2006). The easterly relict river oxbow features do not exhibit alluvial soils, but qualify as palustrine forested wetlands.

During dedicated assessments completed on May 5 and May 23, the botanist documented a previously unrecorded population of false mermaidweed (*Floerkea proserpinacoides*; State Endangered) with more than 10,000 individuals occurring throughout the area adjacent to the Quinnipiac River (Figure 3) both within the Study Area and southward to Toelles Road. Plants within the Study Area occur primarily in the floodplain along the banks of the Quinnipiac River throughout the western extent of the Study Area at elevations ranging between 20 and 25 feet above mean sea level. A more limited number of individuals were also documented in the open utility ROW within the floodplain, a somewhat atypical habitat for the species. The population is generally robust, with several hundred to several thousand plants occurring at each sub-location. A detailed habitat description and list of associated species can be found in the Connecticut Natural Diversity Data Base - Rare Plant Survey Form provided to NDDB.

False mermaidweed is an early flowering, short-lived herbaceous annual. It germinates in late winter, emerges in late March-April, flowers in May, then produces seed and senesces in late May-early June; a life cycle of less than 60 to 70 days. The plants are undetectable through the summer, autumn and winter months. Plants produce relatively large seeds that are dispersed primarily by gravity but sometimes by water according to Moorehead & Farnsworth (2003). Seeds do not persist more than a year in the soil, hence the species’ vulnerability to stochastic events such as sudden habitat or land-use changes.

False mermaidweed is found throughout much of North America but is rare in New England. According to the regional assessment of plant rarity, *Flora Conservanda* (Brumback & Gerke, 2013), the plant is only historically known from Vermont, Massachusetts, and Connecticut; all of the known New England populations have been extirpated except for four in Connecticut. In Connecticut, extant populations occur in the towns of Greenwich, Meriden, North Haven/Wallingford, and Southbury. It is possible the identified population is connected to, or part of the North Haven/Wallingford site described by Moorehead & Farnsworth (2003) as inhabiting “the floodplain of a stream that meanders across a large glaciofluvial sand plain supporting characteristic coastal plain species...”

Although numerous occurrences documented during the survey occur within the Study Area, no Project-related activities are proposed in FEMA or field-mapped forested floodplain. Without perturbation of the floodplain community, we expect this population to be relatively secure, notwithstanding the vulnerability of its annual life cycle in the face of stochastic events.

Stripped Barren Habitat

A small (0.83 acre) low quality area of Stripped Barren habitat was documented on the northeastern edge of the MIRA parcel (Figure 2, Photo 9). This area is distinct from the mapped Sand Barren habitat referenced in the NDDDB correspondence in that it is anthropogenetically derived, as opposed to being a naturally occurring habitat. For this reason, we have applied a distinct name to this habitat that is relictual to relatively recent land disturbances.

The dominant cover-type in this area is bare sand, a remnant of former land stripping or mining. This area, as well as a large area surrounding it, was stripped and apparently mined for the underlying minerals, with work continuing as recently as the 1980s according to archival orthophotography. The adjacent cover types are degraded, as might be expected of an area historically stripped to mineral soils and abandoned.

Unlike the intact Sand Barren Habitat located 1,670 or more feet to the south of the Study Area, which has associated Dry Acidic Forest and pitch pine woodland in its surroundings, this Stripped Barren area is dominated by bare sand, little bluestem and poverty grass. It also supports numerous non-native and invasive plants around its perimeter including cheatgrass (*Bromus tectorum*), spotted knapweed, autumn olive (*Elaeagnus umbellata*), common reed (*Phragmites australis*), as well as clustered sedge (*Carex cumulata*) and dwarf dandelion (*Krigia biflora*). The above attributes, as well as its modest dimensions, indicate that this area is the last remnant of the historically disturbed and excavated zone to revegetate, likely due to it being the area least capable of retaining soil moisture. With time and soil stabilization by adventitious mosses and lichens, this area is likely to succeed to predominantly non-native species on par with its surroundings.

Within this patch habitat we observed several specimens of frostweed, potentially *Crocantemum propinquum* (Low Frostweed, State Special Concern; Photo 10). Targeted listed insect species were not observed in this location during several seasonally appropriate site-days.

Deciduous Forest

The Study Area, particularly in the central portion of the MIRA parcels, includes areas of deciduous non-floodplain forest (approximately 16 acres), as shown on Figure 2 and Photo 11. Medium to large trees (>10-24 inches diameter at breast height (DBH)) are present, particularly in areas where historic perturbation has not recently occurred. The canopy is a mixture of deciduous species, but primarily includes American beech (*Fagus frandifolia*), white oak (*Quercus alba*), red oak (*Q. ruba*), black oak (*Q. velutina*), red maple (*Acer rubrum*), tuliptree, black birch (*Betula lenta*), and yellow birch (*Betula alleghaniensis*). Shrubs include maple leaf viburnum (*Viburnum acerifolium*), sweet pepperbush and spicebush (*Lindera benzoin*). Herbs are variable, but in mesic to wetland conditions ferns dominate and include cinnamon fern (*Osmundastrum cinnamomea*), royal fern (*Osmunda regalis*), and New York fern (*Parathelypteris noveboracensis*). This forest type may be a variant of “American beech – White oak – Red oak – Tuliptree vegetation” community type (Metzler & Barrett, 2006) though it lacks characteristic species like sweetgum (*Liquidambar styraciflua*) and flowering dogwood (*Benthamidia florida*).

SUMMARY

A significant portion of the premises contains ruderal or otherwise degraded or unexceptional areas of limited regulatory or ecological concern. In contrast, the zones associated with floodplain habitat and supporting the regionally rare false mermaidweed (see Figure 3) provide higher quality habitat. These areas are restricted to low elevation portions of the western

fraction of the Study Area, although they occur along the Study Area's entire western edge. No Project-related work is proposed in this area.

Mature deciduous upland forest, interspersed with palustrine wetlands associated predominantly with the Quinnipiac Floodplain or old river oxbows is an intact, productive cover type on the Study Area, not known to have an association with state-listed plant or animal species. Several potential vernal pools have been identified in this vicinity, though most appear to have truncated average annual hydroperiods due to their occurrence in outwash soils experiencing significant annual groundwater amplitude. Additional investigations would be required in the appropriate spring season to confirm whether such areas provide a vernal pool function.

The Stripped Barren is not an historic component of the former Wallingford/North Haven sand barren habitat, but is an artefact of mineral extraction within the latter part of the last century. As a nutrient-poor habitat it shares some attributes with that cover type, but as can be seen in the accompanying photographs, it is both of moderate dimensions and being encroached upon by non-native vegetation. It may support several specimens of low frostweed as discussed above, and could potentially support listed tiger beetle species derived from native Sand Barren habitat in the vicinity. Any such presence by these species remains unconfirmed at this time.

Much of the highest quality habitat, including Floodplain Forest supporting the endangered *Floerkea proserpinacoides* lies beyond the limits of the Project's proposed limit of work (Figure 3). This most sensitive habitat that is supportive of the state endangered false mermaidweed is virtually all within jurisdictional wetlands and FEMA floodplain; this ecotype and its flora will remain intact. Mature, but fragmented deciduous forest, the stripped barren area, as well as historically degraded areas of landfill and other areas of poor quality scrub-shrub habitat will be utilized in support of the Project.

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REPRESENTATIVE SITE PHOTOGRAPHS



Photo 1. (above) Old asphalt road bed in ruderal area being gradually reclaimed by succession in eastern MIRA property.
Photo 2. (below) View of slope of the capped Wallingford Landfill from beneath the adjacent conductors.





Photo 3. (above) Rubbish pile along northern end of Town landfill, within floodplain woodland.

Photo 4. (below) Successional habitat with Russian olive and other typical waste area herbaceous and woody species (MIRA).





Photo 5. Forested floodplain adjacent to Quinnipiac River in autumn (above).
Photo 6 (below) Spring view of typical forested floodplain.





Photo 7. False mermaidweed growing within the forested floodplain near SW corner of MIRA property (5/4/2017).
Photo 8. Close view of false mermaid weed in flower.



Photo 9. (above) View of stripped barren habitat fragment with common reed advancing in the right of the photo.
Photo 10. (below) One of several frostweed thalli provisionally identified as *C. propinquum*, low frostweed.



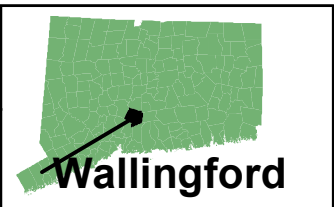
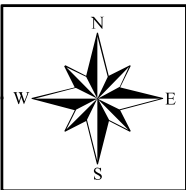
Photo 9. (above) View of stripped barren habitat fragment with common reed advancing in the right of the photo.
Photo 10. (below) One of several frostweed thalli provisionally identified as *C. propinquum*, low frostweed.





Photo 11. Typical medium aged, second growth hardwood deciduous forest, fall conditions.

Figures, 1- 3



Legend

- Lease Area
- 5ft Contour
- Parcels
- Parcels

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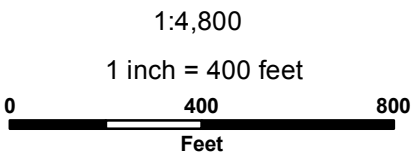
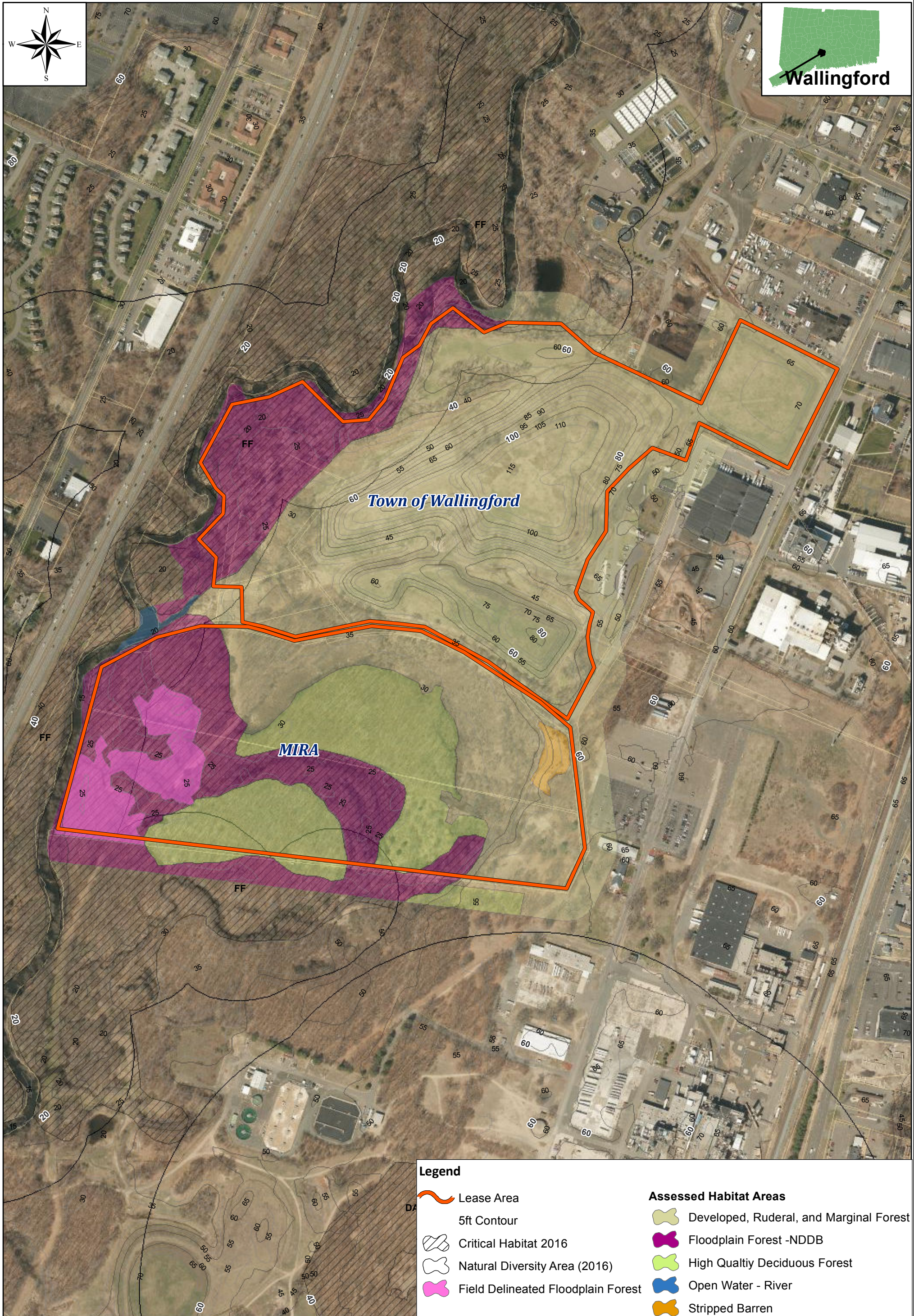


Figure 1.
Site Locus
2016 Spring Orthophotograph
WRE Project Site
Wallingford, CT
December 18, 2017



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Legend

- | | |
|------------------------------------|---|
| Lease Area | Assessed Habitat Areas |
| 5ft Contour | Developed, Ruderal, and Marginal Forest |
| Critical Habitat 2016 | Floodplain Forest -NDDB |
| Natural Diversity Area (2016) | High Quality Deciduous Forest |
| Field Delineated Floodplain Forest | Open Water - River |
| | Stripped Barren |

Figure 2.
Habitat Cover Types
2016 Spring Orthophotograph
WRE Project Site
Wallingford, CT
December 18, 2017



Legend

- False Mermaidweed
- Lease Area
- 5ft Contour
- Parcels

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Figure 3.
False Mermaidweed Occurrences
2016 Spring Orthophotograph
WRE Project Site
Wallingford, CT
December 18, 2017