


**NATURAL RESOURCE INVENTORY
AND IMPACT ASSESSMENT**

**Solar Array Farm
Walnut Hill and Grassy Hill Road
East Lyme, Connecticut**

Prepared For:

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1.0 INTRODUCTION

Environmental Planning Services (EPS) was retained by Greenskies Renewable Energy LLC to assess the potential impact of a proposed 4.9-megawatt ground mounted photovoltaic solar array system covering +/-33 acres located at 40 & 44 Grassy Hill Road and 89 Walnut Hill Road in East Lyme, Connecticut, referred to hereafter as “the site”.

Biological field surveys were conducted on the site between March and September of 2012. The 2012 field work builds upon biological surveys conducted on the site as well as additional surrounding lands by EPS in 2006 in support of a previous application to construct a residential subdivision at the site. This larger survey area which includes the area of the proposed solar arrays is referred to hereafter as “the study area” (see Figures 1 and 2).

The specific purpose of this year’s field work was to reconfirm wetlands previously delineated in 2006, inventory flora and fauna, characterize vegetation cover types in order to map study area habitats, evaluate wetland functions and values, and assess the impact of the proposed solar farm. GIS software (ArcMap v10.0) was used to review open source GIS data layers in order to catalog abiotic resources and understand the significance of the study area in relation to the entire watershed.

2.0 SITE DESCRIPTION

The study area lies in the Latimer Brook sub-regional watershed. The majority of the wetlands drain south into Cranberry Meadow Brook, a tributary of Latimer Brook. One of the wetlands (Wetland A), along the existing northernmost driveway drains to the north into a tributary of Latimer Brook (see Figure 3). Wetland F is an isolated wetland at the western boundary of the study area.

Wetlands consist primarily of wooded swamps where Red Maple (*Acer rubrum*) is the dominant tree species. Wooded swamps are the most abundant wetland type in Connecticut and have a plant community which is characterized by a forest canopy at least 20 feet tall. Several ponds are located within these wooded swamps; they have an open canopy where marsh and emergent wetland vegetation occur. Six vernal pools occur on or immediately adjacent to the study area, in pools embedded within wooded swamps.

Table 1: Summary of study area characteristics, Greenskies Renewable Energy Solar Farm, East Lyme, CT

RESOURCE	CHARACTERISTICS
Location (USGS quadrangle)	Montville, CT
Local/Sub-Regional Drainage Basin Location	Cranberry Meadow Brook / Latimer's Brook
Distance to Nearest CT DEP NDDDB Area	Overlaps northern portion of study area (maps dated December 2011)
Upland Soil Types Present	Charlton-Chatfield complex, Paxton and Montauk, Woodbridge, Hollis-Chatfield rock outcrop complex, Agawam
Wetland Soil Types Present	Ridgebury, Leicester and Whitman
Wetland Habitat Types Present	Wooded swamp, wet meadow, vernal pool, man-made pond
Upland Habitat Types Present	Hayfields, successional fields, mixed hardwood forest, conifer stands
Surficial Geology	Till and Thick Till
Source: CT DEP GIS data (digital USGS topographic maps, local basins datalayer, digital NRCS soil mapping, digital surficial geology map and digital FEMA floodzone maps) as well as field observations	

3.0 WETLAND DELINEATION

The wetland delineation was conducted by a soil scientist, according to the requirements of the CT Inland Wetlands and Watercourses Act (P.A. 155). Wetlands are defined as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist. Watercourses are defined as bogs, swamps, or marshes, as well as lakes, ponds, rivers, streams, etc., whether natural or man-made, permanent or intermittent. Any competent professional may delineate watercourses.

The wetlands were originally delineated on March 18 and 20, 2006 and reconfirmed in the field on March 20, 2012. Wetlands were delineated by examining the upper 20" of the soil profile with a spade and auger. Those areas meeting the requirements noted above were marked with pink plastic flagging tape numbered with the following sequences: WL 1-29, WL 30-84, WL 85-150, WL 151-165, WL 166-171, WL 172-176, WL 177-181, WL 182-198 and WL 199-200.

Wetland soils consist of Ridgebury, Leicester and Whitman as well as Aquents soils. Ridgebury, Leicester and Whitman is an undifferentiated mapping unit consisting of two poorly drained (Ridgebury and Leicester) and one very poorly drained (Whitman) soil developed on glacial till in depressions and drainageways in uplands and valleys. Their use interpretations are very similar, and they typically are so intermingled on the landscape that separation is not practical. The Ridgebury and Leicester series have a seasonal high water table at or near the surface (0-6") from

fall through spring. They differ in that the Leicester soil has a more friable compact layer or hardpan, while the Ridgebury soils have a dense to very dense compact layer. The Whitman soil has a high water table for much of the year and may frequently be ponded.

The Aquentis map unit is a miscellaneous land type used to denote man-made or man-disturbed areas that are wet. These soils have an aquic soil moisture regime and can be expected to support hydrophytic vegetation. Typically, these soils occur in places where less than 2 feet of earthen material have been placed over poorly or very poorly drained soils; areas where the natural soils have been mixed so that the natural soil layers are not identifiable; or where the soil materials have been excavated to the water table.

The non-wetland soils were not examined in detail, except as was necessary to identify the wetland boundary. They consist of Charlton-Chatfield complex, Paxton and Montauk, Woodbridge and Udorthent soils. The Charlton series is a very deep, well drained loamy soil formed in friable till. They are nearly level to very steep soils on till plains and hills. Depth to bedrock and the seasonal high water table is commonly more than 6 feet.

The Chatfield series consists of moderately deep, well drained, and somewhat excessively drained soils formed in till. They are nearly level to very steep soils on glaciated plains, hills, and ridges. Slope ranges from 0 to 70 percent. Crystalline bedrock is at depths of 20 to 40 inches. The soils formed in a moderately thick mantle of glacial till overlying granite, gneiss, or schist bedrock. Rock outcrops are rare to common and are limited to the more resistant bedrock.

The Paxton series consists of well drained loamy soils formed in subglacial till. The soils are very deep to bedrock and moderately deep to a densic contact (known locally as hardpan). They are nearly level to steep soils on till plains, hills, and drumlins. The depth to the densic contact and material is commonly 20 to 40 inches but the range includes 18 to 40 inches. Depth to bedrock is commonly more than 6 feet. Rock fragments range from 5 to 35 percent by volume.

The Montauk series consists of very deep, well drained soils formed in glacial till derived primarily from granitic materials. These soils are on upland till plains and moraines. Slope ranges from 0 to 35 percent. The landscape in some areas has many closed depressions, some of which are filled by perennial ponds or wet spots. The soils formed in thick moderately coarse or medium textured glacial till mantles underlain by firm sandy till. Some areas have very stony or extremely stony surfaces. The potential for runoff is low to high. Permeability is moderate or moderately rapid in the solum and slow or moderately slow in the substratum.

The Woodbridge series consists of moderately well drained loamy soils formed in compact, subglacial till. They are very deep to bedrock. They are nearly level to moderately steep soils on till plains, hills, and drumlins. Depth to the compact layer (hardpan) is 18 to 40 inches. Depth to

bedrock is commonly more than 6 feet. Woodbridge soils have a seasonal high water table on top of the compact layer (18-40") from fall through late spring.

4.0 HABITAT TYPES

Habitats were field inventoried by EPS biologists and their extent is shown on Figure 3. The following nine habitat types (4 wetland and 5 non-wetland) were identified in the study area:

- (1) Wooded swamp
- (2) Perennial stream
- (3) Scrub-shrub wetland
- (4) Pond/emergent marsh
- (5) Residential lawn & ornamental landscape
- (6) Mixed hardwood forest
- (7) Hayfields
- (8) Early old field
- (9) Late old field

4.1 Wetland Habitats

Seven discrete wetlands occur in the study area and are labeled A-G. These wetlands are illustrated on Figure 3 and described in the following sections. Most of the wetlands are wooded swamps that include areas of wet meadow/emergent marsh, open water (i.e., ponds), or shrub-scrub embedded within them. Wet Meadow/Emergent Marsh habitats are dominated by persistent and non-persistent grasses, sedges, rushes, and other herbaceous grass-like plants. Shrub-Scrub wetlands are dominated by woody vegetation, shrubs with some scattered stunted trees, less than 20 feet (6 m) in height. Wooded swamps are the most abundant wetland type in Connecticut and have a plant community which is characterized by a forest canopy at least 20 feet (6 m) tall.

Wetland A

Wetland A (Wetland Flags WL 182-198) is a pond with an emergent marsh along the edge and wooded swamp. The emergent marsh consists mainly of Wool Sedge (*Scirpus cyperinus*), sedges (*Carex spp.*), grasses (*Poaceae spp.*), Sensitive Fern (*Onoclea sensibilis*), American Burreed (*Sparganium americanum*), Soft Rush (*Juncus effusus*), and smartweed (*Polygonum sp.*). The wooded swamp portion is predominantly Red Maple (*Acer rubrum*) with an open shrub layer of mostly Multiflora Rose* (*Rosa multiflora*).

Wetland B

Wetland B (Wetland Flags WL 1-29) is a wooded swamp with an excavated pond at the upper end. The tree canopy is mostly Red Maple with Yellow Birch (*Betula alleghaniensis*). The open shrub

layer is mostly Spicebush (*Lindera benzoin*), Multiflora Rose*, Japanese Barberry* (*Berberis thunbergii*), and Highbush Blueberry (*Vaccinium corymbosum*). The herb layer includes Skunk Cabbage (*Symplocarpus foetidus*), grasses, Tussock Sedge (*Carex stricta*), sedges, peat moss (*Sphagnum sp.*), Sensitive Fern, Cinnamon Fern (*Osmunda cinnamomea*). The vine layer is largely Common Greenbriar (*Smilax rotundifolia*) and Poison Ivy (*Toxicodendron radicans*).

The pond has a partial emergent edge of Common Cattails (*Typha latifolia*). Extensive mats of filamentous green algae was observed floating on the water's surface.

Wetland C

Wetland C (Wetland Flags WL 172-176, 177-181) is a small shrub-scrub swamp. The scattered tree layer is mostly Red Maple with Green Ash (*Fraxinus pensylvanica*). The shrub layer is mainly Multiflora Rose*. The herb layer consists largely of grasses (*Poaceae spp.*), goldenrods (*Solidago spp.*), and Soft Rush (*Juncus effusus*). The vine layer is mostly wild grape (*Vitis sp.*).

Wetland D

Wetland D (Wetland Flags WL 30-84, 85-150) is a large wooded swamp associated with a south-flowing watercourse. There is an excavated pond at the north end. This area was restored in 2009. The pond has a narrow emergent edge with 3 wet meadow pockets in the restoration areas. The herb layer consists mostly of grasses, sedges, and Soft Rush.

The wooded swamp has a nearly continuous tree canopy consisting largely of Red Maple, Black Gum (*Nyssa sylvatica*), Green Ash, and Yellow Birch. The shrub layer is mostly Spicebush, Multiflora Rose, Highbush Blueberry, and dense stands of Japanese Barberry*. The herb layer includes Skunk Cabbage (*Symplocarpus foetidus*), grasses, Cinnamon Fern (*Osmunda cinnamomea*), peat moss, and sedges. The vine layer is largely Common Greenbriar (*Smilax rotundifolia*).

Wetland E

Wetland E (Wetland Flags WL 166-171) is a small seasonally saturated wooded swamp. The tree layer consists mostly of Red Maple. The shrub layer is largely Multiflora Rose* and Japanese Barberry*. The herb layer includes grasses and sedges.

Wetland F

Wetland F (Wetland Flags WL 151-165) is an isolated wetland depression which is seasonally ponded. Vegetation grows along the edge of the pool and is wooded swamp consisting mostly of Red Maple. The shrub layer is largely Multiflora Rose* and Japanese Barberry* with a scattered sedges in the herb layer.

Wetland G

Wetland G (Wetland Flags WL 1X-5X) is a small wooded swamp. The open tree canopy is mostly Red Maple with a few Highbush Blueberry (*Vaccinium corymbosum*) in the understory. The extensive herb layer consists largely of grasses, Soft Rush, and Sensitive Fern.

4.2 Upland Habitats

Five non-wetland (upland) habitat types occur in the study area. Their locations are illustrated on Figure 3. Their characteristics are described in the following sections:

Hayfields

Hayfields consist predominantly of cool season forage grasses. Common Milkweed (*Asclepias syriaca*) and goldenrods (*Solidago spp.*) are also present.

Mowed Turf/Ornamental Landscapes

There are two residential landscapes in the study area, which consist primarily of mowed turf grasses with ornamental plants.

Old Field - Early and Late

In the early years after abandonment, agricultural land is characteristically vegetated with an extensive herb layer of grasses and forbs. In a matter of years, sun-loving, woody species colonize the field and eventually shade out the grasses as the vegetation develops into a young forest.

The extensive herb layer consists mostly of grasses (*Poaceae spp.*), annual weeds, and forbs. In addition to grasses, the herb layer includes Rough-stemmed Goldenrod (*Solidago rugosa*), milkweed (*Asclepias sp.*), and clovers (*Trifolium spp.*). In recent years, several invasive non-native species have come to be dominant colonizers of open land including Multiflora Rose* (*Rosa multiflora*), Japanese Barberry* (*Berberis thunbergii*), Tree-of-heaven* (*Ailanthus altissima*), Autumn Olive (*Eleagnus umbellatus*), and Asiatic Bittersweet* (*Celastrus orbiculatus*). These species are all present in the old field habitats.

The most common woody colonizer of old fields is Red Cedar (*Juniperus virginiana*) which occurs as scattered individuals as well as two groves. Other native woody species are: Sassafras (*Sassafras albidum*), White Pine (*Pinus strobus*), oak (*Quercus spp.*), Tulip Tree (*Liriodendron tulipifera*), and Black Cherry (*Prunus serotina*), and brambles (*Rubus spp.*).

Mixed Conifer Stand

There is a small stand of planted White Pine and Spruce (*Picea sp.*) associated with the southern residential site on Walnut Hill Road. The stand is located at the edge of a small field east of the house.

Mixed Hardwood Forest

This is the most plentiful and characteristic type of vegetation in Connecticut. Our forests are included in the Central Hardwoods-Hemlock zone in a classification of New England forests. Since most of Connecticut has been cleared in the past, forests are called second growth and usually consist of relatively young trees with a diameter at breast height (dbh) of less than one foot.

The wooded portions of the study area include hedgerows, small forest patches as well as larger contiguous forest blocks. The tree canopy characterized by oak (*Quercus spp.*), Black Birch (*Betula lenta*), Gray Birch (*Betula populifolia*), Black Cherry (*Prunus serotina*), Sugar Maple (*Acer saccharum*), hickory (*Carya sp.*), American Beech (*Fagus grandifolia*), Red Cedar (*Juniperus virginiana*), and Eastern Hemlock (*Tsuga canadensis*). The shrub layer varies from open to dense and includes Spicebush (*Lindera benzoin*), Mountain Laurel (*Kalmia latifolia*), dense stands of Japanese Barberry*, Multiflora Rose*, Wineberry* (*Rubus phoenicolasius*), and Highbush Blueberry (*Vaccinium corymbosum*). The vine layer includes Common Greenbriar, Asiatic Bittersweet* (*Celastrus orbiculatus*), wild grape (*Vitis sp.*), Virginia Creeper (*Parthenocissus quinquefolia*). The herb layer includes Garlic Mustard* (*Alliaria petiolata*), Japanese Honeysuckle* (*Lonicera japonica*), Christmas Fern (*Polystichum acrostichoides*), Hay-scented Fern (*Dennstaedtia punctiloba*), White Wood Aster (*Eurybia divaricata*), Poison Ivy (*Toxicodendron radicans*), and sedges (*Carex spp.*)

5.0 GEOLOGY

5.1 *Surficial Geology*

Surficial geology refers to the distribution of surficial (unconsolidated) materials that lie between the land surface (below the pedogenic soil) and the bedrock surface. Surficial material in Connecticut ranges from a few feet to several hundred feet in thickness. These earth materials significantly affect anthropogenic land uses. Most of the unconsolidated materials are deposits of continental glaciers that covered all of New England at least twice during the Pleistocene ice age. These glacial deposits are divided into two broad categories, glacial till and glacial stratified deposits. Surficial geology consists of thin glacial till. Till, the most widespread glacial deposit, was laid down directly by glacier ice and is characterized by a non-sorted matrix of sand, silt, and clay with variable amounts of stones and large boulders.

The study area is located on a north-south oriented drumlin known as Pigeon Hill. Drumlins are formed over a short distance within the receding glacier ice and record the final direction of ice movement. Drumlins occur in symmetric, spindle, parabolic, and transverse asymmetrical forms.

5.2 *Bedrock Geology*

Bedrock underlying surficial material consists primarily of Quartzite with smaller fractions of Schist and Gneiss also present. Quartzite is metamorphosed sandstone composed primarily of quartz. It is light-colored to gray, massive to layered, medium-grained and very hard and resistant. Schist is light, silvery to dark, coarse-to very coarse-grained, strongly to very strongly layered metamorphic rock whose layering is typically defined by parallel alignment of micas. Primarily composed of mica, quartz, and feldspar; occasionally spotted with conspicuous garnets. Gneiss is light and dark, medium- to coarse-grained metamorphic rock characterized by compositional banding of light and dark minerals, typically composed of quartz, feldspar, and various amounts of dark minerals. Gneiss occurs with a variety of compositions and is a characteristic rock of CT uplands.

6.0 NATURAL DIVERSITY DATABASE REVIEW

The Connecticut Department of Energy and Environmental Protection's Natural Diversity Database program represents current documented data showing the known locations of any endangered, threatened or special concern species and significant natural communities. Submission to the database for information regarding a given site is done if the subject site:

- Occurs within a designated NDDB area
- Overlaps a waterbody that has been designated a NDDB area
- Is upstream or downstream (by less than ½ a mile) from a NDDB area

The most recent (June 2012) NDDB mapping (see Appendix) shows that the site does not meet any of the three criteria listed above. However, an earlier iteration that was reviewed prior to the start of the field season, showed that a NDDB record overlapped the study area, an information request application was submitted to the NDDB program. A response letter was received on May 8, 2012 (copy attached) indicating that the state special concern butterfly species Henry's elfin (*Callophrys henrici*) and the federally endangered perennial herb American chaffseed (*Schwalbea americana*), occur in the vicinity of the site (see appendix). Suitability of the study area for these species is discussed in Section 8.1D.

7.0 WETLAND FUNCTIONS AND VALUES ASSESMENT

Over the last three decades, ecologists, wetland scientists, biologists, hydrologists, and environmental engineers have recognized not all wetlands perform the same functions, or provide the same values for their various functions.

There are many methods of evaluating wetlands and these methods have often chosen different parameters to evaluate. This study uses *The Highway Methodology Workbook Supplement, Wetland Functions and Values: A Descriptive Approach* issued by the US Army Corps of Engineers New England District (ACOE NED), September 1999. This evaluation provides a qualitative approach in which wetland functions can be considered primary, secondary, or unlikely to be provided at a significant level. Functions and values can be principal if they are an important physical component of a wetland ecosystem (function only), and/or are considered of special value to society, from a local, regional, and/or national perspective. The ACOE NED recommends that wetland values and functions be determined through “best professional judgment” based on a qualitative description of the physical attributes of wetlands and the functions and values exhibited.

The Highway Methodology recognizes the following 13 separate wetland functions and values: groundwater recharge/discharge, floodwater storage, fish and shellfish habitat, sediment/toxicant/pathogen retention, nutrient removal/retention/transformation, production export, sediment/shoreline stabilization, wetland wildlife habitat, recreational value, educational/scientific value, uniqueness, visual/aesthetic quality and threatened and endangered species habitat.

The degree to which a wetland provides each of these functions is determined by one or more of the following factors: landscape position, substrate, hydrology, vegetation, history of disturbance, and size. Each wetland may provide one or more of the listed functions at significant levels.

The determining factors that affect the level of function provided by a wetland can often be broken into two categories. The effectiveness of a wetland to provide a specified function is generally dependent on factors within the wetland whereas the opportunity to provide a function is often influenced by the wetland’s position in the landscape and adjacent land uses. For example, a depressed wetland with a restricted outlet may be considered highly effective in trapping sediment due to the long residence time of runoff water passing through the system. If this wetland is located in gently sloping woodland, however, there is no significant source of sediment in the runoff therefore the wetland is considered to have a small opportunity of providing this function.

A variety of wetland characteristics affect a wetlands overall functions and values. The most important wetland characteristic influencing a wetlands functions and values is hydroperiod (i.e.

depth and duration of standing water). Hydroperiod is related to a wetlands micro-topography and location on the landscape. Wetlands with a short hydroperiod tend to provide only limited functions and values and are often small and occur on moderate-steep slopes. Wetlands with longer hydroperiods tend to provide a wide range of functions and values, and are often located at the base of the slope in valleys and drainageways.

The site’s wetlands provide many significant functions and values. Wetlands A, B, D and F have significant wildlife habitat value because they provide breeding site’s for several amphibian species. Wetland Units A, B, C and D are headwater systems which act as groundwater discharge areas with significant floodwater storage, sediment retention and nutrient attenuation function. These wetland units play an important role in protecting and preserving the downstream water quality of Latimer Brook, which flows into the Niantic River and Long Island Sound.

Wetland functions and values for site wetlands are summarized below in Table 2 and described in the following sections.

Table 2: Summary of wetland functions and values, Grassy Hill and Walnut Hill Roads, East Lyme, CT

Function/Value	Wetland A	Wetland B	Wetland C	Wetland D	Wetland E	Wetland F	Wetland G
Groundwater recharge/discharge	High (discharge)	High (discharge)	High (discharge)	High (discharge)	Low-Moderate (discharge)	Low	Low-Moderate (discharge)
Floodwater storage	High	High	Low	High	Low	Moderate	Low
Fish and Shellfish Habitat	None	None	None	None	None	None	None
Sediment retention	High	High	Low	High	Low	Moderate	Low
Nutrient removal/retention/transformation	Moderate	High	Low	High	Low	Low-Moderate	Low
Production Export	Moderate	Moderate	Low	Moderate	Low	Moderate	Low
Sediment and Shoreline Stabilization	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wetland wildlife habitat	High	High	Low	High	Low	High	Low
Recreation	Low	Low	Low	Low	Low	Low	Low
Educational/scientific value	Low	Low	Low	Low	Low	Low	Low
Uniqueness	Low	Low	Low	Low	Low	Low	Low
Visual/Aesthetic Quality	Moderate	Moderate	Low	Moderate	Low	Low	Low
Threatened and Endangered Species Habitat	None	None	None	None	None	None	None

7.1 Wetland Functions and Values - Discussion

Groundwater Recharge/Discharge

Wetlands A, B, C, D – These wetlands are headwater wetlands which eventually drain to Latimer Brook. Groundwater discharges from the adjacent hillside while the underlying till material limits the recharge function of this unit's wetlands.

Wetlands E and G are small isolated wetlands whose main function is groundwater discharge.

Floodflow Alteration (storage and desynchronization)

The floodwater storage capability of wetlands is directly related to wetland topography, hydroperiod (i.e. depth and duration of standing water) and soils type (organic vs. mineral soils).

Wetland Units A, B, D – The man-made pond(s) located within these wetland systems provides some floodwater storage capacity. The sinuous streamflow and organic soil horizons also aid in the desynchronization and storage of stormwater flow.

Wetland Unit C – This wetland system is a sloping intermittent stream with no flanking wetlands or overbank storage.

Wetland Unit F – This wetland contains a man-made pond capable of moderate floodwater storage and desynchronization. However, the wetland is isolated and not part of a perennial system.

Wetlands E and G are small, shallow wetlands with limited flood storage capacity.

Sediment/Toxicant/Pathogen Retention

Wetland Units A, B, D – The man-made pond located within these wetland units is capable of storing sediments and toxicants associated with runoff from the adjacent uplands.

Wetland Unit C – This wetland unit is a narrow, graded, intermittent stream with no flanking wetlands or overbank flood storage.

Wetlands E and G are small, shallow wetlands with limited storage potential of sediments and toxicants.

Nutrient Removal/Retention/Transformation

Wetlands which are highly productive at pollution renovation are typically permanently ponded, contain sinuous, diffuse flows and abundant submergent and emergent wetland vegetation (i.e. deepwater marsh, shallow ponds).

Wetland Units A, B & D – These wetland units contain areas of permanent open water with submergent aquatic and emergent wetland vegetation suitable for efficient nutrient attenuation.

Wetland Unit C - This wetland unit is a narrow sloping intermittent stream with no flanking wetlands, no overbank flood storage and lacks significant wetland vegetation.

Wetlands E and G are small, shallow vegetated wetlands with limited capacity for pollution renovation.

Wetland Unit F – This wetland unit contains permanent open water (man-made pond) but lacks significant wetland vegetation capable of nutrient uptake. Additionally, the wetland is isolated and not part of a perennial system.

Production Export

Wetland Units A, B, D and F provide breeding sites for a variety of amphibians species. Amphibians account for a significant amount of a forest ecosystem's biomass and are a food source for many higher-order predators. Wetland Units C, e, and G have low production export value.

Wildlife Habitat

Wetland Units A, B, D and F provide breeding site's for a variety of amphibian species. Wetland Unit C is a sloping intermittent stream and lacks the hydroperiod necessary to support most wetland-dependant wildlife.

Wetland E and G are seasonally saturated with short hydroperiods which do not support most wetland-dependent wildlife.

Recreation / Educational / Scientific Value/Uniqueness

The site's wetlands are classified as wooded swamps. Wooded swamp wetlands are the most common wetland type occurring in CT. The site's wetlands have low recreational value and lack uniqueness based on the following factors: the site is privately owned, does not possess unique wetland attributes, provides no hunting or fishing opportunities and has limited aesthetic value. The presence of vernal pool indicator species in Wetland Units A, B, D and F offers some opportunity for educational and scientific study.

Visual Quality/Aesthetics

Although this value is somewhat subjective, the man-made ponds within Wetlands A, B and D could be considered to have high aesthetic value. Wetlands C, D, E, F, and G lack attributes typically associated with wetlands of high aesthetic value such as vistas, open water or flowering plants.

Threatened or Endangered Species Habitat

Site flora and fauna was surveyed in both 2006 and 2012 by an EPS wildlife biologist and botanist. No threatened or endangered species were observed on the site. One species of special concern, the American Kestrel (*Falco sparverius*), was observed during migration (see Section 8.1C). Consultation with the CT DEEP NDDB program revealed the presence of the state special concern butterfly

species Henry's elfin (*Callophrys henrici*) and the federally endangered perennial herb American chaffseed (*Schwalbea americana*) in the vicinity of the site (see Section 8.1D).

8.0 VERTEBRATE WILDLIFE INVENTORY

The wildlife inventory was developed by cataloguing potential as well as observed reptile, amphibian, mammal and bird species. Observed wildlife species include those species observed during field work conducted on March 23, May 23, June 5, June 12, June 20 and September 12, 2012 as well as species observed during field work conducted in 2006. The list of potential wildlife was developed by reviewing current literature documenting the habitat requirements of Connecticut's vertebrate wildlife (see References, Section 9). A species was considered potentially present if the site is biogeographically suitable and suitable habitat occurs in the study area. Species listed as potentially present were not observed during field surveys.

A vernal pool study was conducted in the spring of 2006 (see appendix). That study identified five vernal pools within the overall study area as well as one vernal pool located immediately north of the northeastern property boundary. Those species confirmed during that survey have been included in the wildlife inventory. Note that for bird species listed as potential site users (i.e., species that were not observed), only species in which suitable breeding habitat (as opposed to migratory habitat) were included in the inventory.

Reptiles and amphibians were surveyed via visual observation, cover searching (turning over rocks, logs and debris), dip-netting and minnow-trapping. Birds were observed via visual observation using binoculars as well as through identification of songs or calls. Breeding birds were surveyed during the early morning hours from 5:00am to 9:00am. The seasonal timing was optimal for the observation of the majority of breeding birds (late May – mid June) and weather during early morning surveys was optimal, with clear skies and little or no wind. Mammal species were recorded incidentally via visual observation as well as identification of scat or tracks.

A total of sixty nine species (six mammals, 50 birds and 13 reptiles and amphibians) were observed in the study area. One state-listed species, the American Kestrel, was observed on the site as discussed in Section 8.1C. Based on the survey effort expended to inventory birds, those diurnal bird species that are listed as "potential" site inhabitants are considered to have a low probability of occurrence, as it is reasonably likely that they would have been encountered during our survey work. Species of conservation concern not observed but considered potential site inhabitants are discussed in greater detail in Section 8.1

Table 3: Confirmed and potential wildlife species, Grassy Hill and Walnut Hill Roads, East Lyme, CT

KEY			
Habitat Types		Status	
(1) Wooded swamp (2) Perennial stream (3) Scrub-shrub wetland (4) Pond/emergent marsh (5) Residential turf & ornamental landscape (6) Mixed hardwood forest (7) Hayfields (8) Early old field (9) Late old field		O – denotes species observed on the site; the remainder of species are potential site inhabitants based on the presence of suitable habitat. (SC), (T) or (E) – denotes a federal or state listed special concern, threatened or endangered species. Listed species are noted in bold. A (+) indicates federally listed species.	
Common Name	Scientific Name	Habitats	Status
Mammals			
Big Brown Bat	<i>Eptesicus fuscus</i>	4,5,6,7,8,9	
Bobcat	<i>Lynx rufus</i>	1,2,6,7,8,9	
Coyote	<i>Canis latrans</i>	1,2,6,7,8,9	O
Deer Mouse	<i>Peromyscus maniculatus</i>	6,7,8,9	
Eastern Chipmunk	<i>Tamias striatus</i>	5,6	O
Eastern Cottontail	<i>Sylvilagus floridanus</i>	5,6,7,8,9	O
Eastern Mole	<i>Scalopus aquaticus</i>	5,6,7,8,9	
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	4,5,6,7,8,9	
Ermine	<i>Mustela erminea</i>	6,8,9	
Gray Squirrel	<i>Sciurus carolinensis</i>	5,6,9	O
Hoary Bat	<i>Lasiurus cinereus</i>	4,6,7,8,9	SC
House Mouse	<i>Mus musculus</i>	5	
Indiana Bat	<i>Myotis sodalis</i>	6,7,8,9	E+
Little Brown Myotis	<i>Myotis lucifugus</i>	4,5,6,7,8,9	
Long-tailed Weasel	<i>Mustela frenata</i>	6,7,8,9	
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	7,8,9	
Meadow Vole	<i>Microtus pennsylvanicus</i>	6,7,8,9	

Northern Myotis	<i>Myotis septentrionalis</i>	4,5,6,7,8,9	
New England Cottontail	<i>Sylvilagus transitionalis</i>	9	
Northern Short-tailed Shrew	<i>Blarina brevicauda</i>	6,7,8,9	
Raccoon	<i>Procyon lotor</i>	1,2,3,5,6,7,8,9	O
Red Bat	<i>Lasiurus borealis</i>	4,6,7,8,9	SC
Red Fox	<i>Vulpes vulpes</i>	1,6,7,8,9	
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	4,6,7,8,9	SC
Southern Flying Squirrel	<i>Glaucomys volans</i>	6	
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	6,9	
Star-nosed Mole	<i>Condylura cristata</i>	1	
Striped Skunk	<i>Mephitis mephitis</i>	5,6,7,8,9	
Virginia Opossum	<i>Didelphis virginiana</i>	6	
Water Shrew	<i>Sorex palustris</i>	1,2	
White-footed Mouse	<i>Peromyscus leucopus</i>	5,6,7,8,9	
White-tailed Deer	<i>Odocoileus virginianus</i>	1,5,6,7,8,9	O
Woodchuck	<i>Marmota monax</i>	7,8,9	
Woodland Jumping Mouse	<i>Napeozapus insignis</i>	6	
Woodland Vole	<i>Microtus pinetorum</i>	6	
Birds			
American Crow	<i>Corvus brachyrhynchos</i>	5,6,7,8,9	O
American Goldfinch	<i>Carduelis tristis</i>	5,6,7,8,9	O
American Kestrel	<i>Falco sparverius</i>	6,7,8,9	T, O
American Redstart	<i>Setophaga ruticilla</i>	5,6	
American Robin	<i>Turdus migratorius</i>	5,6	O
American Woodcock	<i>Scolopax minor</i>	6,7,8,9	
Barn Swallow	<i>Hirundo rustica</i>	7,8,9	O
Barred Owl	<i>Strix varia</i>	6,7,8,9	
Belted Kingfisher	<i>Ceryle alcyon</i>	4	

Black-and-white Warbler	<i>Mniotilta varia</i>	6	
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	7,8,9	
Black-capped Chickadee	<i>Parus atricapillus</i>	6	O
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	6	
Blue Jay	<i>Cyanocitta cristata</i>	5,6	O
Blue-gray Gnatcatcher	<i>Poliotilta caerulea</i>	5,6	
Blue-winged Warbler	<i>Vermivora pinus</i>	7,9	O
Bobolink	<i>Dolichonyx oryzivorus</i>	7	SC
Broad-winged Hawk	<i>Buteo platypterus</i>	1,4,6	SC
Brown Creeper	<i>Certhia americana</i>	1	
Brown Thrasher	<i>Toxostoma rufum</i>	9	SC
Brown-headed Cowbird	<i>Molothrus ater</i>	5,6,9	O
Canada Goose	<i>Branta canadensis</i>	4	
Canada Warbler	<i>Wilsonia canadensis</i>	1,6	
Carolina Wren	<i>Thryothorus ludovicianus</i>	9	O
Cedar Waxwing	<i>Bombycilla cedrorum</i>	6	O
Cerulean Warbler	<i>Dendroica cerulea</i>	1,2,4,6	
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	9	O
Chipping Sparrow	<i>Spizella passerina</i>	5,6	O
Common Yellowthroat	<i>Geothlypis trichas</i>	1,2,3	O
Cooper's Hawk	<i>Accipiter cooperii</i>	6,7,8,9	
Downy Woodpecker	<i>Picoides pubescens</i>	6	O
Eastern Bluebird	<i>Sialia sialis</i>	7,8	O
Eastern Kingbird	<i>Tyrannus tyrannus</i>	7,8,9	
Eastern Meadowlark	<i>Sturnella magna</i>	7,8,9	SC
Eastern Phoebe	<i>Sayornis phoebe</i>	5,8,9	O
Eastern Screech-Owl	<i>Otus asio</i>	6,7,8,9	
Eastern Wood-Pewee	<i>Contopus virens</i>	6	O

European Starling	<i>Sturnus vulgaris</i>	5,6,7,8,9	O
Field Sparrow	<i>Spizella pusilla</i>	9	O
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	7,9	E
Gray Catbird	<i>Dumetella carolinensis</i>	1,5,8,9	O
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	6,9	O
Great Horned Owl	<i>Bubo virginianus</i>	6,7,8,9	
Green Heron	<i>Butorides virescens</i>	4	
Hairy Woodpecker	<i>Picoides villosus</i>	6	O
Hooded Warbler	<i>Wilsonia citrina</i>	6	
House Finch	<i>Carpodacus mexicanus</i>	5	
House Sparrow	<i>Passer domesticus</i>	5,7	
House Wren	<i>Troglodytes aedon</i>	7,8,9	
Indigo Bunting	<i>Passerina cyanea</i>	7,8,9	O
Louisiana Waterthrush	<i>Seiurus motacilla</i>	1,2	
Mallard	<i>Anas platyrhynchos</i>	4	
Mourning Dove	<i>Zenaida macroura</i>	5,6	O
Northern Cardinal	<i>Cardinalis cardinalis</i>	5,6	O
Northern Flicker	<i>Colaptes auratus</i>	6,7,8,9	O
Northern Mockingbird	<i>Mimus polyglottos</i>	7,8,9	O
Northern Oriole	<i>Icterus galbula</i>	5,8,9	
Orchard Oriole	<i>Icterus spurius</i>	7,8,9	
Ovenbird	<i>Seiurus aurocapillus</i>	6	O
Pileated Woodpecker	<i>Dryocopus pileatus</i>	6	O
Prairie Warbler	<i>Dendroica discolor</i>	7,8,9	
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	6	O
Red-eyed Vireo	<i>Vireo olivaceus</i>	6	O
Red-shouldered Hawk	<i>Buteo lineatus</i>	1,4,6	O
Red-tailed Hawk	<i>Buteo jamaicensis</i>	5,6,7,8,9	O

Red-winged Blackbird	<i>Agelaius phoeniceus</i>	7	O
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	6,9	O
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	5,6,8,9	O
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	6,9	O
Savannah Sparrow	<i>Passerculus sandwichensis</i>	7,9	SC
Scarlet Tanager	<i>Piranga olivacea</i>	6	O
Song Sparrow	<i>Melospiza Melodia</i>	7,9	O
Tree Swallow	<i>Tachycineta bicolor</i>	7,9	
Tufted Titmouse	<i>Parus bicolor</i>	6	O
Turkey Vulture	<i>Cathartes aura</i>	5,6,7,8,9	O
Veery	<i>Catharus fuscescens</i>	1	O
Warbling Vireo	<i>Vireo gilvus</i>	7,8,9	O
Whip-poor-will	<i>Caprimulgus vociferus</i>	6	SC
White-breasted Nuthatch	<i>Sitta carolinensis</i>	6	O
White-eyed Vireo	<i>Vireo griseus</i>	7,8,9	O
Wild Turkey	<i>Meleagris gallopavo</i>	6,7,8,9	O
Willow Flycatcher	<i>Empidonax traillii</i>	7,8,9	O
Wood Duck	<i>Aix sponsa</i>	4	
Wood Thrush	<i>Hylocichla mustelina</i>	6	O
Worm-eating Warbler	<i>Helmitheros vermivorus</i>	6	
Yellow Warbler	<i>Dendroica petechia</i>	1,6,9	O
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	7,8,9	
Yellow-breasted Chat	<i>Icteria virens</i>	9	E
Yellow-throated Vireo	<i>Vireo flavifrons</i>	7,8,9	
Reptiles and Amphibians			
Black Rat Snake	<i>Elaphe obsoleta</i>	6	O
Bullfrog	<i>Rana catesbeiana</i>	4	O
Eastern American Toad	<i>Bufo americanus</i>	4	O

Eastern Box Turtle	<i>Terrapene carolina</i>	1,2,6,7,8,9	SC
Eastern Garter Snake	<i>Thamnophis sirtalis</i>	1,4,5,6,7,8,9	O
Eastern Milk Snake	<i>Lampropeltis triangulum</i>	5,6,7,8,9	
Eastern Ribbon Snake	<i>Thamnophis sauritus</i>	1,2,3,4,7,8,9	SC
Four-toed Salamander	<i>Hemidactylium scutatum</i>	1	
Gray Treefrog	<i>Hyla versicolor</i>	1,3,4	O
Green Frog	<i>Rana clamitans</i>	1,2,3,4	O
Northern Black Racer	<i>Coluber constrictor</i>	7,8,9	
Northern Brown Snake	<i>Storeria dekayi</i>	5,6,7,8,9	
Northern Ringneck Snake	<i>Diadophis p. edwardsii</i>	6,5,7,8,9	
Northern Water Snake	<i>Nerodia sipedon</i>	1,2,3,4	
Northern Dusky Salamander	<i>Desmognathus fuscus</i>	1,2	
Northern Two-lined Salamander	<i>Eurycea bislineata</i>	1,2	
Painted Turtle	<i>Chrysemys picta</i>	4	O
Pickerel Frog	<i>Rana palustris</i>	1,3,4	O
Redback Salamander	<i>Plethodon cinereus</i>	6	O
Red-spotted Newt	<i>Notophthalmus viridescens</i>	1,4,6	O
Smooth Green Snake	<i>Opheodrys vernalis</i>	7,8,9	SC
Snapping Turtle	<i>Chelydra serpentina</i>	4	
Spotted Salamander	<i>Ambystoma maculatum</i>	1,4,6	O
Spotted Turtle	<i>Clemmys guttata</i>	1,4,6,9	
Spring Peeper	<i>Pseudacris crucifer</i>	1,3,4,6	O
Wood Frog	<i>Rana sylvatica</i>	1,4,6,9	O

8.1 Species of Conservation Concern

Species of conservation concern include those species that are considered to be regionally rare or are currently listed as special concern, threatened or endangered under the Connecticut or Federal Endangered Species Acts. The following sections discuss the habitat requirements and study area habitat suitability for these notable species.

8.1A Mammals

Eastern Woodland Bats

Potentially suitable habitat occurs on the site for four listed bat species known to occur in Connecticut; the Silver-haired Bat, Red Bat, Hoary Bat and Indiana Bat. All of these species are listed as species of special concern except for the Indiana Bat, which is listed as state and federally endangered. These bats are tree-roosting, with feeding occurring in open as well as wooded habitats. These species non-specific habitat requirements coupled with the limited data available on the distribution and abundance of bats in Connecticut necessitate the inclusion of these bat species as potential site inhabitants.

The Silver-haired Bat roosts in wooded and semi-wooded areas and feeds over watercourses and water bodies. Eastern Red Bats are a solitary tree roosting bat. They typically roost amongst live or dead leaves on the branches of live hardwood trees. Feeding often occurs around lights and in forest edges or clearings. The Hoary Bat is a solitary tree roosting bat and feeds in clearings or around water. Little is known about the abundance and distribution of Indiana Bat in Connecticut (Krukar, 2008). In summer, the Indiana Bats roost in small colonies, usually under loose bark of trees in semi-wooded areas, in upland or bottomland forest, or even in completely open areas while foraging occurs in forested areas (Whitaker, 1998).

New England Cottontail

While not a state or federally listed species, the New England Cottontail is listed as a priority species in Connecticut's Comprehensive Wildlife Conservation Strategy as one of nine spotlight species within the U.S. Fish and Wildlife Service's (USFWS) Region 5 and is designated as a candidate for federal threatened or endangered status by the USFWS (Rothbart, 2012). This species is known to occur in the vicinity of the study area, with records in the vicinity of Chesterfield, Montville. New England Cottontail inhabit early-successional forest generally less than 25 years of age (USFWS, 2006). Potentially suitable habitat exists throughout the early-successional portions of the study area, particularly the areas of late old field habitat.

8.1B Reptiles and Amphibians

Vernal Pool Species

A vernal pool survey conducted by EPS in March-April of 2006 confirmed the presence of five vernal pools located throughout the northern portions of the study area as well as one pool located offsite within 100 feet of the northern property boundary. The full report has been included in the appendix of this report. Two obligate vernal pool species, the Spotted Salamander and the Wood Frog, were found breeding on the site. Spotted Salamanders were observed in all six vernal pools while Wood Frogs were observed in two of six pools.

Eastern Box Turtle

Eastern Box Turtles inhabit old field habitat and deciduous forest ecotones, including powerline cuts and logged woodlands. Although strictly terrestrial, this species is seldom found far from water. Box turtles are widely distributed from sea level up to an elevation of 500 feet, becoming scarce and localized to an elevation maximum of just above 700 feet (Klemens, 1993). This species is considered scarce in southeastern Connecticut. The matrix of wetlands, forest and early-successional habitats at the site is suitable for Eastern Box Turtle. Targeted surveys for this species during a period of high activity in May-June did not reveal their presence. However, this species is highly cryptic and difficult to observe, particularly in densely vegetated habitats such as those present in the site. This species would be difficult to detect at the low population densities which would be expected, given the site's location in southeastern Connecticut.

Eastern Ribbon Snake

The Ribbon Snake inhabits a wide variety of shallow water aquatic habitats, favoring open, grassy or shrubby areas which border upon streams or wooded swamps (Klemens, 1993). Klemens (1993) documents this species in the Latimer's Brook watershed. The matrix of wooded swamps and vernal pools bordered by early-successional habitats provide suitable habitat for the Ribbon Snake along the perimeters of the wetlands.

Smooth Green Snake

The Smooth Green Snake inhabits unforested habitats including meadows, pastures, fens, coastal grasslands and mountaintop "balds" but is also found in transitional and lightly-forested habitats such as grassy old fields with scattered shrubs and trees, as well as oak-pitch pine woodlands. The majority of statewide records occur in eastern Connecticut and the species is widespread in the coastal sections of Rhode Island (Klemens, 1993). Klemens (1993) documents this species presence in East Lyme. The late old field habitats as well as early-successional habitat ecotones are suitable habitat for this species.

8.1C Birds

Whip-poor-will

Whip-poor-will occurs in scrubby immature woods or areas of regrowth following disturbance. Sites are often on relatively dry, sandy soils (Bevier and DiGiorgio, 1994). Breeding sites include dry open woodland and early successional forests adjacent to large clearings or brushy fields (DeGraaf and Yamasaki, 2001). This species is known to occur locally in areas such as Nehantic State Forest in nearby Old Lyme. Potentially suitable habitat exists on the site in the areas of immature forest, late old field and early-successional habitat ecotones.

Broad-winged Hawk

The Broad-winged Hawk exhibits a diversified nest site habitat selection. Although traditionally associated with deep tracts of deciduous forest, the species may also nest in isolated woodlots, often near roads and houses, and almost invariably close to a lake, pond or wetland (Bevier and DiGiorgio, 1994). Approximately 50-75% of former nest sites are re-occupied by the same pairs. The forest and forest ecotones areas, particularly those areas near wetlands or ponds, provide potentially suitable nesting habitat for this species.

Cooper's Hawk

Although recently de-listed in the 2010 revision to the state list of special concern, threatened and endangered species, Cooper's Hawk remains an uncommon breeder in the state. Breeding habitat for Cooper's Hawk consists of deciduous or coniferous stands near wetlands or open areas such as fields, scrubby growth or clearings. In general, Cooper's Hawk nests in sub-mature woodlands, sometimes surprisingly close to residential areas (Bevier and DiGiorgio, 1994). The site's matrix of forest, fields and successional habitats provide suitable nesting habitat for this species.

American Kestrel

The Kestrel favors grassland or shrubland at the edge of forest or open country with scattered trees, including agricultural areas, large parks and power-line rights-of-way. The two primary habitat requirements are open terrain for hunting and cavities, particularly tree holes, for nesting (Bevier and DiGiorgio, 1994). The complex of fields with bordering hedgerows and scattered trees provide suitable nesting habitat for the kestrel. Detailed breeding bird surveys did not reveal the presence of nesting Kestrel. A pair of Kestrels were observed on September 12, 2012 in the western fields and near the existing barn. Due to the time of year, these birds were considered to be migratory individuals, as the nesting season for this species in Connecticut is April – May.

Grassland Birds

During EPS' 2006 survey work the site's hayfields were being actively managed for hay production. Under a prescribed annual mowing regime, these fields had the potential¹ to provide nesting habitat for grassland species which utilize smaller grasslands for breeding (i.e., +/-25 acres), such as the Grasshopper Sparrow, Savannah Sparrow, Eastern Meadowlark and Bobolink. Subsequently, the hayfields were temporarily left fallow, and as a result, they reverted to shrublands (i.e., late old field), with the majority of fields dominated by Multiflora Rose. The dense rose thickets which had developed in these fields rendered them largely unsuitable for grassland birds when the early 2012 field work was conducted. In late September of 2012 the northwestern field was mowed

¹ In order to realize this potential, the hayfields would require a restricted mowing regime, with only one cutting per year, after approximately August 15.

again, making this area potentially suitable for grassland birds for the upcoming 2013 nesting season.

Brown Thrasher

The thrasher inhabits dry thickets in wooded areas, pitch/pine scrub oak barrens, second growth, power-line rights-of-way, brushy fields, hedgerows, briar patches, roadsides, forest edges and clearings (DeGraaf and Yamasaki, 2001). The late old field habitats provide suitable habitat for this species. The late September 2012 mowing left the northwestern field as sub-optimal habitat. The fields within the southern and eastern portion of the study area remain suitable habitat.

Yellow-breasted Chat

The chat inhabits second growth, shrubby old pastures, thickets, brushy areas, scrub, woodland undergrowth, and fence rows including low wet places near streams, pond edges, or swamps. Habitats include thickets with few tall trees, early successional stages of forest regeneration and commonly in sites close to human habitation. Nests are found in bushes, brier tangles, vines, and low trees, generally in dense vegetation less than 2 m above ground (Thompson, et. al, 1996). The chat is a rare breeder in southwestern Connecticut. Suitable breeding habitat exists in the late old field portions of the site.

8.1D CT DEEP NDDDB Records

A response letter was received on May 8, 2012 indicating that the state special concern butterfly species Henry's elfin (*Callophrys henrici*) and the federally endangered perennial herb American chaffseed (*Schwalbea americana*), occur in the vicinity of the site. Targeted surveys for the host plant of Henry's Elfin and for American Chaffseed were conducted on June 6, June 29, August 1, and September 25, 2012

Henry's Elfin

The NDDDB response was not received in time to conduct field surveys for Henry's Elfin, which flies during the period April-May. Therefore, the targeted survey for the preferred host plant, *Frangula sp.* was considered to be an acceptable alternative. The plant does not occur on the site. Therefore, there is a low probability that there is breeding habitat for this species on site.

American Chaffseed

Targeted surveys were conducted for this species in fields and forest openings throughout the growing season. It was not found on the site.

9.0 IMPACT ASSESSMENT

9.1 *Wetlands and Watercourses*

As noted above, the study area contains seven discrete wetland units, including ponds, wooded swamps, swamps flanking an intermittent watercourse, and isolated depressions. There will be no direct impact on wetlands or watercourses. All activity associated with the construction or operation of the solar farm will occur outside of wetlands and watercourses. The project plans include detailed erosion and sediment control plans and a detailed narrative. The overall construction consists of minor to moderate regrading of the site of the solar arrays, which will not occur in any areas adjacent to wetlands or watercourses; and installation of storm water management basins, which in order to operate properly, must be located in areas near wetlands and watercourses. These facilities have been designed in such a manner that they can be constructed and operated with minimal adverse impacts. Detention of peak flows and water quality treatment functions that take place in the basins will, in fact, prevent adverse impacts to the water resource areas due to degradation of water quality or increase in peak flows.

The wetlands contain five vernal pools located in the northern portions of the study area as well as one pool located 100 feet north of the northern property boundary. Vernal pools 1, 5, and 6 are remote from any proposed activity. Vernal pool 4 is located on the abutting parcel. None of the vernal pools will be altered in any way. The proposed removal of forest will result in a very small loss of terrestrial habitat for adult amphibians but will be far less than the 25% critical threshold identified by Calhoun and Klemens (2002). While there may be loss of individual animals during construction, will be no adverse impacts on population dynamics and the pools will continue to support viable amphibian populations.

9.2 *Vegetation*

Development of the solar farm will require placing the photo-voltaic panels along the eastern slope of Pigeon Hill. The northern portion of the solar arrays will be located in the fields described above. The southern portion of the solar arrays will be located in an area that is presently mixed hardwood forest. The existing vegetation will be removed to allow these areas to be re-graded as required. Due to the need to prevent shading, these areas will be permanently stabilized with a no-mow lawn mix, which will result in the conversion of 18 acres of old field and 15 acres of mixed hardwood forest to rough lawn. The seed mix chosen does not require irrigation or fertilization. Based on our botanical surveys, this change in vegetation type will not result in the loss of any state or federally listed plant species, rare habitats or "Critical Habitats" mapped by the CT DEEP NDDB.

9.3 *Wildlife*

The project will result in the conversion of native habitats to rough lawn. Clearing and re-grading of approximately 33 total acres of the site will be required, resulting in the conversion of approximately 18 acres of old field and 15 acres of mixed hardwood forest habitat. Provided in the following sections are the implications of that habitat conversion on the species confirmed present or those that could potentially occur on the site based on the presence of suitable habitat.

9.3A State or Federally-Listed Species & Species of Conservation Concern

Eastern Woodland Bats

Potentially suitable habitat occurs on the site for four listed bat species known to occur in Connecticut; the Silver-haired Bat, Red Bat, Hoary Bat and Indiana Bat. While the NDDDB review did not indicate that these species occur at the site, their non-specific habitat requirements coupled with the limited data available on the distribution and abundance of bats in Connecticut necessitate the inclusion of these listed bat species as potential site inhabitants. Restricting tree-clearing from March through November will prevent direct loss of individual bats which might be roosting on the site during this period, as they are generally on or moving toward wintering grounds during the late fall and winter months (November through March).

New England Cottontail

The resumption of regular mowing has eliminated the suitable late old field habitat from the northwestern field which encompasses a portion of the area that will be used for the solar arrays. This will limit the loss of suitable habitat to the southwestern fields totaling approximately eight acres. The eastern portions of the study area will remain suitable habitat for this species.

Vernal Pool Species

As noted in Section 9.1 above, an analysis of the site plans against the results of our vernal pool survey concluded that while there may be loss of individual animals during construction, there will be no adverse impacts on population dynamics and the pools will continue to support viable amphibian populations.

Eastern Box Turtle

The majority of the site contains potentially suitable habitat for Box Turtle. Targeted surveys for this species during the period of high activity in May-June did not reveal their presence. Because this species is cryptic and difficult to observe in densely vegetated habitats, it would be difficult to detect at the low population densities which would be expected in southeastern Connecticut. Suitable habitat will remain at the margins of the arrays as well as within the undisturbed portions of the study area.

Eastern Ribbon Snake

Although potentially suitable habitat exists at the site, this species was not detected during our surveys. The Eastern Ribbon Snake is a wetland-dependant species. It is rarely found far from wetlands or areas immediately adjacent to wetlands. The areas which will be utilized for the solar arrays are unlikely to be used by Ribbon Snake except for rare occasions where they might be used in a transitory manner.

Smooth Green Snake

The resumption of the historic mowing of the northwestern field makes that portion of the proposed development area sub-optimal habitat. This will limit the loss of suitable habitat to the southwestern fields totaling eight acres. The fields in the eastern portion of the study area, which will not be altered, will remain suitable habitat.

Whip-poor-will

Potentially suitable habitat exists in the study area, in immature forest, late old field and early-successional habitat ecotones. The resumption of the historic mowing of the northwestern field makes that portion of the development site sub-optimal habitat. This will limit the loss of suitable habitat to the southwestern fields and adjacent forest totaling 23 acres. The eastern portions of the study area will remain suitable habitat for this species.

Broad-winged Hawk

This species was not identified at the site during our 2012 survey work. The forest and forest ecotones near wetlands or ponds, which are the most suitable nesting habitat for this species, will not be altered.

Cooper's Hawk

This species was not identified at the site during our 2012 survey work. The matrix of forest, fields and successional habitats in the study area will continue to provide potentially suitable nesting habitat for this species.

American Kestrel

Detailed bird surveys during the breeding season did not reveal the presence of any nesting Kestrels. Two Kestrels were observed on September 12, 2012 in the western fields. Due to the time of year, these birds were considered to be migratory individuals, as the nesting season for this species in Connecticut is April – May. There are no indications that Kestrels are limited by availability of migratory stopover habitat and portions of the study area will remain suitable for that use. There will be no adverse impact on state or U.S. listed species.

Grassland Birds

No grassland birds were identified at the site during the surveys. The small to moderate size of the hayfields (with respect to suitability for grassland birds) and the dense rose thickets which developed after mowing was temporarily halted made the former hayfields largely unsuitable for grassland birds. The resumption of regular mowing of the northwestern field makes this potentially suitable for those grassland species that require small to moderate size grasslands. However, the typical two cuttings per season management regime typically practiced in New England would prevent successful fledging of young and would likely make the site unproductive for grassland birds.

Brown Thrasher

The late old field habitats that developed since 2006 provide potentially suitable habitat for this species. However, Brown Thrashers were not detected in our 2012 survey. The resumption of mowing this year will render the northwestern field as unsuitable habitat. This will limit the loss of suitable habitat to the southwestern fields totaling eight acres. The eastern portions of the study area will remain suitable habitat for this species.

Yellow-breasted Chat

Although suitable breeding habitat existed in the late old field portions of the site, this species was not detected in our 2012 survey. Loss of suitable habitat will occur in the southwestern fields totaling eight acres. The eastern portions of the study area will remain suitable habitat for this species.

9.4 Water Quality & Quantity

Construction phase water quality impacts will be mitigated by strict adherence to the sediment and erosion control plan. During operation, there are no discharges from the solar arrays. The no mow seed mix that is proposed for the array area does not require regular mowing, fertilization or pesticide application. The sanitary effluent from the maintenance building will be treated and discharged to the ground via a code-compliant sub-surface sewage disposal system. Because of the limited area being converted to impervious surfaces, impacts to water quantity are expected to be minimal and are far less significant than would be expected from a conventional residential development, as the solar array field will still allow rainfall to infiltrate into the ground. Based on these factors, we believe there will be no adverse impact on water quality and quantity.

10.0 SUMMARY AND CONCLUSIONS

Greenskies Renewable Energy Companies has proposed construction of a 4.9-megawatt ground mounted photovoltaic solar array system covering +/-33 acres located at 40 & 44 Grassy Hill Road and 89 Walnut Hill Road in East Lyme, Connecticut. EPS conducted wetland and biological surveys of the site in the spring of 2006 and again between March and September of 2012.

The project has been designed so that there will be no direct impacts on wetlands and watercourses. Furthermore, it is our professional opinion that the project will not have any secondary or indirect impacts to wetlands or watercourses, as work in the adjacent upland review areas has been minimized to the maximum extent feasible. Strict adherence to the detailed erosion and sediment control plan and stormwater pollution prevention plan will minimize any impacts to water quality during construction. Once the soils are stabilized and the arrays are operational, the facility is not expected to have any adverse impact.

The project will result in some loss of native habitats, as clearing and re-grading of approximately 33 total acres of the site will be required, resulting in the conversion of 18 acres of old field and 15 acres of mixed hardwood forest habitat to rough lawn. Detailed biological surveys did not reveal the presence of any nesting or breeding Connecticut or federally-listed species. The proposed development will not impact rare or critical habitats, as detailed botanical surveys did not reveal the presence of such habitats. The impacts to habitat and wildlife are expected to be less significant when compared to impacts associated with residential development. This assumption is based on the fact that the proposed project will result in less human activity around the site's remaining native habitats and more edge or ecotone habitats will remain undisturbed. The use of no-mow lawn mix will provide better habitat for invertebrates than traditional lawn grass, creating a food base that insectivorous wildlife, particularly birds, can feed on, and will eliminate the need for irrigation or fertilization after establishment.

11.0 REFERENCES

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APPENDICES

- (1) Figures 1-4
 - (2) Site Photos
 - (3) CT DEP NDDB response letter (May 8, 2012)
 - (4) EPS Amphibian Breeding Survey (2006)
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