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VIA ELECTRONIC MAIL **September 9, 2017**

Ms. Melanie A. Bachman, Esq.. Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06501

Re: Petition 1313 -DWW Solar II, LLC Petition for Declaratory Ruling that No Certificate of Environmental Compatibility and Public Need Is Required for a 26.4 Megawatt AC Solar Photovoltaic Electric Generating Facility in Simsbury, Connecticut

Dear Attorney Bachman:

Attached please find (1) the prefiled testimony of our expert, George T. Logan; (2) Mr. Logan's CV (Exhibit 1), and (3) Mr. Logan's report (Exhibit 2). An original and fifteen (15) copies of same will FedExed to you on Monday.

Very Truly Yours,

Alan M. Kosloff, Esq.

Enclosures

Cc: Service List (via electronic mail)

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

DWW SOLAR II, LLC PETITION FOR DECLARATORY RULING THAT NO CERTIFICATE OF ENVIRONMENTAL COMPAT ABILITY AND PUBLIC NEED IS REQUIRED FOR A 26.4 MEGAWAIT AC SOLAR PHOTOVOLTAIC ELECTRIC GENERATING FACILITY IN SIMSBURY CONNECTICUT	)	PETITION NO. 1313
	)	September 8, 2017

PRE-FILED TESTIMONY OF GEORGE LOGAN

Q1. Mr. Logan, please state your name and position.

A. George T. Logan. I am President of REMA Ecological Services, LLC (REMA). REMA's office is located at 164 East Center Street, Suite 8, Manchester, CT 06040. I serve as Principal Environmental Scientist/Senior Ecologist for the firm.

Q2. Please state your qualifications.

A. I hold a Master of Science degree in Natural Resources, Wildlife Management & Conservation Biology, from the University of Rhode Island, Kingston, R.I.; a Bachelor of Science degree in Natural Resources, Wildlife Management & Wetlands Ecology, from the University of Rhode Island, Kingston, R.I.; I am a Certified Senior Ecologist by the Ecological Society of America; Certified Professional Wetland Scientist by the Society of Wetland Scientists; a Registered Soil Scientist with the Society of Soil Scientists of Southern New England; I am also a Certified Associate Wildlife Biologist by the Wildlife Society. A copy of my C.V. giving a more complete listing of my credentials is attached hereto as Exhibit 1.

Q3. Please describe your involvement in this matter.

A. I was contacted by Attorney Kosloff sometime in early July. Attorney Kosloff asked me whether I was willing to assist his clients and him in evaluating the technical materials submitted in support of DWW's petition that is the subject of this proceeding. Specifically, Attorney Kosloff asked me to review and evaluate DWW's technical materials within areas of my firm's expertise, i.e. natural resources (soils, geology, wetland/aquatic science, botany, ecology, wildlife biology, water quality); gaps and issues in natural resource inventories and characterizations, issues/errors in analysis regarding potential short-term and long-term impacts to natural resources; He also asked me to provide recommendations for further inventories/analysis and mitigation; I was also to provide a summary of findings in a brief report or memorandum.

Q4. And did you perform that work?

A. Yes. We prepared a letter report setting forth our findings. The letter report is attached hereto as Exhibit 2.

Q5. Based upon your evaluation, in your opinion, would there be adverse environmental effects associated with the project?

A. Yes.

Q6. What would those adverse environmental effects be?

A. There a variety of effects, as discussed in our report, including adverse effects upon local and regional ecology, adverse effects upon on-site habitats, adverse effects upon wildlife species, including "listed" species, that is, endangered, threatened, and special concern species, adverse effects upon migratory avians, adverse effects upon wildlife movement and dispersal between habitats, both on-site and off-site, adverse

effects upon adjacent protected Open Space, and adverse effects upon both groundwater and surface water quality during construction and after construction.

Dated: September 8, 2017

George T. Logan

EXHIBIT 1

PROFESSIONAL RESUME

George T. Logan, MS, PWS, CSE

Principal Environmental Scientist/Senior Ecologist

EDUCATION:

M.S. Natural Resources, *Wildlife Management & Conservation Biology,* University of Rhode Island, Kingston, R.I., 1989.

B.S. Natural Resources, *Wildlife Management & Wetlands Ecology,* University of Rhode Island, Kingston, R.I., 1986.

Continuing Education

The Transportation Project Development Process: Training in the PennDOT Environmental Impact Statement Handbook, Harrisburg, PA, January 1994

Rapid Bioassessment Protocols of Aquatic Systems (EPA Protocols), Wetland Training Institute, Williamsport, PA, August 3-6, 1993

CERTIFICICATIONS: ***(current)***

Certified Senior Ecologist *(2005, 2014)* - Ecological Society of America

Certified Professional Wetland Scientist (No. 581) *(1994)* - Society of Wetland Scientists

Registered Soil Scientist *(1989)* - Society of Soil Scientists of Southern New England

Certified Associate Wildlife Biologist *(1989)* – The Wildlife Society

EXPERIENCE:

Mr. Logan is the Co-Owner and *Principal Environmental Scientist* and *Senior Ecologist* for Rema Ecological Services, LLC. He specializes in tidal and inland wetland delineations and evaluation, permitting, wetland mitigation design, implementation and monitoring, and the preparation of environmental compliance documents in accordance with national (NEPA), state (e.g., CEPA, MEPA), and local criteria and guidelines. He also provides design, construction supervision and implementation for a wide variety of habitat restoration and enhancement projects. Mr. Logan performs watershed-wide and surface water quality evaluations and provides guidance in the design of stormwater Best Management Practices (BMPs), including stormwater wetlands and bioretention basins, as well as for LID (low impact development) practices.

Mr. Logan has over 29 years of experience as a wildlife biologist/ecologist conducting wildlife habitat evaluations and focused avian, mammalian, invertebrate, and herpetofaunal surveys using both active and passive methods. He frequently conducts targeted surveys for sensitive, rare, and "listed" species (i.e. endangered, threatened, special concern), and aquatic biosurveys to assess the biodiversity and biotic health of ponds, lakes, vernal pools, rivers, and streams. Mr. Logan has extensive experience in performing herpetological surveys, including over 230 vernal pool investigations and evaluations.

Mr. Logan has participated in over 2,400 individual projects in New England and the Mid-Atlantic States and in 159 of 169 municipalities in Connecticut.

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

PROFESSIONAL AFFILIATIONS:

Society of Soil Scientists of Southern New England
Society of Wetland Scientists
Association of Massachusetts Wetland Scientists
Ecological Society of America
The American Birding Association
The Wildlife Society
Soil & Water Conservation Society
Connecticut Association of Wetland Scientists (CAWS) *(Past-President, Charter member)*

PUBLICATIONS: ***(selected)***

Logan, G.T. & S.N. Gadwa. 1999. Quinnipiac River Watershed Association Stream Study. Water Quality in the Quinnipiac River. Proceedings of a Symposium on the Impact of Nonpoint Source Pollution in the Quinnipiac River Watershed, pp. 66-70.

Logan, G.T. & S.N. Gadwa. 1998. Stream Biosurveys: *A Primer.* Quinnipiac River Watershed Association Educational Series for the Adopt-the-River Programs.

Pawlak, E.M. & G.T. Logan. 1996. Town of Cromwell Wetland Evaluation Project. Connecticut Association of Conservation and Inland Wetlands Commissions. The Habitat, Vol. 10:1

Logan, G.T., F.B. Titlow & D.G. Schall. 1995. The Scientific Basis for Protecting Buffer Zones. Proceedings of the 16th Annual Meeting of the Society of Wetland Scientists.

Pawlak, E.M. & G.T. Logan. 1995. Town of Cromwell Wetland Buffer Zone Designation Methodology. Proceedings of the 16th Annual Meeting of the Society of Wetland Scientists.

Logan, G.T., J.H. Brown, Jr., T.P. Husband & M.C. Nicholson. 1994. Conservation Biology of the Cretan Agrimi (*Capra aegagrus cretensis*). Biologia Gallo-Hellenica, Vol. 21, pp. 51-57.

Nicholson, M.C., T.P. Husband, J.H. Brown, Jr. and G.T. Logan. 1994. Implications of behavior on the management of the Cretan Agrimi (*Capra aegagrus cretensis*). Biologia Gallo-Hellenica, Vol. 21, pp. 45-50.

WORKSHOPS & CONFERENCES: ***(selected)***

Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. Corps Training Workshop. May 2011. *(sponsor, participant)*

Vernal Pools: *The Jewels of the Forest.* Technical Workshop for the Town of Southwick Conservation Commission. January 2005. *(Guest Lecturer)*

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

WORKSHOPS & CONFERENCES: ***(selected)***

The Importance of Habitat Edges. Riverside Landscaping Conference. The Rivers Alliance of Connecticut. June 1998. (*Guest Lecturer*)

Riparian Buffer Function, Performance & Limitations. Urban Riparian Buffers Conference & Technical Training Session. April 1999. *(Guest Lecturer)*

Sedimentation and Erosion Control Review Session. USDA. Natural Resource Conservation Service and CPESC (Certified Professionals in Erosion Control), Concord, NH. September 2001.

Buffer Strips as Storm Water Quality Controls. EnviroExpo, Boston. May 1999. *(Guest Speaker)*

Identifying Wetland Soils, Fauna and Flora. Municipal Inland Wetland Staff Technical Workshops. June 1999. *(Guest Speaker)*

Water Quality in the Quinnipiac River: A Symposium on the Impact of Non Point Source Pollution in the Quinnipiac River Watershed. November 1998. *(Presenter)*

Our Hidden Wetlands: Vernal Pools in Connecticut. Co-sponsored by CT DEP and the Center for Coastal and Watershed Systems. November 1997 and January 1998 *(Workshop Leader)*

Aquatic Invertebrate & Stream Ecology Workshop. Quinnipiac River Watershed Association Workshop Series. September 1997, May 1998, June 1999, January 2000 (*Workshop Leader*)

The Massachusetts Association of Conservation Commissions Third Annual Conference: Wetland Buffer Zones, March 1996 (*Guest Lecturer*)

16th Annual Conference of the Society of Wetland Scientists: Wetland Understanding, Wetland Education, May 1995 (*Presenter*)

Quinnipiac River Watershed Association Forum on Non-Point Pollution: Significance of Wetlands and Wetland Buffers, October 1992 (*Guest Lecturer*)

The Massachusetts Association of Conservation Commissions Second Annual Conference, April 1995 (*Guest Lecturer*)

The Society of Soil Scientists of Southern New England Riparian Buffer Zone Conference, November 1994 (*Presenter*)

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

SUPPLEMENTARY INFORMATION:

1996 to present

Rema Ecological Services, LLC
Principal Environmental Scientist/Ecologist, Co-Owner

- Founded the company to provide natural resources management, environmental planning, compliance and permitting services, and client advocacy throughout the Northeast.
- Has participated in nearly 2,000 individual projects since the company's inception, including six gas-fired, combined-cycle power plant projects, numerous municipal projects, including over 20 new schools, several higher education projects, numerous wetland replacement projects, several new golf courses, and many large residential, industrial and commercial endeavors.
- Was the Interim Environmental Planner for the Town of Waterford, Connecticut, during a ten-month tenure. Responsibilities included providing procedural and technical support to the town's Conservation Commission (a.k.a. Inland Wetlands and Watercourses Agency), and working closely with Planning Department staff.

1994 to 1996

Fugro East, Inc. *(Currently AECOM)*
Senior Project Manager/Environmental Scientist

- Office Manager for the firm's Connecticut office, responsible for day-to-day operations, marketing, and business development.
- Wetland delineations in accordance with state and federal criteria.
- Natural resource inventories of upland, wetland and aquatic ecosystems, specializing in wildlife habitat assessments.
- Preparation of environmental compliance documentation for over 100 projects including large-scale commercial development.

1993 to 1994

A.D. Marble & Company, Inc.
Senior Environmental Planner/Wildlife Biologist

- Participated in the management of major transportation improvement projects and in the preparation of environmental documents in accordance with the National Environmental Policy Act (NEPA) while continuing involvement in the collection of baseline field data.
- Application of the Pennsylvania Department of Environmental Resources (PADER) hierarchical methodology for the selection of suitable wetland replacement sites.
- Field verification of Threatened, Endangered or Special Concern species listed by the Pennsylvania Game Commission.
- Wetland boundary identification in accordance with the unified PADER and U.S. Army Corps of Engineers (USACOE) methodology.
- Participated in nearly 30 projects, mostly for major transportation corridors, such as the rehabilitation of the I-95 corridor in PA.

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

SUPPLEMENTARY INFORMATION *(continued):*

1989 to 1993

Soil Science & Environmental Services, Inc.
Wildlife Biologist-Ecologist & Soil Scientist

- Project Manager responsible for field operations and report preparation for nearly 300 individual projects in over 75 towns in New England, including one town-wide wetland mapping, inventory and evaluation project (Town of Cromwell).
- Wetland boundary delineation according to state and federal criteria (e.g., Connecticut and Massachusetts Statutes, U.S. Army Corps of Engineers methodologies).
- Ecosystem analyses and biological inventories of upland areas, tidal and inland wetlands, estuaries, streams, rivers, ponds and lakes.
- Environmental impact evaluations, including site plan review, analyses of proposed impacts and design of mitigation strategies.
- Local, state and federal permitting for impacts to natural resources, including wetlands.
- Implementation of water quality monitoring programs for streams and rivers.
- Design, construction supervision, and monitoring of wetland enhancement, restoration and creation.
- Aquatic biosurveys of streams and rivers utilizing standardized methods (e.g. EPA Rapid Bioassessment Protocols).
- Detailed faunal surveys and censuses using both active and passive methods (e.g. direct and indirect observation, live-trapping, point count avian censuses, pellet counts, etc.).
- Expert witness testimony for court and administrative proceedings.

1988 to 1989

Independent Contracts
Soil & Wetland Scientist

- *Summer of 1988*: Was hired by the Town of Canton, CT to identify, inventory, and evaluate wetlands and watercourses within the entire municipality. Was responsible for amending the municipality's *Official Wetland and Watercourses Map*.
- *Spring of 1988*: Was hired by the Connecticut Chapter of the Nature Conservancy to determine and report on the historic expansion of invasive plants (*Phragmites australis*, *Lythrum salicaria*) on eight TWC preserves. Scope included site visits, remote sensing using archived aerial photographs, and report.

TECHNICAL REPORTS:

Mr. Logan has completed several hundred comprehensive studies (e.g. Wetlands Assessments, Ecological Evaluations, Environmental Impact Analyses/Statements, Vernal Pool Investigations, Listed-Species Surveys & Management Plans, aquatic vegetation surveys, and a variety of other specialized studies. A representative list of these technical reports can be provided upon request.

EXHIBIT 2

● 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

September 8, 2017

Mr. Alan M. Kosloff, Esq.
Alter & Pearson, LLC
701 Hebron Avenue
P.O. Box 1530
Glastonbury, CT 06033

RE: REVIEW OF PETITION FOR DECLARATORY RULING – (NO. 1313)
Tobacco Valley Solar – DWW Solar II, LLC
Simsbury, CT

REMA Job No.: 17-2006-SIM42

Dear Attorney Kosloff:

At your request, REMA Ecological Services, LLC (REMA) has reviewed the above-referenced petition for the proposed construction, maintenance and operation of a 26.4 MW AC solar photovoltaic electric generating facility on approximately 289 acres, in Simsbury, CT.

As part of our review we made ourselves familiar with all of the documents and attachments found on the Connecticut Siting Council's website, to date (i.e. 8/31/17). Additionally, we reviewed a variety of secondary-source data such as archived aerial photographs, and available natural resource GIS mapping (e.g., CT Environmental Conditions Online).

Following we will summarize our findings, focusing on:

1. What is missing or lacking in the submitted petition in regards to the description and inventory of the site's natural resources, with a particular emphasis on terrestrial habitats and ecology;

2. What is missing in the submitted petition in regards to the analysis of potential impacts to habitats and wildlife species, including "listed-species" (i.e. endangered, threatened, special concern);

3. What is missing from the submitted petition in regards to mitigation and the off-set of adverse impacts to the site's ecological resources; and,

4. What, in our opinion, are unsubstantiated or misleading claims in regards to long-term ecological and species impacts.

Overall, we find that while the petitioner has provided a substantial body of information, including wildlife evaluations and descriptions and inventories of regulated wetlands and watercourses, there remain gaps of study and analysis, particularly of terrestrial habitats and of wildlife, including of "listed-species" (i.e. Endangered, Threatened, and Special Concern).

From our perspective, the petitioner has not properly or adequately taken into account the site's landscape context and its relation to three Class A, perennial watercourse corridors (i.e. Munnisunk, Bisell, and Saxton Brooks), and the Farmington River. Moreover, the petitioner has not fully integrated into the planning process the fact that the site is within a landscape that is a *hot-bed* of "listed" species. Finally, the petition does not fully discuss or analyze the indirect effects of a solar energy facility of this magnitude in regards to habitat loss, habitat fragmentation, and habitat degradation.

We note that we have also reviewed a review letter by the State of Connecticut Council on Environmental Quality (CEQ), dated August 29th, 2017. In this letter CEQ raises several valid concerns regarding the petition, including the "need for a comprehensive environmental review," the "project's potential impacts on wildlife and vegetation," "stormwater management," and "post-construction and post-commissioning inspection and management." In our application review we will touch and/or expand upon most of these concerns.

1.0 ECOLOGICAL INVENTORY

1.1 Upland Vegetative Communities

The primary focus of the petitioner's ecological inventories is upon regulated resources (i.e. wetlands and watercourses), and upon Federally- and State-listed species.

Descriptions of upland habitats are limited to less than two pages of general discussion and description of the major vegetation cover types (e.g. agricultural fields, broad-leaved deciduous forest) in *Section 6.0: Affected Environment* and about one page in *Section 7.0: Environmental Consequences*. There is no formal inventory or specific descriptions of any of the forested areas to be converted for the energy facility. A botanical inventory of the terrestrial habitats, including the very important forest-field ecotones, was not conducted. We will further touch upon this data gap again below.

Past land use history was not documented using readily available archived aerial photographs (e.g., UConn MAGIC site, CT State Library Online). This would have provided valuable insight on the interrelationship of various habitats within the landscape over the past 80 to 90 years.

The roughly 30 acres of forest to be impacted for the proposed solar arrays should have been carefully described and inventoried and their ecological values/functions assessed. The bulk of the forest to be converted is found in three areas: (1) just north of the northernmost agricultural field, associated with the Munnisunk Brook riparian corridor; (2) just north and northeast of the "central" agricultural field, north of Hoskins Road, associated with the Saxton Brook riparian corridor; and (3) east and southeast of the southernmost field, south of Hoskins Road.

Review of the 1934 and 1965 archived aerial photos (CT State Library Online), shows that the bulk (i.e. > 75%) of these areas were in forested cover types in 1934. By 1965 even the remaining roughly 25% had been allowed to revert to forest. It is worth noting that these areas were not put into agriculture, partly because they are characterized by steeper slopes. This is particularly the case in the northernmost forested areas, which contains a small steep-sloped ravine.

What is also notable is the lack of any discussion in the petition documents regarding existing invasive plant species for the entire site, including the forested areas. The location, relative abundance, and types of these species in the various upland habitats, allows for an assessment of potential impacts to the remaining forested habitats, and forest/field ecotones,

in the post-construction phase, which would also inform a mitigation strategy to eradicate, control, and manage for invasive plant species, which is also lacking.

1.2 Wildlife Inventories

As mentioned above, the petitioner has submitted the results of a variety of wildlife-related studies, with an emphasis on "listed species," particularly avians, and amphibians associated with site's four agricultural ponds, with the potential for being breeding habitats for obligate "vernal pool" amphibians.

However, we should note that the avian surveys are problematic, and that a thorough herpetological survey of the site was not conducted. The latter is obvious by the fact that even the most common of snake species, the common garter snake, was not observed (O). When "listed species" are identified as potentially occurring on a site by CT DEEP's Natural Diversity Database (NDDB), they note that *"field surveys of the site should be surveyed by a qualified biologist."* A list of all of the herpetofauna encountered by the qualified biologist is a requirement.

The petitioner opted to not conduct targeted searches for any of the "listed" herpetofauna (i.e. wood turtle, box turtle, eastern hognose snake, and northern leopard frog). The petitioner has stated that surveys are not necessary for the turtles because mitigative measures, which would minimize impacts, are being proposed. The problem with that particular strategy is that we do not know to what extent these turtles, if present, utilize the site, and which portions of the site they use. Both the box turtle and the wood turtle utilize upland wooded areas, particularly those that are associated with wetlands and watercourses, habitats which are present at the subject site (Klemens 1993[1], Ernst and Lovich 2009[2], DeGraaf and Yamasaki 2001[3], Dodd 2001[4], WDNR, 2016[5]).

The present proposal impacts a significant acreage of woodland associated with the site's three perennial streams. Therefore, it is very likely that if the two turtle species utilize the

[1] Klemens, M.W. 1993. Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geological and Natural History Survey of Connecticut. Bulletin No. 112.
[2] Ernst, C.H., and J.E. Lovich. 2009. Turtles of the United States and Canada. 2nd Edition. John Hopkins University Press.
[3] DeGraff, R.M, and M. Yamasaki. 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England.
[4] Dodd, K. 2001. North American box turtles: a natural history. University of Oklahoma Press.
[5] Wisconsin Department of Natural Resources (WDNR). 2016. Wisconsin Wood Turtle (*Glyptemys insculpta*) Status Assessment and Conservation Strategy. PUB NH-935 2016. Wisconsin Deartment of Natural Resources, Madison, Wisconsin, USA.

site, preferred forested habitat for them would be converted to accommodate the solar facility. This would have significant impacts upon turtle populations. Additional inventories and analysis is necessary.

The avian surveys also suffer in their planning and execution. According to the petitioner only one line transect survey was conducted during the breeding season of avians, including the targeted "listed" avians. The March and May[6] surveys do not qualify as "breeding season," since certain avians are still migrating through the region, and breeding and defense of territories is not yet in full swing. During the June 8th, 2017 survey, agricultural activities, including the operation of a tractor, is less than ideal, as many avians will not be observable and/or will not sing and call. Also significant portion of the site were missed during the June 2017 survey. A proper breeding bird survey would have been conducted at least twice during June[7], for the overall avian population, and in the second half of May and again in June, for grassland birds, and cover more or less the same routes.

Another issue is the use of call back surveys for songbirds. This is not the standard procedure, and introduces a variable that will adversely affect survey results. Call back surveys are standard for owls, whip-poor-will, and marsh birds, but not for daytime general breeding bird surveys.

Finally, we note that the list of avian that were observed included American kestrel (*Falco sparverius*). This is listed as a Species of Special Concern by the CT DEEP's NDDB. Yet no discussion is presented of how this species, which utilizes the site's agricultural fields, would be affected by the proposal.

1.3 Entomological Surveys

The CT DEEP identified four invertebrates that potentially use the site, one odonate (Rapids clubtail), two lepidopterans (Spinose flower moth, and Scribbled sallow moth), and one coleopteran (Big sand tiger beetle).

To date we have not seen that a survey of these taxa has been undertaken by a qualified entomologist. While the presence or absence of the larval host plant for the two moths is

[6] The May survey qualifies as a breeding bird survey, but only for grassland bird species, which is supplemented by the June survey. However, a May survey was not conducted for grassland birds in the central or southern agricultural fields. The widely accepted protocol requires both mid- to late-May and June surveys.

[7] The widely accepted breeding avian survey protocol for woodlands and scrub shrub areas is twice in June, separated by at least 7 days.

one of the techniques that can be used, it should not replace specific field surveys during the flight times of these species, which in this case would include the use of nighttime light arrays to attract insects. A robust invertebrate list would be necessary to preclude that these "listed" species, or potentially other "listed" lepidopterans, are not present at the site.

We note that protecting the larval host plants for the two moths, if found, is not a good strategy, as it does allow for proper site planning that would take into account the long-term protection of a population. The appropriate way of planning for the likely presence of these species at the landscape level is to provide substantial areas of preferred habitat as part of the overall plan. For instance, sandy areas, meeting the specific habitat requirements for the Big sand tiger beetle could have been proposed at several locations.

1.4 Botanical Surveys

As mentioned in a previous section, botanical surveys of the site, especially its upland habitats, has not been undertaken. The CT DEEP's NDDB has indicated that four "listed" vascular plants could occur at the site. Two of these (i.e. Starry campion, Dillenius tick-trefoil), can be found in upland or transitional areas, and are not likely to be associated with the site's wetlands and watercourses.

While vegetative inventories of the site's regulated wetland/watercourse resources have been conducted, these are still limited to dominant species, and were conducted during a narrow window of time. Proper botanical surveys should span spring, summer, and fall. While the petitioner has indicated that summer surveys will be conducted this is less than ideal, especially after the submission of the petition, as it does not allow for proper ecological planning should any of these "listed" or other "listed" plant species be observed.

We note, based on our experience in conducting ecological surveys, that on a large site such as this, with a variety of habitats, it would not be at all unusual to come across additional "listed" plant and animal species that were not on the lists provided originally by the NDDB[8]. Therefore, it is important that all of the surveys, including botanical ones, be conducted prior to the final planning for a large project such as the present one.

[8] For example, during a recent ecological inventory on a large site with several documented listed species, we also encountered two additional species: eastern box turtle, and ribbon snake. The latter is likely a Species of Special Concern, which we would expect to be present at the subject site.

1.5 Wetland/Watercourse-Related Discussion

The petitioner's omission of discussion of wildlife functions and impacts thereto, is based on the assumption that the proposed 100 foot setback, in most locations, will adequately protect function, such that a functional assessment is unnecessary. However, such an assumption is not correct for the *wildlife support* function, which is closely correlated to the larger scale landscape setting, per all the established wetland functional methodologies, including the most widely used USACE "*The Highway Methodology: the Descriptive Method,*" first developed in 1995.

One of the rationales for the wildlife support function per the USACE method pertains to the proportion of the wetland boundary located with *a minimum 400 foot* undisturbed buffer. This is because usage by larger wetland-associated predators, such as barred owl, broad-winged hawk, and mink, and the shy, area/disturbance sensitive songbirds, like Louisiana waterthrush, depends on the proximity of substantial open space areas.

Also, predator numbers and diversity in wetlands is expected to decrease because polarized panel surfaces, mistaken for open water[9] by many wetland-dependent avians, and by many aquatic invertebrates, will lower prey numbers, drastically for some species, based on the literature, as will the wildlife support function, and associated human use functions (e.g. recreation and education/scientific) related to enjoyment/study of the fauna in natural areas[10].

Aesthetic value (one of the thirteen functions/values on the USACE list) and also economic considerations for towns and land trusts managing open space areas nearby is also affected by landscape-level impacts, even if wetland buffers are maintained at about 100 feet. Colonization rates by several disfiguring or vile-smelling invasive plant species, have been found to be significantly lower in broad open space areas (e.g. forested buffers >400 feet) such as at several traprock ridge systems (Metacomet Range) in Berlin and Middletown, CT[11].

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[9] This is also referred to as the "lake effect" phenomenon.

[10] Horvarth, G., M. Blaho, A. Egri, G. Kriska, I. Seres, and B. Robertson. 2010. Reducing the maladaptive attractiveness of solar panels to polarotactic insects. Conservation Biology, Volume 24, No. 6, 1644-1653.

[11] In particular, this is true for Asiatic bittersweet, and *Ailanthus altissima* (Tree of Heaven), especially if they are not self-pollinators (personal communication, 2013, Penelope Sharp, CT Botanical Society Board of Directors), main author of *The Trap Rock Ridges of Connecticut: Natural History and Land Uses*, 2013, CTDEEP Geological and Ntural History Survey Publication # 3, and CT College Arboretum

2.0 POTENTIAL IMPACTS

2.1 Ecological & Wildlife Impacts - *Continued*

We have touched upon impacts to terrestrial habitats, forest/field ecotones, and the wildlife species, including "listed" species, which utilize them in previous sections of this review report. These impacts are predominately due to conversion and degradation of forested habitat and forest/field ecotones to accommodate the proposed solar facility.

In their submitted documentation the petitioner has indicated that long-term impacts to ecological resources, including wildlife have been addressed and minimized. Yet we find that this statement cannot be substantiated based on our findings, research, and the above discussion.

For instance, in the petitioner's *Exhibit I – Wildlife Evaluations Technical Memorandum, Potential Impacts of Solar Arrays on Birds*, it states that a literature review by Harrison et al. (2016) *"found relatively little scientific evidence of a direct impact."* We agree with that statement. There is indeed next to no peer-reviewed scientific studies that prove that solar arrays *do not* have a significant direct impact on avian populations. In fact we find this statement in the executive summary of the same publication (Harrison et al. 2016):

> "No peer reviewed experimental scientific evidence exists relating solely to the ecological impacts of solar PV developments."

That should greatly caution us from jumping to a conclusion that solar array developments are ecologically "neutral" or even ecologically "green." In fact, recent studies are emerging[12] showing that utility-scale solar energy facilities are directly impacting avifauna through direct impact with arrays, and through disorientation that leads to increased predation.[13]

Impacts to avifauna as well as other wildlife should have been analyzed by the petitioner in the context of a *comparison* of the existing conditions, with agricultural fields and forest/field ecotones, with those of the proposed conditions with solar array fields and new field/forest ecotones. No substantive discussion along those lines is offered by the

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Bulletin 41. This phenomenon was discussed at the educational open CIPWG meeting in the winter of 2015.

[12] Kagan, R.A., Viner T.C., Trail P.W., and E.O. Espinoza. Avian mortality at solar energy facilities in Southern California. National Fish and Wildlife Forensics Laboratory.

[13] Walston, L.J., K.E. Rollins, K.E. LaGory, and K.P. Smith. 2016. A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States. Renewable Energy 92: 405-414.

petitioner. We will provide such a comparison in a following section, to show that long-term impacts are real and potentially substantial.

The petition shows that "grassland field" will be provided between the fenced solar array fields and the new or existing woods edge. We do not know, however, based on the incomplete avian surveys, whether "listed" grassland avians such as grasshopper sparrow (*Ammodramus savannarum*) or savannah sparrow (*Passerculus sandwichensis*), or others, utilize the overall site, but the potential is at moderate-high. The grassland fields shown on the proposed plans are not of sufficient size, configuration, or location to accommodate the habitat requirements of these "listed" avians, based on the scientific literature, as well as our experience in encountering grassland avians in Connecticut, and elsewhere, for the past 30 years.

2.2 Ecological & Wildlife Impacts – *Movement and Dispersal*

Another category of both localized and landscape-wide impacts upon wildlife, not thoroughly discussed by the petitioner, is the issue of wildlife movement and dispersal, and of habitat connectivity.

Because the solar array fields are enclosed by a 7-foot high chain link fence, passage and dispersal of wildlife will be hampered. Species that move through the landscape from one preferred habitat patch to another, such as box turtle, spotted turtle, and ribbon snake, and others, will not be able to do so due to the prosed fence. While the argument could be made that such species can move around the fence to the other side, exposure to predators will increase as they become disoriented or stranded. Mortality of these and other species will increase as they attempt to move back and forth between habitat patches. In essence the solar array fields will contribute to habitat fragmentation and isolation, and limit gene flow between wildlife populations.

2.3 Water Quality Impacts

Potential impacts to water quality would be associated with erosion and sedimentation, for both the construction and post-construction phases. This would particularly be the case in areas of significant grading *and* clearing activities within forested areas with steeper slopes, where risk of erosion and sedimentation is much higher, also elevated due to downgradient perennial streams. For example, a significant amount of grading is proposed in the wooded section just north of the northernmost agricultural field, just upgradient of Munnisunk Brook and its associated wetlands. According to the plans, 26.1 acres of land will drain to

one small area just above the watercourse. There was a very good reason that agricultural activities have avoided this problematic area with steep slopes and a direct conduit to the riparian corridor via a steep-sloped ravine. Therefore, the risks for water quality degradation of Munnisunk Brook, and to aquatic habitat, are quite high both during construction and thereafter.

We note that in each of the three wooded areas that would be cleared and/or graded, the State GIS (i.e. CT Environmental Conditions Online; CTECO) shows mapping units (i.e. polygons) with the following label:

> "Erosion Susceptibility; Erosion Category: 1; Description: Highly erodible soil and coarse grained erodible surficial materials."

An additional issue, which has not been discussed in the petition, has to do with the potential for residual pesticide mobilization, particularly for those portions of agricultural fields that would be graded and which would runoff towards the site's perennial streams. Once mobilized the soluble fraction of residual pesticides will enter the groundwater regime with a high potential of discharging to the site's perennial streams, and adversely impacting water quality and the aquatic habitat.

Another factor that elevates concerns regarding short-term and long-term water quality issues is the fact that the site area constitutes major portions of the headwaters of each of the three named perennial streams, this particularly being the case for Munnisunk and Saxton Brooks. Water quality impacts in the headwater regions of perennial brooks are more acutely experienced (i.e. "magnified") since there is limited dilution by groundwater discharge and surface flows, as would be the case lower down in the watersheds of these same streams.

3.0 OPEN SPACE PARCEL CONSIDERATIONS

The petitioner did not discuss what the potential impacts would be from this large-scale solar array facility upon protected Open Space parcels that adjoin the subject site. A quick review of Town of Simsbury GIS, and CT DEEP GIS mapping, reveals a minimum of *eight* (8) Open Space parcels, immediately adjacent to the site, with a total area of 98.3 acres. Three of these are sizeable, with a total area of 48.3 acres, and would be situated in close proximity to the proposed solar arrays. It is our professional opinion that the ecological integrity and wildlife utilization of these parcels would be substantially diminished by the proposal. As discussed above, wildlife movement and dispersal will be hampered by the solar array fields.

4.0 AGRICULTURAL VEGETATION & ECOLOGICAL VALUES COMPARED TO PROPOSED CONDITIONS

The petitioner argues that not much is lost with respect to habitats and ecological resources and services because, for the most part, only the existing agricultural fields are being utilized for the solar arrays. The assumption is that row crops and other agricultural activities must not provide good habitat for wildlife, and do not have much ecological value. That is far from being true, particularly for the subject site due to its landscape setting, with riparian corridors, and other significant habitats nearby.

An ecological assessment of the vegetation and habitat values of field areas is called for with any development application being reviewed under CEPA. However, even though all but 30 acres of the active solar farm will be located in field areas, the application virtually ignores the fields, in terms of vegetation inventory and discussion of usage by pollinators, herbivorous insects, and wildlife, especially migrating and predatory avian species, and the canid predators. This is in contrast to the moderately thorough inventory of the wetland resources, though a functional assessment is lacking, as discussed elsewhere. Predators are very important for tick control, because they prevent population spikes of white-footed mouse, the second obligate host of the deer tick (a.k.a. black-legged or Lyme) disease tick.

A balanced field edge ecosystem has been in place at this site since at least the early 1990's, based on review of archived aerial photographs (e.g. Google Earth, UConn MAGIC, CTECO) including some fallow fields. Even in the tobacco-growing era portions of the site had high seed production and robust populations of a variety of small mammals, year-round, as well as high-protein insect food (such as overwintering caterpillar larvae). As with any farm in New England the most meadow food is available in fall, winter, and early spring, when farming operations are dormant.

Unfortunately the proposed solar panels will be minimizing plant growth, and limit the productivity of the base of the food chain, which bodes ill for year round resident sparrows, and a wide range of migrating songbirds in the Spring and Fall seasons[14]. Apparently little light from the east of west will reach under the panels, as they will be arranged in nearly continuous east-west oriented strips.

As discussed above, the scale of the proposed project will greatly reduce the ecological integrity of the forested wetlands as well as the forested uplands, in combination with a diminished food supply from agricultural weeds. This group of flora typically has evolved

[14] The site, with its proximity to the Farmington River corridor, is considered a very important migratory flyway for avians.

a very long blooming and seeding period, so that these weed species could survive under a wide variety of cropping regimens. The plummeting of populations of migrating monarch butterflies has been caused by the reduced food supply of "weed" plants (sources of larval leaf food, and nectar) as agri-business, with broad-scale use of herbicides in the mid-west has increasingly supplanted more old-fashioned farming such as that which appears to be practiced at this site, with many field edges, fallow field patches, and weedy narrow strips between black plastic swaths (which are, in any case, lifted for the fall, winter, and spring seasons).

The *existing* field ecosystem, in the areas where panel arrays are proposed, like most farmland systems, receives full sunlight for most of the day, though there is shading and competition from taller crop plants in the latter part of the summer. It is populated with grass and forb species adapted to flower and set seed early, and they develop and bloom at any time that light is available during the growing season. Weed seeds are also typically very long-lived and heat tolerant, so that they can persist for long periods in the seed bank, either in over-heated surface soil, or buried deep by plowing; this means that many seeds survive at the edges of black plastic strips[15], used for weed control.

Most of the farmland weeds have also evolved to germinate and grow in response to sunlight and/or warm temperatures (typically irrespective of day length). Another adaptation of agricultural weeds is large seed numbers, so as to be able to colonize new suitable areas, as farmers till and practice crop rotation. Finally, farmland weeds of lands that are regularly tilled tend to be large, to allow seedlings that germinate in deep soil, to have sufficient reserves, to grow upward, until they reach the light, and also to allow growth despite temporary shading by an adjacent crop plant. Once light conditions improve agricultural weeds can produce many large seeds quickly, making them a vital food for migratory songbirds, such as the native sparrows and juncos.[16]

By contrast many forest plants bloom at the same time each year, and often for a very brief time. Their blooming is tied to the progress of the seasons, triggered by photoperiod (day length. They too typically germinate in response to heat and light triggers, in gaps, because competition is so acute in the low-light forest environment, that the best strategy for establishment in new locations (or, often, reestablishment, after the above ground plants have been outcompeted by taller plants) is to take advantage of a disturbance that results in temporal variability in light levels. This may be due to tree demise (perhaps due to a bark

[15] We note that based on review of aerial photographs (1991 – 2016), the plastic strips for weed control in row crops are not used throughout all the agricultural fields at the same time.
[16]Fenner, Michael, Seed Ecology, 1985

borer) or tree branch losses in storms, and change in hydrology (e.g. upgradient flooding following road construction or dewatering following utility installation). A major hurricane or a logging operation will also create numerous and often large gaps. Forest plants need to be able to germinate in response to warm soil and light in a new forest gap.

The proposed unchanging (at least year to year) configuration of solar panels will not include temporally variable "gaps" or periods of a few years when sunlight levels are markedly higher. The proposed conditions will not maintain existing summer-long "crops" of associated, annual "weed" species between rows and in fallow patches, just those along forest edges; these will not persist (due to competition by perennials) without active habitat management. The petition does not mention regular soil disturbance to allow agricultural weeds to persist along forest edges. They will likely be supplanted by effective perennial colonizers such as goldenrods (*Solidago* spp.).

Goldenrod is a fine pollen and nectar source in late summer and early fall, and does not cause hay fever, but its seeds are tiny, requiring much search effort for utilization by avian or small mammal foragers. It is a native long-lived post-disturbance dominant. Neither goldenrod nor the increasingly widespread invasive newcomer mugwort (*Artemisia vulgaris*), are sources of abundant nutritious and high-calorie seeds, unlike the suite of annual or short-lived perennial agricultural weeds.

Note that only a few agricultural weeds are native to northeastern North America; none of those that originated in Europe and colonized New England during the colonial period (e.g. dandelion, Queen Anne's Lace and ox-eye daisy) are on the official CT Invasive Plant list. They were usually introduced via dumped ballast from sailing cargo ships, sent back to Europe loaded with heavy raw materials, like white pine ship masts and sassafras for a popular new tea.

A few increasingly widespread annual weeds from Asia, like long-bristled smartweed, are on the list, but should be removed, in the opinion of several experienced botanists in the CT Botanical Society, including Lauren Brown, author of the best known basic field guide to grasses and sedges, and the contributing author of this report section, Sigrun Gadwa[17]. We do not think they belong on the list – in dramatic contrast to mugwort - because they grow mostly in disturbed habitats, and do not disrupt established native ecological communities. Even when they do grow in natural wetlands, they are readily out-shaded by native species.

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and Picket, S.T,A, and P.S. White, 1985,editors, *The Ecology of Natural Disturbance and Patch Dynamics.*

[17] Ms. Gadwa, is a botanist and ecologist, who colaborates with REMA on various projects (her resume is also attached).

Post-construction, wildlife foraging opportunities will *significantly diminish* especially relative to the fallow fields and fallow strips - which, over the past 26 years, have often occupied as much as 40% of the total field area, per the aerial photo record. The proposed narrow gaps between panels may well become year-round ecological deserts of mugwort (*Artemisia vulgaris*), in contrast to the summer gaps between black plastic panels, which produce wholesome vegetables such as squash (themselves used by pollinators), with enough weeds, in combination, to sustain diverse populations of longstanding agricultural weeds and farm-associated insects, that support rural wildlife.

Light reaching under the panels will be very limited, especially due to the lack of gaps on the east and west sides, likely not enough to trigger germination of species such as evening primroses (*Oenotheras*), field mallows, veronicas, chickweeds, or the ecologically highly important *Digitarias* (crabgrasses) and *Setarias* (foxtail grasses). They need regularly disturbed soil to persist, as seedlings do not persist in healthy, relatively thick turf.

Beneath the panels, even near the edges, it is unlikely that there will be significant numbers of composite field plants such as daisies, dandelions, summer daisies (*Erigero*n), thistles (*Circium* and *Sonchus* spp.) goldenrods, and Joe Pye weeds and boneset (*Eupatorium sp*p.). The last group is found in damp spots in fields, often not jurisdictional wetland due to soil disturbance by plowing.

Some perennial composites (e.g. rough stem goldenrod and Joe Pye) may form long-lived clones, but even these are heavy seed producers and continue to occupy temporally variable farmland sites, by recolonizing new areas often, persisting as a short-lived, fast-reproducing perennial, that becomes established in bare soil patches. Ecologically valuable meadow plants that are potentially perennial, and could persist in a meadow managed by mowing once every few years, with mowing timing geared to the species' bloom and seeding times; however the application has no mention of a careful, ecologically timed mowing regimen. In fact, there is very little if anything in the petition with regards to future ecologically sensitive vegetation management. Just a statement that grasses and legume will be maintained through annual mowing.

Note that the diversity of any hayfield - or the proposed long-term grass and legume/dominated strips - will continue to diminish as the years pass, unless bare soil areas open up in them. These "weedy" composite wildflowers are likely common on this site (though the reviewers are not sure as the field habitats were not characterized). Based on many years of experience, we know that they are common in agricultural landscapes throughout Connecticut; they are all important pollen and nectar sources, for a wide variety of pollinators, especially those with crop rotation practices. Note that they may be lacking

in some mid-western-type agribusiness landscapes dependent on glyphosate herbicides and "Round-up ready" GMO crops), but even old fashioned, non-organic tobacco farms, support many ecologically valuable "weed" species along field edges. Seeds of most species in the aster family (a.k.a. sunflower or composite family) are quite small (though there are a few exceptions such as *Erechtites hieracifolia*) but they are an important food for a few specialized bird species, such as gold finches, and also for diverse tiny seed weevils.

Long-lived, shade tolerant forest species, such as the forest goldenrods and asters (e.g. *Solidago arguta*, *Solidago caesia*, and *Symphiotricum cordifolium*) could perhaps survive in the strips between panels, but they will not be present in the seed bank. Connecticut is highly backward, when it comes to collecting seed of native forest plants for restoration use, such that even if the applicant decided to plant these strips with native forest plants, and soil microbes would also not be suitable, it would not be feasible, in our opinion, without considerable institutional changes in the Connecticut nursery industry.

The effects of *shading* of the ground by the solar panels, in addition to the proposed cultural practices (e.g. mowing), will contribute to the paucity of agricultural weeds and other meadow species, severely limiting biodiversity and the production of foraging sources for wildlife, especially avians during migration, and for overwintering species.

Emerging studies are showing that panels have a number of impacts on microclimate. One study (Armstrong et al. 2016)[18], has shown that from spring to fall, soil under solar panels was up to 5.2 degrees Celsius cooler, on average, than soils in control plots. Lower soil temperatures are likely to affect soil-plant processes, such as productivity and decomposition. The same study found additional microclimate impacts under panels, including less moisture, which leads to less transpiration due to lower photosynthesis rates.

5.0 CONCLUSION

It is our professional opinion that the proposal as presented in the petition has many gaps and omissions in survey and analysis. It is not ready for "prime" time, and has not been planned and configured in a way that minimizes impacts to aquatic and terrestrial ecology and wildlife species, including "CT-listed" species. We are of the opinion that as presented there is a reasonable high likelihood of unreasonable degradation of natural resources, including habitat and wildlife species. Finally, in our professional opinion there exist

[18] Armostrong, A., N.J. Ostle, and J. Whitaker. 2016. Solar park microclimate and vegetation management effects on grassland carbon cycling. Environ. Res. Lett. 11(2016) 074016.

alternatives to the extent, configuration, and layout of such a facility at the subject site, which would have a lesser impact to the local and regional ecology. However, such alternatives could only be formulated after all of the issues, surveys, and inventories discussed herein have been researched, completed, and analyzed.

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

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

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

VIA E-MAIL

Attachments: Professional Resumes (George T. Logan, Sigrun N. Gadwa)

PROFESSIONAL RESUME

George T. Logan, MS, PWS, CSE

Principal Environmental Scientist/Senior Ecologist

EDUCATION:

M.S. Natural Resources, *Wildlife Management & Conservation Biology*, University of Rhode Island, Kingston, R.I., 1989.

B.S. Natural Resources, *Wildlife Management & Wetlands Ecology*, University of Rhode Island, Kingston, R.I., 1986.

Continuing Education

The Transportation Project Development Process: Training in the PennDOT Environmental Impact Statement Handbook, Harrisburg, PA, January 1994

Rapid Bioassessment Protocols of Aquatic Systems (EPA Protocols), Wetland Training Institute, Williamsport, PA, August 3-6, 1993

CERTIFICICATIONS: ***(current)***

Certified Senior Ecologist *(2005, 2014)* - Ecological Society of America

Certified Professional Wetland Scientist (No. 581) *(1994)* - Society of Wetland Scientists

Registered Soil Scientist *(1989)* - Society of Soil Scientists of Southern New England

Certified Associate Wildlife Biologist *(1989)* – The Wildlife Society

EXPERIENCE:

Mr. Logan is the Co-Owner and *Principal Environmental Scientist* and *Senior Ecologist* for Rema Ecological Services, LLC. He specializes in tidal and inland wetland delineations and evaluation, permitting, wetland mitigation design, implementation and monitoring, and the preparation of environmental compliance documents in accordance with national (NEPA), state (e.g., CEPA, MEPA), and local criteria and guidelines. He also provides design, construction supervision and implementation for a wide variety of habitat restoration and enhancement projects. Mr. Logan performs watershed-wide and surface water quality evaluations and provides guidance in the design of stormwater Best Management Practices (BMPs), including stormwater wetlands and bioretention basins, as well as for LID (low impact development) practices.

Mr. Logan has over 29 years of experience as a wildlife biologist/ecologist conducting wildlife habitat evaluations and focused avian, mammalian, invertebrate, and herpetofaunal surveys using both active and passive methods. He frequently conducts targeted surveys for sensitive, rare, and "listed" species (i.e. endangered, threatened, special concern), and aquatic biosurveys to assess the biodiversity and biotic health of ponds, lakes, vernal pools, rivers, and streams. Mr. Logan has extensive experience in performing herpetological surveys, including over 230 vernal pool investigations and evaluations.

Mr. Logan has participated in over 2,400 individual projects in New England and the Mid-Atlantic States and in 159 of 169 municipalities in Connecticut.

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

PROFESSIONAL AFFILIATIONS:

Society of Soil Scientists of Southern New England
Society of Wetland Scientists
Association of Massachusetts Wetland Scientists
Ecological Society of America
The American Birding Association
The Wildlife Society
Soil & Water Conservation Society
Connecticut Association of Wetland Scientists (CAWS) *(Past-President, Charter member)*

PUBLICATIONS: ***(selected)***

Logan, G.T. & S.N. Gadwa. 1999. Quinnipiac River Watershed Association Stream Study. Water Quality in the Quinnipiac River. Proceedings of a Symposium on the Impact of Nonpoint Source Pollution in the Quinnipiac River Watershed, pp. 66-70.

Logan, G.T. & S.N. Gadwa. 1998. Stream Biosurveys: *A Primer.* Quinnipiac River Watershed Association Educational Series for the Adopt-the-River Programs.

Pawlak, E.M. & G.T. Logan. 1996. Town of Cromwell Wetland Evaluation Project. Connecticut Association of Conservation and Inland Wetlands Commissions. The Habitat, Vol. 10:1

Logan, G.T., F.B. Titlow & D.G. Schall. 1995. The Scientific Basis for Protecting Buffer Zones. Proceedings of the 16th Annual Meeting of the Society of Wetland Scientists.

Pawlak, E.M. & G.T. Logan. 1995. Town of Cromwell Wetland Buffer Zone Designation Methodology. Proceedings of the 16th Annual Meeting of the Society of Wetland Scientists.

Logan, G.T., J.H. Brown, Jr., T.P. Husband & M.C. Nicholson. 1994. Conservation Biology of the Cretan Agrimi (*Capra aegagrus cretensis*). Biologia Gallo-Hellenica, Vol. 21, pp. 51-57.

Nicholson, M.C., T.P. Husband, J.H. Brown, Jr. and G.T. Logan. 1994. Implications of behavior on the management of the Cretan Agrimi (*Capra aegagrus cretensis*). Biologia Gallo-Hellenica, Vol. 21, pp. 45-50.

WORKSHOPS & CONFERENCES: ***(selected)***

Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. Corps Training Workshop. May 2011. *(sponsor, participant)*

Vernal Pools: *The Jewels of the Forest.* Technical Workshop for the Town of Southwick Conservation Commission. January 2005. *(Guest Lecturer)*

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

WORKSHOPS & CONFERENCES: ***(selected)***

The Importance of Habitat Edges. Riverside Landscaping Conference. The Rivers Alliance of Connecticut. June 1998. (*Guest Lecturer*)

Riparian Buffer Function, Performance & Limitations. Urban Riparian Buffers Conference & Technical Training Session. April 1999. *(Guest Lecturer)*

Sedimentation and Erosion Control Review Session. USDA. Natural Resource Conservation Service and CPESC (Certified Professionals in Erosion Control), Concord, NH. September 2001.

Buffer Strips as Storm Water Quality Controls. EnviroExpo, Boston. May 1999. *(Guest Speaker)*

Identifying Wetland Soils, Fauna and Flora. Municipal Inland Wetland Staff Technical Workshops. June 1999. *(Guest Speaker)*

Water Quality in the Quinnipiac River: A Symposium on the Impact of Non Point Source Pollution in the Quinnipiac River Watershed. November 1998. *(Presenter)*

Our Hidden Wetlands: Vernal Pools in Connecticut. Co-sponsored by CT DEP and the Center for Coastal and Watershed Systems. November 1997 and January 1998 *(Workshop Leader)*

Aquatic Invertebrate & Stream Ecology Workshop. Quinnipiac River Watershed Association Workshop Series. September 1997, May 1998, June 1999, January 2000 (*Workshop Leader*)

The Massachusetts Association of Conservation Commissions Third Annual Conference: Wetland Buffer Zones, March 1996 (*Guest Lecturer*)

16th Annual Conference of the Society of Wetland Scientists: Wetland Understanding, Wetland Education, May 1995 (*Presenter*)

Quinnipiac River Watershed Association Forum on Non-Point Pollution: Significance of Wetlands and Wetland Buffers, October 1992 (*Guest Lecturer*)

The Massachusetts Association of Conservation Commissions Second Annual Conference, April 1995 (*Guest Lecturer*)

The Society of Soil Scientists of Southern New England Riparian Buffer Zone Conference, November 1994 (*Presenter*)

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

SUPPLEMENTARY INFORMATION:

1996 to present

Rema Ecological Services, LLC
Principal Environmental Scientist/Ecologist, Co-Owner

- Founded the company to provide natural resources management, environmental planning, compliance and permitting services, and client advocacy throughout the Northeast.
- Has participated in nearly 2,000 individual projects since the company's inception, including six gas-fired, combined-cycle power plant projects, numerous municipal projects, including over 20 new schools, several higher education projects, numerous wetland replacement projects, several new golf courses, and many large residential, industrial and commercial endeavors.
- Was the Interim Environmental Planner for the Town of Waterford, Connecticut, during a ten-month tenure. Responsibilities included providing procedural and technical support to the town's Conservation Commission (a.k.a. Inland Wetlands and Watercourses Agency), and working closely with Planning Department staff.

1994 to 1996

Fugro East, Inc. *(Currently AECOM)*
Senior Project Manager/Environmental Scientist

- Office Manager for the firm's Connecticut office, responsible for day-to-day operations, marketing, and business development.
- Wetland delineations in accordance with state and federal criteria.
- Natural resource inventories of upland, wetland and aquatic ecosystems, specializing in wildlife habitat assessments.
- Preparation of environmental compliance documentation for over 100 projects including large-scale commercial development.

1993 to 1994

A.D. Marble & Company, Inc.
Senior Environmental Planner/Wildlife Biologist

- Participated in the management of major transportation improvement projects and in the preparation of environmental documents in accordance with the National Environmental Policy Act (NEPA) while continuing involvement in the collection of baseline field data.
- Application of the Pennsylvania Department of Environmental Resources (PADER) hierarchical methodology for the selection of suitable wetland replacement sites.
- Field verification of Threatened, Endangered or Special Concern species listed by the Pennsylvania Game Commission.
- Wetland boundary identification in accordance with the unified PADER and U.S. Army Corps of Engineers (USACOE) methodology.
- Participated in nearly 30 projects, mostly for major transportation corridors, such as the rehabilitation of the I-95 corridor in PA.

Professional Resume: *(continued)*

George T. Logan, MS, PWS, CSE

SUPPLEMENTARY INFORMATION *(continued):*

1989 to 1993

Soil Science & Environmental Services, Inc.
Wildlife Biologist-Ecologist & Soil Scientist

- Project Manager responsible for field operations and report preparation for nearly 300 individual projects in over 75 towns in New England, including one town-wide wetland mapping, inventory and evaluation project (Town of Cromwell).
- Wetland boundary delineation according to state and federal criteria (e.g., Connecticut and Massachusetts Statutes, U.S. Army Corps of Engineers methodologies).
- Ecosystem analyses and biological inventories of upland areas, tidal and inland wetlands, estuaries, streams, rivers, ponds and lakes.
- Environmental impact evaluations, including site plan review, analyses of proposed impacts and design of mitigation strategies.
- Local, state and federal permitting for impacts to natural resources, including wetlands.
- Implementation of water quality monitoring programs for streams and rivers.
- Design, construction supervision, and monitoring of wetland enhancement, restoration and creation.
- Aquatic biosurveys of streams and rivers utilizing standardized methods (e.g. EPA Rapid Bioassessment Protocols).
- Detailed faunal surveys and censuses using both active and passive methods (e.g. direct and indirect observation, live-trapping, point count avian censuses, pellet counts, etc.).
- Expert witness testimony for court and administrative proceedings.

1988 to 1989

Independent Contracts
Soil & Wetland Scientist

- *Summer of 1988*: Was hired by the Town of Canton, CT to identify, inventory, and evaluate wetlands and watercourses within the entire municipality. Was responsible for amending the municipality's *Official Wetland and Watercourses Map*.
- *Spring of 1988*: Was hired by the Connecticut Chapter of the Nature Conservancy to determine and report on the historic expansion of invasive plants (*Phragmites australis*, *Lythrum salicaria*) on eight TWC preserves. Scope included site visits, remote sensing using archived aerial photographs, and report.

TECHNICAL REPORTS:

Mr. Logan has completed several hundred comprehensive studies (e.g. Wetlands Assessments, Ecological Evaluations, Environmental Impact Analyses/Statements, Vernal Pool Investigations, Listed-Species Surveys & Management Plans, aquatic vegetation surveys, and a variety of other specialized studies. A representative list of these technical reports can be provided upon request.

PROFESSIONAL RESUME

Sigrun N. Gadwa, MS, PWS

Principal Ecologist/Wetland Scientist

EDUCATION:

M.S., Plant Ecology, Natural Resources, University of Connecticut, Storrs, CT, 1997.

B.A., Biology, Brown University, Providence, R.I., 1975.

Continuing Education

16 credit hours in Soil Science and Geology, 1993 – 2001
University of Connecticut, Storrs
Graduate course in Phycology, Pan American University, Brownsville, Texas, 1982
Arboriculture course, Quinnipiac College, Hamden, CT, 1984
Five Plant Pathology courses, Cook College, Rutgers University, New Brunswick, N. J. 1978 - 1979
Series of CT DEEP training workshops: Rapid Bioassessment Techniques, & Stream Ecology Training Workshops. Bethany Laboratory & Field Sites. 1996 and 1997.
Freshwater Mussel Workshop. New Hampshire Department of Environmental Conservation. August 2004.

CERTIFICICATIONS:

Registered Soil Scientist,
Society of Soil Scientists of Southern New England
Certified Professional Wetland Scientist
Society of Wetland Scientists

EXPERIENCE:

Ms. Gadwa has over 28 years of experience in site plan reviews and wetland permitting, wetland functional assessment, and impact analyses. As an ecologist, Ms. Gadwa specializes in the assessment, monitoring, and delineation of wetlands and water resources, in botanical and habitat inventories of ecological communities, in assessment and control of invasive plant species, and searches and assessment of listed plant and turtle populations. Ms. Gadwa is experienced with water quality testing and data analysis, preparation of mitigation plans and habitat restoration/management plans, open space acquisition planning, highway alternatives analyses, and delineation of jurisdictional wetland boundaries (CT and U.S. Army Corps of Engineers). Mr. Gadwa specialties in stream bio-assessments, vernal pools studies, listed turtle surveys, wetland mitigation design, and sedges. Ms. Gadwa has participated in over 1,600 projects in Southern New England and in New York State.

Professional Resume: *(continued)*

Sigrun N. Gadwa, MS, PWS

EMPLOYMENT HISTORY:

1999 to present	**Carya Ecological Services, LLC**, **Principal,** *subcontractor* to **Rema Ecological Services**, LLC, Manchester, CT, an environmental science collaborative; Ecological fieldwork, planning, and reporting, as described above;
2013 to present	**K & W Construction,** Southbury, CT, *subcontractor* Erosion & Sediment Control Inspections, Turbidity testing for CTDEEP
2014 to present	**South Central CT Regional Water Authority**, New Haven, CT Responsible for long term vegetation monitoring each fall, and reporting for compliance with CTDEEP Wellfield Diversion Permit.
2015 to present	**Post University, Waterbury Campus** Adjunct Botany Professor. Teach a four credit class every other fall.
2001 to 2004	**CTDEEP Wildlife Division,** *subcontractor* Vegetation and wetland inventories & mapping of large Wildlife Management Areas (WMAs).
2003 to May 2016	**Ships' Hole Farm Partnership,** Smithtown, Long Island, NY Responsible for vegetation management & invasive control; growing seed and nursery stock of native species on family farm.
1995 to 2000	**Quinnipiac River Watershed Association Meriden, CT** Executive Director/Staff Scientist Led a volunteer monitoring program, including stream bio-assessments, turbidity testing, and bird/wildlife surveys; site plan reviews of projects impacting the watershed; wrote testimony, grants, publicity, and educational materials; liaison with officials. Chair of Habitat Work Group of the **Watershed Partnership**, which identified and documented Quinnipiac watershed habitats in need of protection or restoration until 2003. Continue as advisor/coordinator for turtle monitoring program.
1991 to 1995	**De Leuw-Cather, Inc.,** East Haven, CT Environmental Planner/Field Ecologist Field data collection, analysis, and report preparation, primarily for large highway projects; specialties included listed plant searches, wetland functional assessments, mitigation design, vegetation monitoring, & wetland delineation (ACOE method).

Professional Resume: *(continued)*

Sigrun N. Gadwa, MS, PWS

EMPLOYMENT HISTORY:
(continued)

1987 to 1991	**Univ. of Connecticut Department of Civil Engineering,** Storrs, CT Wetlands Researcher Part of an interdisciplinary team, studying man-made replication wetlands and natural reference wetlands. Took part in research design; collected vegetation, soils, & hydrologic data; literature searches; data analysis. Research used for wetlands mitigation-related manual for the Connecticut Department of Transportation and for master's thesis.
1974 to 1975	**Brown University,** Providence, RI Teaching Assistant, Plant Systematics
1968 to 1975	**Long Island Nature Conservancy,** Stewardship Volunteer Nature trail development & maintenance, botanical inventories, wrote preserve descriptions & self-guided nature trail brochures.
	Other clients have included Groton Open Space Association, Cardinal Engineering, Berlin Land Trust, Joshua's Trust, and Catherine Pratt.

PROFESSIONAL AFFILIATIONS:

Connecticut Botanical Society (Board of Directors)
Connecticut Invasive Plant Working Group (CIPWG)
Connecticut Association of Wetland Scientists
Society of Soil Scientists of Southern New England
Connecticut Ornithological Society
Ecological Society of America
New England Wildflower Society (PCV Program)

PUBLICATIONS:

Lefor, M.W. Barklay, J.S. Cooke, R.S. Craig, S.N. Gadwa, T.S. Murray, April 1990. *Annotated Bibliography for Wetland Mitigation.*

August 1990. *Patterns of Herb Layer Species Association.* In Lefor, M.W. et al *Wetland Mitigation: Interim Report* No. CT-RD-JHR-90-8, TheTransportation Institute, Storrs, Conn. 97 pp.

1994. *Forests.* In Chesanow et al. *Trails.* The Cheshire Land Trust and the Cheshire Environment Commission, Cheshire, CT 96 pp.

May 1995. *Wetland Mitigation: Botany.* Volume 1 of 6. Lefor, M.W. and S.N. Gadwa. Report No. JR95-241. Dept. Civil Engineering, Joint Highway Research Council, Transportation Institute, Storrs, Conn. 259 pp.

Professional Resume: *(continued)*

Sigrun N. Gadwa, MS, PWS

PUBLICATIONS:

December 1997. *Plant Colonization Processes and Patterns along Shorelines of Man-made Mitigation Basins in Relation to Reproductive and Life History Traits.* MS Thesis. Dept. Ecology & Evolutionary Biology. Univ. of Connecticut, Storrs, CT. 181 pp.

River Resources Education Series, Quinnipiac River Watershed Association, Meriden, CT. May 1995 *New Haven Oysters;* June 1996 *What Good are Streamside Woods;* August 1996 *Taking a Close Look at Streamside Woods;* June 1997 *Foraging in the Quinnipiac Estuary;* March 1998 *Stream Biosurveys* (G.T. Logan & S. Gadwa) ; Sept. 2000 *Muddy Waters*

1999. Logan, G.T. & S.N. Gadwa. *Quinnipiac River Watershed Association Stream Study.* Water Quality in the Quinnipiac River. Proceedings of a Symposium on the Impact of Nonpoint Source Pollution in the Quinnipiac River Watershed, pp. 66-70.

October 2000. *A Report on the Water Quality of the Quinnipiac River.* M. Tyrell, C. Cappannari, D. Galt, S. Gadwa, L. MacMillan, R. Walters. Report to the Steering Committee of the Quinnipiac River Watershed Partnership. Q.R.W.P. Water Quality Workgroup, New Haven, CT. 19 pp.

Winter 2003. *Management of Invasive Plants: On-Site Open Space Management.* The Habitat 15(2):3-4 Connecticut Association of Conservation and Inland Wetland Commissions, Inc.

.

Spring 2003. *Management of Invasive Plants: Protecting Open Space and Wetlands, Tools for Land Use Boards and Town Staff.* The Habitat 15(3):4-5. Connecticut Association of Conservation and Inland Wetland Commissions, Inc.

July 2003. Interpreting Quinnipiac Songbird Surveys: Effects of Landscape Setting on Avian Community Composition. *The Connecticut Warbler*. 23(3):81-114.

June 2004. *Connecticut Turtles of Special Concern.* Quinnipiac River Watershed Association. 4pp. (with Tony Ianello)

Fall 2005. S. N. Gadwa. *Preliminary Assessment of the Habitat & Historic Resources in North Cheshire, West of Route 10 & Recommended Protection Measures.* The Cheshire Land Trust & Habitat Workgroup of the Watershed Partnership.

October 2011 S. N. Gadwa & G.T. Logan. *The Scientific Basis for Wetland & Watercourse Buffer Zones*. 23 pp. White Paper. Rema Ecological Services, LLC.

Professional Resume: *(continued)*

Sigrun N. Gadwa, MS, PWS

WORKSHOPS & CONFERENCES ***(selected)*:**

ESA Mid-Atlantic Chapter Symposium, Blacksburg Virginia
Lessons for Mitigation Design from Shoreline Seedling Colonization Patterns April 12-14. 2012. (*Poster Presentation)*

New England Invasive Plant Summit, Framingham Massachusetts: Wetlands permitting – a potentially powerful tool to control invasive plants. September 19-20. 2003. (*Poster Presentation).*

Sedimentation and Erosion Control Review Session. USDA Natural Resource Conservation Service and CPESC (Certified Professionals in Erosion Control), Concord, NH, September, 2001.

Riparian Buffer Function, Performance & Limitations. Urban Riparian Buffers Conference & Technical Training Session. April 1999.

Environmentally Sensitive Development along the Ten Mile River. Riverside Landscaping Conference. The Rivers Alliance of Connecticut. June 1998. (*Guest Lecturer*)

Water Quality in the Quinnipiac River: A Symposium on the Impact of Non Point Source Pollution in the Quinnipiac River Watershed. November 1998. *(Presenter)*

April 13, 2012 ESA Mid-Atlantic Chapter Symposium, Blacksburg, Virginia. *Lessons for Mitigation Design from Shoreline Seedling Colonization Patterns (Poster presentation)*

CTDEEP Quinnipiac River Watershed Association Workshop Series. September 1997, May 1998, June 1999, January 2000. River Ecology. *Instructor.*

October, 2014. Documenting and Conserving Eastern Box Turtles in Central Connecticut: 19 years of Citizen Monitoring. Berlin Land Trust and Nature Center. Evening Membership Program. (*Guest Lecturer)*

2011 to 2116. For CT Botanical Society, have led two guided botany field trips and/or field botany workshops each year. On CBS Board of Directors, & on Education Committee and Ecology & Conservation Committee (*chair*).

2013 – 2016 Connecticut Invasive Plant Working Group (CIPWG); 1-2 power point programs or posters pertaining to invasive plants each year.

CERTIFICATION

I hereby certify that on this day that the foregoing was delivered by electronic mail in accordance with RCSA §16-50j-12, to all parties and intervenors of record, as follows:

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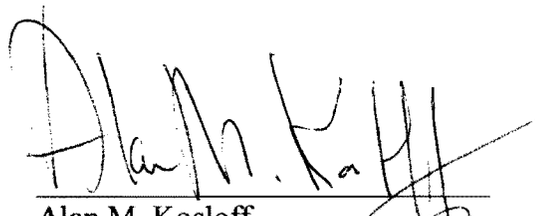

Alan M. Kosloff
Commissioner of the Superior Court
September 9, 2017