THERRIEN-LANATA STUDY

of an

Eversource Right-Of-Way

2042 & 2060 NEW LONDON TURNPIKE
GLASTONBURY, CONNECTICUT

April 2020

REMA

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EXECUTIVE SUMMARY

THERRIEN - LANATA STUDY OF AN EVERSOURCE RIGHT-OF-WAY SEGMENT

2042 & 2060 NEW LONDON TURNPIKE, GLASTONBURY - SUMMER & FALL OF 2019

- REMA Ecological Services, LLC (REMA), was retained by the Therrien and Lanata families to study the 950-foot long Eversource right-of-way (ROW) section which they own, and an adjacent 1,150-foot long section owned by Eversource, just north of New London Turnpike. We collected data on vegetation, avians, soils, and hydrology in this botanically diverse, shrub-dominated Eversource ROW in east central Glastonbury between July and November of 2019. In all, we studied a roughly 2,100-foot segment of Eversource Transmission Line (i.e., "ROW") encompassing approximately 14 acres.

- Additional surveys of avians and invertebrates are planned for the 2020 growing/breeding season.

- We were also commissioned to investigate and compare the ecological impacts of several different management strategies, used in different sections of the ROW.

- For each distinct ecological community, representative +/- 2000 square foot plots were described in detail, and all plants identified. Three plots were established in upland communities in the southwestern Therrien-Lanata ROW, of which one was a control plot on the hilltop where work pads were developed, for replacement of wood poles with steel poles. Two plots were located in wetlands in the northeastern ROW segment, owned by Eversource.

- A total of 213 vascular plant species were recorded on the site, including 41 native shrub species. Structure and taxa richness were greatest in the natural hilltop and upland slope communities in the southwestern Therrien segment under the power lines; and lowest on the stone process work pads, and in the logged areas where thick wood chips had been left behind. Diversity and cover were moderate in logged wetlands and uplands with minimal chip deposition, and in the northern areas managed by intermittent herbicide application.

- Wildlife Habitat values of several key vegetation components were assessed in depth: eastern red cedars, low ericaceous shrubs, grasses, and oak saplings.

Gravel Placement

- On the shallow-to-bedrock hilltop where work Pads #1 and #3 were built, environmental value of the pre-existing cover type was far higher than the vegetation that developed on these two work pads filled for pole replacement. Natural vegetation has similar levels of shrub and forb cover, and forbs included substantial native grasses and sedges, intermixed with shrubs and along grassy access pathways. Some bare soil was present on the brow of the off-site east hill. Habitat provided excellent cover, early and late season nectar, diverse larval hosts, summer and fall graminoid seeds, and bare soil for resting stages of invertebrate fauna.

- *Significant areas of natural, high-quality habitat were lost*: A roughly 0.75-acre area and another 0.5-acre area of diverse low shrub-meadow cover type was replaced by a near monoculture of invasive mugwort, with sparse red clover and fescues. The dense fill pads for pole replacement, and gravel roadways caused downgradient erosion; minimal infiltration of rainfall increases the volume of flashy, erosive runoff.

- The steep hill to the southwest of the Therrien-Lanata ROW segment has a broad, recently formed gully at the base.

- Even very small rain events (<0.24") wash fine sediment onto the adjacent hillsides, a nutrient source expected to alter the natural slope vegetation, adapted to nutrient-poor soils. This hillside is more vulnerable to erosion than in prior decades, because its protective cover of eastern red cedars was removed in January of 2019. Adverse hydrologic impacts of conversion from a shrub-dominated to a meadow cover type would also be expected following a wide-spread switch to mowing.

- Mugwort seeds from the extensive mugwort population will also be washed downhill from the pads in runoff, which is a serious concern. This ROW segment had little mugwort until introduced to the pads.

Timber Matting Alternative

- Timber matting was used for pole replacement at Pad #4 in 2019, and minimal damage was done to pre-existing high quality shrub community, with pasture juniper, mountain laurel, sweet fern, huckleberry, and little bluestem.

- Turning off the power for one approximately six-hour period, meant that the work area could be smaller because only one crane and one excavator were required to move the wires from old poles to new. Moving wires from old poles to new while the power was on at Pad #2 (near New London Turnpike) took three large cranes and an excavator.

- Especially where topography is not very steep, timber matting is a viable alternative. Eversource continues to use timber matting but only within delineated wetlands.

- Our clients reminded Eversource that the sub-petition language states that fill pads are only temporary, such that property owners have a right to insist on fill removal after the work. This is costly, and Eversource was willing to use Timber Matting instead, for Pad #4.

Topsoil Placement for Restoration

- At Pad #4 topsoil was placed only in one small area where the soil had been disturbed by heavy equipment. Here again, a serious weed infestation resulted; topsoil must have been contaminated by jimsonweed seeds. Gary Therrien cut down the whole patch before seeds were ripe.

- The study included soil tests of natural soil and applied topsoil, which showed that the natural upland soils on the site are naturally acidic (pH of 4.3 to 4.4), and low in nutrients (e.g., phosphorous conc. of 2 to 2.5 ppm), but also high in organic matter (>8%). This is the case throughout our state in hilly terrain with crystalline bedrock.

- This in-situ soil supports only slow growth of woody species & offers far less favorable growing conditions to common woody invasives than most commercially available topsoil. The natural soil on these rocky, acidic ROWs is less vulnerable to invasives, than fertile farmland soil.

- It is strongly recommended that fertile garden-type soil not be spread over work pads built for pole replacement, with the intent of planting a suitable growing medium for flowering native species, to benefit pollinators. They are likely to be overrun by nutrient-loving weeds.

- To restore degraded ROW areas with typical acidic infertile soil, plant both warm season grasses and native wildflowers from the excellent pallet of native drought-tolerant species that thrive on natural rights of way. Optimally, stockpile and re-spread preexisting topsoil.

Selective Cutting/Herbiciding

- An important observation throughout the site was that seedlings of oaks and other trees, did not become established within patches of native shrubs, such as huckleberry and pasture juniper.

- Eliminating shrub cover by close mowing or spraying will foster tree colonization over the long term. Note that the Therrien/Lanata ROW has been a "no-spray zone" for over 25 years because of the watershed area that makes up most of the ROW slopes toward the Therrien drinking water well, and could compromise the Therrien's already major health issues. There has been spraying in the ROW owned by Eversource on the north side of New London Turnpike.

- Killing shrubs and tree saplings does fertilize the soil, as the roots decompose and release nutrients. Woody colonizers, both invasives and trees, were often observed around and on stumps, woody debris, or herbicided sapling stems.

- On the Therrien & Lanata parcels, moderate numbers of *red cedar and oak saplings are allowed to approach non-conforming height before they are trimmed or topped* (oaks are still too young to produce acorns). This approach significantly improves habitat quality for wildlife and insects. It also reduces soil fertilization by rotting root systems, and colonization by new tree seedlings.

- *This "pollarding" approach maintains succulent oak foliage for larval host plants, providing insect food for birds, and the valuable cover and abundant, long-lasting fruit of red cedars.* It is presumably the reason that birds were so much more abundant in the southern Therrien-Lanata ROW segment than in the northern segment, per the August 2019 REMA bird survey. Oaks are the larval food plant for a great many moth species and herbivorous insects prefer the tender leaves of saplings. Oak saplings also furnish browse to white-tailed deer.

- Note that these recommendations are not applicable to corridors with fertile agricultural soils, which do not naturally support the low ericaceous-dominated shrub community characteristic of this study site. Tree grow faster in naturally fertile soils, though they could likely be managed to become stable shrub thickets of other taller shrub species such as dogwoods and American hazelnut.

Wood Chip Deposition

- *Thick wood chip deposition* during clear-cutting virtually eliminated the diverse hilltop/upper slope low shrub/groundcover vegetation from the westside of the NE ROW segment. Living blueberry and maple-leaf viburnum are the dominant understory shrubs in the adjacent forest, and could have formed the core for post-logging low vegetation in this area.

- *Thick chip deposition also significantly impaired pocket wetlands* with mucky, black soils, and sedge tussocks, overlooked by logging contractors (Plot 5). Species richness and vegetation cover were very low.

- By contrast, chips were not spread through the more southern, contiguous wetlands (represented by Plot 4), as is clearly shown on Figure 4. This logged area recovered very well, with 17 herbs and five shrubs, and understory cover of 95%. Dense patches of robust wetland wildflowers, such as jewelweed, arrow tear-thumb, and Joe-Pye were not harmed by logging and effectively excluded all seeding establishment, by trees. Sedge tussocks and wet organic soils were also not colonized.

- *This is a reason to carefully identify the small wetland areas in ROW stretches*, including the perimeter, not shown on soils maps, before maintenance logging or service road work. Property owners should check for potential overlooked wetlands in their ROW sections. Additionally, note that Timber Matting, rather than stone process fill, must be used for equipment crossings in wetlands.

- In the absence of a wood chip blanket, bare areas on the former forest floor were a good seed bed for patches of rosette panic grass and bristly sarsaparilla and oak seedlings. Seeding with dry-site herbaceous species tolerant of acidic, nutrient-poor soils, would be useful in these areas.

Vegetation Management in NE ROW Segment.

- Bare patches resulted from *overspray*, where birch and maple saplings had been treated with herbicides.

- *Graminoids were less well developed in the herb stratum* of the Eversource-owned segment, than in the southwestern segment, perhaps due to use of non-selective glyphosate herbicide, which kills grasses and sedges as well as forbs.

- The contractor killed all the highbush blueberry shrubs as well as patches of lowbush blueberries and huckleberries, perhaps due to misidentification. Fast-growing tulip tree saplings were left in place.

- Invasive glossy buckthorn sprouted in red cedar cuttings.

Logging and Wildlife

- At this site, after logging, buffers remain largely broad enough that they screen residential lighting, headlights, and street lighting, and protect night-flying insects from significant adverse lighting impacts. Along this ROW segment, lighting impacts do not appear to negate the potential to support diverse and abundant lepidopteran fauna, provided by its diverse plant community.

- Other property owners of Eversource rights-of-way should consider the extent to which proposed logging outside the "line zone" will damage the integrity of an adjacent forested buffer. Is it already marginally wide, such that it would no longer be broad enough to protect insect fauna from light impacts after the proposed logging?

- Woods-edge shrubs and small trees like arrowwood and ironwood are conspicuously lacking along the new edge in the Study ROW. Other ROW property owners could argue that a narrower swath of forest should be logged, and that small tree and tall shrub species along the existing edge should be replaced or, if possible, preserved. These are issues to raise during the sub-petition review process, and when negotiating with Eversource vegetation managers or contractors.

- The quality of the forest bordering the logged swath in this study ROW is excellent, which significantly enhances the overall wildlife habitat value of the ROW. Mature, large diameter trees and woody debris are present, and the understory is dominated by native species, not invasives shrubs and vines.

Conclusion

- The high quality of the habitat in this ROW segment, with its eastern red cedars, diverse shrubs, and well-developed native meadow flora is enhanced by the combined width and quality of the adjacent forest. High habitat quality is consistent with the exceptionally high usage by migrating birds, per the August survey: 152 individuals and 31 species were tallied in the southern portion of the ROW during one early morning survey.

- Establishment of tree seedlings and invasives is deterred by the types of stable shrub-meadow vegetation which naturally develop in the acidic, infertile, rocky soils at this site, and are also prevalent throughout much of the State of Connecticut.

- ROW maintenance and management practices resulted in substantial loss of habitat, biodiversity, and aesthetics, as well as soil erosion, in portions of the study area. However, other practices similar to past practices in this state, had minimal adverse environmental impacts, allowing ongoing preservation of habitat and biodiversity, with low long-term costs.

● Ecology
● Soil & Wetland Studies
● Water Quality Monitoring ● GPS
● Environmental Planning & Management
● Ecological Restoration & Habitat Mitigation
● Aquatic, Wildlife and Listed Species Surveys
● Application Reviews ● Permitting & Compliance

April 14, 2020

VIA E-MAIL & HAND-DELIVERY

Mr. & Mrs. Gary and Linda Therrien
2060 New London Turnpike
Glastonbury, CT 06033-3822

RE: Findings with regard to Natural Resources and Management Methods on the Eversource Right-of-Way in Glastonbury, south of New London Turnpike, on the Therrien and Lanata Property, and the Adjacent Eversource-owned Right-of-Way Segment to the North

REMA Job No.: 19-2193-GLA30

Dear Mr. & Mrs. Therrien,

Per your request, REMA Ecological Services, LLC (REMA), summarizes herein our *preliminary* findings and recommendations with regard to Natural Resources found along Right-of-way (ROW) habitats, taking ecological, safety, and aesthetic considerations into account.

1.0 INTRODUCTION

An in-depth natural resources study of flora, soils, and hydrology was conducted along a roughly 2,000-foot segment of Eversource Transmission Line (i.e., "ROW") in east central Glastonbury, between July and November of 2019. The study area encompasses approximately 14 acres of land, along the ROW, both to the northeast and to the southwest of New London Turnpike (see Figures 1 and 2, Attachment A). The ROW segment to the southwest of New London Turnpike is roughly 1,100 feet, while to the northeast it is roughly 900 feet.

REMA was retained to collect baseline data on vegetation, avians, soils, and hydrology in this botanically diverse, shrub-dominated right-of-way, and to investigate and compare the ecological impacts of several different management strategies, used in different areas, between 2014 and 2019. Figure 2 (Attachment A), and Table 2A (Attachment C) show where within the study area different management methods were applied.

The owners of the east side of the southwestern portion of this right-of-way (ROW) segment, contracted with REMA to do this work. They are Gary and Linda Therrien, who live at 2060 New London Turnpike, immediately to the east side of the ROW, and Steven and Stacy Lanata, at 2042 New London Turnpike, immediately to the west of the ROW. The study area includes the ROW segment owned by Eversource to northeast of New London Turnpike, with a substantial wetland component, and with a different management history.

Following are the ROW Management and Pole Replacement Methods that were evaluated:

- Placement of thick layers of stone process for work pads, versus use of timber matting, to support heavy equipment used for transmission pole replacement
- Placement of fertile topsoil versus pervious, stockpiled sandy soil, on top of the impervious fill
- Logging with deposition of thick chips, on the northeastern ROW segment, versus thin or no chip deposition on the southwestern ROW segment
- Herbicide application and mowing (used on the northern Eversource-owned segment), versus selective cutting, topping, used on the southwestern Therrien/Lanata segment
- Slope grading (deep cuts and fills), for access road construction, and drainage control

It should be noted that several illustrative annotated photographs taken within the study area, during the course of our investigations, are included in Attachment B.

2.0 METHODS

For each distinct ecological community, representative plots were described in detail, using the Braun-Blanquet methodology[1], which was the basis for the Metzler and Barrett Vegetation Classification system for Connecticut (2006). Each plot was about 2000 square feet in area. Three plots were established in upland communities in the southwestern Therrien-Lanata ROW,

[1] The **Braun-Blanquet** methodolgy, is a **method** of describing an area of vegetation devised by J. **Braun-Blanquet** in 1927. It is used to survey large areas very rapidly.

and two were located in wetlands in the northeastern ROW segment (see Figure 1, Attachment A, for plot locations).

Data was collected on vegetation structure (percent cover and stratum height data, for each vegetation layer), species composition, sociability, and physical ecological properties such as aspect, rock and woody debris cover, and moisture regime. All vascular species within each plot were identified to species, as possible, given seasonal limitations. Challenging plant specimens were collected for examination in the laboratory under magnification, and voucher specimens were pressed and retained. Plot data also provides the habitat information needed for assessment of suitability for different wildlife and moth species (see Table 3, Attachment C).

At each plot a composite soil sample (or several samples if the plot included different hydrologic regimes or treatments), was also collected on September 25th, 2019, and submitted to the University of Connecticut Soil Analysis laboratory at Storrs. Results are shown in Table 1 (Attachment C). On November 11th, 2019 infiltration rates were tested in natural hilltop soil, on Pad #4, where timber matting had been used, and also on Pad #3, where stone process fill had been placed. Small scale runoff, infiltration, and sedimentation patterns were observed during a rain event on November 12th, 2019. A backhoe was used to collect four samples of the rocky fill used in pad construction.

Vegetation was also surveyed and photographed in each portion of the survey area, each with a different management history, paying close attention to the distribution of tree seedlings and tree saplings, invasive species, signs of erosion, and bare areas. Species composition, as noted during qualitative surveys, was compared to that in the qualitative plots, for an understanding of the distribution of plant communities over the whole study area.

Data on relative abundance of different plant species was used to predict a likely suite of herbivorous insects, pending an invertebrate field survey (not possible in 2019, because the study began too late in the growing season) (See Table 4, Attachment C).

Two early morning bird surveys were conducted between 6:13 am and 7:55 am, on August 10th, 2019 (i.e., the Therrien-Lanata segment), and between 6:17 am and 7:45 am on August 14th, 2019 (in the segment just to the northeast, owned by Eversource). The number of individuals of each bird species observed were tallied. Identification was based somewhat more on visual identification than calls, because the survey took place after the breeding season. Local breeders would still have been present in mid-August, and some birds on migration from further north would have been tallied as well. The abundance of different feeding guilds provided

valuable information on utilization of different foraging resources. More comprehensive breeding bird surveys are scheduled for 2020.

3.0 OVERVIEW OF RIGHT-OF-WAY HABITATS & IMPACTS

The study area encompasses several natural cover types, as well as man-altered (or maintained) vegetation. The plant communities and their values for wildlife are summarized below, with discussions of impacts from management activities. Table 2 (Attachment C) and the Section on Results provide additional detail.

3.1 Lower Slope

In the Therrien-Lanata ROW Segment, the moist lower slope is traversed by the gravel service road, and Representative Plot 1 is located here. It supports tall, dense thickets with winged sumac, grape and green briar vines, glossy buckthorn, and oak & red cedar saplings (regularly cut back). The thickets provide cover for songbirds and Eastern cottontails (observed), early season flowers, summer and early fall fruit, and especially, insect-gleaning opportunities for birds. Upland moist meadow is concentrated at the sides of the service road and in other clearings; it includes perennial herbs such as rough goldenrod, boneset, and rosette panic grasses, and dwarf shrubs like steeplebush and meadowsweet. Blooming pink *Polygala sanguinea* was striking in August. (See Photos 1to12, Attachment B)

One of the rosette panic grasses, *Dicanthelium sphaerocarpon, var. isophyllum* (the round-fruited rosette-panicgrass) is a ***state-listed Species of Special Concern,*** that is presumed to be extirpated.[2] Identification of the variety was not possible in late summer, but *Dicanthelium spaherocarpon* does occupy a grassy, open path perpendicular to the gravel road. The only population of sheep laurel on the site is also located here. The hillside shrub thicket includes bear oak (*Quercus ilicifolia*), which is locally very uncommon, though not state-listed. The very high number of species in this community (68 total) allow for foraging opportunities through the whole growing season.

In 2014 the area between the service road and the Therrien home was graded and filled with several feet of stone process, to broaden the road and create a narrow rip-rap-filled drainage ditch, to control flooding onto the Therrien property. A steep roadside embankment, up to three feet high, has replaced the former gradual bank. Though this portion of the site was visited

[2] DEEP 2015. Connecticut's Endangered, Threatened and Special Concern Species (2015). State of Connecticut Department of Energy and Environmental Protection, Bureau of Natural Resources. Note that

multiple times, including morning visits in sunny weather, no basking snakes were observed on the service road, and no crossing Eastern box turtles, frogs, toads, or salamanders; herptiles were often seen prior to 2014, according to the Therriens.

REMA was asked to evaluate why the frequent former (pre-2014) herptile observations ceased following the road improvements. Our hypothesis is that hydrologic changes have made the habitat to the east of the road unsuitable for the herptiles; the dense, poorly permeable fill for the road, has blocked natural seepage from upslope, to the northwest, and the ditching of the drainageway together, have dried the adjacent ground. Natural topsoil and vegetation were also disturbed during grading. The steep banks that were created would impede easy passage by Eastern box turtles and spotted salamanders, but they could move around the obstacle, if there were still desirable habitat downgradient of the road. Direct mortality of hibernating turtles or snakes during construction, when they were too torpid to flee is also possible.

A suite of flowering weeds such as field thistle and evening primrose has sprouted on the margins of the stone process service road. Only one small patch of invasive mugwort was observed, which was slated for removal.

3.2 Upper Slope and Hill-top

A different, diverse shrubland community occupies the drier upper slopes, and the hilltops of the southwestern Therrien-Lanata ROW segment: low to medium-height shrubs like huckleberry, lowbush blueberries, maleberry, sweet fern, pasture juniper, meadowsweet, and mountain laurel are dominant, though scattered red cedars and taller shrubs are still present. Low-bush blueberries grow in a forest understory, as well as on open ROWs, but fruit set is greater in the open. (See Photos 13 to 22, Attachment C.) The species total is 40, on the upper slope, along the gravel service road, and 32 in Plot 3, on the hilltop, lower than in Plot 1, where the total encompasses species of moist soils and disturbed soils. The uplands in the northeastern Eversource-owned ROW segment supports some of the same shrub species and most of the herbs, but cover of graminoids and low shrubs is substantially lower, likely influenced by decades of management using glyphosate herbicides.

The low shrubs grow as a mosaic with clumps and patches of herbaceous vegetation and drought-tolerant groundcovers like running pine (a clubmoss), *Polytrichum* mosses, occasional *Cladonia* lichens, and dewberries. Heavy-seeding rosette panic grasses, little bluestem grass, and Penn sedge are important larval host plants for skippers and other insects, and provide good habitat for small rodents, the principal food for raptors in Connecticut. Flowers are used by

pollinators, not only by bees, but also flies, beetles, and thrips (Thysanoptera). Herbaceous foliage is eaten by the larvae of many small generalist insects. Herb species include whorled loosestrife, wild indigo, gray goldenrod, hairy boneset, golden-top, and sweet everlasting. Herbs are concentrated on the sides of the service road and along older maintenance roads.

3.3 Work Pads for Pole Replacement

The ecological value of the vegetation that has developed on the compact fill is far lower than the preexisting shrub-meadow cover types. (See Photos 23 to 26 and 27 to 30, Attachment B.) A near monoculture of invasive mugwort, with a sparse lower stratum of red clover and fescues, now occupies Pad #1, a roughly 0.75-acre area in in the southwestern portion of the hilltop. In 2015, up to 12 feet of fill stone process and very rocky/gravelly subsoil were placed here. About 3-4 inches of clay-based topsoil was spread over the fill; it was seeded with clover and grass, but clearly was also contaminated with mugwort seeds.

For Pad #3 a similar procedure eliminated about half an acre of high quality dry shrubland habitat, though the topsoil was scraped off a portion of the pad. The area without topsoil is essentially impervious, and currently bare. The portions with topsoil now support patches of mugwort and several other rank, tall weeds: horseweed, invasive spotted knapweed, and jimsonweed (or devil's snare), a highly toxic species. Sparse, low red clover remains from the initial seeding.

Timber matting was used for pole replacement at Pad #4 in 2019. (See Photos 24 and 27-30, Attachment B) Turning off the power for one approximately six-hour period, meant that one large crane and one excavator could do the work, rather than two cranes and one excavator, which are needed when wires remain live through the replacement process. Minimal damage was done to the preexisting high quality shrub community, with pasture juniper, mountain laurel, and little bluestem. Topsoil placement was limited to one small area where the soil had been disturbed by heavy equipment. Here again, a weed infestation resulted; topsoil must have been contaminated by jimsonweed seeds. Gary Therrien cut down the whole patch before seeds were ripe.

Mugwort is currently sparse in the study area, except where it has been introduced to the pole replacement pads. It has high potential for continued adverse impacts to the entire ROW ecosystem. Seeds are too tiny to have nutritional value for birds and rodents. Its inconspicuous flowers are wind pollinated and lack nectar, of low value to pollinators. Foliage contains aromatic oils, repellent to most herbivorous insects in the United States. It effectively

outcompetes and prevents colonization by other herbaceous species with higher ecological value, with a combination of closely spaced stems, dense rhizome network, and 4 to 5-foot height. It is a perennial, with a documented poor response to herbicides, hand pulling, and occasional mowing. (See Photos 23 and 25, Attachment B)

Aside from their harmful vegetation, the dense fill work pads for pole replacement, as well as the gravel roadways, create downgradient erosion problems, because infiltration of rainwater is minimal, resulting in increased volumes of flashy, erosive runoff. (See Photos 31 and 32, Attachment C) The steep hill to the southwest of the Therrien-Lanata ROW segment has a deep, recently formed gully at the base. This hillside is more vulnerable to erosion than in prior decades, because its protective cover of red cedars was removed in January of 2019. Eastern red cedars have dense and widely spreading root systems, which results in very effective soil stabilization, something which is much needed in the rocky and shallow soils that often characterize many ROWs, including the one associated with your property. (See Photos 24 and 27 to 30, Attachment B.)

The low porosity of the fill used for the pads (both the stone process and the rocky till, and the rocky till), was clear from a simple inspection of several samples obtained with a backhoe.

	Traprock Process Sample #1		Rocky Subsoil Sample #3
Rocks, 2 - 5”	20%		30%
Gravel, > 0.5”	10%		15%
Small gravel	40%		5%
Fines	30%	(stone dust)	50%

An in-field infiltration test, with a double ring infiltrometer, showed a significantly lower infiltration rate in the topsoil portion of Pad #3 (with stone process fill), versus a portion of Pad #4 with natural hilltop soils, minimally compacted by timber matting. In Pad #4, each one-inch drop in water level took between one and two minutes (mean of 1.56) throughout the test. In the filled Pad, #3, the initial rate was 3.3 minutes; by the fourth drop this had increased to 9.5 minutes for a one-inch drop.

Pads were closely observed during the onset of a low intensity rain on the day after the infiltration test; puddling and dislodging of fine soil/stone dust particles was observed already, before 0.25 inches of rain had fallen. The fine silt is carried by runoff into a drain on the east side of the service road.

One serious concern is that mugwort seeds will also be transported in runoff, especially the seeds that fall onto the sloping brow of the southwestern edge of Pad # 1, which is densely infested with mugwort.

3.4 Western Logged Swath

Clear-cutting took place in 2016, along the west side of the privately owned portion of the ROW, owned by the Lanatas; and in 2017 along the northwest side of the northeastern ROW segment owned by Eversource. (See Photos 33to 38, Attachment B.) The logged area in the northeastern ROW segment includes both wetlands and sloping upland terrain. Although trees are now lacking, species diversity and cover levels are substantially lower than in the eastern shrub communities within the wire zone. Herbs are sparse in the western logged areas, forested until recently. Bristly sarsaparilla and a sprawling rosette panic grass are the two early colonizers. Many forest understory shrubs have survived, but only where thick chips were not deposited.

Wood chips were spread irregularly in the logged area owned by the Lanatas. They were reported to have been locally thick, but not as widespread and thick as the mulch layers found on the Eversource-owned segment to the northeast. Extensive cover, over 40%, of low ericaceous shrubs of huckleberry, low-bush blueberry, sweet fern, and mountain laurel, is present in the Lanata logged area. Virtually no oak seedlings have sprouted within the continuous low shrub patches, but young oaks are abundant in adjacent otherwise bare areas. However, cover and diversity of low ericaceous shrubs is very low on the recently logged west side of the northeastern ROW segment.

In the Eversource ROW segment, blankets of wood chips of variable thickness were left, four to five inches deep in many areas, several inches deep in others, only just starting to decompose by the late summer of 2019. Thick wood chips were also deposited in several wetlands. Some areas without chips were also present, less than 25%. It is readily recognized that wood chips release phosphorus into the soil as they decompose as well as phytotoxins (Rex 2016, Hurley et al. 2017). Species diversity is very low; pilewort, pokeweed, and to a lesser extent, common blackberry tolerate the effects of the wood chips. The harmful effects of excess nutrient inputs into aquatic ecosystems are widely known; it is less widely understood that they also cause adverse changes in the composition of terrestrial plant communities, favoring certain species, like pokeweed and pilewort, that thrive under high nutrient regimes (Jordan 1977).

By contrast, the few upland areas not covered with wood chips supported healthy stands of ericaceous plants and the characteristic groundcovers, with clubmosses, dewberry, wintergreen, and haircap moss. The huckleberries, low-bush blueberries and running pine were present in the forest understory, prior to logging. Those species still grow in the adjacent forest. A groundcover of rosette panic grasses, cinquefoils, prickly dewberry, and haircap (*Polytrichum*) mosses also thrived in logged areas where chips were not deposited. (See Photo 50, Attachment B.)

3.5 Northeastern Wetlands

The wetlands to the northeast of New London Turnpike include a tall wetland shrub thicket with viburnums, elderberry, winterberry, and invasive glossy buckthorn; tree saplings, mostly birches and red maples, were recently treated with herbicide, and highbush blueberry shrubs were killed as well. Shrubs are interspersed with substantial areas of tall, dense, lush wet meadow, including high quality wildflowers for pollinators, such as jewelweed, arrow-leaved tearthumb, ironweed, purple loosestrife, and Joe Pye, but low grass and sedge cover. Pockets of marsh, with sedge tussocks and cinnamon fern occur in the logged area. There are diverse associated forbs, where thick wood chips were not deposited, but extremely low diversity (a total of only 7 species total in Plot D) where wood chips were deposited within wetlands. (Photo 38, Attachment B.)

The dense shrub thickets, the dense, tall herbaceous vegetation, and the unvegetated mucky hydric soils in these wetlands naturally resist tree colonization, based on the distribution of tree seedlings and saplings observed. Wetlands are often overlooked as they are often not on NRCS-USDA maps (i.e., Web Soil Survey), and not given the *special treatment afforded by the Connecticut Inland Wetlands Act.*

4.0 BACKGROUND ENVIRONMENTAL DATA

4.1 Right-of-Way Configuration

The width of the cleared corridor was approximately 185 feet before the west side of the right-of-way was logged; in summer 2019 the ROW was approximately 275 feet wide. Logging took place in 2016 on the southwestern Therrien-Lanata ROW segment, and in 2017 along the northeastern portion of the study area, owned by Eversource. As discussed further below, wood chips were handled differently.

This Transmission Line Corridor conveys power along two sets of three lines each; at this location it is oriented southwest to northeast. The eastern lines (on the right, facing northeasterly) carry 115 KV of current, and the western lines carry 345 KV. The study area begins on a flat-topped, 490-foot high hill, with two pairs of poles for each set of lines. The TIC proceeds 960 feet downhill, to an elevation of roughly 440 feet, adjacent to New London Turnpike. It continues uphill, about 900 feet, rising fifty feet in elevation to another hilltop (i.e., 490-feet), the northern limit of the study area (see Figure 2, Attachment A). Prior to the logging the lines had been centered along the cleared corridor, but now they are skewed to the south.

On the southern hilltop three pairs of wooden poles have been replaced with steel poles since 2015, using different techniques, which were compared as part of this study. Timber matting was used for the replacement of the northwestern pair (Pad #4), which took place in 2019, and its native shrubland vegetation, has been little altered. Much stone process and rocky till fill was placed to provide pads (a stable work surface for heavy machinery), for replacement of the southwestern pair of poles (Pad #1), and the northeastern pair (Pad #3). The dense fill was covered with fertile topsoil, and seeded, but robust invasive weeds are now dominant, likely from seeds contaminating the topsoil. (See Photos 23 to 32, Attachment B)

A service road with a bluestone (crushed traprock) surface averages about thirteen feet wide. On the upper hillside of the southwestern segment, and on the hillside in the northeastern segment the service road largely follows the natural grade. (Photos 7 and 8, Attachment B.) However, substantial grading occurred in 2014 on the east side of the lower slope on the Therrien-Lanata segment, creating a steep fill bank, and changing the hydrology, as noted in a previous section of the report. Moist areas with facultative wetland plants occur west of the road where seepage and drainage are now impeded. A channelized ditch has replaced a broad, natural drainageway, likely degrading former herptile habitat. Grading has also eliminated the natural topsoil horizons on the southeastern side of the service road, on the lower hillside, creating conditions suitable for colonization by weedy pioneer species. Loss of herptile fauna may be related to this roadbuilding activities.

4.2 Landscape Setting

The surrounding land-use is low-density residential interspersed with moderate-sized blocks of forest, ten to thirty-acres in size. Forest buffers are broad enough to screen residential lighting, headlights, and street lighting, except near New London Turnpike, and at three locations to the east of the northeastern Eversource-owned segment. Disruption of insect behavior by night-time artificial lighting is expected to be minimal in the Therrien-Lanata segment. There is

sufficient complementary forested habitat for larger wildlife adapted to developing landscapes, but not for area-sensitive neo-tropical migrants. This is consistent with the late summer bird data set. The list includes pileated woodpecker, with high forest needs, though tolerant of forest fragmentation, but only one forest interior neo-tropical migrant, the Eastern Wood Pewee, known also to occur in smaller forest patches.

4.3 Geology and Soils

The bedrock-controlled, hilly terrain and acidic, infertile soils on this ROW segments are typical of large portions of Connecticut in the eastern and western highlands. The *bedrock* is crystalline (metamorphic). At this site the bedrock formation is gray, medium to coarse-grained Glastonbury gneiss. Bedrock outcrops occur on both ends of the study segment, on the northern and southern hilltops, though they occupy less than 5% of the total area.

Soils are derived from glacial till; they are thin, acidic, and infertile, and interspersed with rock outcrops. Upland soils are mapped by NRCS-USDA as a complex of Hollis, Chatfield, Rock Outcrop fine sandy loams (Mapping Unit 75C), and a complex of Chatfield and Charlton fine sandy loams (Mapping Units 73E and 73C) (see Web Soil Survey, Attachment D). Typical depth to bedrock is 50 to 100 cm for Chatfield soils and under 50 cm for the Hollis Series. The deeper Charlton soil series is present along the ROW, but only to a limited extent. The shallow Chatfield and Hollis soils have low moisture-holding capacity. Droughty growing conditions for plants are intensified by the lack of shade by a forest canopy in the interior of the ROW corridor.

In addition to the mapped upland soil series, substantial areas of *wetland soils* were identified during field investigations on the lower slope of the northeastern ROW Study Segment: poorly drained Leicester fine sandy loams, and small areas of very poorly drained Whitman soils with a thick organic upper horizon (the Ridgebury, Leicester, and Whitman soil series complex, Mapping Unit 3, is mapped nearby outside of the study area). They were interspersed with moderately well-drained Sutton fine sandy loam (Mapping Unit 52C), which was also found on the lower slope of the southeastern ROW Segment. (See USDA Soils Map in Attachment D.

5.0 RESULTS

5.1 Soil Analysis

Representative Plots included each major soil type on the site. In addition to vegetation data, ancillary physical data and composite soil samples were collected from each plot. Plot 1 is on the lower hillside of the southwestern ROW Segment, on both sides of the service road. Plot 2 is located on the filled Pad #3; the topsoil spread over the stone process was sampled. A sample was collected from the undisturbed hilltop soil (Plot 3). In the northeastern ROW segment, three soil samples were taken from Plot 4, established in a logged, slope base wetland at the base of the northern hill, without wood chip deposition. Samples 4A, 4B, and 4C were collected from poorly drained, very poorly drained, and herbicide-treated portions of Plot 4. The final sample came from Plot 5, in a very poorly drained wetland subjected to thick (4-5") of wood chip deposition.

Table 1 (Attachment C) shows the pH, nutrient levels, CEC (cation exchange capacity), percent organic matter, texture, of each soil sample. The two natural upland soils from Plots 1 and 3, are very acidic, with a pH of 4.3 and 4.4, but both have a high organic matter content (9.5% and 8.5%), and high cation exchange capacity (14.5 and 12.7). Compared to levels found in agricultural soils, shown in the column at far right of table, nutrient concentrations are very low. Phosphorus is only 2.5 and 2.0 mg/liter, less than one third of the optimal threshold for a farm soil (7 mg/l). Symbiotic activity by mycorrhizae and other soil biota, in the dark topsoil, high in organic matter, enable ericaceous shrubs and other native species to find sufficient nutrition for good health in these infertile soils, but growth rates are slow.

The very poorly drained wetland soil samples show even lower pH (4.0), and very high percent organic matter, about 35%. Their nutrient profile is different from that of the upland soils, but still low overall, though levels are consistently higher in the sample enriched by wood chips. Upland tree seedlings do not colonize these soils.

Interestingly, Sample TH 4A, from a somewhat elevated mound within the Plot 4 wetland, has a similar nutrient profile to the imported topsoil sample in Plot 2, described below; its origin is likely also fill, perhaps associated with construction of New London Turnpike, only 30 feet to the east; its redoximorphic features are also less well developed, than one would expect, based on its hydrology.

The fertile introduced topsoil sample from Pad #3 (Soil Sample TH 3), which supports four to five-foot weeds, is very different from to Soil Sample TH 2, from the undisturbed hilltop Plot 3. Sample TH 3 had phosphorus concentration approximately double that in Soil Sample TH 3: 4.5 mg/l, versus 2.2 mg/l. Magnesium concentration was also about twice as high, and calcium concentration was over five times as high. In the topsoil spread over the compact fill, pH was 5.6 and organic matter content was only 2.8%. By contrast pH was only 4.4 and organic matter content was 8.5% in the control sample from undisturbed hilltop soil.

The native hilltop shrubs and herbs along this ROW, and elsewhere in the state, prefer soil with a low pH, and high organic matter content. These soil conditions support characteristic suites of native flowering ericaceous shrubs, flowering forbs, and graminoid plants. This is the dominant plant community in both in the Glastonbury study area, and the Groton Avery Farms ROW study area (also studied by REMA staff within roughly the same time period). By contrast, fertile, mineral soil, with a higher pH, provides better growing conditions for invasive weeds such as mugwort, invasive honeysuckles, and spotted knapweed.

5.2 Vegetation

Vegetation data from the five (5) representative Plots is presented in five of the columns of Table 2 (see Attachment C). The other columns contain additional species observations along the less intensively inventoried "survey routes."

Plot 1, on both sides of the service road on the lower slope in the southwestern ROW segment includes minimally disturbed, and areas shaded by tall shrubs, and several moisture regimes. A strip of blooming forbs is on each side of the service road, and along one access path. Plot 1 has high density, complex structure and high species diversity: 19 woody species and 40 herb species. A robust population of the round-fruited rosette panicgrass, *Dicanthelium sphaerocarpon* is dominant in a hillside meadow; a variety of this grass is listed as a CT *Species of Special Concern*, likely to be extirpated. *(*See Photos *5* and 6, Attachment B.) Woody species include several regularly topped red cedars, oak saplings less than 15 feet tall, and invasive glossy buckthorn. This buckthorn is considered invasive, though it provides good cover, is an excellent nectar source, and is the larval host plant for several native butterflies (e.g., Henry's elfin, common brimstone) (See Table 3, Attachment C). Oaks serve as larval hosts for diverse butterflies and moths; they are cut down before non-compliance. The red cedars provide winter cover, perches, and are an important winter food source.

Plot 3 supports hilltop vegetation reflecting the former ROW maintenance methods. (See Photos 13-16 , Attachment B.) It is the control plot in the SE corner of the hilltop on the privately-owned, southwestern ROW segment, where the pair of wooden poles have not yet been replaced by steel poles. This stable low shrub community has shrubs of lower stature (53% cover of low shrubs, versus 30% in Plot1). Diversity and cover of drought-tolerant shrubs like *Smilax glauca* (catbrier) is greater than in Plot 1 on the lower slope. Density of tall, native graminoids and forbs is 50% in both plots, supporting a food chain base of small mammals and diverse insects. The southeastern edge of Plot 3 is at the top of the south-facing hillside, past the poles. It is sparser and droughtier than the rest of the plot, and supports an uncommon wildflower, Bicknell's rock rose (*Crocanthemum bicknellii*), with showy large yellow flowers in June. Groundcover mosses and clubmosses are also an important part of this community.

This droughty hilltop plot with shallow bedrock has very few deciduous tree seedlings & saplings, but >20 small red cedar seedlings. Growth of woody vegetation is very slow, allowing reduced frequency of maintenance to exclude trees. Similar vegetation occurs on the upper west-facing slope, along the service road, and also on the remaining undisturbed parts of the hilltop (e.g., NW Pad #4, where timber matting was used instead of dense process fill). (See Photos 17 to 20, 31 and 32, Attachment B.) The hilltop on the northeastern ROW segment also supports a similar drought-tolerant community dominated by low shrubs and tall herbs, including rock roses, wild indigo, goldentop *Euthamia*, and others, but with a lower proportion of grasses and upland sedges. Portions of this northeastern area also overlap a pole replacement pad. This is where lowbush blueberry (*Vaccinium vaccillans*) patches were observed, that had been damaged by herbicide treatment. (See Photos 37 to 45, Attachment B.)

Plot 2 (on Pad #3) documents the resulting vegetation two years after a vegetation community similar to that in Plot 3 was covered by dense stone process in 2018, in order to replace wood poles with metal ones. (See Photos 24 and 27, Attachment B.) Fertile loamy topsoil was added, but some was scraped off; in September 2019 Plot 2 consisted of patches of dense rank weeds, with some red clover and grasses, and large bare areas. Horseweed (*Erigeron canadensis*), with very low pollinator value, invasive spotted knapweed, and mugwort all have high cover. The latter has become widespread and a prolific invasive, producing severe infestations, in Connecticut only relatively recently. Pad #1 has a 0.75-acre area of this dense weedy cover, a near monoculture of mugwort. (See Photo 23, Attachment B.)

Plot 4 was established in the wetland area, not shown on the NRCS-USDA soils map, that occupies the south side of the northeastern Eversource-owned ROW segment, mostly under the wires. The wetland habitat in Plot 4 was not buried by thick wood chips, as shown in Figure 4.

Species diversity is high with a total of 16 herbs, and 10 woody species. By contrast ***Plot 5***, where thick chips were deposited, has three species each of forbs and sedges and one shrub species. (Photo 38, Appendix B, was taken near Plot 5)

Plot 4 includes arrowwood and elderberry, excellent nectar and fruit sources. Further east these shrubs and others form extensive, dense wetland shrub thickets and dense, high, wet meadow areas with species of high value for pollinators. They include arrow tearthumb, New York ironweed, jewelweed, and tall goldenrod. Invasive purple loosestrife, also an excellent nectar source, is present as well, but is not a serious threat to this ROW ecosystem, as stature is limited by its introduced biocontrol agent, *Galerucella* beetles, such that it can no longer shade out other herb species, and establish monocultures.

On the hillside of the northeastern ROW segment, in uplands and wetlands, negligible tree colonization was noted in the dense shrub thickets or in dense, high wet meadow patches. They are both a significant resource for pollinators. Mostly, red maple and birch colonized somewhat higher ground, with moderately well-drained soil, and lower density vegetation. Also, the bare patches created by foliar herbicide application, were colonized by multiple seedlings, including those of red maples and birches. Decomposing roots and foliage of herbicide-treated vegetation, and of felled red cedars, is a source of nutrients that fosters the survival and growth of unwanted tree seedlings and invasive buckthorn.

Species identification was flawed during the most recent tree sapling culling; highbush blueberries were consistently killed, but fast-growing tulip poplar saplings were left alive under the wires. They will exceed allowable height before the next maintenance cycle. . (See Photos 45 to 51, Attachment B.)

5.3 Vegetation Findings Pertaining to Logging

Thick wood chip deposition during clear-cutting has virtually eliminated the diverse hilltop/upper slope low shrub/groundcover vegetation from the north side of the ROW; living blueberry and maple-leaf viburnum are the dominant forest understory shrubs in the adjacent forest, and could have formed the core for post-logging low vegetation in this area. This native low shrub community is still found about fifty feet further east, under the wires. Wood chips function not only as a mulch, blocking light and air, they exude phytotoxic compounds as they decompose (Rex, 2016). (See Photo 34, Attachment B)

5.3.1 Inhibition of Oak Seedling Establishment

Many oak saplings have already colonized the area logged in 2016, on the west side of the southern ROW segment. Their distribution is noteworthy: oak saplings are entirely absent from patches of blueberries or huckleberries and also from groundcover patches, but plentiful in bare areas lacking other vegetation and on/near stumps, where soil has presumably fertilized by wood chips and by decomposing tree roots. (See Photo 18, Attachment B.) The dense mat of rhizomes and roots beneath patches of huckleberries and both lowbush blueberry species effectively resists tree seedling establishment (Reinter 1965, Sullivan 1996). Clonal spread by each these three low shrub species also allows them to fill in gaps following tree sapling removal, reducing the frequency and extent of maintenance needed. This is a reason to spare low shrub patches, to avoid close mowing or herbicide treatment, and not to cover shrub patches with thick chips.

Thick chip deposition also significantly impaired pocket wetlands with mucky, black soils, and sedge tussocks, overlooked by logging contractors (Plot 5). Species richness in the area with thick chip deposition was very low: three species of sedges/rushes that from large tussocks and only two wetland forbs, rooted on higher ground with thinner chips. This is a reason to identify the small wetland areas in ROW stretches, not shown on soils maps, before vegetation maintenance or service road work.

Logging with Minimal Chip Deposition in the southwest part of the Eversource-owned ROW, near New London Turnpike, has resulted in a diverse, balanced wetland community (Plot 4) except where foliar spraying of birch saplings has eliminated the herb stratum.

The 2016 logging treatment, in the southwestern segment, left a mosaic of bare soil or chips and low shrub and ground cover patches, which are in good condition. Pre-logging conditions are shown in Figure 3 (Attachment A), a spring aerial photo. They can be compared with post-logging conditions, shown in Figure 4, where bare areas have become an excellent seed bed for oak saplings and patches of rosette panic grass and bristly sarsaparilla. (See Photos 33 to 36, Attachment B.) Species diversity is still low; this area was forest just four years ago. Seeding with dry site herbaceous species tolerant of acidic, nutrient poor soils, would be useful in logged areas. Pre-existing blueberry and huckleberry patches can be expected to spread, if they have not been killed by wood chip deposition.

5.4 Wildlife

The avian inventory at the northeastern and the southwestern ROW segments, was conducted outside of the breeding season, during a time when most avians have left their territories and have begun migrating (see Attachment E). Nevertheless, this initial avian inventory provides valuable information on the use of the site for foraging by migrating and resident birds. It clearly shows heavy usage of the site's habitats by a wide range of avian groups, including finches, orioles, warblers, wrens, woodpeckers, and sparrows. It also shows that both species diversity and abundance were high, and more so in the southwestern Therrien-Lanata segment, than in the northeastern Eversource-owned segment (see attached Avian Inventory, Table 2.).

It should be noted that the Therriens have observed a significant decline in many wildlife species since Eversource increased aggressive activity in the ROW since 2015, including; brown thrashers, towhees, spotted salamanders, cotton-tailed rabbits, white-tailed deer, red fox, other herptiles (i.e., snakes, toads, frogs), including eastern box turtle, ground hogs, and skunks, to name a few.

A number of factors could explain these observations, but at a minimum, the southwestern segment had a higher overall vegetative structural and species diversity, and an abundance of oaks seedlings and saplings, compared to the northeastern segment. Moreover, the northeastern segment lacked ***eastern red cedar*** and deciduous tree saplings, which had been recently removed. By comparison, the southwestern segment had a number of cedars, actively being used for cover by avians (see also following discussion on red cedars). Oak saplings were common as well. The oak saplings in particular are used by a great many lepidopteran species for larval feeding, more than any other northeastern plant genus. Immature foliage on saplings and branch tips is preferred to mature leaves on trees. The sapling component of the southeastern ROW segment attracts insects and gleaning by birds.

5.4.1 Rare, Uncommon, and Declining Species

We note that one brown thrasher, a ***Species of Special Concern***, was observed in the southwestern segment. This uncommon, disturbance-sensitive avian was likely just moving through, but found the Study segment to be secluded enough for foraging.

Two ravens, recently delisted by CTDEEP, were also observed in the southern segment of the study area. These are shy species as well. Their presence suggests that a suitable cliff for nesting must be in the site vicinity. Two declining shrubland species, Field Sparrow and

Rufous–sided Towhee were predominantly in the southern segment, and two others, Prairie warbler and Indigo Bunting, with a stronger affinity for open habitat, were limited to the northern segment. Additional listed or uncommon species were also observed outside of the quantitative avian inventory, including American kestrel and merlin. The former is Connecticut breeder, and listed in Connecticut as a Species of Special Concern, while the latter is only seen during spring and fall migrations.

Future avian surveys conducted during the 2020 breeding season, following one of several census methods (e.g., point census), will allow for more robust comparisons between the two segments and the ROW management methods that are represented therein.

6.0 WILDLIFE USAGE OF VEGETATION COMPONENTS

6.1 Tall Shrubs and saplings

Dense deciduous shrubs, woody vines, and tree saplings are a major habitat component in the northeastern shrub swamp wetlands, and on the southwestern hillsides (e.g. Plot 1). Tall to moderate shrubs and vines include arrowwood, sweet pepperbush, winterberry clumps, buckthorns, elderberry, winged sumac, staghorn sumac, grape, and Virginia creeper. Red cedars and oak saplings, under 15 feet in the wire zone and under 25 feet tall in the edge zone, are important in the Therrien-Lanata ROW section.

6.1.1 Cover

Dense shrubs and mounds of woody vines provide valuable cover and *nest sites* for numerous songbirds. Nine catbirds and nine house wrens were counted in the bird survey of the southwestern ROW segment. They also provide *cover*, low to the ground, for Eastern cottontail rabbits, observed during plant surveys. and nest sites, earlier in the season, for thicket warblers such as yellow warbler and common yellow throat. Note that the quality of shrub stratum cover was diminished in the southwestern segment, which had many gaps where small saplings of birch and maple had been treated with foliar herbicides.

The dense foliage of red cedars provides highly effective *winter cover for birds*. Mammals can also shelter under them from snow and inclement weather. This value is heightened by the scarcity of other small to medium-size evergreens in Connecticut's flora. Little other evergreen cover is available. Mountain Laurel (*Kalmia latifolia*) is one other evergreen shrub, but it often

fails to thrive in open habitats, where the soil freezes earlier than in a closed forest, and the foliage becomes drought stressed.

Red cedars (*Juniperus virginiana*) are a very important habitat component of electric ROWs, and the effects of their removal are readily seen on the northeastern segment of the study area, as well as outside of the study area. REMA has authored a separate report, dated August 19, 2019, which provides additional information regarding the importance of this species (see Attachment E), than what is provided herein.

Red cedars provide secure cover during the day, a phenomenon observed at this site, during our ongoing bird surveys. (See Photo 7, Attachment B.) Smaller birds can remain hidden, safe from hawks, between feeding forays in nearby exposed locations. Saw-whet owls roost in securely hidden, red cedars during the day, which helps prevent harassing by crows and jays. This important nocturnal carnivore, which is also a Connecticut-listed species, feeds primarily on deer-footed mice (vector of Lyme Disease). Throughout the United States this owl is found in red cedar stands on open land.

Red cedar is also important for nesting, and is used for this purpose by chipping sparrow, song sparrow, brown thrasher, robin, and mockingbird, among others. Shreds of cedar bark are also an important nest-building material.

6.1.2 Food Sources

These deciduous shrubs and saplings and the red cedars are important sources of food. Songbirds glean caterpillars and other insects from their foliage and bark. See Table 3, attached, for a list of some of the butterflies and moths whose caterpillars feed on the shrubs and saplings in these ROW segments.

The shrubs produce fruit for songbirds during fall migration, mostly in late summer and early fall. One Ohio study (Gorchov 1977) found staggered fruit ripening. Ripening onset for important shrubs at this site include elderberry on August 2nd, Virginia Creeper on September 10th, and staghorn sumac on September 14th. Only winterberry (not abundant at this site) yields persistent winter fruit. Shrubs with seed capsules, like maleberry and mountain laurel are also a source of seeds for winter birds.

By contrast, red cedar provides abundant fruit during the winter season, that is consumed by a large number of mammals as well as birds. The blue persistent fruits are eaten through the

winter months by roving winter flocks, as well as winter resident wildlife. (See Photo 9, Attachment B.) Wildlife species that consume red cedar fruits include the following: Eastern cottontails, red and gray squirrels, red and gray foxes, striped skunks, and opossums, robins, cedar waxwings, mockingbirds, goldfinches, grosbeaks, flickers, wild turkey, brown thrashers, towhees, Eastern bluebirds, and ruffed grouse, among others. Of these the last four species are in decline, and the brown thrasher, which is listed in Connecticut as a "species of special concern" was observed within the ROW on your property during our ongoing ecological investigations. White tailed deer browse the foliage, but only lightly, such that the cedars survive.

The availability of this food source in the landscape is limited. Because red cedar is highly shade-intolerant, it cannot grow within adjacent, contiguous forested habitats. The sharp decline in successional farmland habitat in Connecticut, over the past fifty years, means that now a much higher relative proportion of red cedars occur on ROWs and along highway corridors. By contrast, most of the other tree species, routinely culled from ROWs, tolerate shade, and are abundant in forests.

Birds also glean caterpillars from red cedar foliage, in summer. Red cedars also contribute to insect biodiversity. *Juniperus virginiana* is the larval host plant of a lovely rare, olive-green butterfly, the Juniper hairstreak, *Callophrys gryneus*, which is a species of conservation concern nationwide. Red cedar saplings also furnish browse to white-tailed deer.

6.1.3 Sapling Management

Red cedar grows very slowly, especially in the acidic, rocky, infertile soil that is so widespread in Connecticut, such that maintaining scattered cedars at a safe height by means of occasional topping is indeed practical. In contrast to red cedar, white pine, grows so quickly that it would be impractical and dangerous to try to maintain trimmed white pines along ROW's. White pine does grow within forests, so its continuing presence in the landscape is more secure.

We suggest allowing some red cedar seedlings to grow up, to replace older trees that have grown so stout that topping becomes difficult (see Attachment F regarding eastern red cedars). Killing shrubs and tree saplings (instead of trimming) does fertilize the soil, as dead roots decompose, which fosters growth of woody colonizers, both invasives and trees. On the east side of the southeastern segment, tree seedling clusters (mostly red maple and black birch) were observed at the base of herbicide treated saplings.

Delay in cutting down oak saplings in the Therrien/Lanata southwestern ROW segment has had a significant habitat benefit for insect-gleaning songbirds, during the breeding season and during migration. This is because oaks are the larval food plant for many hundred of moth and butterfly moth species in New England, and herbivorous insects prefer the tender leaves of saplings. The lovely banded hairstreak (*Satyrium calamus*) was observed during September fieldwork (see Table 3, Attachment C).

To manage a right-of-way to be optimal larval habitat for a diverse suite of butterflies and moths, the shrub stratum can be maintained to include up to 20% of oak saplings, either by trimming saplings, or by allowing new seedlings to replace saplings that have been culled, before they reach non-conforming height.

6.2 Herbaceous Cover

6.2.1 Graminoid Cover

Red tailed hawks, mourning doves, and chipping sparrows were observed almost exclusively in the bird survey of the southwestern segment, not the northeastern. Native grass cover is significantly better developed in the southwestern ROW segment, than in the northestern, which has undergone decades of targeted, but foliar applications of glyphosate. Graminoid cover is about 50% cover in both Plot 1 and Plot 3, in the southwestern ROW segment. Dominant species are heavy-seeding rosette panic grasses (*Dicanthelium* spp.), and two perennial species with extensive root systems, Little blue stem grass, and Penn sedge.

On the east side of the northeastern ROW segment, dead patches of sedges were noted at the bases of multiple small tree saplings, likely killed by glyphosate overspray by an Eversource contractor. If Triclopyr had been used, this would not have occurred, as it does not harm grasses, rushes, or sedges.

Ground-feeding birds like chipping sparrows eat the seeds of panic grasses, including deer tongue grass; most species have two crops of seeds, one in early summer and one in fall. These grasses are also larval host plants for small skipper butterflies, including the Delaware skipper (*Anatrytone logan*).

Grasses also provide forage and cover for eastern cottontails, and good habitat for small rodents such as meadow voles (*Microtus pensnylvanicus*). Meadow voles feed on succulent green vegetation during the growing season and on seeds and roots during the winter; they are active

year-round, serving as food for predators, including blue jays, crows, garter snakes, and foxes, and skunks, as well as hawks and owls. An essential habitat component is a layer of litter over the ground, for protection against predation. The species is very prolific, with litters spaced twenty days apart, a significant food source for local wildlife.

6.2.2 Forbs

The northeastern ROW segment has several abundant late-season-seeding composite forb species, in the wetlands and on the upland hillside, and much pilewort (*Erechtites hieracifolia*) in the western logged swath. The seeds of pilewort were ripe already by mid-August. Those seeds are a plentiful food for gold finches and house finches, which were the most abundant species observed during the avian survey, in both segments, with totals of 20 and 21 individuals, in the respective surveys. Forbs also support a variety of insects, many of them generalist herbivores. The larva of the painted lady butterfly (*Vanessa cardui*) feeds on a wide range of composites, from Joe Pye weed, to goldenrods, to a variety of thistles.

The wetland composites are excellent late season nectar sources, for pollinators, including jewelweed for hummingbirds, based on the bird survey. Flowering forbs are not abundant in the southwestern ROW segment, limited to narrow strips along the service road, and along several other informal paths, though there is a substantial population of ragged boneset (*Eupatorium pilosum*) a handsome wildflower, much visited by bees and not well-known. Additional or wider open roadways could expand the area of forb meadow.

6.2.3 Low Shrubs

Low patches of lowbush blueberry, and huckleberry (under 20 inches tall), and some sweet fern as well, are another significant component of vegetation on the Therrien-Lanata ROW section, on the drier slopes. These ericaceous heaths are highly productive nectar sources for native bees in May. They provide cover to small mammals, and fruit in July to songbirds and other wildlife. Several abundant small herbivorous insects, a leaf hopper and a spittlebug, serve as a food chain base (Reinter 1965). Like the oaks, these three heaths also are larval hosts to a variety of caterpillars, including the larvae of the spring azure and common blue butterflies and the apple sphynx moth (see Table 3, Attachment C).

To plan vegetation management that fosters herbaceous cover for pollinators, while preserving low ericaceous shrubs, and limiting tree seedling density, we need additional data on the responses of these three similar heath species to mowing. *Vaccinium vacillans*, with the deepest rhizomes, may be more tolerant of mowing than *Vaccinium angustifolium* or black huckleberry,

Gaylussacia baccata. All three are vigorous clonal spreaders, but rarely reproduce by seed, and rarely colonize farmland or disturbed soils through seed dispersal. They do well in the dry, high-organic, infertile, acidic soils of their natural ridgeline habitats, depending on endo-mycorrhizae to secure the necessary nutrients. Preserving heaths in situ, is especially important because they are hard to grow in imported mineral soils, and because, as noted above, heath patches resist colonization by tree seedlings.

6.2.4 Microclimate Diversity

The low ericaceous shrubs benefit from partial shade created by scattered clumps of red cedars or tree saplings; their natural habitat on rocky ridgetops is woodland or savanna, with widely spaced trees (Reinter 1965). In full sun groundcover patches of mosses, clubmosses, and dewberries in full sun shown signs of scorching; here as well, vegetation would benefit from partial shade from scattered taller cedars or shrubs.

For many millennia, red cedars have been a dominant small tree species in Connecticut's open ridge crest & rock outcrop ecological communities, closely associated with shade-intolerant native wildflowers and grasses, and presumably associated with the same suite of beneficial mycorrhizae as the cedars. Perennial herbs and low shrubs are better able to persist on the north and eastern sides of these evergreens, where winter shade slows snow melt and reduces the intensity and frequency of frost-heave cycling. They also provide protection from winter winds. For example, REMA recently observed wood betony (*Pedicularis canadensis*) at the base of a red cedar on an Eversource ROW in the Town of Cheshire; this wildflower is also found among cedars on the traprock summits of the Hanging Hills in Meriden. Structural diversity of vegetation, on a large scale, affects microclimate, which fosters herb species diversity.

6.2.5 Adjacent Forest

The quality of the forest bordering this study ROW is excellent, which enhances the overall wildlife habitat value of the ROW. For example, hickory is common on adjacent forest though virtually absent from the ROW. Norway spruces on the adjacent Therrien property provide winter cover. Red maple swamp is nearby as well, near the Therrien home. Adjacent to logged swaths, the understory is dominated by native species, not invasive shrubs and vines, and mature, large diameter trees are present. This is consistent with the strong presence of woodpeckers, nuthatches, and other bark-gleaning year-round resident species on the bird survey list.

As shown on Figures 1 and 2, at this site, after logging, buffers remain largely broad enough that they screen disturbance from nearby residences, which is consistent with foraging by disturbance-sensitive bird species. Except close to New London Turnpike, during the growing season, tree foliage protects night-flying insects from the significant adverse impacts of night-time artificial lighting (Travis & Langcore 2000). This further increases the potential of this ROW segment to support diverse and abundant lepidopteran fauna; its high shrub and forb diversity within the ROW will increase the diversity of lepidopteran prey, provided moth behavior is not disrupted by light pollution.

Durring regulatory reviews of other segments of Eversource rights-of-way, slated for logging, an important consideration should be the extent to which proposed logging outside the "line zone" would damage the integrity of an adjacent forested buffer. Is it currently marginally wide, such that it would no longer be broad enough to protect insect fauna from light impacts after the proposed logging? This issue should be raised during the sub-petition review process, and when negotiating with Eversource vegetation managers or contractors.

Small trees/large shrubs are conspicuously lacking along the new, post-logging forest edges edge in the Study Area ROW. Flowering dogwoods, ironwood, and woods-edge shrubs like arrowwood and gray dogwoods, which provide *fall fruit* for birds are missing from these edges, or scarce. During the review period for proposed logging, we recommend evaluating whether a narrower swath of forest should be logged, and how to mitigate anticipated ecological harm, e.g. by preserving or replacing the shrub and low tree species along the existing edge, which will be in the edge zone or planting evergreens. Planting red cedar and Norway spruce and along the new forest edge can reduce the extent of artificial light pollution through a narrow buffer.

The diversity of vegetation structure and plant species within the right of way, combined with the width and quality of the adjacent forest, helps explain the high usage by migrating birds, per the August avian survey: 152 individuals and 31 species were tallied in the southern portion of the ROW during one early morning survey.

7.0 SUMMARY OF MANAGEMENT RECOMMENDATIONS

1. Use timber matting on pole-replacement work pads. Based on the excellent recovery of the shrub-meadow community in Work Pad # 4, after use of Timber matting, this method is much less harmful to wetland (and upland) vegetation and rare species habitat, than thick fill placement. Less runoff will be generated than from nearly impervious stone process fill on work pads.

2. It is strongly recommended that fertile garden-type soil not be spread over pads built for pole replacement, with the intent of planting a suitable growing medium for flowering native species, to benefit pollinators. Unless regularly maintained over the long term, these planting beds are likely to be overrun by nutrient-loving weeds, in particular a very challenging, severe new invasive weed: mugwort (*Artemisia vulgaris*).

3. Instead, stockpile and re-spread the preexisting acidic, infertile topsoil, rich in organic matter & mycorrhyzae. This is the optimal growing medium for the native, local shrub-meadow community, that resists colonization by tree seedlings and invasives. If stockpiling is not an option, acidic, infertile loamy sand is preferable to imported fertile topsoil. We recommend planting both warm season grasses, wildflowers, and shrubs from the excellent pallet of native drought-tolerant species that thrive on natural rights of way.

4. Avoid whole-sale close-mowing of rocky ROW's with acidic infertile soil, that currently support a mosaic of shrubs and meadow. Maintain the dominant shrub cover and allow some tree saplings to approach non-conforming height.

5. In each ROW segment, allow red cedars to approach non-conforming height, before they are topped, maintaining the valuable cover and abundant, long-lasting fruit of red cedars. Thin oak saplings but leave some in place (under ten feet tall) so that oak foliage will continue to provide an ample supply of insect food for birds. The removal of all eastern red cedars and oak saplings from Eversource ROWs, including within your property, is not an ecological-friendly vegetation management practice. It will significantly reduce both the diversity and abundance of wildlife within the ROW, especially of breeding and migrating avifauna and cause soil destablization and erosion.

6. A vegetation management operation to widen the ROW should never spread wood chips over the nearby ground and groundcovers. Spare understory shrubs, especially ericaceous groundcovers, and taller native shrubs suitable for the edge zone.

7. Spread out Eversource activity to every four years (as has been the past practice under CL&P and Northeast Utilities) to alleviate the negative impact on wildlife, especially disturbance sensitive species that are in decline such as the Brown Thrasher, and to allow natural restoration.

8.0 CONCLUSION

Major changes in how Eversource conducts vegetation management in ROWs, and in the methods for replacing wooden transmission poles with steel poles, have had significant impacts on the natural environment, and in particular the use of heavy equipment that requires large work pads. This report assesses how these changes have impacted the natural environment in the Therrien-Lanata southwestern segment of the ROW study area upon avians, and other fauna, on flora, soil composition, and soil hydraulic characteristics, and on soil erosion. It compares the impact of these new ROW maintenance practices on habitats and ecology, by conducting a fairly comprehensive inventory of habitat components, such as vegetation diversity and structure, and by comparing them to those inventoried within the northeastern segment of the study area, owned by Eversource.

While it is not the purpose of this study to understand the rationale of these vegetation management changes by Eversource within transmission lines, it is clear from the results that there is a negative impact on the natural environment that can be significantly reduced by utilizing temporary work pads made of wooden mats, and by minimizing the use of heavy equipment such as skidders and wood chippers, so that restoration of the land can take place within a few growing seasons, rather within decades, if at all. Negative ecological impacts can also be reduced by more selective practices with regard to trimming shrub and tree species whose benefits to the ecology of these areas far outweigh the danger they may impose on the safety of the electric transmission lines in Connecticut.

The significant ecological impacts of these recent changes in Eversource management practices, have raised the concern of many land owners, land trusts and environmental groups, who are advocating changes in these practices, to reduce both short-term and long-term adverse environmental effects. Private land owners can be well suited to help maintain ROW stretches that are greenway pathways, rich in biodiversity and habitat values, to maintain both the health of the natural environment and transmission line safety.

In this case, as attested by our surveys, the ROW landowners (i.e., Therrien and Lanata) have taken upon themselves to carefully manage vegetation on their land to protect their environment while maintaining a safe distance from the transmission lines.

In our professional opinion, our surveys have conclusively demonstrated that some of the ROW management practices employed by Eversource and their contractors are detrimental to the natural environment, and need to be re-evaluated. We hope that this study will be used to that end. We look forward to continuing our wildlife inventories, including avians and invertebrates during the 2020 growing season.

Please feel free to contact our office with any questions on the above.

Respectfully submitted,

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Attachments:
A: Figures (1 through 4)
B: Annotated Photographs (1 Through 51)
C: Tables (1 through 4)
D: Web Soil Survey of Study Area
E: Avian Survey
F: Eastern Red Cedar: Ecological Values & ROW Management

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ATTACHMENT A: Figures

Figures 1 through 4

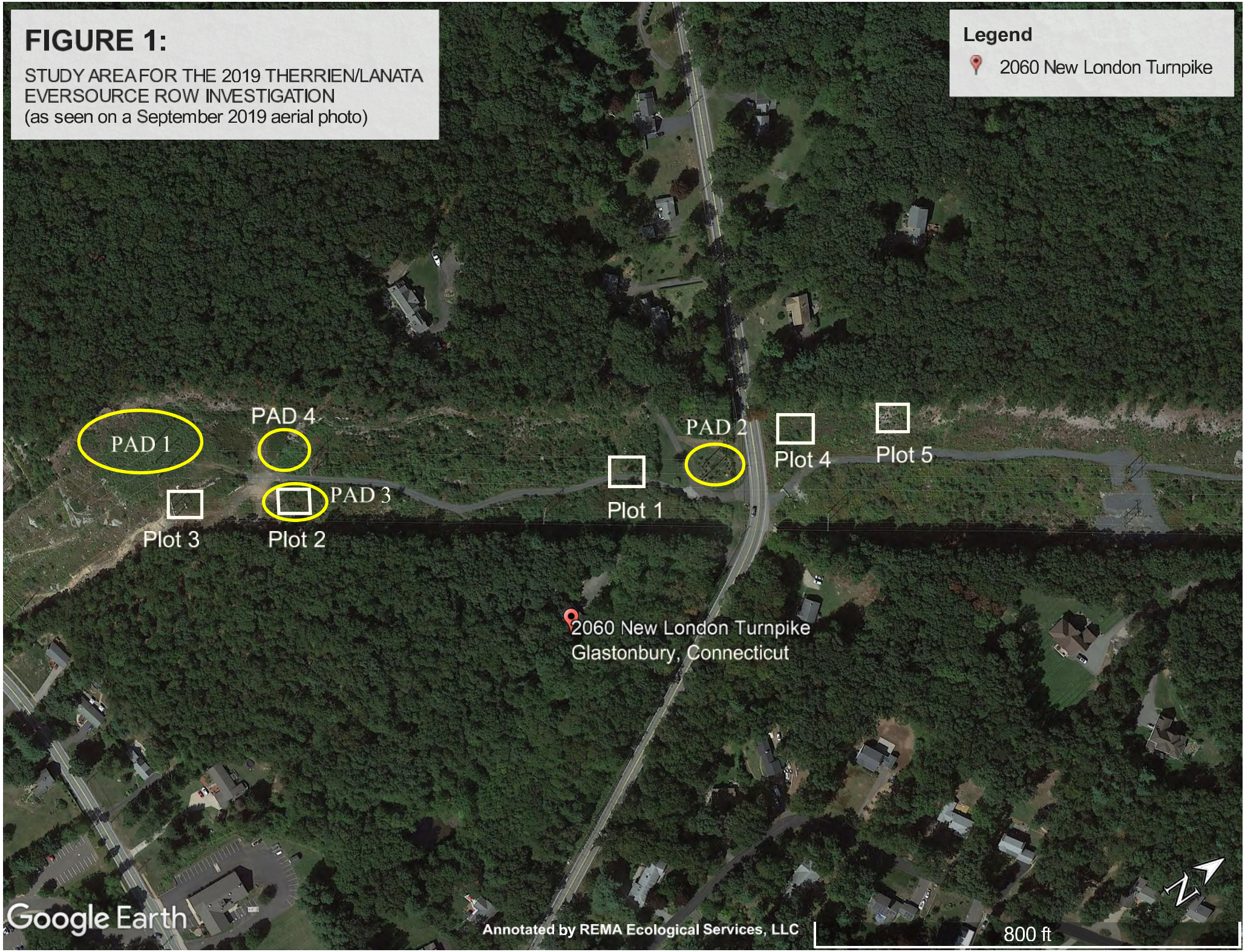
FIGURE 1:
STUDY AREA FOR THE 2019 THERRIEN/LANATA EVERSOURCE ROW INVESTIGATION
(as seen on a September 2019 aerial photo)
Legend
2060 New London Turnpike
PAD 1
PAD 4
PAD 3
PAD 2
Plot 3
Plot 2
Plot 1
Plot 4
Plot 5
2060 New London Turnpike
Glastonbury, Connecticut
Google Earth
Annotated by REMA Ecological Services, LLC
800 ft

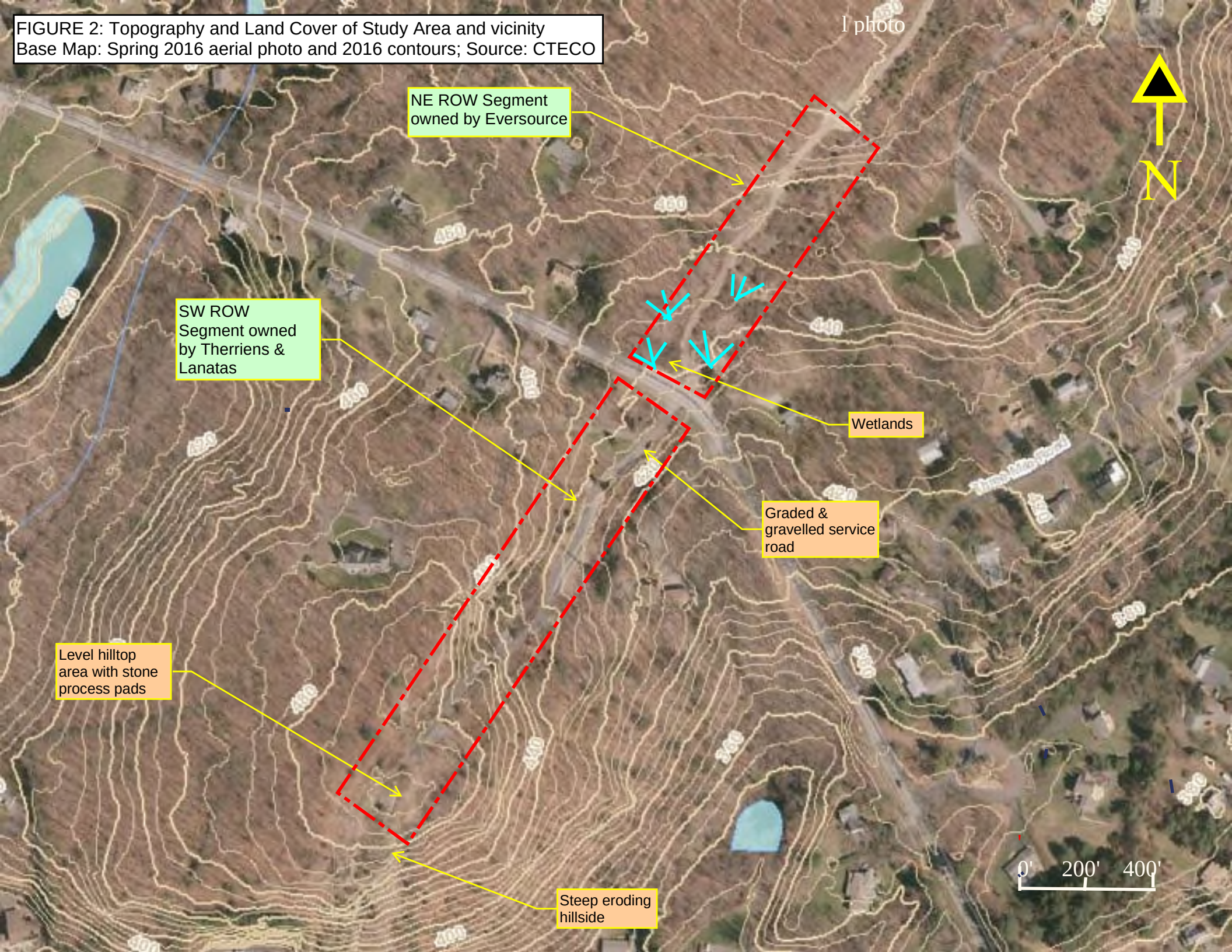
FIGURE 2: Topography and Land Cover of Study Area and vicinity
Base Map: Spring 2016 aerial photo and 2016 contours; Source: CTECO
NE ROW Segment owned by Eversource
SW ROW Segment owned by Therriens & Lanatas
Wetlands
Graded & gravelled service road
Level hilltop area with stone process pads
Steep eroding hillside
N
0'
200'
400'


FIGURE 3:
STUDY AREA, SOUTHWEST SECTION
IN SEPTEMBER 2015 BEFORE PADS WERE BUILT
THERRIEN/LANATA SECTION OF EVERSOURCE ROW
Legend
2060 New London Turnpike
2060 New London Turnpike
Glastonbury, CT
Google Earth
Annotated by REMA Ecological Services, LLC
500 ft
N

FIGURE 4:

STUDY AREA, CENTRAL PORTION
IN SEPTEMBER 2017 RIGHT AFTER LOGGING

ATTACHMENT B: Annotated Photographs

Photos 1 through 51

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 1: Study area, southwestern ROW segment, on Therrien property; low shrub-meadow cover type on hillside, facing southeasterly

Photo 2: Steep hillside in study area, facing northwesterly, on Lanata property; mix of high and low shrub cover types; huckleberry at center is dark red-brown. 10-7-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 3: House wren in a tall arrowwood shrub in the shrubland cover type on hillside. Nine were observed in the Southwestern ROW segment on 8-10-20.

Photo 4: Juvenile Baltimore orioles in a tall mountain laurel, on southward migration. 11 were seen in the S.W. ROW segment on 8-10-20 - the most abundant bird species.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 5: Mosaic of low shrub, meadow & high shrub cover types in Plot 1 in the southwestern ROW segment, on Lanata property, facing northwesterly. 10-7-19.

Photo 6: Round-fruited rosette panic grass (*Dicanthelium sphaerocarpon*) is common in the meadow area, providing seeds for birds in wildlife in early summer and fall. Its semi-prostrate foliage provides leafy forage, litter, and good erosion control.
A variety, *D. isopyllum*, is a CT Species of Special Concern, but presumed extirpated. Determination to variety must take place in early summer, using morphology of vernal fruiting culms. Bristly dewberry (*Rubus hispidus)* at right, is widespread on this site. The *Dicanthelium* genus is currently experiencing major revision, with many name changes.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 7: Study area, southwestern ROW segment; low shrub-meadow cover type on hillside, facing easterly. Note topped red cedar and blooming rough boneset 9-10-19.

Photo 8: Mid slope shrub thicket, with elderberry, grape, and winged sumac, facing easterly, on Therrien property; low shrub-meadow cover type; 10-7-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT Photos by REMA Ecological Services, LLC

Photo 9: Abundant fruits of red cedar are and important winter food for birds. 5-17-19.

Photo 10: Both winged sumac and staghorn sumac are heavy producers of fruit in mid fall. 5-17-19.

Photo 11: Rough boneset, *Eupatoreum pilosum*, with a fly pollinator; inter-mixed with low shrubs on the lower hillside of SW ROW segment. All three bonesets on the site are much used by pollinators. 9/9/19.

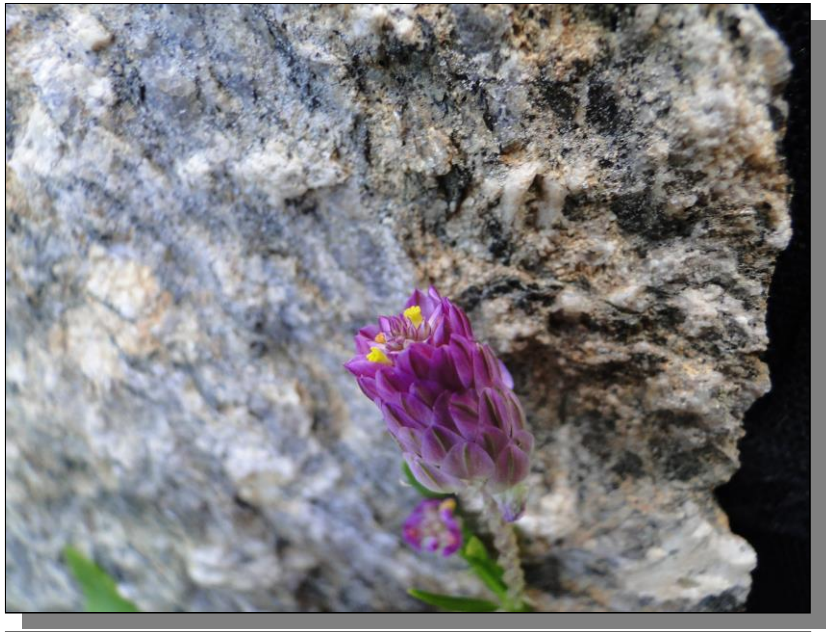

Photo 12: Purple milkwort, *Polygala sanguinea*, occurs in Plot 1 and sporadically elsewhere in moist, sunlit portions of the hillside.

2019 Therrien/ Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT Photos by REMA Ecological Services, LLC

Photo 13: Dense grasses & fine-bladed, rhizomatous Penn sedge dominate the east side of Plot, 3 with very few deciduous tree seedlings.

Photo 14: Shrub-dominated section of Plot 3, the control hilltop plot, to the east of bedrock sill that defines western boundary of plot. 8-10-19.

Photos 13, 15, and 16 were taken on 11//12/19.

Small red cedar seedlings were recorded in Plot 3, with 5% cover, and also 6% cover of pasture juniper. Cat briar, huckleberry, winged sumac, buckthorn, blackberry, and several birch seedlings were also present.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 17: Southwestern ROW segment, facing northeasterly; low shrub-meadow cover type on hillside. Note little bluestem, pasture juniper, red cedar and red oak seedlings.

Photo 18: Large hillside area of low ericaceous shrubs (huckleberry & blueberry); oak saplings are on the perimeter, but not within the patch. Facing northeasterly.10-7-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 19: Study area, SW ROW segment, upper hillside, with patches of oak saplings and seedlings. 11-8-19.

Photo 20: Oak seedlings and saplings are the larval host plants for hundreds of species of moths and butterflies, a very important food source for nesting songbirds.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

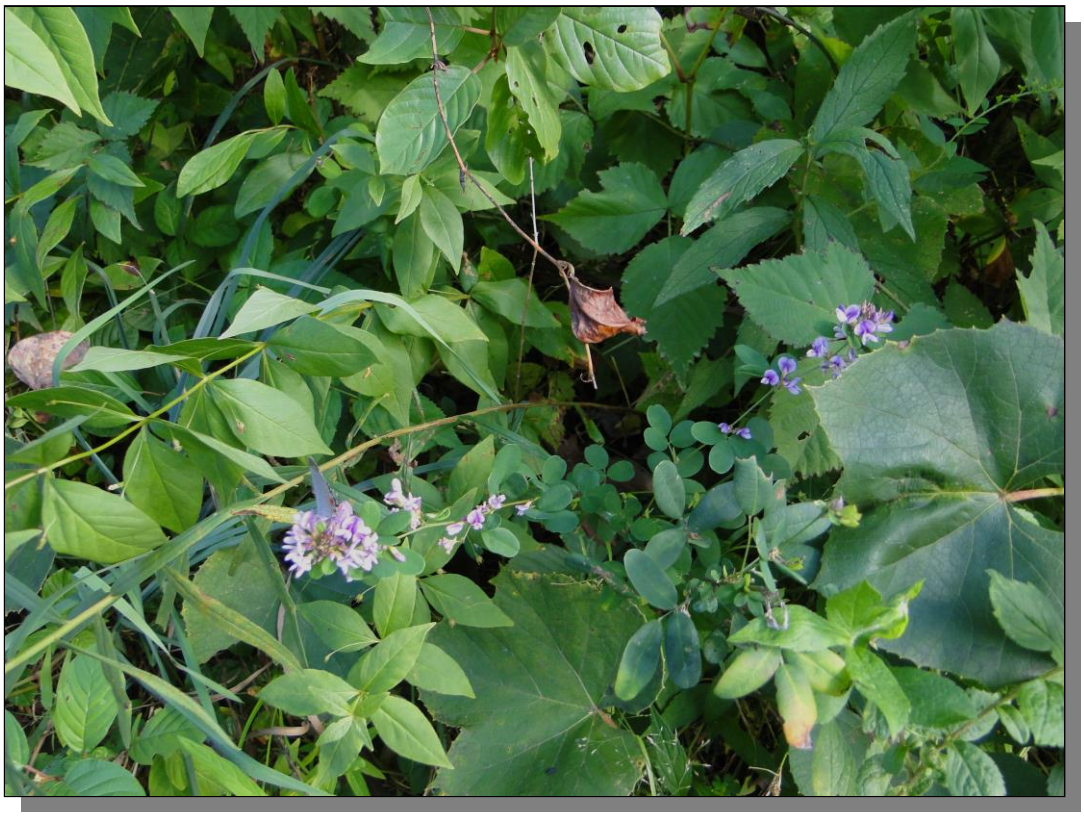

Photo 21: SW ROW segment; diverse roadside plants on lower hillside (Plot 1) with whorled loosestrife, violet bush clover, an uncommon tick trefoil, *Desmodium ciliare,* fox grape, and glossy buckthorn (top center, with feeding holes) (8-16-19).

Photo 22: Dry roadside on upper slope; low-growing vascular plants include gray goldenrod, sweet fern, upland boneset, bracken fern, and little blue stem. 9-10-19.

2019 Therrien/ Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT Photos by REMA Ecological Services, LLC

Photo 23: Replacement of wooden poles with steel poles resulted in a ¾-acre stand of dense mugwort*, Artemisia vulgaris,* on Work Pad # 1.

Photo 24: Part of Pad #3 received fertile topsoil & sprouted mugwort & other tall weeds, like toxic Jimson weed. Rest is bare & poorly permeable.

Photo 25: On Pad # 1 thick impervious stone process fill was covered with 2-4" of fertile, garden-type topsoil that contained mugwort seeds. It was seeded with clover & grasses, soon overtopped by mugwort.

Photo 26: ~ 200 sf of the poisonous Jimson weed were cut down from Pad #3 and a part of Pad #4, before seeds were ripe, & bagged by Mr. Therrien. However, seed from mugwort on Pad #1 washed down the hill.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT Photos by REMA Ecological Services, LLC

Photo 27: Most of the native shrub & grassland cover has been lost, & over 2 acres of dense fill was added for service roadways & work pads.

Photo 28: A double ring infiltrometer used to confirm that substrate on Work Pad #3 is much less pervious than natural hilltop soil. 11-11-19.

Photo 29: Observations during a minor rain event on 11-12-19, showed that runoff begins early in the event, & dislodges nutrient-laded fine soils, washing them N down the hill. This will alter naturally infertile soils.

Photo 30: Runoff has already caused substantial erosion on the steep south-facing hill below the new pads on the hilltop. It was worsened by cutting multiple red cedars that had anchored the hillside soil. 8-16-19.

2019 Therrien/ Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 30: Southerly view. Timber matting was used over a small area, instead of placing impervious fill. Much natural vegetation remains around Work Pad #4.11-8-19.

Photo 31: Northwesterly view of Pad #4. Heavy equipment clearly operated from this side. Permeability was good, averaging 0.56 minute for each 1" drop in water level.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 33: Northeasterly view. Wood chips were irregularly distributed after logging along west side of ROW in 2014. Where chips were thick, herbs are sparse in 2019.

Photo 34: Blackberries and bristly sarsaparilla have colonized areas with thin chips along the edges of chip piles. 11-8-2019.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 35: Northeasterly view. Where wood chips were thin or absent, native grass cover is now established, mostly, rosette panic grasses (*Dicanthelium* spp.) and some little bluestem grass.

Photo 36: *Dicantheliums* have a low, spreading growth form. Heavy seeders, they have been major colonizers after the logging in 2014, and provide wildlife food/cover. However, herb layer diversity is far lower than in unlogged areas of the ROW.11-8-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 37: More recent logging along the N.E. ROW segment of the study area was accompanied by widespread, thick chip deposition, and understory death.8-14-19.

Photo 38: Although no chips were spread in wetlands near New London Tpke., 4-5" layers are in several small slope wetlands. Larger sedges with tussock growth form survive, & pilewort colonizes (*Erechtites hieraciifola),* left foreground, right.

2019 Therrien/ Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 39: Early goldenrod, *Solidago juncaea*, is heavy-flowering native dry-site goldenrod species, growing adjacent to hillside logged area in NE segment. Background is a dense stand of pilewort. 8-26-19.

Photo 40: Two low, native dry site shrubs, present in both ROW segments, are sweet fern (*Comptonia peregrina*) at left and bush honeysuckle, *Diervilla lonicera*, at center/righ.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
2042 & 2060 New London Turnpike, Glastonbury, CT Photos by REMA Ecological Services, LLC

Photo 41: (left) Indian tobacco (*Lobelia inflata*) is occasional in dry sparsely vegetated areas, in both the NW & SE ROW segments, a native "weedy" species. 8/26/19

Photo 42: Field thistle, *Circium discolor, with* nectaring bumblebee*;* this *native species* grows at the edge of the gravel service road. 8-16-19.

Photo 43: Upland boneset (*Eupatoreum sessifolium*) is occasional in partly shaded, upland habitats, in sandy, acid soil. Leaves sessile but not perfoliate, unlike *P. pilosum & P. perfoliatum*, also on the site. 9/10/19.

Photo 44: Wild indigo, *Baptisia tinctoria,* is present in the dry, low shrub-meadow community, on both the Therrien-Lanata segment, and the NE Eversource segment. An important lepidopteran host. 8-14-19.

2019 Therrien/ Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 45: On hilltop of NE segment lowbush blueberry or huckleberry has been treated with herbicide, likely glyphosate, based on absence of grasses in treated area. 8-26-19.

Photo 46: Northeasterly view. Highbush blueberry shrubs (center right, at the species' maximum height), were treated with herbicide, while a sapling of fast-growing tulip tree (left) was spared. 8-26-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 47: On upland hilltop of NE ROW segment vegetation has been managed using selective herbicide treatment. Herb layer has poorly developed grasses. 8-26-19.

Photo 48: Invasive buckthorns have sprouted under red cedar debris. Red cedars were cut in 2018 in Eversource-owned NE segment. Pilewort & goldenrod in background.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 49: Stable forest edge (not logged) in NE ROW segment; pasture juniper, mountain laurel, & native groundcover inhibit tree seedlings establishment. 9-18-19.

Photo 50: Typical native groundcover on acidic infertile soil in the study, with haircap moss, princess pine (*Paralycopodium obscurum)* & bristly dewberry. 9-18-19.

2019 Therrien / Lanata Eversource Right-of-Way Investigation
New London Turnpike, Glastonbury, CT
Photos by REMA Ecological Services, LLC

Photo 51: Observation of multiple undesirable seedlings (birch, red maple, and buckthorn) in soil that has presumably been enriched by decomposition of a deer head. Nitrates are known to trigger seed germination of many plant species (Fenner 1985). Nutrients are also released by herbicide-killed vegetation. This photo taken at the eastern edge of the NE ROW segment represents a vegetation management question raised by the Therrein-Lanata study: how and to what extent does "fertilization" by decomposition of wood chips, sapling roots, & woody debris, and topsoil from offsite affect ROW colonization by trees & invasives?

ATTACHMENT C: Tables

Tables 1 through 3

Table 1. Analytical results and field observations for seven composite soil samples, collected on September 25, 2019, and analyzed by the UConn Soil Nutrient Analysis Laboratory, College of Agriculture (CAG), in Storrs, Connecticut. Samples were taken from five representative plots from an Eversource Transmission Line Corridor (TLC) in Glastonbury including a +/-1,110-foot segment owned by the Lanata & Therrien families, at 2042 and 2060 New London Turnpike, and the ~900 -foot long segment just to the northeast, owned by Eversource. Plot Locations are shown on Figure 1.

Sampling Location ***(Shown on Fig. 1)***	*Rep. Plot 1, North side of stone process entry road*	*Rep.Plot 3 in thin natural topsoil over bedrock (control plot; poles not yet replaced)*	*Rep.Plot 2 in Pad 3, thin topsoil over fill (stone process & rocky subsoil)*	*Rep.Plot 4A in logged wetland (2018), west of Turnpike; seasonally saturated portion.*	*Rep.Plot 4B in logged wetland (2018), west of Turnpike; seasonally flooded portion.*	*Rep.Plot 4C in logged wetland , west of Turnpike; herbicide-treated portion.*	*Rep.Plot 5 in logged wetland west of Tpke; under 4" thick, wood chips.*	*Thresh-holds, & usual CT ranges (ppm) per Uconn CAG Soil Nutrient Analysis Report 1/7/2020*
Cover Type	Shrub thicket	Mosaic of low shrubs & meadow	Tall Weeds & Bare Soil	Diverse wet meadow with some tree, seedlings & shrubs	Sparse emergent wetland with sedges	Sparse wetland with cudweed, tree seedlings	Sparse emergent wetland with cudweed	
Lab Soil Sample ID:	**TH 1B**	**TH 2**	**TH 3**	**TH 4A**	**TH 4B**	**TH4C**	**THL5**	
Soil Sampling Date:	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	
Percent Organic matter	9.5	8.5	2.8	10.8	35.9	11.8	35.0	Thresh-hold for optimum level for farm soils (approx):
Cation Exchange Capacity	14.5	12.7	6.8	6.1	17.8	12.4	17.9	
pH	4.3	4.4	5.6	5.0	4.0	4.6	4.0	
Calcium (ppm)	98.5	122.5	629.5	632.5	257.5	438.5	282.0	>850
Magnesium (ppm)	26.5	26.5	58.5	60.5	39.0	59.5	70.5	>90
Phosphorus (ppm)	2.5	2.0	4.5	2.0	1.5	2.0	2.5	>7
Potassium (ppm)	60.5	50.0	57.0	56.5	16.0	60.0	18.0	>80
Boron (ppm)	0.1	0.1	0.4	0.3	0.2	0.3	0.2	CT Range: 0.1-2 ppm
Copper (ppm)	0.2	0.2	0.5	0.2	0.1	0.2	0.1	CT Range: 0.3-0.8 ppm
Iron (ppm)	16.3	24.9	17.2	62.8	91.1	112.2	106.7	CT Range: 1-40 ppm
Manganese (ppm)	4.1	3.8	2.6	2.9	16.7	4.3	18.9	CT Range: 3-20 ppm
Zinc (ppm)	1.4	1.9	1.0	2.0	5.9	3.2	9.8	CT Range: 0.1-70 ppm
Sulphur (ppm)	27.1	15.1	38.2	50.4	20.9	40.0	22.6	CT Range: 0.13-70 ppm
Est. Lead (ppm)	86.1	79.6	74.5	209.7	80.8	201.2	82.7	low
Aluminum (ppm)	287.9	185.8	70.0	143.2	49.6	140.9	57.2	CT Range: 10-300 ppm
Soil Series	Charlton-Chatfield complex	Hollis-Chatfield Rock crop complex	Udorthent, graded	Leicester Series	Whitman Series	Leicester Series	Whitman Series	
Soil Description : texture, depth of topsoil, color,mottles, percentage coarse fragments	2" loose sitter fine sandy loam, 8" of topsoil, (7.5 YR 3/3) over 2" very stony subsoil (7.5YR 6/3). To stony to dig further.	fine sandy loam, 0-2" 10YR 3/3; 2-8" 10YR 6/4 with no gravel; bedrock below 8" 5% cover of surface rocks	fine sandy loam, 1-2" topsoil over dense stone process	loam, 14" of v. dark topsoil, Chroma 2 predominates in matrix, from 14 to 20"	Black silty topsoil high in OM; gleyed & low chroma mottles (Chroma 1 & 2) below 12"	Loamy fine sand slightly moist, high root density, 2-3' dark brown A horizon, likely truncated during grading ca. 1965	Below the 4" wood chip layer, 4-5" black silt loam over dark gray silt loam (Chr 2) with chroma 1 mottles & dark red mottles	

TABLE 2: THERRIEN-LANATA STUDY OF AN EVERSOURCE RIGHT-OF-WAY SEGMENT: COMPARISON OF ECOLOGICAL CONDITIONS UNDER SEVERAL MANAGEMENT REGIMES, #2042 & #2060 New London Turnpike, Glastonbury, Connecticut

	SOUTHWESTERN ROW SEGMENT Therrein & Lanata Properties, 2060 & 2042 New London Turnpike								*NORTHEASTERN ROW SEGMENT Eversource Property, N. of New London Tpke*					
	Center & South Side of ROW				*North Side of ROW*				*North Side of ROW*			*Center & South Side of ROW*		
#'S OF PLOTS, SURVEY ROUTES, & PADS:	CENTRAL SOUTH **PLOT 1**	**SOUTH EAST ROUTE**	SE CONTROL **Plot 3**	**SWPad#2 Plot 2**	**NE Pad#1**	**NWPad#4**	**SOUTH WEST ROUTE**	BY RD **Pad#3**	**Plot 4**	**Plot 5**	NORTH WEST ROUTE	SOUTH ROUTE	NORTH EAST ROUTE	NORTH CENTRAL ROUTE
ROUTINE ROW VEGETATION MANAGEMENT REGIMES AND SPECIAL RIGHT-OF-WAY MAINTENANCE ACTIVITIES:	SAPLINGS & INVASIVES CUT TO COMPLY; NO HERBICIDE USE. GRADING & GRAVELLING OF SERVICE ROAD IN 2015,		SAPLINGS & INVASIVES CUT TO COMPLY; NO HERBICIDE USE	2017 DENSE FILL ON 1/2 ACRE. 1-2" TOP-SOIL OVER PART OF PAD.SEEDED WITH CLOVER & GRASS; NOW MIXED WEEDS	2015 DENSE FILL ON 30,000 SF, 3" TOPSOIL SEEDING WITH CLOVER & GRASS; NOW MIXED WEEDS	2019 TIMBER MATTING, NO FILL PLACEMENT , SOME TOPSOIL	2014 LOGGING, 100' WIDE SWATH, NOT UNDER LINES, WOOD CHIP DEPOSITION IRREGULAR, MOSTLY LOW	2018 RECENT LOGGING, NATIVE LANDSCAPING BORDER, LAWN	2018 RECENT LOGGING, WOOD MODERATE, IRREGUALR CHIP DEPOSITION; LOCALIZED SELECTIVE HERBICIDE SPRAYING OF WOODY	2018 RECENT CLEAR-CUT LOGGING,100' WIDE SWATH, NOT UNDER LINES, IRREGULAR CHIP DEPOSITION , LOCALLY VERY THICK(> 4")		UPLAND SAPLINGS & INVASIVES HERBICIDED & CEDARS CUT TO COMPLY; LIMITED SHRUB CUTTING IN WETLANDS, POOR IDENTIFICATION		GRAVELLING OF SERVICE ROAD WITH MINIMAL GRADING; ONLY 12-13' WIDE
SUMMARY OF MAINTENANCE ACTIVITIES:	**GRAVELLED RD**		**CONTROL**	**POLE REPLACEMENT PAD-BUILDING**		**TIMBER MATS**	**NORTH SIDE LOGGING, IRREGULAR CHIPS**	**NO CHIPS**	**LOGGING, THICK CHIPS**			**HERBICIDE/CUT**		**HERBIC./CT GRAVEL RD**

KEY — VEGETATION STRUCTURE

PERCENT COVER CODE	**Percent Cover Class**	**TOPOGRAPHIC POSITION HYDROLOGIC REGIME**	**PLOT 1, 5% lower slope, Moist Upland**	**Upper Slope, By Acess Rd. Dry Upland,**	**PLOT 3, Dry, level Upland Hilltop Control**	**PLOT 2, Hilltop Pad #2**	**Hilltop Pad #1**	**Hilltop Pad #4**	**Upper Slope, Dry upland**	**Lower slope, Landscaped**	**PLOT 4 Wetland level, slope base**	**PLOT 5 2% slope base Thick chips**	**Slope & Hill top, north side**	**Slope wetland south side**	**Upland slope & hilltop, south side**	**Upper Slope & hilltop Along Acess Rd**
r	rare	**SPECIES TOTALS:**	**68 spp.**	**40 spp.**	**32 spp.**	**12 spp.**	**7 spp.**	**23 spp.**	**27 spp.**	**19 spp.**	**30 spp.**	**7 spp.**	**19 spp.**	**30 spp.**	**21 spp**	**30 spp.**
+	sporadic	**STRATUM**														
1-	*1- 2%*	**Tree %Cover Avg stratum Ht.**	**5% 15'**		**2%**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**-**
1+ (1P abundant <5%)	*2-5%*	**High Shrub %Cover Avg stratum Ht.**	**30% 15'**		**4% 4'**	**-**					**4% 6'**	**-**				
2-	*5-12%*	**Low Shrub- total Cover Ericaceous Avg. Stratum Ht**	**30% 15% 1.5'**		**(53%) 8% 2'**						**-**	**-**				
2+	*12-25%*	**Non-ericaceous % Cove:r Avg. Stratum Ht:**	**15% 5'**		**45% 3'**	**3% 2.5'**					**2% 2.5'**	**2% 6'**				
3	*25-50%*	**Herbs Total % Cover : Avg. Stratum Ht :**	**50% 10"**		**50% 2.5'**	**42% 3.5'**	**mugwort**			**lawn**	**95% 1.5' - 3'**	**35% 1.2'-3'**				
4	*50-75%*	**Gram. %Cover:**	**25%**		**20%**	**12%**					**20%**	**15%**				
		Forbs %Cover:	**25%**		**30%**	**30%**					**75%**	**20%**				
5	*75-100%*	**Moss clubmoss%Cover:**	**4%**		**12%**	**0%**	**-**			**-**		**0%**				

TABLE 2, CONT. PLANT SPECIES COMPOSITION	TOPOGRAPHIC POSITION AND HYDROLOGIC REGIME	Lower slope, Moist Upland	Upper Slope, By Acess Rd. Dry Upland,	Dry Upland Hilltop No Pad, Control Plot	Hilltop Pad #2	Hilltop Pad #1	ID confidence	Upper Slope, Dry upland	Lower slope, Landscaped	Wetlands, slope base	Wetlands, slope base, Thick wd chips	Slope & Hill top	Slope wetlands south side	Upland slope & hilltop,	Upper Slope & hilltop Along Acess Rd		
SCIENTIFIC NAME **213 TOTAL SPECIES**	**COMMON NAME**	CENTRAL SOUTH **PLOT 1**	**SE ROUTE**	SE CONTROL **Plot 3**	**SWPad#2 Plot 2**	**NE Pad#1**	**NWPad#4**	**SW ROUTE**	BY RD **Pad#3**	**Plot 4**	**Plot 5**	NORTH WEST ROUTE	NORTH EAST ROUTE	NORTH EAST ROUTE	CENTRAL ROUTE	CT DEEP OFFICIAL STATUS	WETLAND INDICAT
TREES 16 Total		10 spp.	3 spp.	3 spp	1 spp.	0 spp.	3 spp.	5 spp.	3 spp.	7 spp.	0 spp.	5 spp.	6 spp.	5 spp.	0 spp.		
Acer rubrum	Red maple seedlings	2-.1															FAC
Ailanthus altissima (cut)	Tree of Heaven	1-.2														invasive	UPL
Betula lenta	seedlings	1+.1		1+	1-.1					killed				killed			FACU
Betula populifolia	seedlings			1+.1													FAC
Hamamelis virginiana	Eastern witchhazel																FACW
Juniperus virginiana	Eastern red cedar	1-.1		1+													FACU
Liriodendron tulipifera	Tulip Tree									1-.1							FAC
Populus deltoides	Eastern cottonwood									1-.1							FAC
Populus tremuloides	Trembling Aspen	1-.2															FACU
Prunus pensylvanica	Pin cherry sdlng	1-.1															FACU
Prunus serotina	Black cherry	1-.1								1-.1							FACU
Quercus coccinea	spling/sdling	1-.1								1-.1							UPL
Quercus rubra	spling/sdling									1-.1							FACU
Quercus velutina	sprling.sdling	2-.1	*sdlgs*														UPL
Sassafras albidum	Sassafras	1-.1								1-.1							FACU
Tsuga canadensis	Eastern hemlock																FACU
SHRUBS 43 Total		19 spp.	12 spp.	7spp			9 spp.	9 spp.	7 spp.	7 spp.	1 spp.	5 spp.	6 spp.	5 spp.	5 spp.		
Aronia cf. arbutifolia	Black chokeberry																FAC
Clethra alnifolia	pepperbush																FAC
Comptonia peregrina	Sweet-fern	1-.3															UPL
Corylus spp.	Hazelnut	1-.1															
Diervilla lonicera	Bush honeysuckle	2+.2															UPL
Elaeagnus umbellata	Autumn-olive	1-.1														invasive	UPL
Gaylussacia baccata	Black huckleberry	2+.3		2+.3													FACU
Ilex verticillata	Winterberry																FACW
Juniperus communus	Common juniper			2-.1													FACU
Kalmia angustifolia	Sheep laurel	2+.3															FAC
Kalmia latifolia	Mountain laurel			2-.2													FACU
Lindera benzoin	Northern spicebush									2-.1							FACW
Lyonia ligustrina	Maleberry																FACW
Morella caroliniensis	Bayberry																FAC
Quercus ilicifolia	Bear oak	r.1															UPL
Rhus copallinum	Winged sumac	2-.3		1+.2													NI
Rhus typhina	Staghorn sumac	2+.3															UPL
Rhamnus alnus	buckthorn	2+.3		2-.2						1-.1							
Rosa multiflora	Multiflora rose									1-.1						invasive	FACU
Rubus allegheniensis	Common	2+.3		1+.2						1-.1							FACU

SHRUBS, cont.																	
SCIENTIFIC NAME	**COMMON NAME**	CENTRAL SOUTH **PLOT 1**	**SE ROUTE**	SE CONTROL **Plot 3**	**SWPad#2 Plot 2**	**NE Pad#1**	**NWPad#4**	**SW ROUTE**	BY RD **Pad#3**	**Plot 4**	**Plot 5**	NORTH WEST ROUTE	NORTH EAST ROUTE	NORTH EAST ROUTE	CENTRAL ROUTE	CT DEEP OFFICIAL STATUS	WETLAND INDIC STATUS
Salix discolor	Pussy willow	1-.2								1-.2	1+.1						FACW
Smilax glauca	Cat briar	3.3		3.3													FACU
Spiraea latifolia	Meadowsweet	1+.2															FACW
Spiraea tomentosa	Steeplebush	1-.2															FACW
Vaccinium angustifolium	Lowbush																FACU
Vaccinium corymbosum	Hi.bush blueberry	1-.1											killed				FACW
Vaccinium pallidum	Hillside blueberry	2+.3															UPL
Viburnum acerifolium	Maple-lf. viburnum									1-.2		stressed					UPL
Viburnum dentatum	Smth. arrowwood	1-.1															FAC
Viburnum lentago	Nannyberry																FACU
HERBS 154 Total		39 spp.	25 spp.	22spp.	11 spp.	7 spp.	11 spp.	13 spp.	9 spp.	16 spp.	6 spp.	9 spp.	18 spp	11 spp.	25 spp.		
Forbs 114 Total		32 spp.	18 spp.	19 spp.	10 spp.	5 spp.	5 spp.	7 spp.	2 spp.	12 spp.	3 spp.	6 spp.	14 spp	8 spp.	21 spp		
Ambrosia artemisifolia	Ragweed	1-.1		1-.1													FACU
Aralia hispida	Bristly sarsparilla																UPL
Artemesia vulgaris	Common	2-.1			3.3											invasive	UPL
Baptisia tinctoria	Yellow wild indigo	1-.2															UPL
Bidens frondosa	Devil's beggar-ticks										1-.1						FACW
Centaurea stoebe	Spotted knapweed			1+.3	3.2											invasive	UPL
Circium discolor	Field thistle	1-.1														invasive	UPL
Crocanthemum bicknelli	Bicknell's rockrose			2-.2													UPL
Crocanthemum canadense	Canada frostweed																UPL
Datura stramonium	Jimson weed				3.3												UPL
Desmodium ciliare	Sm.-leaf. Tick trefoil	1-.1															UPL
Daucus carota	Queen Anne's lace	1-.2			+.1											naturalized	FACU
Epilobium coloratum	Purple willowherb									1-.3							OBL
Erechtites hieraceifolia	Pilewort	1-.2								2+.1	4.1						FACU
Erigeron canadensis	Horseweed	2-.3		1-.1	3.3												UPL
Eupatorium perfoliatum	Boneset thoroughwort	1+.2															FACW
Eupatorium pilosum	Ragged thoroughwort	2-.2															FACW
Eupatorium sessifolium	Sessile thoroughwort			1+.2													UPL
Eurybia divaricatus	White wood aster																UPL
Euthamia caroliniana	Coastal plain grass-leaved-goldenrod	1-.2															FAC
Euthamia graminifolia	goldenrod	1+.2		1+.2						1+.2	1+.1						FAC
Eutrochium dubium	Coastal pln Joe Pye			1-.1													FACW
Eutrochium maculatum	Spotted Joe Pye																OBL
Fallopia japonica	Japanese knotweed				nearby											invasive	FACU
Fragaria virginiana	Wild strawberry	2+.3															FACU
Galium mollugo	Common madder				1-.1											naturalized	FACU
Gaultheria procumbens	Wintergreen									1+.3							FACU
Helianthus spp.	wild sunflowers																
Hieraceum scabrum	Hairy hawkweed			1+.1													UPL
Hieraceum spp.	Hawkweed rosette			1-.1													UPL

Table 2, cont. HERBS, Forbs, cont.																		
SCIENTIFIC NAME	**COMMON NAME**	CENTRAL SOUTH **PLOT 1**	**SE ROUTE**	SE CONTROL **Plot 3**	**SWPad#2 Plot 2**	**NE Pad#1**	**NWPad#4**	**SW ROUTE**	BY RD **Pad#3**	**Plot 4**	**Plot 5**	NORTH WEST ROUTE	NORTH EAST ROUTE	NORTH EAST ROUTE	CENTRAL ROUTE	CT DEEP OFFICIAL STATUS	WETLAND INDIC STATUS
Hypericum punctatum	Spotted St.John'swort	1-.2															FAC
Impatiens capensis	Jewelweed																FACW
Lespedeza violacea	Wand bush-clover	1-.2															UPL
Lobelia inflata	Bladder-pod lobelia	1+.1															FACU
Lotus corniculatus	Birds-foot trefoil				2+.3											naturalized	FACU
Ludwigia alterniflora	Seedbox									1-.1							OBL
Ludwigia palustris	Mud purslane									1+.2							OBL
Lycopus americana	Horehound																OBL
Lysimachia nummularia	Moneywort									1-.3						pot. Invas.	FACW
Lysimachia quadrifolia	Whorled loosestrife	1-.2															FACU
Lythrum salicara	Purple loosestrife	1+.2														invasive	OBL
Melilotus sppp.	Sweet clover	1-.1														naturalized	UPL
Oenothera biennis	Evening-primrose	1-.1			+.1					1-.2							FACU
Oxalis stricta.	Com. wood-sorrel																FACU
Persicaria sagittata	Arrow-lv. tearthumb																OBL
Phytolacca americana	Pokeweed	1-.1															FACU
Pilea pumila	Clearweed									1-.2							FACW
Plantago lanceolata	Narrowlf. plantain	1+.2														naturalized	FACU
Plantago major	Broad-leaf plantain															naturalized	FACU
Polygala sanguinea	Blood milkwort	r. 2		1-.2													FACU
Polygonum aviculare	Dooryd. Knotweed	1-.2		1+.3													FACU
Potentilla canadensis	Dwarf cinquefoil																UPL
Potentilla simplex	Old-field cinquefoil	2+.3		2+.2												naturalized	FACU
Pseudognaphalium obtusifolium	catsfoot			1-.1													UPL
Pycanathemum muticum	Sht-tooth mtn. mint			1-.1													
Rubus hispidus	Bristly dewberry	1+.3									2-.3						FACU
Rubus flagellaris	Prickly dewberry	1+.3		2+.3													FACU
Solidago altissima	Tall goldenrod																FACU
Solidago canadensis	Canada goldenrod	1-.2		1+.2													FACU
Solidago bicolor	White goldenrod			1-.1													UPL
Solidago caesia	Blue goldenrod	1-.2															FACU
Solidago juncea	Early goldenrod																FACW
Solidago nemoralis	Gray goldenrod			1+.1													UPL
Solidago rugosa	Rough goldenrod	1+.2		2-.3						2+.3							FAC
Solidago spp.	Goldenrods																
Symphyotrichum lanceolatum	Lance-lf Am.-aster									1+.1							OBL
Symphyotrichum lateriflorum	Calico Am. aster																FACU
Symphyotrichum pilosum	Awl Am.-aster																FACU
Symphiotrichum racemosum	Sm.white Am-aster									1+.2							FACW
Trifolium dubium	Lesser hop clover				1-.2												FACU
Trifolium pratense	Red clover				2+.2	2-.2											FACU
Verbascum thapsus	Common mullein	1-.2														naturalized	UPL
Vernonia noveborecensis	NY Ironweed	r.2															FACW
Grasses		4 spp.	5 spp.	2spp.	3spp.	2 spp.	4 spp.	5 spp.		1 sp.							
Agrostis gigantea	Black bent															naturalized	FACW
Andropogon virginicus	Broomsedge																UPL
Danthonia compressa	Canada bluestem															native	
*Dicanthelium acuminatum**	Hairy ros.pan.grass	1-.2														SC*	FACW
Dicanthelium clandestinum	Deer tongue grass	1+.2															FACW
Dicanthelium spp.	Ros. panic grasses																

Grasses, cont.		4 spp.	5 spp.	2spp.	3spp.	2 spp.	4 spp.	5 spp.		1 sp.		NORTH WEST ROUTE	NORTH EAST ROUTE	NORTH EAST ROUTE	CENTRAL ROUTE	CT DEEP OFFICIAL STATUS	WETLAND INDIC STATUS
SCIENTIFIC NAME	**COMMON NAME**	CENTRAL SOUTH **PLOT 1**	**SE ROUTE**	SE CONTROL **Plot 3**	**SWPad#2 Plot 2**	**NE Pad#1**	**NWPad#4**	**SW ROUTE**	BY RD **Pad#3**	**Plot 4**	**Plot 5**						
*Dicanthelium spaerocarpon**	Round-fruited rosette panicgrass	1-.2															FAC
Digitaria spp.	Crabgrass spp..	2-.3		1-.1	2-.3												
Echinochloa crusglli	barnyardgrass				1-.1											naturalized	FAC
Festuca spp.	Fescues				2-.2												
Panicum capillare	Witch grass									1+.2							FAC
Panicum virgatum	Switchgrass	1-.2															FAC
Schenodorus pratensis	Meadow rye grass																
Schizachyrium scoparium	Little bluestem			3.3													FACU
Setaria faberi (Herrm.)	Chinese foxtail				2-.2											naturalized	UPL
Setaria viridis	Green foxtail	1-.1														naturalized	UPL
Tridens flava	Purpletop Grass																FACU
Sedges & Rushes		1 spp.	2spp.	1 spp.				2 spp.			3 spp.						
Bulbostylis capillaris	Tufted hair-sedge																UPL
Carex lurida	Sallow sedge									2+.2							OBL
Carex pensylvanica	Penn sedge			2+.3													UPL
Carex stricta	Tussock sedge										1-.2						OBL
Carex tribuloides	Blunt broom sedge										1+.2						FACW
Carex spp.	Sedges																
Cyperus strigosus	Umbrella sedge	1-.2															FACW
Eleocharis obtusa	Spike rush																
Juncus effusus	Common soft rush									2-.3							FACW
Juncus tenuis	Path rush																FAC
Scirpus cyperinus	Woolrush										2-.1						FACW
Ferns		2 spp.	2spp.					1sp.	2 sp.	1 sp.			1 sp.				
Athyrium felix-femina	Lady fern									1+.2							FAC
Dennstaedtia punctiloba	Hay-scented fern	2-.3															UPL
Onoclea sensibilis	Sensitive fern																FACW
Osmundastrum cinnamomeum Cinnamon fern																	FACW
Pteridium aquilinum	Bracken fern	1-.2															FACU
VINES		3 spp.	3spp						2 spp.			1 sp.					
Celastrus orbiculatus	Asian bittersweet	1+.3														native	UPL
Fallopia scandens	Climbing buckwheat																FACU
Parthenocissus quinquefolia	Virginia creeper	2-.3															FACU
Vitis labrusca	Grapes	3.3															FACU
Clubmosses		1 spp.		2 spp.			2 spp.	2 spp.				1 spp.					
Dendrolycopodium obscurum	Princess Pine																listed
Diphasiastrum digitatum	So.ground cedar			2+.3													listed
Lycopodium clavatum	Staghorn clubmoss	1+.2		1-.2													listed
MOSSES																	
Politrichum spp.																	listed
LICHENS																	
Cladonia sp.	Reindeer lichen																listed
Table 2, continued.																	

NOTES:

* *Dicanthelium sphaerocarpon* var. isophyllum is a CT Special Concern species, presumed extirpated. Survey season was not correct for ID to variety for this genus.

Survey was conducted by Sigrun N.Gadwa,MS of Carya Ecological Services,LLC between August and mid October 2019, for REMA Ecological Services, LLC of Manchester, CT

Search Intensity: High in plots (with Braun-Blanquet scores); low to moderate along survey routes.

Therrien/Lanata segment is SW of New London Turnpike; Length is ~ 1040 feet. Eversource TLC Segment isnortheast of turnpike; Length is ~ 950 feet

Table 3: Woody Right-of-Way Species: Host Plants for Selected Lepidopterans & Other Habitat Values

Scientific Name	Common Name	Selected lepidopterans for which it is a larval food plant	Habitat values
Alnus incana (A. rugosa)	Speckled alder	Yellow-haired dagger moth *(Acronicta impleta*); also feeds on hickory	Smooth gray trunk, twiggy, broad shape, nitrogen-fixer, shades streams
Comptonia peregrina	Sweetfern	Sweetfern underwing (*Catocala anti-nympha*). Also many generalist moths	Drought-tolerant evergreen heath; low winter cover, pollen souce. Sizable nuts.
Gaylussaccia baccata	Black huckleberry	Spring azure *(Celastrina ladon),* Common blue *(Polyommatus icarus)* Apple sphynx moth (*Sphynx gordius),* among others.	Blooms in early spring, sweet fruit in mid summer; eaten by many generalist caterpillars
Ilex verticillata	Winterberry	*Callophrys henrici* (Henry's elfin) Generalist feeder Harris's Three-spot (*Harrisimemna trisignata)* also eats cherry,viburnum, willow & many others.	Multi-stem clumps, poor cover, but whip-poor-wills could fly through them. Persistent red winter fruit.
Lindera benzoin	Spicebush	*Papilio troilus* (Spicebush swalowtail), also eats sassafras	wetland forest understory shrub, oil-rich late fruit in mid fall, yellow early spring flowers
Juniperus virginiana and Juniperus communis	Red cedar & Pasture juniper	Juniper hairstreak *(Callophrys gryneus)* , *Juniper geometer (Patalene olyzonaria); Digrammia continua (* Curve-lined angle)	*J. virginiana* Dense low tree, valuable cover in winter, perch site, abundant blue fruits are valuble food for birds. *J. communis* Spreading clumps, blue fruits in fall & winter, attract birds.
Morella pennsylvanica	Northern bayberry	Purple crested slug, *Adoneta spinuloides*	semi-evergreen, oil-rich blue fruits in fall & winter, aromatic
Rhamnus alnus	European buckthorn	Henry's Elfin (*Callophrys henricii*) & Tissue moth, a carpet (*Triphosa haesitata*) - host-specific; Canadian melanolophia	Listed as invasive in Connecticut;rapid clonal spreader shades & crowds out herbs & lower shrubs; its spread has let rare moths recover.
Rubus allegheniensis	Allegany Blackberry	Lunate Zale (*Zale lunata*), to 5cm long; also apple, cherry, willow; tufted thyatrid	large pink flowers, large purple fruits, good for jam, & birds, valuable cover, thorny, purplish fall color
Rhus spp.	Sumac spp.	Spring azure (*Celastrina ladon*), Common blue (*Polyommatus icarus*) Slender	Forms tall patches, often extensive; early spring flowers, mid fall fruit .
Salix discolor	Silky willow	Mourning cloak (*Nymphalis antiop* a), Viceroy (*Limenitis archippus*),Deamy duskywing (*Erynnis icelus*) the generalist, Speckled fruitworm (*Orthosia hibisci),* which flies in early spring	Attractive foliage, bank stabilizer, dense, yellow-green twigs, attracts birds
Sambucus nigra	Common elderberry	Ruby quaker (*Orthosia rubescens*), a generalist, flies in early spring	Abundant flat flower clusters in midsummer, large clusters of juicy black fruit in late summer, early fall
Spiraea latifolia	Meadowsweet	early instars only; New England buck moth (*Hemileuca leucena*)	Mid-summer flowers, produces small seeds for birds, rodents.

Table 3, continued

Scientific Name	*Common Name*	*Selected lepidopterans for which it is a larval food plant*	*Habitat values*
Vaccinium angustifolium, Vaccinium vacillans	Low-bush blueberry	Spring azure (*Celastrina ladon*), Common blue (*Polyommatus icarus*) Slender clearwing (*Hemaris gracilis*) Sordid	Forms very low patches, often extensive; early spring flowers, summer fruit is low enough for BT's.
Vaccinium corymbosum	High-bush blueberry	Yellow-necked caterpillar (*Datana ministra*), 4.5 cm; also oak, birch, rose	Large juicy fruit, delicate twiggy branches, used by many insects
Viburnum dentatum	Arrowwood viburnum	Rose hooktip (*Oreta rosea*) - limited to viburnums; also eaten by many moths that	Leaves with sharp-teeth, crisp veins, white showy flowers, dark blue fruit clusters, multiple stems.
Viburnum lentago	Nannyberry viburnum	One of many larval hosts of Intractable Quaker (*Himella intractata*), common.	late spring flowers, early fall fruit, multi-stemmed, dense growth form.
TREES ON RIGHT-OF-WAY, CUT DOWN AS SAPLINGS			
Quercus coccinea	Scarlet Oak	Each feeds on all oaks: banded hairstreak (*Satyrium salanus*), red-lined pano-poda (*Panoparda rufimargo*), Common oak moth (*Phoberia atomaria*) pupa overwinters, flies in April. Definite tussock moth *(Orygia definita*), Variable oak leaf caterpillar (*Lochmaeus manteo*) . Red-crossed button slug (*Tortricidia obliqua*), early buttonslug (*Tortiricidia estacea*), elegant-tailed slug (*Packardia elegans*), one-spotted variant (*Hypagyrtis unipunctata*) plus many hundreds more butterfly & moth species.	
Quercus rubra	Red oak		
Quercus velutina	Black oak		

ATTACHMENT D: Web Soil Survey

Of Subject Site

Soil Map—State of Connecticut
(Vicinity of 2060 New London Turnpike, Glastonbury, CT)

Map Scale: 1:4,760 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 19, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 15, 2019—Aug 29, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	3.8	3.3%
13	Walpole sandy loam, 0 to 3 percent slopes	2.4	2.1%
36A	Windsor loamy sand, 0 to 3 percent slopes	0.0	0.0%
36B	Windsor loamy sand, 3 to 8 percent slopes	9.9	8.6%
36C	Windsor loamy sand, 8 to 15 percent slopes	1.8	1.5%
38A	Hinckley loamy sand, 0 to 3 percent slopes	1.7	1.4%
38C	Hinckley loamy sand, 3 to 15 percent slopes	8.9	7.7%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	0.3	0.3%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	1.3	1.1%
60C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes	5.4	4.7%
60D	Canton and Charlton soils, 15 to 25 percent slopes	3.4	2.9%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	31.8	27.5%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	6.3	5.4%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	17.9	15.5%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	16.0	13.8%
305	Udorthents-Pits complex, gravelly	0.9	0.8%
306	Udorthents-Urban land complex	2.0	1.7%
307	Urban land	1.3	1.1%
W	Water	0.6	0.5%
Totals for Area of Interest		**115.7**	**100.0%**

ATTACHMENT E: Avian Survey

Of Subject Site

REMA ECOLOGICAL SERVICES, LLC
164 East Center Street, Suite 8
Manchester, CT 06040

SITE: Eversource ROW, 1000' north & south of 2060 New London Turnpike, Glastonbury, CT
PROJECT: Therrien-Lanata Natural Resources Inventory
DATE OF SURVEY: August 10, 2019 (south of road) & August 14, 2019 (north of road)
STUDY AREA ACREAGE: +/- 14

AVIAN SURVEY

Common Name	Scientific Name	Numbers of Individuals	
Avians		South Segment	North Segment
Red-tailed hawk	*Buteo jamaicensis*	2	
Wild turkey	*Meleagris gallopavo*		1
Mourning dove	*Zenaida macroura*	7	
Ruby-throated hummingbird	*Archilochus colubris*	2	1
Red-bellied woodpercker	*Melanerpes carolinus*	2	
Downy woodpercker	*Picoides pubescens*	8	4
Northern flicker	*Colaptes auratus*	5	6
Pileated woodpecker	*Dryocopus pileatus*		1
Eastern wood-pewee	*Contopus virens*	5	2
Eastern phoebe	*Sayornis phoebe*	6	6
Eastern kingbird	*Tyrannus tyrannus*	7	
Blue jay	*Cyanocitta cristata*	6	
American crow	*Corvus brachyrhynchos*	2	
Common raven	*Corvus corax*	2	
Black-capped chickadee	*Parus atricapillus*	7	4
Tufted titmouse	*Parus bicolor*	5	4
White-breasted nuthatch	*Sitta carolinensis*	4	2
Carolina wren	*Thryothorus ludovicianus*	2	2
House wren	*Troglodytes aedon*	9	4
Eastern bluebird	*Sialia sialis*	6	
Veery	*Catharus fuscescens*	1	
American robin	*Turdus migratorius*		4
Gray catbird	*Dumetella carolinensis*	9	7
Brown thrasher ◆	*Toxostoma rufum*	1	
Yellow warbler	*Dendroica petechia*	2	
Praire warbler	*Dendroica discolor*		2
Black-and-white warbler	*Mniotilta varia*	5	2
Common yellowthroat	*Geothlypis trichas*	2	
Indigo bunting	*Passerina cyanea*		2

Common Name	Scientific Name	Numbers of Individuals	
Avians		South Segment	North Segment
Rufous-sided towhee	*Pipilo erthrophthalmus*	7	4
Chipping sparrow	*Spizella passerina*	8	1
Field sparrow	*Spizella pusilla*	4	
Song sparrow	*Melospiza melodia*	3	1
Northern oriole	*Icterus galbula*	11	1
House finch	*Carpodacus mexicanus*	12	*8*
American goldfinch	*Carduelis tristis*	10	11
TOTAL INDIVIDUALS:		**152**	**69**
TOTAL SPECIES:		**31**	**23**

◆

Species of Special Concern

ATTACHMENT F: REMA Red Cedar Letter

Eastern Red Cedar: Ecological Values & ROW Management
(August 19, 2019)

● Ecology
● Soil & Wetland Studies
● Water Quality Monitoring ● GPS
● Environmental Planning & Management
● Ecological Restoration & Habitat Mitigation
● Aquatic, Wildlife and Listed Species Surveys
● Application Reviews ● Permitting & Compliance

August 19, 2019

VIA E-MAIL

Mr. & Mrs. Gary and Linda Therrien
2060 New London Turnpike
Glastonbury, CT 06033-3822

RE: Preliminary Recommendations with regard to Management of Eastern Red Cedar (Juniperus virginiana) on the Eversource Right-of-Way in Glastonbury, south of New London Turnpike, on the Therrien Property

REMA Job No.: 19-2193-GLA30

Dear Mr. & Mrs. Therrien:

Per your request, REMA Ecological Services, LLC (REMA), summarizes herein our *preliminary* findings and recommendations regarding ecological, safety, and aesthetic considerations with regard to Eastern Red Cedar, a keystone species found along Right-of-way (ROW) habitats.

It should be noted that REMA is in the process of conducting an ecological survey of the Eversource ROW within your property, as well as nearby. Final recommendations on ecologically-friendly vegetation management of the ROW will be available by November 1st, 2019.

This species is a medium-sized, slow-growing, exceptionally hardy and trouble-free dioecious or rarely monoecious tree, tolerating extremes of cold and heat, and drought. However, because this evergreen tree is highly shade-intolerant, it cannot grow within adjacent, contiguous forested habitats. By contrast, most of the other tree species, routinely culled from ROWs, tolerate shade, and are abundant in forests. The sharp decline in

successional farmland habitat in Connecticut, over the past fifty years, means that now a much higher relative proportion of red cedars occur on ROWs and along highway corridors.

1.0 FOOD

Red cedar is a highly significant food source, with very abundant fruit, that is consumed by a large number of mammals as well as birds. The blue persistent fruits are eaten through the winter months, as well as by bird species migrating during the spring and fall seasons. Wildlife species that consume red cedar fruits include the following: Eastern cottontails, red and gray squirrels, red and gray foxes, striped skunks, and opossums, robins, cedar waxwings, mockingbirds, goldfinches, grosbeaks, flickers, wild turkey, brown thrashers, towhees, Eastern bluebirds, and ruffed grouse, among others. Of these the last four are in decline, and the brown thrasher, which is listed in Connecticut as a "species of special concern" was observed within the ROW on your property during our ongoing ecological investigations. White tailed deer browse the foliage, but only lightly, such that the cedars survive.

2.0 COVER

The dense foliage of red cedars, is present near the ground, and provides highly effective, dense cover for birds. It is important for nesting, and is used for this purpose by chipping sparrow, song sparrow, brown thrasher, robin, and mockingbird, among others. Shreds of cedar bark are also an important nest-building material. Red cedars provide secure cover during the day, year-round, a phenomenon observed at this site, during our ongoing bird surveys. Smaller birds can remain hidden, safe from hawks, between feeding forays in nearby exposed locations.

Saw-whet owls roost in securely hidden, red cedars during the day, which helps prevent harassing by crows and jays. This important nocturnal carnivore, which is also a Connecticut-listed species, feeds primarily on deer-footed mice (vector of Lyme Disease). Throughout the United States this owl is found in red cedar stands on open land.

Red cedars have great value as winter cover for birds. This value is heightened by the scarcity of other small to medium-size evergreens in Connecticut's flora. Mammals can also shelter under them from snow and inclement weather.

3.0 OTHER ECOLOGICAL VALUES

For many millennia, red cedars have been a dominant small tree species in Connecticut's open ridge crest & rock outcrop ecological communities, closely associated with shade-intolerant native wildflowers and grasses, and presumably associated with the same suite of beneficial mycorrhizae as the cedars. Perennial herbs are better able to persist on the north and eastern sides of these evergreens, where winter shade slows snow melt and reduces the intensity and frequency of frost-heave cycling. They also provide protection from winter winds. For example, REMA recently observed wood betony (*Pedicularis canadensis*), at the base of a red cedar, on an Eversource ROW in the Town of Cheshire; this wildflower is also found among cedars on the traprock summits of the Hanging Hills in Meriden[1].

Juniperus virginiana is also the larval host plant of a lovely rare, olive-green butterfly, the Juniper hairstreak, *Callophrys gryneus*, which is a species of conservation concern nationwide.

We would be remiss not to mention that eastern red cedars have dense and widely spreading root systems, which results in very effective soil stabilization, something which is much needed in the rocky and shallow soils that often characterize many ROWs, including the one associated with your property.

4.0 MANAGEMENT CONSIDERATIONS

Red cedar grows slowly, especially in dry or rocky environments, but it can reach heights that could interfere with electric transmission lines. REMA recommends a policy of topping the trees, rather than removal, on ROW properties where property owners or responsible non-profit organizations are willing to do the work, and are also willing to sign a Red Cedar Control form every four years, accompanied by digital photos, stating that no red cedars exceed fifteen feet, on their ROW section. We suggest topping at fifteen feet, a height which is manageable with a pole saw. Moreover, we recommend that the highest top branches be trimmed back to a length of two to three feet to prevent them from becoming leaders. As cedars do have low branches, and ample foliage below fifteen feet, they should remain healthy under a topping management approach, and still able to provide ample food and high quality cover.

[1] REMA is in the process of conducting a comprehensive botanical inventory, and vegetative cover type mapping within the ROW on the Therrien property, as well as on the adjacent Lanata property.

5.0 CONCLUSION

Based on the scientific literature, our combined experience spanning more than 65 years, and the preliminary findings of the ongoing ecological studies on your property, as well as nearby, it is our professional opinion that the removal of all eastern red cedars from Eversource ROWs, including within your property, is not an ecological-friendly vegetation management practice. In fact, it will significantly reduce both the diversity and abundance of wildlife within the ROW, especially of breeding and migrating avifauna. Moreover, as mentioned above, red cedars promote microhabitat diversity, which contributes to increased plant biodiversity within ROWs. Therefore, their removal constitutes a significant impact to biodiversity. Finally, red cedars clearly promote exceptional soil stabilization within ROWs, and protect against erosion and sedimentation events.

Please feel free to contact our office with any questions on the above.

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

George T. Logan, MS, PWS, CSE
Professional Wetland Scientist
Wildlife Biologist/Certified Senior Ecologist

Sigrun N. Gadwa, MS, PWS
Ecologist, Registered Soil Scientist
Professional Wetland Scientist

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