STATE OF NEW HAMPSHIRE
SITE EVALUATION COMMITTEE

DOCKET NO. 2019-02

APPLICATION OF CHINOOK SOLAR, LLC FOR A CERTIFICATE OF SITE AND FACILITY FOR THE CHINOOK SOLAR PROJECT IN FITZWILLIAM, NEW HAMPSHIRE

PREFILED DIRECT TESTIMONY OF

MICHAEL LEW-SMITH, JEFF PARSONS, AND DR. D. SCOTT REYNOLDS

ON BEHALF OF
COUNSEL FOR THE PUBLIC

July 8, 2020

<u>Qualifications and Purpose of Testimony</u>

<u>Michael Lew-Smith</u>

Q. Please state your name, position and your employer.

A. My name is Michael Lew-Smith. I am a Senior Botanist, Ecologist, and partner with Arrowwood Environmental, LLC ("AE").

Q. Please summarize your education background and work experience.

A. I hold a Masters in Plant Biology from the University of Minnesota and a B.S. in Natural Resource Management from the University of Michigan. I have conducted wetland delineations, ecological restorations and inventories for rare, threatened, and endangered plants. Much of my work involves the mapping and assessment of natural communities – often for public and private land managers and conservation groups. I am one of the founders of the Vermont Vernal Pool Mapping Project, which mapped and assessed vernal pools across Vermont. See my resume attached as Exhibit A.

Q. Have you testified previously before the New Hampshire Site Evaluation Committee or other regulatory bodies?

A. I have testified before the New Hampshire Site Evaluation Committee on behalf of the Counsel for Public in connection with the Northern Pass Transmission Line, Docket 2015-06. I have testified on numerous occasions before the Vermont Public Service Board for a variety of energy development and electrical transmission projects. I have also provided testimony as an expert witness in Vermont Act 250 Proceedings and in Federal Court.

<u>Jeff Parsons</u>

Q. Please state your name, position and your employer.

A. My name is Jeff Parsons. I am a Senior Wildlife Biologist, Wetland Ecologist, and partner with AE.

Q. Please summarize your education background and work experience.

A I hold a Master of Science in Natural Resource Planning from the University of Vermont and a B.S. in Zoological-Anthropology from the University of Michigan. I have conducted wildlife habitat assessments, wetland delineations and functional assessments, and ecological restorations. Much of my work involves the mapping and assessment of wildlife and wildlife habitat, for both public and private entities. See my resume attached as Exhibit B.

Q. Have you testified previously before the New Hampshire Site Evaluation Committee or other regulatory bodies?

A. I have testified before the New Hampshire Site Evaluation Committee on behalf of the Counsel for Public in connection with the Northern Pass Transmission Line, Docket 2015-06. I have testified on numerous occasions before the Vermont Public Service Board for a variety of energy development and electrical transmission projects. I have also provided testimony as an expert witness in Vermont Act 250 Proceedings and in Federal Court.

Dr. D. Scott Reynolds

Q. Please state your name, position and your employer.

A. My name is Dr. D. Scott Reynolds. I am on the Science Faculty at St. Paul's School in Concord, New Hampshire. In addition to teaching at St. Pauls' School, I am the Managing Partner at North East Ecological Services ("NEES"), an ecological consulting firm.

Q. Please summarize your education background and work experience.

A. I am a population biologist and physiological ecologist with a Ph.D. from Boston University. I am a biologist who has been conducting research on bats since 1993; I am currently a Certified Senior Ecologist with the Ecological Society of America. I am also the past-President of the North East Bat Working Group, a research organization focusing on the ecology and conservation biology of bats in the northeastern United States, as well as Executive Committee Member of the North American Bat Conservation Alliance, a group of bat biologists developing conservation, research, and educational strategies for bat conservation across North America. See my resume attached as Exhibit C.

Q. Have you testified previously before the New Hampshire Site Evaluation Committee or other regulatory bodies?

A. I have testified before the New Hampshire Site Evaluation Committee on behalf of the Counsel for Public in connection with the Northern Pass Transmission Line, Docket 2015-06. I have previously provided testimony and testified as an expert witness for regulatory bodies in Connecticut (Connecticut Siting Council), Maryland (Maryland Public Service Commission), and the providence of Ontario (Environmental Review Tribunal).

Panel Testimony

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to introduce the witnesses testing on this panel, to describe the work we performed on behalf of Counsel for the Public, and to summarize our conclusions regarding the proposed Chinook Solar Project (the "Project") (SEC Docket No. 2019-02) proposed by Chinook Solar, LLC (the "Applicant"). Additionally, our testimony introduces our natural resources reports, which contain the full details of the analysis we performed and the conclusions that we reached.

Q. Please describe the work that you were asked to perform.

A. Counsel for the Public asked AE to conduct an independent and objective analysis of the materials submitted by the Applicant related to impacts on natural resources and to review other materials that were available to us to determine if the Project would have an unreasonable adverse effect on those resources. Our assessment focused on four resource areas: significant wildlife habitat, aquatic resources, natural communities, and rare, threatened and endangered ("RTE") species and associated habitats. AE conducted this review in an objective manner based on our professional expertise and the current scientific literature in these fields. The standards used to assess proposed impacts are based on the Site Evaluation Committee ("SEC") rules and RSA 162-H.

The initial step in the assessment process is to review all of the applicable documents relating to significant wildlife habitats, aquatic resources, natural communities, and RTE species filed with the Application. In addition, we conducted an outreach effort in order to collect information about the resource areas. Outreach was limited to individuals and groups that have information about the resource areas including New Hampshire Department of Environmental Services and New Hampshire Fish and Game. AE participated in Technical Sessions of the Applicants' natural resource witnesses on April 8, 2020. AE also conducted field assessments at the Project site. Field assessments were conducted to familiarize AE with specific areas of the Project and, in some cases, to obtain detailed information about the site conditions and specific resources. AE contracted independent contractor, North East Ecological Services for the assessment of bats.

Q. Is the work you performed contained in reports?

A. Yes. Reports detailing the work we performed and our conclusions are attached hereto as Exhibit D.

Q. What are your conclusions about the Project's effects on deer wintering areas?

A. Deer wintering areas ("DWA") are a "significant wildlife habitat" that is critical to the life cycle of deer in New Hampshire. DWAs have not been adequately mapped within or adjacent to the Project area. Rather, the Applicant concluded, contrary to the Applicant's Forest Composition Report, 2017 aerial photographs, and DWA maps produced by New Hampshire Fish and Game and the University of New Hampshire that there were no DWAs within the Project boundaries. The Applicant's conclusion regarding the lack of DWAs is not supported by any evidence provided by the Applicant. The Applicant has not identified or assessed direct or indirect Project impacts on this significant resource. Therefore, AE concludes that there is insufficient information to adequately assess the nature, extent, and duration of the potential effects, both direct and indirect of the proposed Project on deer overwintering habitat.

Q. What, if anything, could mitigate any adverse impact on deer wintering areas?

A. The Applicant can mitigate for the loss of DWAs by protecting the remaining mature coniferous forest, especially in the north, within the Project parcels but outside of the Project limits of disturbance. Such mitigation would require that the Applicant maintain the existing mature coniferous tree cover to provide adequate cover for over-wintering deer. The Applicant can also lessen indirect impacts to remaining DWAs by restricting Project construction activity from December 15 – March 15, which are times when deer may be utilizing DWAs.

Q. What are your conclusions about the Project's effects on moose

concentration areas?

A. Moose concentration area ("MCA") habitat within the Project area was not investigated within the Project boundaries. Evidence that moose utilize the site was observed at a site visit. However, after analysis of the winter snow depths, consultation with New Hampshire Fish and Game, and site-specific evaluation, it is our opinion that this Project does not contain significant moose wintering habitat and the Project will not have any unreasonable adverse impact on MCAs.

Q. What are your conclusions about the Project's effect on mast stands?

A. The nature and extent of hard mast stand resources, a significant habitat for black bear and other wildlife, have not been adequately identified within the Project area. The Project site is under active forest management resulting in only small remnants of mature forest remaining on the Project site and does not contain significant mast stands. It is our opinion that the Project does not contain bear habitat in the form of significant mast stands and that the Project will not have an unreasonable adverse impact on this resource.

Q. What are your conclusions about the Project's effect on wildlife corridors?

A. The Project incorporates two wildlife corridors to facilitate wildlife movements at the site, which should decrease wildlife habitat fragmentation because of this Project. It is our opinion that the Project does not have an unreasonable adverse impact upon wildlife corridors.

Q. What are your conclusions about the Project's effect on wetlands?

A. Wetlands within the Project area are sufficiently mapped and characterized. The Project has been sited to avoid most direct impacts to wetlands. Wetland impacts have been minimized by locating wetland crossings where the wetlands are the narrowest. However, these crossing do impact 3,021 square feet of wetlands and should be reported as wetland impact. Given the minimal extent of the proposed wetland clearing, it is our opinion that the impacts, as proposed, would not constitute an unreasonable adverse impact to these wetlands.

Q. What are your conclusions about the Project's effect on wetland buffers?

A. Wetland W-CHI-DRB-40 incurs buffer impacts from two roads, which encircle the wetlands to access the southern arrays. After reviewing all information available, AE does not believe two roads are necessary to access these arrays. Therefore, unless one road is removed from the proposed Project layout, it is our opinion that the Applicant has not done a sufficient job avoiding wetland buffer impact to a reasonable extent.

Q. What are your conclusions about the Project's effect on streams?

A. Streams and non-jurisdictional drainages within the Project are sufficiently identified and mapped. The Project has been designed to minimize the number of stream crossings. There are two crossings that have been adequately designed to accommodate aquatic organism passage, anticipated bankfull stream flows, and riparian buffers. It is our opinion that the Project will not have an unreasonable adverse impact on streams.

Q. What are your conclusions about the Project's effect on vernal pools?

A. Vernal pools within the Project area are sufficiently identified and characterized. All direct impacts to vernal pools have been avoided. However, due to pre-construction forest management activities, the upland habitat of these pools has been significantly impacted. Due to these impacts, the proposed impacts from the Project to upland habitat are well-below recommended guidelines for conserving amphibian populations in these pools. Direct impacts to vernal pools from the proposed Project do not constitute an unreasonable adverse impact.

Q. What are your conclusions about the Project's effect on natural communities?

A. Rare and exemplary natural communities within the Project site have not been assessed, evaluated, or mapped. Therefore, we are unable to conclude the Project will not have an unreasonable, adverse impact on this resource.

Q. What are your conclusions about the Project's effect on rare, threatened, and endangered animals?

A. The measures developed by the Applicant appear to address the major issues related to potential Blanding's and Wood turtle impacts at the Project site. However, more specific details must be incorporated as conditions to a Certificate to ensure these measures are effective. These conditions should include specific dates for construction of the barrier fence, protocols for training construction personnel, time limits (post-construction) for removal of the barrier fence and specifications on slope gradients in stormwater basins. If these additional conditions are incorporated into the Project, then our opinion is that the Project will not result in unreasonable adverse impacts to these species.

Q. What are your conclusions about the Project's effect on rare, threatened, and endangered plants?

A. There are no inventories for rare plant species on the Project site. Since no rare plant inventories were conducted, we are unable to conclude the Project will not have an unreasonable adverse impact on rare plant species.

Q. What are your conclusions about the Project's effect on bats, generally?

A. There is insufficient data collected by the Applicant to determine the presence or absence of specific bats within the Project area. However, appropriate measures can be taken to ensure unreasonable adverse effects on bats are avoided.

Q. What are your conclusions about the Project's effect on little brown bats?

A. It is unlikely that this project would contribute to a regional decline of little brown bats, but it is possible that a well-designed conservation and habitat enhancement strategy could enhance the conservation and recovery of the little brown bat.

Q. What are your conclusions about the Project's effect on northern long-eared bats?

A. The Applicant's failure to meet the minimum sampling requirements of the United States Fish and Wildlife Service Guidelines prevents a determination of 'absence' for the northern long-eared bat at the Project site. The Applicant's proposal to conduct tree removal during the non-active season (November – March), and conduct construction activities in accordance with United States Fish and Wildlife Service best management practices, allows our conclusion that the Project is unlikely to have population-level impacts on the northern long-eared bat.

Q. What are your conclusions about the Project's effect on eastern small-footed bats?

A. The absence of appropriate sampling for the eastern small-footed bat, especially given its' known proximity to the Project site, raises concern about the potential impact of construction and blasting impacts on this species. Pre-construction monitoring should be performed prior to any relocation or disturbance to rock features within the Project area to determine if bats are roosting. A blasting monitoring plan to ensure that any construction activities address potential impacts to crevice-roosting small-footed bats must be implemented and a condition of a Certificate. If it is impossible to incorporate a specific blasting plan as a condition of the Certification, a Programmatic Agreement with New Hampshire Fish and Game for the eastern small-footed bat addressing appropriate pre-construction survey methods and requiring agency approval for Blasting and Stone Feature Alternation Plans prior to any implementation of such plans should be a condition of the Certificate. The ultimate Blasting and Stone Feature Alteration Plan needs to be based on site-specific information and should include impact assessment and mitigation, habitation conservation and enhancement for the small-footed bat.

Q. What are your conclusions about the Project's effect on silver-haired bats, eastern red bats, hoary bats, big brown bats and tricolored bats:

A. Our concerns about the quality of the sampling to determine the presence or absence of certain bats is reiterated. However, based upon the data produced by the Applicant, it is unlikely the Project would have population-level impact on the silver-haired bat, eastern red bat, hoary bat, big brown bat and tricolored bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

Based upon information submitted by the Applicant to date, professional expertise, and a field survey of the Project site, in our opinion with the above-caveats and requested

Certificate conditions, the Project will not have an unreasonable adverse effect on the seven species of bats at issue here.

Q. Does this conclude your testimony?

A. Yes.

EXHIBITS

A. Michael Lew-Smith Resume
B. Jeff Parsons Resume
C. Dr. D. Scott Reynolds Resume
D. Reports from Arrowwood Environmental, LLC Experts

Exhibit A

MICHAEL LEW-SMITH

PARTNER —ECOLOGIST — BOTANIST

ARROWWOOD ENVIRONMENTAL

Areas of Expertise

- Rare, Threatened and Endangered Plant Inventories
- Aquatic Plant Inventories
- Wetland Delineation
- Natural Community Mapping and Assessment
- Freshwater Mussel Inventories
- Vernal Pool Mapping and Assessment
- Invasive Species Mapping and Management
- Wetland Restoration
- Rare Plant Transplantation and Monitoring

Education & Professional Training

- M.S., University of Minnesota Department of Plant Biology, 1997
- B.S., University of Michigan School of Natural Resources. Natural Resource Management, 1991
- Freshwater Mussel Identification and Ecology, USFWS Training Center, Shepardstown, WV, 2016
- Reptiles and Amphibians of Vermont, Hogback Community College Vt. Family Forests. Bristol VT, 2011
- Boreal Flora, University of Michigan Biological Station, 1995
- Bryophytes, University of Michigan Biological Station, 1995

Mr. Lew-Smith is an ecologist and principal botanist for Arrowwood Environmental. He has worked closely with conservation organizations, agencies, municipalities, companies, and private individuals on natural resource identification, assessment and management. Mr. Lew-Smith conducts botanical inventories, wetland delineations, wildlife habitat assessments, and ecological restorations. He also has considerable experience mapping and assessing natural communities for private organizations and public land managers and is currently working on an aquatic natural community classification system. Mr. Lew-Smith regularly conducts inventories of aquatic invasive species and rare aquatic plants and works closely with lake associations on aquatic vegetation management plans. Mr. Lew-Smith has also worked throughout Lake Champlain mapping and controlling aquatic invasive species. He is one of the founders of the Vermont Vernal Pool Mapping project, which mapped and assessed vernal pools statewide.

Significant Projects & Experience

- Aquatic Species Mapping and Assessment: Map native and non-native aquatic plants in lakes throughout Vermont and develop plans for the management of aquatic nuisance species. Monitoring potential Asian Clam infestation sites in Lake Champlain.
- Northern Pass: Project Manager and ecologist working for the NH Attorney General's office on providing an independent review of the environmental assessment of the proposed Northern Pass transmission line.
- Wetland Reclassification: Provide technical support and detailed analysis to support Class I reclassification petition for the LaPlatte River Marsh Wetlands.
- Renewable Energy: Project manager and principal ecologist working with project sponsors and engineers of small and large scale solar projects to design layouts that avoid and protect significant natural resources.
- Member of the Floral Advisory Group: Advising the Vermont Endangered Species Committee on matters related to Vermont's Rare, Threatened and Endangered Plants.
- Vernal Pool Mapping: Co-founder of the Vermont Vernal Pool Mapping Project. Developed a vernal pool mapping methodology and a statewide Vernal Pool map and database.

Exhibit B

JEFF PARSONS

PARTNER – WILDLIFE BIOLOGIST – WETLAND ECOLOGIST

Areas of Expertise

- Hydric Soils & Wetland Delineation
- Wetland Function & Value Assessment
- Wildlife & Wildlife Habitat Assessments
- Recreational Impacts on Wildlife
- Lake & Reservoir Ecology and Management
- Pesticide Impact Assessment
- Conservation Biology
- Geographic Information Systems

Education & Professional Training

- M.S. Natural Resources Planning, University of Vermont, 1992
- B.S. Zoological – Anthropology: University of Michigan, 1985
- Wildlife Biology: Michigan State University, 1977-1982
- Vermont Natural Shoreline Erosion Control Certification, 2016
- Wetland Ferns, 2013
- Aquatic Plants of Vermont, 2002
- Sedges of Vermont, 1998
- Lichens of Vermont, 2008
- Mosses of the Northeast, 2007

Mr. Parsons is the principle Wildlife Biologist for Arrowwood Environmental responsible for a wide variety of wildlife studies including: single-species and habitat assessments, wildlife impact assessments, field inventories, wildlife tracking and sign assessments, and grassland and high-elevation avian assessments. Mr. Parsons also conducts wetland delineations, function and value assessments, impact assessments, reclassifications, and mitigative and restoration plans and implementation. Accomplishments also include lake, pond and reservoir ecology and management plans, interpretive trail development, and recreational impacts on wildlife, community natural resource planning and environmental permitting.

Significant Projects & Experience

- Instructor: Vermont Law School: 1997-2003.
  - University of Vermont: 1993-1998.
  - Northern Vermont University: 1994-98, 2016-18.
  - Sterling College: 1992-2017.
- Vermont Pesticide Advisory Council: Health and Environment Representative 1991-2000.
- Interim Vermont Recreation Planner: Vermont Recreation Plan Wetlands Component and summary documents 1988
- Lecturer and Field Leader: Wetland Ecology for Federal District Court Judges (Vermont Law School).
- Black Bear Habitat Assessments: Smugglers' Notch Resort, Stowe Mountain Resort, Jay Peak Resort, Sugarbush Resort, Bromley Mountain.
- Bicknell's Thrush Habitat and Species Monitoring: Smugglers' Notch Resort, Jay Peak Resort, and Sugarbush Resort.
- Primary Ecologist and Project Coordinator: Lake and Pond Assessment and Management for Woodbury, Vt.
- Vermont's Golf Course Pesticide Risk Assessment: Author of Protocol addressing pesticide toxicity, half-life, and chemical mobility.
- Ecologist and Wildlife Biologist: Middlebury Gap and Smugglers' Notch Scenic Highway Management Plans .
- Ecologist and Wildlife Biologist: Inventory and management guidance for natural areas wetlands, and wildlife within the cities of Burlington and South Burlington.
- Lead Investigator: Inventory & Prioritization of wetlands for acquisition by the State of Vermont.

Exhibit C

D. Scott Reynolds, Ph.D.
January 2019

North East Ecological Services, LLC
P.O. Box 3596
Concord, New Hampshire 03302
(603) 545-7012
www.neesbats.org

AREAS OF SPECIALIZATION
- Population Biology
- Conservation Biology
- Project Risk Assessment Analysis
- Wind Power Bat Impact Surveys

EDUCATION and CERTIFICATIONS
Ph.D., 1999. Physiological Ecology of Temperate Bats, Boston University; Boston, Massachusetts
B.Sc., 1991. Biology with Environmental Science minor, McGill University: Montréal, Quebec Canada.
Certified Senior Ecologist. Board of Professional Certification of the Ecological Society of America

EMPLOYMENT

North East Ecological Services:	Managing Partner: 1998 - present
St. Paul's School:	Faculty in the Science Division: 2000 - present
Boston University	Research Fellow, Department of Biology: 2009 - 2014
Allegro MicroSystems, Inc.	Facilities Systems Consultant: 1993 – 1999
	Occupational Health and Safety Coordinator: 1991-1993
	Environmental Compliance Coordinator: 1991-1992

PROFESSIONAL MEMBERSHIPS
American Society of Mammalogists: 1992 – present
North East Bat Working Group: 1996 – present
Sigma Xi: 1997 – present
National Science Teachers Association: 2001 – present
Ecological Society of America: 2004 – present
Wildlife Society: 2006 - present

PROFESSIONAL ACTIVITIES
North American Bat Conservation Alliance, Steering Committee: 2014 - present
North East Bat Working Group, President: 2013 – 2015
Northern Long-Eared Bat Endangered Species Listing Committee: 2013 - 2015

RESEARCH EXPERIENCE (since 2009)
Project Risk Assessment for Bats: (completed date)
New Hampshire Army National Guard (Grafton County, NH): NH Adjutant General: 2019
Strong Breeze Wind Project (Ontario, Canada): Invenergy, Corp: 2017
Northern Pass Transmission Project (NH): Council for the Public, NHDOJ: 2017
New Hampshire Army National Guard (Merrimack County, NH): NH Adjutant General: 2017
Verizon Cell Tower Retrofit Project (Carroll County, NH): McLane Law Firm, LLC: 2015
New Hampshire Army National Guard (Merrimack County, NH): NH Adjutant General: 2015
Greeley Wind Farm (Greeley County, NE): Bluestem Energy Solutions, 2015
Heritage Garden Wind Project (Delta County, MI): Heritage Sustainable Energy, 2014
Four Mile Wind Project (Garrett County, MD): Synergics Energy: 2013
Grande Prairie Wind Project (Knox County, NE): Midwest Energy, LLC: 2012
Port Jersey Wind Project (Hudson County, NJ): Port Authority NYNJ: 2011
Fisherman's Atlantic City Wind Project (Atlantic County, NJ): Fisherman's Energy: 2010
Cape May Wind Project (Cape May County, NJ): US Coast Guard: 2009

RESEARCH EXPERIENCE (since 2009)

Pre- and Post-Construction Bat Inventories and Migratory Surveys: (completed date)

Amherst Island Technical Advisory Committee (Ontario, Canada): Algonquin Liberty Corp: 2019
Greeley Wind Farm (Greeley County, NE): Bluestem Energy Solutions, 2015
Garden Peninsula Wind Project (Delta County, MI): Heritage Wind Energy, 2013
Atlantic City Wind Project (Atlantic County, NJ): Fisherman's Energy, 2012
Maple Ridge Wind Project (Lewis County, NY): Iberdrola Renewables, 2010
Wethersfield Wind Project (Wyoming County, NY): Noble Environmental Power: (2010)
Bear Creek Wind Project (Luzerne County, PA): Babcock & Brown Renewable Holdings, 2009
Hounsfield Wind Project (Jefferson County, NY): Babcock & Brown, 2009
Sweden Wind Project (Potter County, PA): STK Renewable Energy, Inc., 2009

Endangered Species Inventory Surveys

New Hampshire Army National Guard (Grafton County, NH): NH Adjutant General: 2019
New Hampshire Army National Guard (Merrimack County, NH): NH Adjutant General: 2017
Bat Survey of Cape Cod, MA (Barnstable County, MA): US Army Corps of Engineers: 2016
Conservation Land Bat Inventory (Cheshire County, NH): Rindge Conservation Commission, 2016
Jackson Ski Trail Expansion Project (Carroll County, NH): Jackson Ski Touring Foundation: 2015
VTrans US Route 4 Improvement Project (Rutland County, VT): 2015
New Hampshire National Guard Training Institute (Merrimack County, NH): 2014
Mt. Storm Wind Project (Grant County, WV): 2014
New Boston Air Force Station (Merrimack County, NH): 2002, 2006, 2007, 2010, 2011, 2012, 2013)
Dan's Mountain Wind Project (Allegany County, MD): 2013
Four Mile Wind Project (Garrett County, MD): Synergics Renewables, LLC: 2010, 2012

Conservation Biology and Habitat Mitigation

Mt. Auburn Cemetery Bat Survey and Management (Middlesex County, MA): Leslie University, 2017
Critical Maternity Colony Relocation in Cornish (Sullivan County, NH): NH Fish & Game: 2005
Vermont Electric Company Northwest Reliability Project: VELCO: 2004
Population Survey of Hibernating Bats in New Hampshire: NH Fish & Game: 1999

EXPERT WITNESS TESTIMONY

Nation Rise Wind Project: Ontario Environmental Review Tribunal, Torys, LLP: 2018
Fairview Wind Project: Ontario Environmental Review Tribunal, Dale & Lessmann, LLP: 2016
Amherst Island Wind Facility: Ontario Environmental Review Tribunal, Torys, LLP: 2015
Bow Lake Wind Facility: Ontario Environmental Review Tribunal, Torys, LLP: 2014
Ostrander Point Wind Project: Ontario Environmental Review Tribunal, McCarthy Tetrault LLP: 2013
Dufferin Wind Power Project: Ontario Environmental Review Tribunal, Torys, LLP: 2013
Prospect Wind Energy Project: Connecticut Siting Council on behalf of Friends of Prospect., 2011
Liberty Gap Wind Project: West Virginia Public Service Commission, US Wind Force, LLC: 2008
Highland New Wind Project: Virginia State Corporation Commission, Highland New Wind, LLC: 2006
Roth Rock Wind Project: Maryland State Corporation Commission, Synergics Energy, LLC: 2005
East Haven Wind Project: Vermont Public Service Board, EMDC, LLC: 2004

RESEARCH GRANTS

Conserving Northern Long-Eared Bat Habitat in Working Forestlands (NRCS-CIG Grant), 2015
Connecting Disparate Datasets to Generate Population Models (US Fish and Wildlife Service), 2014
Population Survey of the bats of New Boston Air Force Station (US Fish and Wildlife Service), 2012
Transect-based Acoustic Monitoring of a Bat Community (US Fish and Wildlife Service), 2011
New Hampshire Winter Bat Population Surveys (NHFG): 2000, 2005, 2008, 2009, 2010
Maple Ridge Post-Construction Monitoring Project (NYSERDA and NJ Audubon): 2007-2009
New Hampshire Comprehensive Plan for Bats (New Hampshire Department of Fish and Game): 2004
North American Bat Conservation Partnership (Bat Conservation International): 1999, 1998

PROFESSIONAL PRESENTATIONS

The value of long-term research on common species. Lessons learned from the little brown bat. Monadnock Natural History Conference, Keene, NH: 2019.

Integrating multiple survey techniques to document shifting bat communities in the wake of White-nose Syndrome. North East Bat Working Group, Roanoke, VA: 2018

Live longer by living alone and staying active: lower mortality of eastern small-footed myotis from White-nose Syndrome. Northeastern Natural History Conference, Springfield, MA: 2016.

Variables that affect acoustic monitoring. North East Bat Working Group, Baltimore, MD: 2016.

The influence of environmental variables on the demography of *Myotis lucifugus*. North American Symposium on Bat Research, Costa Rica: 2013

The use of mobile platforms to conduct pre-construction acoustic monitoring at off-shore wind project sites. North East Bat Working Group, Albany, New York: 2013

Temporal and spatial patterns of bat activity at a large-scale wind energy facility. North American Symposium on Bat Research, San Juan, Puerto Rico: 2012.

The value of long-term banding for White-Nose Syndrome surveillance and research. White-Nose Syndrome Symposium, Little Rock, Arkansas, 2011.

Re-evaluating the role for banding in the population biology of bats. North American Symposium on Bat Research, Denver, Colorado: 2010.

The hibernating bats of New Hampshire: Are we climbing to the edge of a cliff? North American Symposium on Bat Research, Portland, Oregon: 2009.

The Impact of White-Nose Syndrome on the bats of New Hampshire. White-Nose Syndrome Symposium, Pittsburgh, Pennsylvania: 2009.

The value of long-term mark-recapture data for determining the population dynamics of the little brown myotis *Myotis lucifugus*: North American Symposium on Bat Research, Scranton, Pennsylvania: 2008.

The potential value of pre-construction surveys for predicting bat fatality at wind facilities: North American Symposium on Bat Research, Merida, Mexico: 2007

Monitoring the potential impact of wind development for bats in the Northeast: North East Bat Working Group, East Stroudsburg, Pennsylvania: 2006.

The use of passive acoustic monitoring as a biological assessment tool for surveying migratory patterns of bats in relation to wind power development: Annual Meeting of the International Ecology Society and the Ecological Society of America, Montréal, Quebec Canada: 2005.

Pre-Construction Assessment of Habitat Use by Bats at the Flat Rock Wind Power Facility, New York: North American Symposium on Bat Research, Salt Lake City, Utah: 2004.

Long-Term Life History Analysis in Myotis lucifugus: North American Symposium on Bat Research, Burlington, Vermont: 2002.

Data Management in the Study of Temperate Bats: North East Working Group on Bats, Burlington, Vermont: 2002.

Changes in Body Composition During Reproduction and Postnatal Growth in the Little Brown Bat *Myotis lucifugus*, Using Direct and Indirect Analytical Techniques: North American Symposium on Bat Research, Hot Springs, Arkansas: 1998.

The Validation of Total Body Electrical Conductivity Analysis (TOBEC) to Assess Body Composition in *Myotis lucifugus*. North American Symposium on Bat Research, Bloomington, Illinois: 1998.

The Use of Modular Artificial Roosts in the Conservation and Management of a *Myotis lucifugus* Colony in Central Massachusetts. North American Symposium on Bat Research, Gainesville, Florida: 1996.

OTHER PRESENTATIONS

The Natural History and Conservation of the northern long-eared myotis (*Myotis septentrionalis*). Northeastern Regional Meeting of the American Society of Foresters; Bartlett, NH: January, 2015

Why Bats Hit Wind Turbines? New Hampshire Audubon Environmental Lecture Series: 26 July, 2007

Studying Bats in New Hampshire: *Front Porch* interview series, New Hampshire Public Radio: 08 August, 2002

House-Roosting Bat Research and Issues in New Hampshire: New Hampshire Public Television: 2001

PUBLICATIONS

Reynolds, D.S., K. Shoemaker, S. von Oettingen, S. Nager, J.P. Veilleux, and P. Moosman. 2017. Integrating multiple survey techniques to document a shifting bat community in the wake of White-nose Syndrome. Journal of Wildlife and Fisheries Management, i*n review*.

Reynolds, D.S., K. Shoemaker, S. von Oettingen, and S. Nager. 2017. High Rates of Winter Activity and Arousals in Two New England Bat Species: Implications for a Reduced White-nose Syndrome Impact? Northeastern Naturalist, *in press*.

Reichard, J.D., N.W. Fuller, A.B. Bennett, S.R. Darling, M.S. Moore, K.E. Langwig, E.D. Preston, S. von Oettingen, C. Richardson, and **D.S. Reynolds.** 2014. Interannual survival of *Myotis lucifugus* (Chiroptera: Vespertilionidae) near the epicenter of White-Nose Syndrome. Northeastern Naturalist, *in press*.

Reynolds, D.S. 2012. Multi-year acoustic monitoring of bats at the Maple Ridge Wind Project. Report submitted to New York State Energy Research and Development Authority NYSERDA Grant 10498

Hein, C., E. Arnett, M. Schirmacher, M.M.P. Huso, and **D. S. Reynolds.** 2011. Patterns of pre-construction bat activity at the proposed Hoosac wind facility, Massachusetts, 2006-2007. A final project report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas.

Frick, W.F., J.F. Pollock, A.C. Hicks, K. Langwig, **D.S. Reynolds,** G.C. Turner, C. Butchkoski, and T.H. Kunz, 2010. A common bat experiences drastic decline in the northeastern U.S.A. from a fungal pathogen. Science, 329: 679-682.

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Exhibit D

Chinook Solar Project

Independent Review of

Significant Wildlife Habitats, Aquatic Resources,

Natural Communities and Rare, Threatened & Endangered Species

on behalf of: NH Attorney General, Counsel for the Public

July 1, 2020

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Appendix A: Impact Assessment of The Chinook Solar Project on Bats

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1. Introduction

Pursuant to RSA 162-H:9, the Attorney General of the State of New Hampshire shall appoint an Assistant Attorney General as counsel for the public in seeking to protect the quality of the environment and in seeking to assure an adequate supply of energy. Arrowwood Environmental, LLC (AE) was retained for the purposes of providing the counsel for the public an impartial, third party review of the proposed Chinook Solar Project (Project) impacts. AE focused on significant wildlife habitat, aquatic resources, natural communities, and rare, threatened and endangered (RTE) species. AE reviewed the Project area as presented in the SEC application materials. The proposed Project interconnect has not been finalized and was therefore not reviewed by AE.

2. Project Summary

Chinook Solar LLC proposes the construction of a 30 megawatt (MW) alternating-current (AC) solar photovoltaic ground-mounted solar array to be located off of Fullam Hill Road in Fitzwilliam, New Hampshire. The Project is situated on 513 acres in the east central part of Fitzwilliam west of Fullam Hill Road. The primary access to the site is on an existing gravel road off of Fullam Hill Road. The Project will result in 157 acres of disturbance plus an additional 5 acres of temporary laydown and will include access roads, stormwater basins, electrical equipment, solar modules, and electrical substation.

3. Methodology (AE)

AE conducted an assessment of the environmental review of the Project. Our assessment focused on four resource areas: significant wildlife habitat, aquatic resources, natural communities, and RTE species and associated habitats. AE conducted this review in an objective manner based on our professional expertise and the current scientific literature in these fields. The standards used to assess proposed impacts are based on the Site Evaluation Committee (SEC) rules and other state regulatory requirements.

The initial step in the assessment process is to review all of the applicable documents relating to significant wildlife habitats, aquatic resources, natural communities, and RTE species. The following documents were reviewed during this process:

- SEC Permit Application
- Testimony of Expert Witnesses
- Other Relevant Environmental Permits
- Various Agency Comments from Phone Logs and Meeting Minutes

An outreach effort was undertaken by AE in order to collect information about the resource areas including:

- New Hampshire Department of Environmental Services (NHDES)
- New Hampshire Fish and Game (NHFG)

AE participated in Technical Hearings for the Project on April 8, 2020. AE conducted field assessments on June 8 and June 17, 2020. Field assessments were conducted to familiarize AE with specific areas of the Project and, in some cases, to obtain detailed information about the site conditions and specific resources.

AE contracted an outside expert, North East Ecological Services, for the assessment of bats, see Appendix A.

4. Regulatory Framework (SEC Criteria for Review Overview)

AE used the SEC review criteria to assess whether the Applicant provided in their application adequate information regarding the effects of, and plans for avoiding, minimizing, or mitigating the potential adverse effects of, the proposed energy facility on the natural environment. Specifically, AE looked for the following in the application materials:

Site 301.07 (c)

1) Description of how the applicant identified significant wildlife species, rare plants, rare natural communities, and other exemplary natural communities potentially affected by construction and operation of the proposed facility, including communications with and documentation received from the New Hampshire department of fish and game, the New Hampshire natural heritage bureau, the United States Fish and Wildlife Service, and any other federal or state agencies having permitting or other regulatory authority over fish, wildlife, and other natural resources;
2) Identification of significant wildlife species, rare plants, rare natural communities, and other exemplary natural communities potentially affected by construction and operation of the proposed facility;

3) Identification of critical wildlife habitat and significant habitat resources potentially affected by construction and operation of the proposed facility;
4) Assessment of potential impacts of construction and operation of the proposed facility on significant wildlife species, rare plants, rare natural communities, and other exemplary natural communities, and on critical wildlife habitat and significant habitat resources, including fragmentation or other alteration of terrestrial or aquatic significant habitat resources;
5) Description of the measures planned to avoid, minimize, or mitigate potential adverse impacts of construction and operation of the proposed facility on wildlife species, rare plants, rare natural communities, and other exemplary natural communities, and on critical wildlife habitat and significant habitat resources, and the alternative measures considered but rejected by the applicant; and
6) Description of the status of the applicant's discussions with the New Hampshire Department of Fish and Game, the New Hampshire Natural Heritage Bureau, the United States Fish and Wildlife Service, and any other federal or state agencies having permitting or other regulatory authority over fish, wildlife, and other natural resources.

5. Significant Wildlife Habitat Resources

This section addresses the proposed impacts of the Project on significant wildlife habitat resources. Significant habitat resource is defined by the SEC as habitat used by a wildlife species for critical life cycle function. AE reviewed the methodologies the Applicant used to identify these resources. AE next evaluated the Applicant's assessment of Project impacts on these resources. Finally, AE reviewed the effectiveness of the measures planned to avoid, minimize, or mitigate potential adverse impacts of construction and operation of these resources.

AE assessed the Project's review of four distinct terrestrial habitat types considered to be Significant Habitat Resources: Deer Wintering Areas, Moose Concentration Areas, Bear Habitat-Mast Stands and Wildlife Corridors. Each of these assessments is presented below.

5.1 Deer Wintering Areas

White-tailed deer are a prominent component of New Hampshire's wildlife community occurring throughout the state. White-tailed deer (hereafter referred to as "deer") inhabit forest edges and areas interspersed with fields and woodland openings. Deer wintering areas (DWA) are a distinct forest resource utilized by deer during the cold, snowy winter months. DWAs typically consist of stands of mature and mixed age evergreen forest or mixed evergreen and hardwood forests. Eastern hemlock, northern white cedar, spruce and fir trees are dominant woody species within many of New Hampshire's DWAs. Forested DWAs with south-facing, west-facing, and flat topography are generally those receiving the highest use by deer but all topographic aspects can be important in some years.

Deer are near their northern range limit in northern New England and benefit from reduced snow depths and the reduced exposure to the cold in DWAs. In New Hampshire, and northern New England as a whole, the energy savings that deer receive from these habitats can mean the difference between surviving the winter and dying of starvation. In New Hampshire, DWAs may contain 100 or more deer during periods of cold temperatures and deep snow. During the winter months, deer generally move to these habitats when snow depths exceed about 12" and depend on them heavily when snow depths exceed 18" (http://www.wildlife.state.nh.us/wildlife/profiles/deer.html).

In northern Maine (where published data is available) deer can spend over 110 days within DWAs (Wiley and Hulsey 2010) while 60 days is more common in southern Maine. The New Hampshire Extension Service Website (https://extension.unh.edu/goodforestry/html/6-9.htm) states that deer will spend their entire winters in DWAs, as long as deep snow stays on the ground.

An analysis of snow-depths for the past 7 years within the Fitzwilliam area revealed that snow depths exceeded 12" for an average of approximately 1.8 months of the year (National Snow Analysis Center, 2020). In some years such as during the winter 2019 – 2020 when very little snow fell -- snow depths never reached the point where deer would seek refuge in DWAs. Conversely, during the winter of 2017-2018 deer in the Fitzwilliam area experienced snow depths over 12" for upwards of 3.5 months. While it is true that deer do not depend on the presence of DWA's in all years within the Project area – it is also true that DWA's fulfill a critical life cycle function for deer in those winters with deeper accumulations of snow.

Deer are negatively impacted by human activities occurring both within and adjacent to DWAs during the winter months. Deer move to avoid humans, loud and sharp noises, and light associated with human activities. This added stress and avoidance behavior creates an additional depletion of energy beyond that brought by cold temperatures and deep snow. The Vermont Fish and Wildlife Department maintains a 300 foot protective buffer around its DWAs to protect and buffer deer from the negative impacts of humans and their activities (Argentine 2008). This loss of energy associated with the climate-related demands of winter and human-based disturbances is cumulative throughout the winter and begins when plants go into winter dormancy and snow cover coats the forest floor and continues until the first flush of green vegetation in the spring.

5.1.1 Methodology Review

The Applicant did not identify deer wintering areas as significant wildlife habitat and did not investigate the presence or absence of DWAs within the Project boundaries. The Applicant did produce a Forest Composition report (dated 1/23/18) for the New Hampshire Department of Fish and Game. In this report, an overview of the current forest composition and cover types within the Project area is presented. The field evaluation for this report was conducted in 2017. Six forest cover types were assigned with the expectation that forest conditions in the Project area would change due to anticipated tree harvesting. In particular, the northern two project parcels were called out for additional harvesting. Of the six cover types, two included mature forest with hemlock identified as a dominant species. These cover types are at the northern and southern regions of the Project area.

The Applicant met with representatives of NHF&G in 2016 and 2017 to determine what the Agency's specific concerns were regarding wildlife and wildlife habitat. DWA's were not mentioned as a concern by NHF&G.

5.1.2 Impact Assessment

The Project is situated on 513 acres and will result in 157 acres of disturbance plus an additional 5 acres of temporary laydown. Construction is anticipated to commence in the winter of 2021 and be completed in the fall of 2021 (Alteration of Terrain Application, October 2, 2019). Forested lands in the Project area are in varying degrees of succession due to ongoing, recent and historic logging. (Wetland, Waterbody and Vernal Pool Delineation Report, 2019). The Project site has experienced selective clearing of trees throughout. In addition, the northern portion of the Project area was clear cut (See Figure 1) subsequent to the Applicant's forest analysis in 2017.

AE reviewed historical aerial imagery and mapping of DWAs by NHFG and the University of New Hampshire (UNH). The September 2017 aerial photography reveals that the forests in the north (within the Project parcels – both in and out of the Project limits of disturbance) were continuous, contained little to no obvious forest harvesting activities, and were covered by conifer-dominated forest (Forest Composition Report, Attachment 1). The NHFG DWA maps show a small section of mapped DWA, called the Fullam Hill Road DWA in **Error! Reference source not found.** below, located to the southeast of the Project area. In addition to the NHFG maps, a University of New Hampshire (UNH) student completed a DWA mapping project (utilizing dynamic and static modeling methodologies) but largely based on the interpretation of aerial photographs to identify appropriate coniferous forest canopy to model potential DWAs. The UNH model results show extensive potential DWAs both in the northern, central and southern sections of the Project area (See **Error! Reference source not found.**).

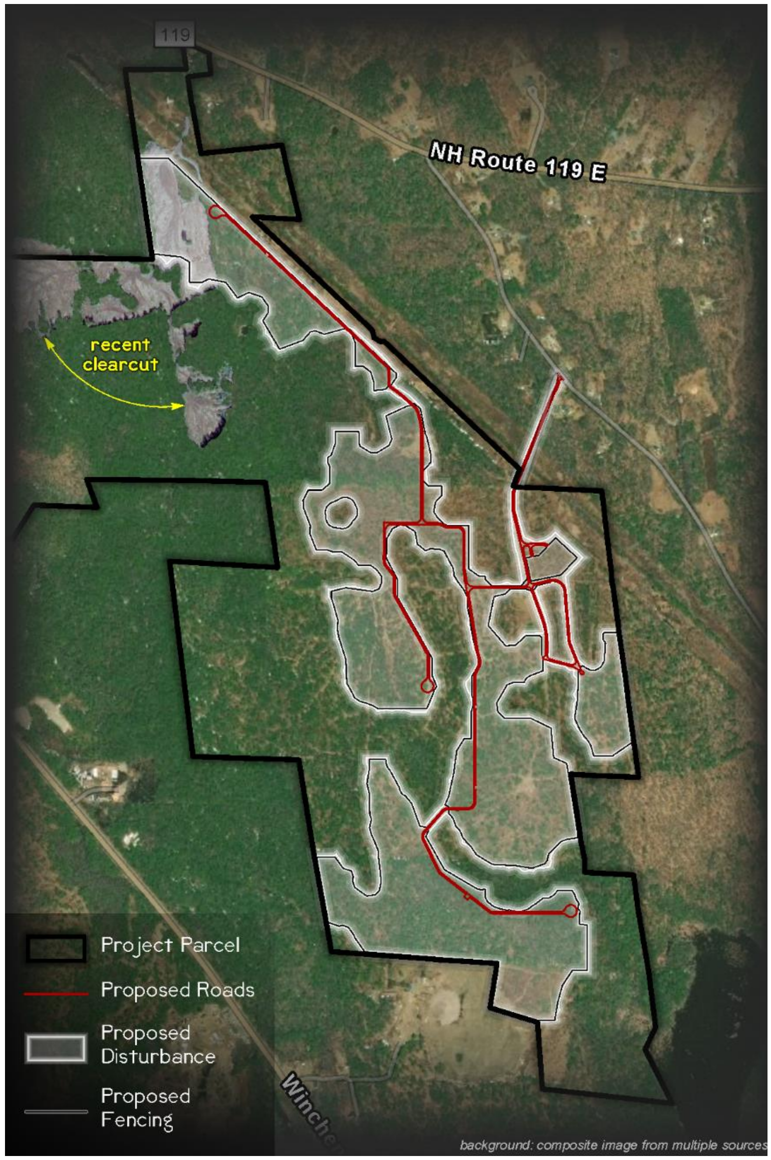

Figure 1 Project limits of disturbance with recent clear cut visible in the northern Project area

In addition to reviewing historical aerial imagery and mapping of DWAs by NHFG and UNH, AE also conducted site visits on June 8 and June 17, 2020 to review the area, including the clear cut (previously mature forest dominated by hemlock per the Forest Composition Report) in the northern Project area and to review the hemlock dominated mature forest in the southern Project area.

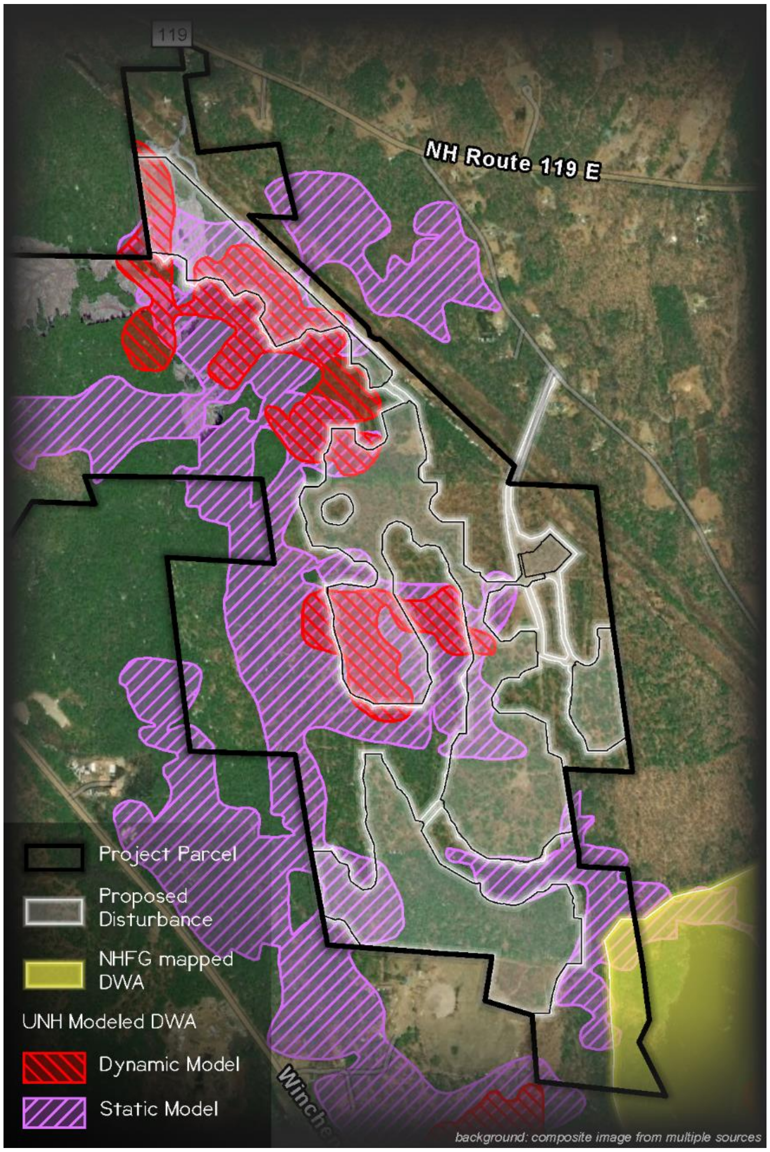

Figure 2 NHFW Fullam Hill Road mapped DWA and UNH DWA model mapping

The field assessment of the northern Project parcel confirmed the presence of a mature Hemlock forest community outside of the Project limits of disturbance. This is the area that prior to the clear cut had comprised over 31 acres of continuous forest with average ages of 60-70 years old and was dominated by Eastern hemlock and white pine (Forest Composition Report). Based on the June 8, 2020 site review, it is likely that previous to forest clearing activities, significant forested areas in the northern Project limits of disturbance provided appropriate coniferous forest structure and functioned as DWA habitat.

AE also visited the approximately 38 acres in the southern Project area that had been identified as mature forests dominated by white pine, Eastern hemlock, and balsam fir (Forest Composition Report). Forest cover types located in the south contained more white pine and based on our field investigation, more deciduous trees – both of which provide less effective cover for DWAs. The field assessment did reveal extensive areas of winter feeding activity in the form of bark stripping, browsing of young hardwood saplings by deer, and the presence of substantial amounts of winter deer scat within the southern Project area as indicated in **Error! Reference source not found.**.

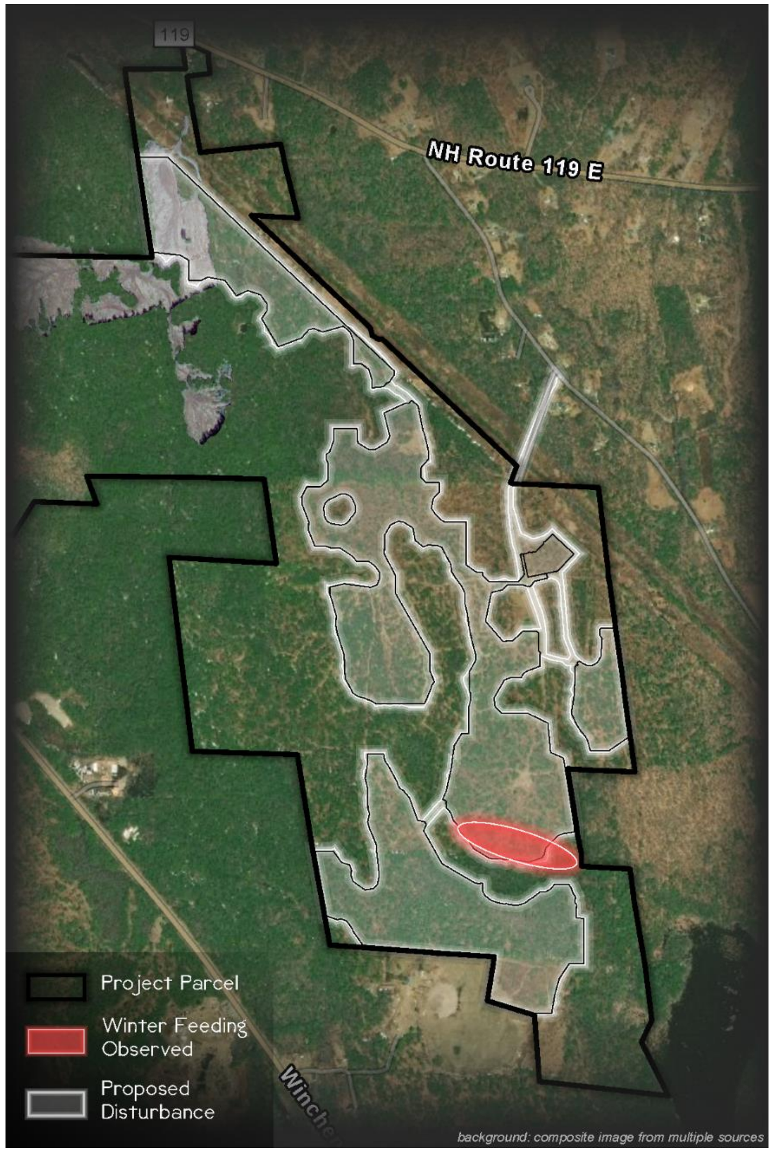

Figure 3. Area of deer winter feeding activity observed (Jeff Parsons, June 8, 2020)

However, field investigations within the southern Project area found very little mature conifer-dominated forest stands remaining within Project parcels. It is likely that deer utilized the young hardwood that resulted from forest cutting activities on-site as winter food but sought out the cover of more mature coniferous forest offsite, or in the small remaining pockets of coniferous forest cover on-site. It is our opinion that in general, the majority of forests in the south Project area, including forestland that was mapped by NHFG as a DWA, are not likely providing adequate cover to function as DWAs.

As discussed above, deer require adequate isolation from human activities to fully benefit from the energy-saving benefits afforded by winter-yarding habitats. Without having DWAs identified and located within and adjacent to the Project limits of disturbance– it is not possible to assess whether the Project is having a potential indirect negative impact on DWA habitat. Intense human activity within 300’ of over-wintering deer can lead to stress and unnecessary critical energy expenditures by deer. The Project limits of disturbance and 300’ beyond that should form the minimum study area for a DWA assessment.

5.1.3 Conclusions

Deer Wintering Areas was not identified as a significant wildlife habitat by the Applicant and investigation of the presence/absence of DWA in the Project area was not conducted. The Applicant concluded that there were no DWAs within the Project boundaries (Agency Stakeholder Meeting Notes, Appendix 17A, pg.10) However, there is no evidence in written material provided by the Applicant that DWAs were investigated during field work conducted at the Project site. Both the Applicant's own Forest Composition Report and 2017 aerial photographs indicate that extensive coniferous forest cover, likely mature forest, was located within areas of the north parcels that are within the Project limits of disturbance. Both UNH models predicted the presence of DWAs within the northern Project parcels. Because of this, areas within the impact area likely contained, and in some areas, still contain DWA habitat in the northern Project area.

It is our conclusion that DWAs fall within the purview of the SEC as a "significant wildlife habitat" that is critical to the life cycle of deer in New Hampshire. The Applicant has not identified or assessed direct or indirect Project impacts on this significant resource. It is therefore our opinion that the Applicant has not met the burden of proof that the Project will not have an unreasonable, adverse impact on this resource.

Furthermore, it is our conclusion that while it is currently impossible to accurately enumerate the areal extent of DWA that has been lost as a result of clearing on the Project parcels, the Applicant can mitigate for the loss of DWAs by protecting the remaining mature coniferous forest, especially in the north, within the Project parcels but outside of the Project limits of disturbance. Such mitigation would require that the Applicant maintain the existing mature coniferous tree cover to provide adequate cover for over-wintering deer.

5.2 Moose Concentration Areas

Moose are an iconic animal found throughout New Hampshire but are commonly associated with northern parts of the state. Moose are the largest living member of the deer family. In recent years, moose have declined significantly in New Hampshire, most likely due to the stresses brought on by global warming and direct mortality from the ravages of winter ticks.

Moose Concentration Areas (MCAs) are forested areas with evergreen trees tall enough to promote the occupation of concentrations of moose during the winter months when snow depths exceed approximately 27". They are often found in relatively higher elevations than DWAs. Evidence of moose concentration includes heavy woody plant browse and significant concentrations of winter moose scat.

In the eastern United States and Canada, there is substantial scientific agreement that moose utilize closed canopy evergreen forests during the winter when deep snow and extreme cold set in (Balsom et al. 1996). There is, however, less of a scientific nexus between use of these habitats by moose, the energy reserves of the moose utilizing MCAs, and winter survival of moose.

5.2.1 Methodology Review

The Applicant did not identify Moose Concentration Areas as a significant wildlife habitat and did not investigate the presence or absence of MCAs within the Project limits of disturbance. NHFG determined that in the vicinity of the Project in southern New Hampshire, moose do not congregate in MCAs because snow depths rarely exceed 27" and then only for short periods of time (Dan Bergeron, NHFG, personal communication, April, 2, 2020).

5.2.2 Impact Assessment

The Project will result in clearing the remaining forest within the 157 acres limits of disturbance plus an additional 5 acres for the temporary laydown area. The Applicant is proposing 2 unfenced wildlife corridors within the Project limits of disturbance at least partially, to facilitate moose movements within the Project area. AE conducted a site visit on June 8, 2020 to assess the Project area for potential moose wintering habitat. AE identified moderately abundant signs of moose browsing activity and scat piles left by moose within the Project site. AE did not identify any areas that would be considered a moose concentration area.

5.2.3 Conclusions

The Applicant did not identify Moose Concentration Areas as a significant wildlife habitat and did not investigate the presence or absence of MCAs within the Project boundaries. Moose utilize the site as evidenced by observed moose browsing activity and scat piles –in both the site's wetlands and forests. However, after both the analysis of winter snow depths and consultation with NHFG and site specific evaluation it is our opinion that the Project does not contain significant moose wintering habitat and that the Project will not have any adverse impact on MCAs.

5.3 Bear Habitat: Mast Stands

Mast stands are groups of trees such as oak and beech that produce fat-rich food sources used by black bear and other wildlife. During the fall months, bear climb the trees to access these beechnuts and acorns, leaving scars from their climbing activities. They often return in spring and scavenge beechnuts and acorns from the ground under the trees.

Studies in Maine have demonstrated the vital importance of beechnuts to bear health and reproductive success. In geographic locations where alternative food sources (acorns, apple reserves, croplands) are largely absent, researchers found the reproductive success of bears was strongly tied to the productivity of beechnuts (Jacobas et al. 2005). This correlation speaks to the importance of the mast resource in the energy cycle of black bear.

5.3.1 Methodology Review

The Applicant did not identify mast stands as significant wildlife habitat and did not address the presence or absence of mast stands within the Project area. In the Forest Composition Report, an overview of the current forest composition and cover types within the development is presented. Of the six cover types identified, none contained mature beech as a dominant species and only two identified mature red oak.

5.3.2 Impact Assessment

AE conducted a site visit on June 8, 2020 to review the Project site for the presence of significant mast stands. AE identified the presence of occasional small beech and oak trees within the Project area –due to ongoing forest management there are no larger (greater than 6" DBH) mature beech remaining on the site and no signs of bear use on the more mature northern red oak trees. AE did not identify any significant mast stands in the Project area.

5.3.3 Conclusions

The Applicant did not identify mast stands as significant wildlife habitat and did not address the presence or absence of mast stands within the Project area. The Project site is under active forest management resulting in only small remnants of mature forest remaining on the Project site. The Project area has a paucity of beech and oak trees in any age class. The Project site lacks significant mast stands. It is our opinion that the Project does not contain bear habitat in the form of significant mast stands and that the Project will have no impact on this resource.

5.4 Wildlife Corridors

Wildlife corridors are meant to facilitate the movement of wildlife through varying land uses that offer some resistance to their movement. Wildlife corridors can be critical in connecting wildlife habitat features that are broken up by roads, agricultural activity and various types of development. In order to be effective, corridors need to provide cover and offer low risk passage through these fragmenting features.

5.4.1 Methodology Review

The Applicant presents a wildlife protection strategy and best management practices based on correspondence and recommendations from meetings with the NHFG in 2017 and 2018 (Email correspondence to Carol Henderson dated 9/4/19). Protection of wildlife corridors is included in the strategy. Specifically, the Applicant states that the "fencing for the solar arrays will be installed around discrete sections of the Project such that corridors for larger wildlife species remain available". It is our understanding that this strategy is in draft form at the time of writing this report and that NHF&G has not formally approved the proposed measures. As stated these corridors may, in particular, provide for passage by moose within the Project area (Kara Moody, Appendix 17a , Agency Stakeholder Meeting Notes, pg. 8).

5.4.2 Impact Assessment

The Project layout provides for 2 wildlife corridors, 1 in the north, and 1 in the south. The northern corridor runs approximately east to west and is about 225'-235' wide. In this area the Project fencing has been designed to leave these openings for large animal movement along a small tributary that crosses the powerline in the northern Project area and along a tributary that flows southerly into Sip Pond in the southern Project area. The southern corridor runs northwest to southeast and is similar in width. This opening provides a continuous north-south movement corridor between Scotts Brook and Sips Pond through the Project area. The Applicant states that these corridors can facilitate the movement of moose and other species of wildlife through the Project area.

5.4.3 Conclusions

The incorporation of 2 wildlife corridors to facilitate wildlife movements at the Project site should decrease wildlife habitat fragmentation as a result of the Project. As a result, it is our conclusion that the Project does not have an unreasonable adverse impact upon wildlife corridors.

6. Aquatic Resources: Wetlands, Streams and Vernal Pools

6.1 Wetlands

Wetlands are regulated in the state of New Hampshire on the federal level by the U.S. Army Corps of Engineers (ACOE) and on the state level by the New Hampshire Department of Environmental Services (DES). The ACOE regulates waters of the United States under the Clean Water Act Section 404.

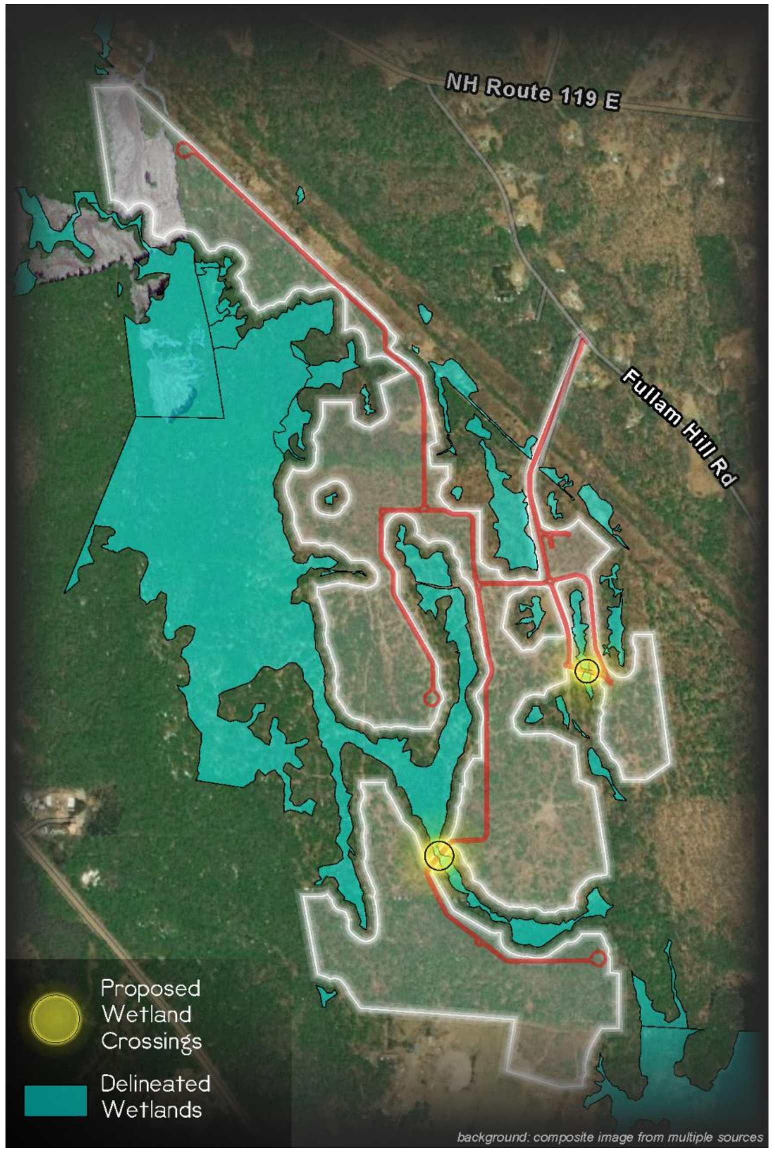

Figure 4. Locations of wetland crossings

The New Hampshire DES regulates wetlands under the Fill and Dredge in Wetlands Law (RSA 482-A). Under this law, New Hampshire DES can regulate activities within jurisdictional wetlands. In addition, further regulatory scrutiny are given to wetlands that classify as "Priority Resource Areas". This includes wetland types such as the bogs, floodplains, and coastal and tidal wetlands. Wetlands can also be determined to be Priority Resource Areas if they contain habitat for threatened or endangered species or have been determined to be a "prime" wetland by a municipality. The Town of Fitzwilliam has undertaken this prime wetland mapping and has designated some wetlands in the town as "prime" wetlands, which include a duly established 100' buffer. In these circumstances, both the wetland and the 100' wetland buffer are regulated by the New Hampshire DES. Fitzwilliam's zoning ordinance also establishes a 75' buffer on all wetlands in the Wetland Protection Overlay District.

6.1.1 Methodology Review

The Applicant appears to have followed industry established standards for the delineation of wetlands in New Hampshire. This includes using the criteria put forth in the U.S. ACOE in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions, v2 (U.S. Army Corps of Engineers 2009). In addition, all wetlands were reviewed by a NH certified wetland scientist.

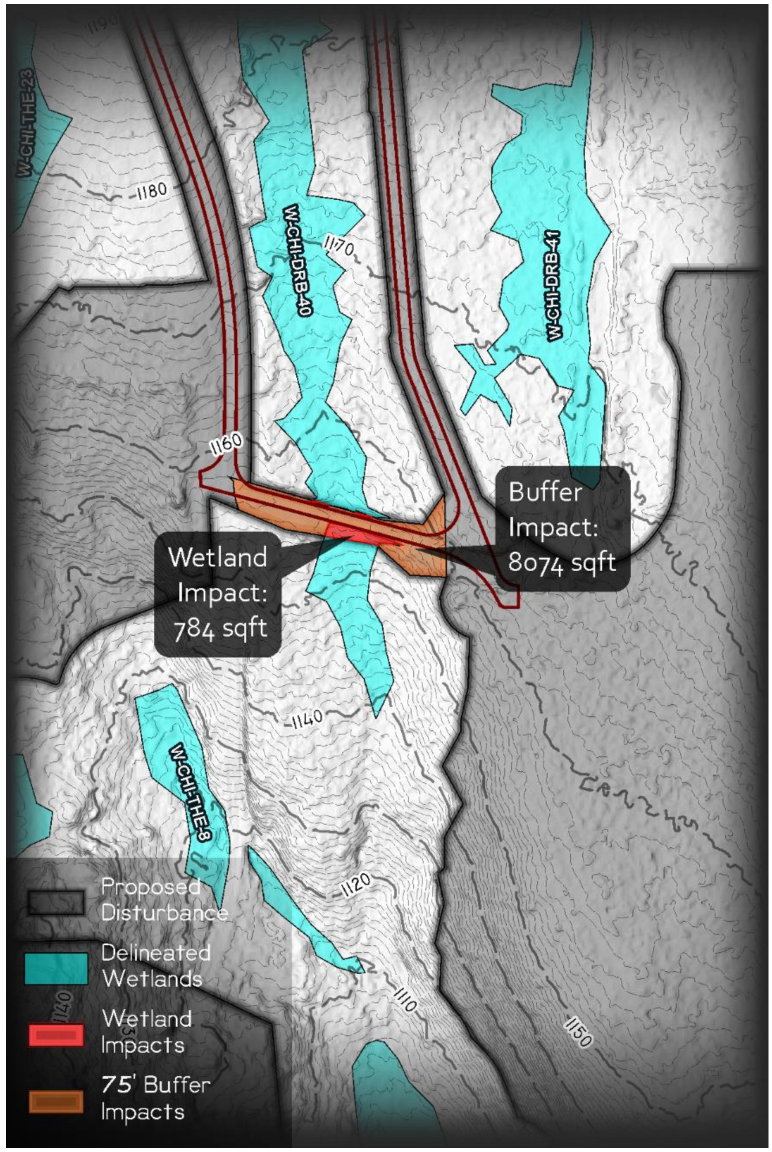

Figure 5. Detail of eastern wetland crossing

In some cases, the certified wetland scientist significantly changed wetland boundaries during the review process. This may have been the result of either changing conditions on the landscape or an inaccurate original delineation. During our analysis, AE has documented numerous instances of these changes occurring. This included instances where the delineated boundary was drawn both closer to and further from the proposed limits of disturbance. Minor changes to a wetland boundary due to landscape conditions are not unusual. Significant changes to a boundary within a short period of time are less common. If the changes are not the result of an inaccurate delineation, they are the result of significant changes in landscape conditions. In the case of this Project, it appears that the significant changes in wetland delineation boundary lines may be due to the ongoing logging that has occurred on site. In certain soil and bedrock conditions, logging activity has been known to impact the presence and extent of wetlands. This can occur by changing drainage patterns on the landscape, increasing soil compaction (thereby decreasing soil drainage) and decreasing evapotranspiration.

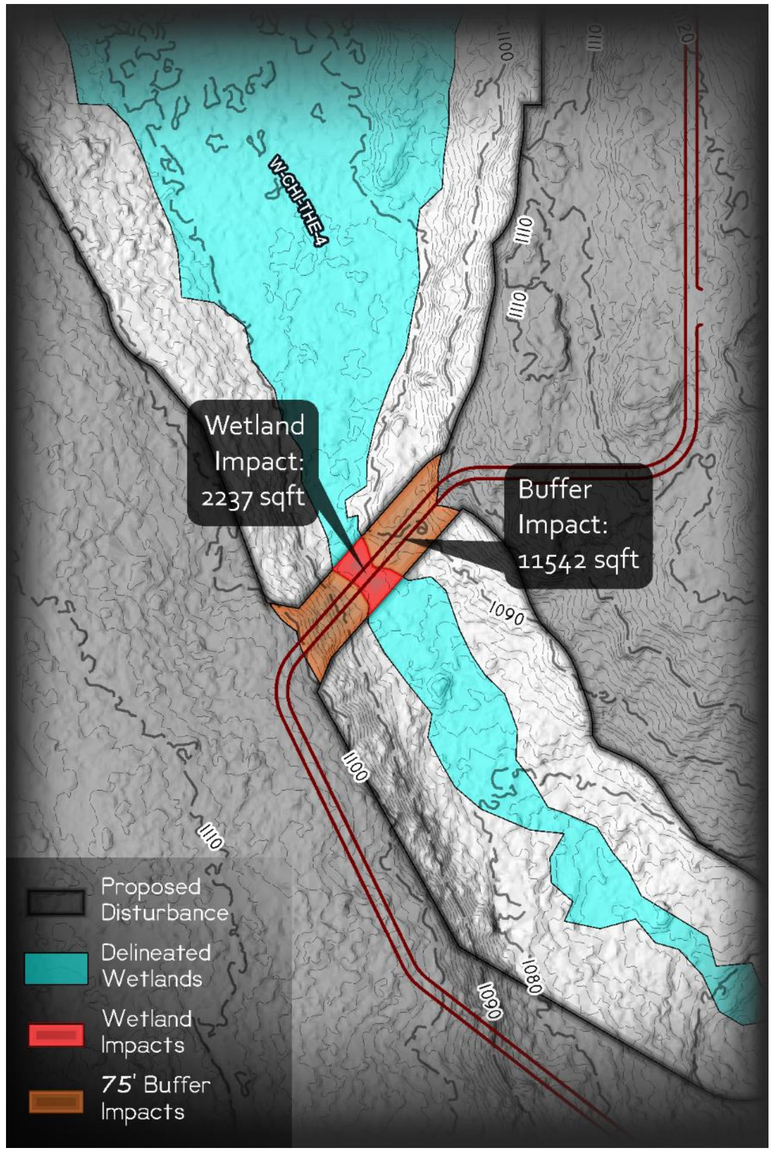

Figure 6. Detail of western wetland crossing

It was beyond the scope of our analysis to conduct a thorough review of the boundaries of the wetlands that were delineated within the Project site. During the June 17, 2020 site visit, however, the boundaries of selected wetlands were reviewed with Erik Lema (NH Certified Wetland Scientist for the Applicant). The recent and ongoing logging on the site has resulted in disturbed vegetation and soils in many places, making wetland delineation difficult. In the areas that were reviewed, AE largely agrees with the delineations put forth by the Applicant.

6.1.2 Impact Assessment

The Applicant mapped 23 different wetlands within the Project area. None of these wetlands were determined by the Applicant to be Priority Resource Areas and none were mapped by the Town of

Fitzwilliam as prime wetlands. The independent analysis by AE has confirmed both of these conclusions.

Overall, the evidence of wetland avoidance is obvious when viewing the Project layout in relation to the wetlands on site. It is clear that most direct wetland impacts have been avoided with Project layout. In addition, impact minimization is evident from the wetland crossings occurring at places where the wetlands are very narrow and the use of a pre-cast concrete bridge at one of the crossings.

The biggest discrepancy that AE has discovered is how the proposed Project impacts have been reported. While the Waterbody Report and prefiled testimony have stated no wetland impacts would occur, the data provided to AE by the Applicant indicate that some impacts are occurring at the location of the two wetland crossings.

The location of the two proposed wetland crossings are shown in **Error! Reference source not found.**. **Error! Reference source not found.** shows a detail of the eastern crossing, which occurs along an existing logging road which had created an upland break in the wetland boundary. Though prefiled testimony has indicated that wetland impacts have been avoided, as can be seen from this figure, the limits of Project disturbance extend into the wetlands on both the north and south side of the road. This results in 784 square feet of wetland impact.

A detail of the second wetland crossing is shown in **Error! Reference source not found.**. According to the testimony of Mr. Valleau and Ms. Moody, wetland impacts have been avoided by the use of an open bottom box culvert. As can be seen in this figure, however, the limits of disturbance extend into the wetland resulting in 2237 square feet of impacts.

The open bottom culvert shown in **Error! Reference source not found.** is located on the border of the wetland. According to Mr. Valleau (personal communication 6/17/20) the Applicant is working on a revised site plan which would locate the culvert further from the wetland boundary. At the time of this report submittal, the revised plan has not been made available and no assessment of those potential changes are therefore possible.

According to Mr. Valleau (personal communication 6/17/20), the nature of the impacts shown in **Error! Reference source not found.** and **Error! Reference source not found.** consist solely of clearing of woody vegetation. In forested wetlands, the removal of woody vegetation can have a significant impact on the nature and functioning of a wetland (Fulton and West 2002; Shepard 1994). While vegetation clearing in wetlands is not regulated by the NH Wetland Rules, it should still be considered a wetland "impact". From our analysis, a total of 3021 square feet of wetland impacts are proposed at these wetland crossings.

Mr. Valleau and Ms. Moody also state in their testimony that the Project layout has avoided and minimized impacts to Fitzwilliam's' 75' wetland buffer to the maximum extent possible. In other correspondence with state agency officials, the Applicant has stated that vegetation clearing within 75' of wetlands will only be needed in very discrete locations of the Project. The Applicant identifies in Section 5 of the AOT permit application that a vegetated buffer of various widths with a minimum distance of 75' to wetlands will be maintained. According to AE's analysis of the Project layout the total impacts to the 75' wetland buffer consist of 117,036 square feet (2.68 acres).

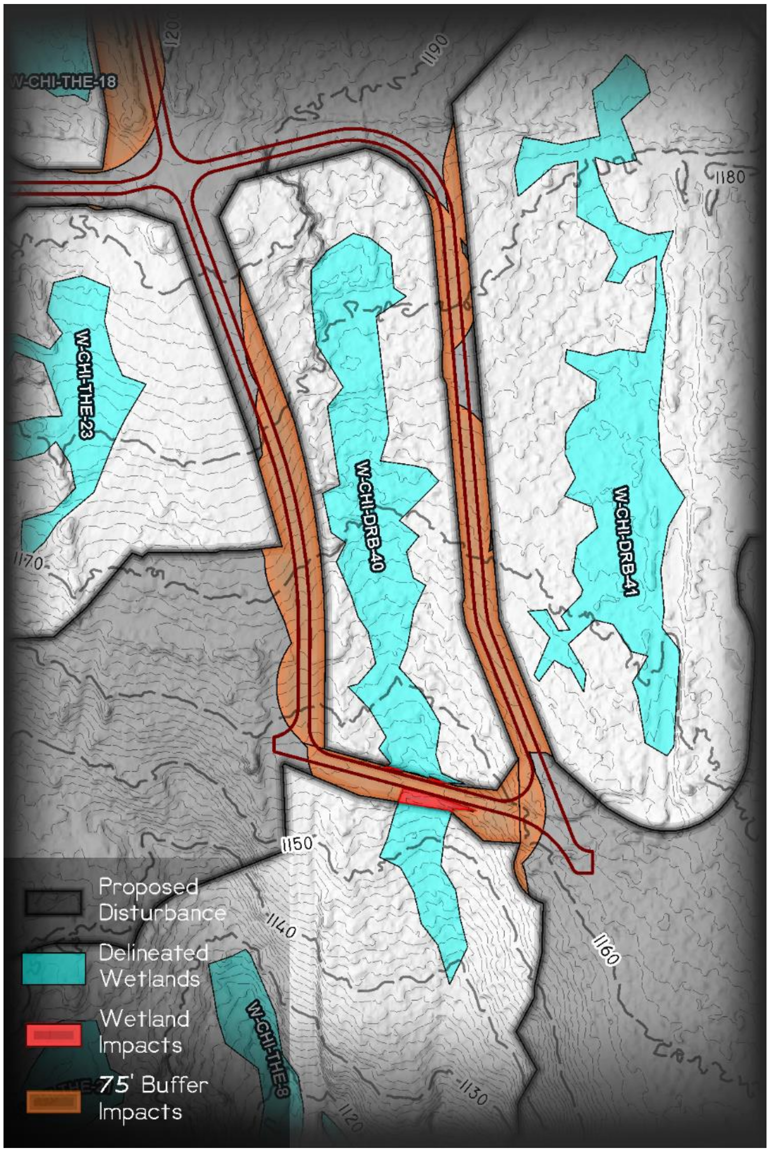

Figure 7. Access roads around wetland W-CHI-DRB-40

AE's analysis of the proposed layout has confirmed that, in most areas, the Project has been sited to avoid impacts to the 75' wetland buffer. Aside from the wetland crossings, there are two notable exceptions to this. First, along the access road across from the proposed substation, there are proposed impacts related to stormwater features up to the wetland boundary. It is unclear from the Project site plans if minimizing these buffer impacts were a consideration when designing the stormwater infrastructure at this location.

Secondly, south of the proposed sub-station, Wetland “W-CHI-DRB-41” is surrounded by access roads and underground powerlines which come within 12 feet of the wetland boundary. The western road is a preexisting logging road while the eastern road would involve new construction. Both roads have been proposed to access the set of solar arrays in the southeast corner of the Project. As can be seen in **Error! Reference source not found.**, both roads have impacts within the 75’ wetland boundary. AE inquired about the necessity of both roads and was told that there are two roads to “provide the contractor…to use the best option for access.” (Mr. Valleau, personal communication 6/11/20). Since both roads serve the same purpose (and both involve impacts to the wetland buffer), it is unclear why both have been proposed if minimizing impacts to wetland buffers are a priority.

6.1.3 Conclusions

The Applicant sufficiently mapped and characterized wetlands in the Project area. The Project has been sited to avoid most direct impacts to wetlands. In addition, wetland impacts have been minimized by locating the crossings where the wetlands are the narrowest. The Project limits of disturbance at these crossings, however, show an impact of 3021 square feet. The NH Wetland Rules allow for the clearing of woody vegetation within wetlands and the Applicant has not reported this activity as wetland “impact” at these crossings. It is our opinion that this activity within the wetlands should be reported as wetland impact. However, given the minimal extent of the proposed clearing, it is our opinion that the impacts as proposed would not constitute unreasonable adverse impacts to these wetlands.

The Town of Fitzwilliam regulates the 75’ upland buffer around all wetlands in the town. The Applicant has stated that the Project layout has avoided and minimized impacts to Fitzwilliam’s’ 75’ wetland buffer to the maximum extent possible. In general, avoidance and minimization of wetland and buffer impacts is apparent from the overall Project layout. However, wetland W-CHI-DRB-40 is incurring buffer impacts from two roads which encircle the wetland to access the southeastern arrays. All of the information available to AE suggests that two roads are not necessary to access these arrays. Unless one of the roads is removed from the proposed Project layout, we conclude that the applicant has not done a sufficient job of avoiding wetland buffer impacts to a reasonable extent.

6.2 Streams

The State of New Hampshire defines a “Watercourse” in the State of New Hampshire Code of Administrative Rules Chapter Env-Wt 101 Definitions as any surface water that:

(a) Develops and maintains a defined scoured channel, with evidence of sediment transport, that: (1) is greater than 75 feet in length; or

(2) is of any length and connected to another jurisdictional area at either end; and

(b) is not a drainage swale (Env-WT 101.109)

Streams provide important aquatic habitat for fish and other organisms. Transportation systems can create barriers to the movement of aquatic species. Culverts in particular can be impassable to aquatic organisms. In addition to organism passage, stream crossings can also impede the flow of water. The development challenge is to design a crossing that accomplishes the project purpose and at the same time accommodates for both stream flow and organism passage.

Riparian areas consist of the land along streams and other waterbodies. These areas perform important ecological functions including but not limited to streambank stabilization, temperature moderation, and sediment filtration. Riparian areas also provide habitat and movement corridors for animal species. Naturally vegetated forested riparian areas generally provide these functions as a higher level.

6.2.1 Methodology Review

The Applicant's consultants conducted stream delineations from 2016-2019 with methods and summary findings of these surveys presented in the Wetland, Waterbody, and Vernal Pool Delineation Report (July, 2019). Six streams were delineated in the Project area with an additional eight non-jurisdictional drainages identified. Streams deep within wetlands were not surveyed and in some instances not indicated on the Resource Map in the report. Streams were defined based on flow characteristics of ephemeral, intermittent, or perennial. AE conducted a site visit on June 17, 2020 and reviewed several of the NJD's and confirmed the typical examples included dug ditches or swales of unnatural origin.

6.2.2 Impact Assessment

The Project involves two stream crossings for access road construction. The northern stream crossing over a small tributary that has been labeled S-CHI-THE-14 has been designed to span the stream channel using a three-sided box culvert (3'H x 6'W). The measured bank width for this stream ranges between 0' and 3' (Wetland and Water Body Delineation Report, 2019). The structure appears to be oriented perpendicularly to the stream channel, providing an easy connection between upstream and downstream through a straight crossing. The open bottom structure is a preferred option to accommodate aquatic organism passage. The span appears to have been designed to accommodate the anticipated average natural channel bankfull flow at 3' width.

The Project involves the installation of a precast box culvert (3'H x 12' width) in the southern project area over what has been labeled S-CHI-THE-5 which is a tributary that flows into Sip Pond. The bank width for this stream ranges between 3' and 10' (Wetland and Water Body Delineation Report, 2019). The structure appears to be oriented perpendicularly to the stream channel, providing an easy connection between upstream and downstream through a straight crossing. The open bottom structure is a preferred option to accommodate aquatic organism passage. The span appears to have been designed to accommodate the anticipated average natural channel bankfull flow at 12' width.

In the testimony of Valleau and Moody it is presented that during construction best management practices (BMPs) for working near waterbodies will be used. It is also stated that during construction and operation, appropriate stormwater runoff and erosion control measures will be implemented. The details of the crossing and the BMPs are provided in the AOT permit application. Section 5 of the AOT permit application provides a brief outline of the control practices to be utilized during construction. Sheets C.501 through C.504 of the engineering plan set detail the erosion control measures to be utilized in accordance with the NH DES Stormwater Manual Volume 2 and NHDES Solar Guidance. The construction sequence for stream crossings calls for work to occur in dry conditions (as possible), installation of erosion control measures prior to start of work, and removal of erosion control measures when the area is stabilized.

In the testimony of Valleau and Moody it is presented that the Project has been designed to minimize the number of wetland crossings, to avoid and minimize Project work within Fitzwilliam's 75-foot wetland buffer and to maximize the distance between Scott Brook and the Project. The identified limit of disturbance generally provides a 75' buffer to the streams in the Project area with the exception of the identified crossings. It is assumed that the vegetated buffer outside of the limits of disturbance will be undisturbed by the Project.

6.2.3 Conclusions

The Applicant has identified and mapped streams and non-jurisdictional drainages in the Project area. The Project has been designed to minimize the number of stream crossings. There are two crossings that have been adequately designed to accommodate aquatic organism passage and anticipated bankfull stream flows. The Applicant has generally provided a 75' vegetated riparian buffer with the exception of the identified stream crossings. For these reasons, it is our opinion that the Project will not have an unreasonable impact on streams.

6.3 Vernal Pools

Vernal Pools are a special type of wetland that provide critical habitat to a wide variety of invertebrate and vertebrate species. In New Hampshire, vernal pools are defined as:

a temporary body of water that does not support fish and provides essential breeding habitat for certain amphibians and invertebrates (including indicator species) (Marchand 2016).

Invertebrate indicator species include fingernail clams and fairy shrimp. Amphibian indicator species include the spotted salamander (*Ambystoma maculata*), the blue-spotted salamander (*A. laterale*), the Jefferson salamander (*A. jeffersonianum*) and the wood frog (*Rana sylvatica*). These species rely on vernal pools as breeding habitat.

While the amphibian indicator species rely on vernal pools for breeding, these animals spend most of their lives in the forests that surround the pools. In the spring, they migrate to the pools to breed, reside for a period of one to two weeks, then return to their upland habitat. The uplands around the pools are therefore critical to the wildlife habitat that the pools provide and integral to the functioning of the pool.

Wood frogs are known to use many different types of forested uplands and wetlands including hardwood forests, mixed conifer/hardwood forests and forested swamps (Colburn 2004; Knox 1992; Heatwole 1961). Likewise, the spotted salamander is known to inhabit a wide variety of upland forests but prefer dry, well-drained soils with moderate slopes in deciduous forests (Petranka 1998). The negative effect of loss of forested habitat on both of these species has been well documented in the literature (Homan et al. 2004; Kolozvary and Swinhart 1999; Porej et al 2004). A study in southern New Hampshire showed that maintaining canopy cover around vernal pools is integral to maintaining the integrity of the pool for amphibians (Herrmann et al. 2005). This study showed that maintaining a 60% forested canopy in uplands after logging will maintain species rich and abundant larval amphibian assemblages in the pool.

6.3.1 Methodology Review

Vernal pools are difficult communities to assess because they are defined by the presence of wildlife indicator species, sign of which may be present only in the spring and early summer. In addition, both biological and physical factors of each pool are unique and important to the functioning of the pool ecosystem. The Waterbodies Report states that the New Hampshire Vernal Pool Documentation Form was used at each pool. This form contains all the appropriate information to fully understand each pool. AE has reviewed these forms and the data collection methodologies. It is our opinion that the data was collected appropriately and was sufficient to fully characterize the vernal pools on site.

As vernal pools are defined in New Hampshire, they do not include man-made features that may offer breeding habitat to amphibians. Despite this, numerous instances of ruts created from logging activity were categorized as vernal pools during the environmental assessment. It was mentioned that these sites were noted as vernal pools to comply with US Army Corps of Engineers protocol (Mr. Valleau, personal communication 6/17/20). These were noted in the Waterbodies Report as pools with unnatural origin. The occurrences of these "unnatural" pools that were visited by AE during the site visit on June 17, 2020 confirms that they are merely ruts created from logging activity within wetlands. All of these unnatural pools assessed during this site visit did not offer viable habitat for successful reproduction of wood frogs or spotted salamanders because the hydroperiods were far too short. For this reason, these sites should be considered population "sinks", where individuals will repeatedly lay eggs that will not survive (instead of choosing viable habitat).

6.3.2 Impact Assessment

Using the New Hampshire vernal pool definition, a total of 20 pools were mapped in the Project area. This includes fifteen natural, undisturbed pools and five pools that are of natural origin but have been impacted by human activities. All direct impacts to these vernal pools have been avoided by the proposed Project. The USACE requires buffers around these wetlands when they have jurisdiction on a project. As mentioned in the Waterbodies Report, New Hampshire currently does not have a standard buffer width for vernal pools. However, as described above, the buffers around vernal pools are typically used by amphibian indicator species and the nature and condition of these areas is integral to the functioning of the vernal pool. While the Applicant avoided direct impacts to wetlands with the proposed layout, no analysis was conducted on potential impacts to vernal pool buffers.

AE performed analysis on the Project's potential impacts to vernal pool buffers. Given the distribution of these amphibians on the landscapes surrounding vernal pools, numerous researchers have attempted to quantify what the critical thresholds are for maintaining population viability in the face of forest management or development-related changes in the landscape (Calhoun and deMaynadier, 2004; Semlitsch, 1998; Cushman, 2006; Harper et al 2008). Calhoun and Klemens (2002) developed buffer zone recommendations designed to maintain the ecological integrity of the vernal pool systems and based on the biology of the amphibians using the vernal pools. These approaches to buffering vernal pools to conserve amphibian populations were applied to the pools in the Project area. Instead of drawing circular buffers around each pool, the buffer layout was modified to match the existing landscape and known habitat preferences for these species. This methodology is intended to provide a more biologically accurate depiction of likely amphibian habitat surrounding vernal pools than is provided by a typical fixed-distance buffer. The concept for this buffer modification is based on work by Baldwin et.al (2006) who recommended a shift away from the core-habitat model and towards a more spatially explicit approach to conserving amphibian habitat.

In the case of the proposed Project, one confounding factor in determining how to evaluate critical terrestrial habitat before and after the proposed project construction is the forest conditions currently present. The forest within the Project area has been heavily managed as a timber resource for many years with varying amounts of deforestation and regeneration. We opted to evaluate pre-construction habitat based on current conditions at the time of available LiDAR data collection in the area spanning fall 2015-summer 2016. Using this data provided a standardized and repeatable method for measuring canopy closure and exhibits canopy conditions generally consistent with those observable in historical aerial imagery for the last ~30 years.

Utilizing GIS technology, we conducted a cost-based amphibian habitat analysis using canopy closure classifications derived from LiDAR data and wetland boundaries provided by the Applicant to identify potential upland habitat in the vicinity of select vernal pools within the study area. This analysis takes into account habitat preferences for these amphibians for the construction of the buffer areas. Both spotted salamanders and wood frogs are known to avoid areas with canopy closure of less than 60% (Herrmann et al. 2005). 2016 vintage LiDAR data provided by NH GRANIT was used to derive a 2.5’ x 2.5’ digital elevation model (DEM) which represents bare earth surface elevations and a digital surface model (DSM) representing absolute vegetation elevation. When DEM is subtracted from a DSM, the normalized DSM (nDSM) results which illustrates the relative canopy height above ground. The nDSM was further processed to represent 2 canopy height classes: <15’ and >15’ above ground resulting in a binary grid at the resolution of the original DEM showing canopy presence/absence. This was used as to calculate canopy coverage over the surrounding 50’ radius at each grid location, and then classified as greater than or less than 60% canopy closure. In addition to canopy, wetland presence was considered using wetland boundaries provided by the Applicant. Classifications were assigned in 4 categories: upland with >60% canopy, wetland >60% canopy, upland <60% canopy, and wetland <60% canopy.

A combined cost/distance value was derived for each 6.25 square foot cell (2.5'x2.5') of ground surrounding each vernal pool out from the pool edge to a maximum of 1000'. The highest value cells (lowest cost) surrounding each pool were then cumulatively selected until the total area selected was equal to the area of a "normal" fixed-distance buffer from a pool surrounded by mostly natural, closed-canopy forest conditions. The result is a pool buffer that, while maintaining the same area as a standard fixed-distance buffer, utilizes the most appropriate habitat elements first, while avoiding the areas currently providing poor quality non-breeding habitat. This provided an assumed maximum cost/distance factor for a pool with relatively high-quality surrounding habitat that was applied as a maximum cost threshold to other pools in the study area. If cumulative assessments of the other pool habitat areas reached this threshold before the 750' buffer areal equivalent, the habitat modeling was terminated at that point.

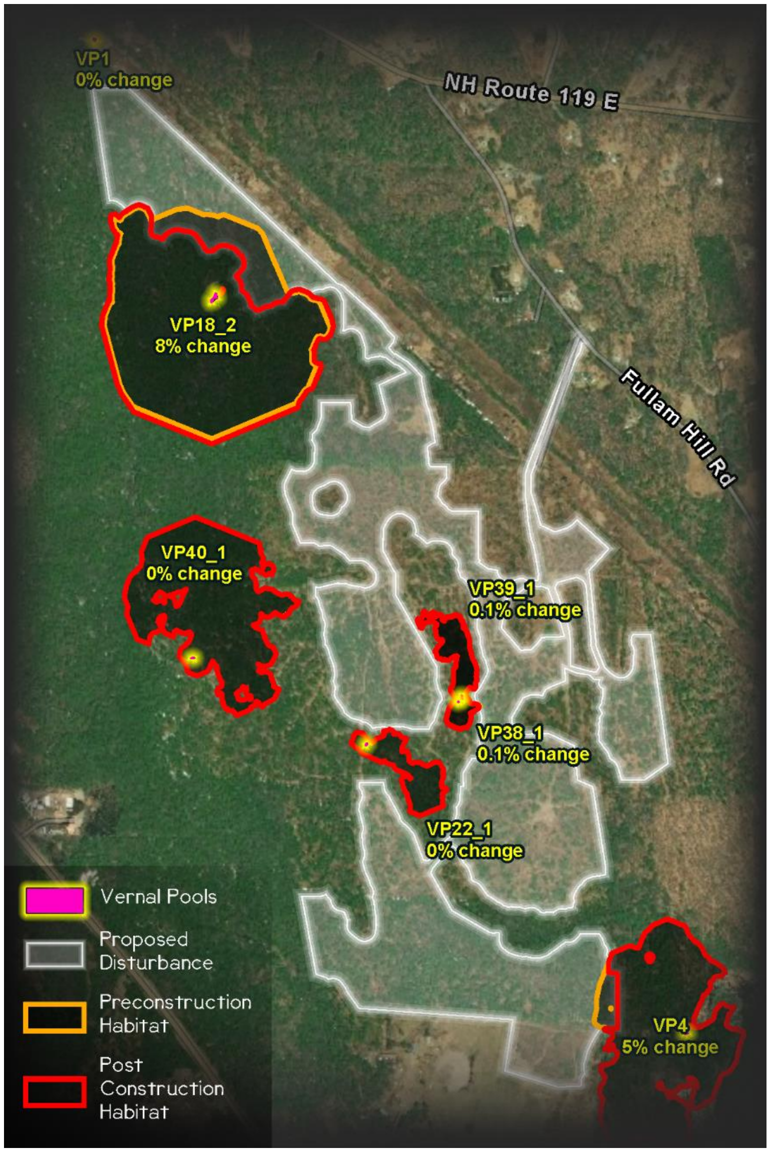

Figure 8. Vernal pools and upland habitat

The modeled available pool-surrounding habitat was therefore measured in three steps in this order:

- Equal to the maximum cost derived from a reference pool

- Equal to the area of a standard 750’ buffer
- Maximum of 1000’ from the pool edge

This approach considers the existing degraded habitat and does not suggest the presence of quality habitat that is unlikely to exist given current land management practices.

Because the proposed Project will remove all woody vegetation for the foreseeable future, a post-construction model was built with the same parameters as the existing conditions model described above except all land within the Project limit of disturbance was considered non-habitat, or exclusionary.

Based on AE’s field visit on June 17, 2020 and review of the data collected by the Applicant, we ran this analysis on the pools that were natural and appeared to have consistent and stable habitat for wood frogs and spotted salamanders. The pools and their modelled upland habitats are shown in **Error! Reference source not found.**. As can been seen in this map, the upland habitat surrounding the pools near the center of the proposed arrays (VP39_1, VP38_1 and VP22_1) is highly restricted. This is the direct result of the intensive forest management that has been occurring on the Project parcels. The clearing of surrounding upland habitat has had a significant impact on the appropriate habitat available for these amphibians.

The only appropriate habitat remaining exists within the wetlands and small pockets of uplands with >60% forested cover. The pools on the edge of the proposed Project area (VP18_2, VP40_1 and VP4) show a more traditional pattern of upland habitat because these areas have not experienced as much recent logging.

This figure also shows the preconstruction habitat compared to the habitat that remains postconstruction. The calculations for these impacts are shown in Table 1. As can be seen from this table, the proposed solar arrays would have very little impact on the upland habitat of these vernal pools. The largest impacts are on VP18_2 which would be only 8% impacted by the proposed solar development. This is well-below the thresholds for conservation set by Calhoun and Klemens (2002).

Table 1 Analysis of upland habitat around vernal pools

Vernal Pool ID	Pre Construction Acres Upland Habitat	Post Construction Acres Upland Habitat	% of Upland Habitat Remaining Post Construction
RS_CN_VP18_2	43.715	40.208	92%
RS_CN_VP22_1	3.625	3.625	100%
RS_CN_VP38_1	3.354	3.350	100%
RS_CN_VP39_1	3.285	3.281	100%
RS_CN_VP40_1	21.875	21.875	100%
TRC_VP4	25.965	24.670	95%

The main reason that the proposed solar facility would have such a low impact on the upland habitat around these vernal pools is that the previous logging has resulted in the (temporary) elimination of most of that habitat. While the impact from logging is detrimental to the amphibians that use that habitat, impacts from typical forest management activities are temporary. Amphibians will generally re-populate an area once canopy cover is reestablished. However, the area occupied by the proposed solar facility would be a much longer-term impact.

6.3.3 Conclusions

The Applicant has done a sufficient job of identifying and characterizing vernal pools on the Project site. All direct impacts to vernal pools have been avoided by the Project. Due to pre-construction forest management activities, the upland habitat of these pools has been significantly impacted. Due to these impacts, the proposed impacts from the Project to upland habitat are well-below recommended guidelines for conserving amphibian populations in these pools. Direct impacts to vernal pools from the proposed Project are therefore not considered unreasonable adverse impacts.

7. Natural Communities

Rare and exemplary natural communities are regulated by the SEC based on *Site 301.07 (c) 1-6.* Natural Communities are classified in New Hampshire based on The Nature of New Hampshire: Natural Communities of the Granite State (Sperduto and Kimball 2011). The New Hampshire NHB tracks occurrences of rare and exemplary natural communities in the state. The NHB designates as "exemplary" all rare natural community types as well as all high-quality examples of common community types. Determining if a particular natural community is a "high-quality" example is based on relative rarity, size of the community and ecological integrity in state and regional contexts.

7.1 Upland Natural Communities

7.1.1 Methodology Review

The Applicant consulted with NHB regarding natural communities and NHB determined that there were no known rare or exemplary natural communities in the Project site. This is not an uncommon occurrence since most of the rare and exemplary communities in the state are not mapped. The Applicant also conducted a Forest Composition Report which was presented as Appendix 15g of the SEC application. This report detailed the major tree canopy species and amount of forest cover present based on recent logging on the site. NHB, upon viewing the Forest Composition Report, noted that the dominant community was likely the Hemlock-beech-oak-pine forest.

No mapping, evaluation, or assessment of natural communities on the Project site was performed by the Applicant. While the Forest Composition Report may seem similar to a natural community report, there are significant differences. Most importantly, the Forest Composition Report only noted dominant canopy species and did not use the natural community classification as a basis for its assessment. Secondly, lacking this classification, the natural communities on the site were not mapped, therefore no physical representation of size of each occurrence could be obtained. Third, no assessment was conducted of the community condition. All of these factors are necessary components for determining if the community is exemplary.

In his prefiled testimony, however, Mr. Valleau states that "TRC did not identify any significant natural communities …as a result of its surveys or during agency consultations." This statement is misleading since no surveys of natural communities were actually conducted. Furthermore, Mr. Valleau states that "None of the surveyed communities in the Project area would qualify as "exemplary". Lacking any map or assessment of the natural communities at the site, or any justification for such a statement, it is unclear how such a claim can be made or supported.

7.1.2 Impact Assessment

The Applicant has stated that no exemplary natural communities are present in the Project area and therefore no impacts are expected to this resource. While it is beyond the scope of our review to conduct a complete independent mapping and assessment of natural communities on the site, a few observations are worth noting. First, based on our site visit on June 17, 2020 and review of existing materials, we concur with NHB that the site contains areas of Hemlock-beech-oak-pine forest. However, the site also contains areas of the Hemlock forest natural community. Both of these community types are common in southern New Hampshire. Therefore, in order for these to be considered exemplary, they would need to be considered "high-quality" examples of the types. Localized logging has impacted both of these communities, which decreases the community condition criteria. However, when mapping and assessing natural communities, it is important to assess the community occurrence as a whole; this means looking beyond the Project area to determine size and condition throughout the occurrence. Only by undertaking this methodology can a determination of "exemplary" be confirmed or denied. None of this analysis has been conducted.

7.1.3 Conclusions

Rare and exemplary natural communities are regulated by the SEC based on *Site 301.07 (c) 1-6.* The Applicant has not assessed, evaluated or mapped natural communities on the Project site. Claims by the Applicant that the Project site lacks exemplary natural communities have been made without justification or data to support such a claim. It is therefore our opinion that the Applicant has not met the burden of proof that the Project will not have an unreasonable, adverse impact on this resource.

8. Rare, Threatened and Endangered Species

Rare threatened and endangered species are regulated by the SEC based on *Site 301.07 (c) 1-6.* This includes species of animals and plants that are listed federally by the United States Fish and Wildlife Service or in the state of New Hampshire by NHDES. This section is broken up into subsections on Animals and Plants.

8.1 RTE Animals

Two rare or uncommon reptiles are known to exist near the Chinook Project site, the Blanding's turtle and the wood turtle. Both of these species are known to occur in wetlands northeast and southwest of the Project. In addition, NH Natural Heritage Bureau has also documented the Blanding's turtle on the Project site.

Blanding's Turtle (*Emydoidea blandingii*) State Endangered

In the northeast, the Blanding's turtle is found in Massachusetts, southern Maine and south-central New Hampshire, where the largest population is found. This species is considered of Severe conservation concern by NEPARC (2011) and a species of Regional Concern (Therres 1999). This species thrives in areas with a mosaic of upland habitat mixed with a diversity of wetland types. It often travels between wetland habitats using the intervening upland areas (Beaudry et.al. 2009). The turtles nest in open habitats with loose, well-drained soils including human influenced areas such as pastures, sand and gravel pits and powerline ROW. They are long-lived, slow to mature and have low fecundity rates. These factors, coupled with susceptibility to traffic mortality and habitats that overlap with dense human development, have led to decline in populations. Hibernation typically occurs in the muddy substrate at the bottom of open water wetlands.

Wood Turtle (*Glyptemys insculpta*) Special Concern

The Wood turtle's range in New Hampshire includes most of the state. This species is considered a Severe conservation concern by NEPARC (2011). The Wood turtle's main habitat consists of rivers and streams with hard (sand-gravel) substrate and the surrounding upland forests, shrubland and open areas. Most of their upland movements are within approximately 300m of rivers or streams (Kaufmann 1992; Arvisais et al. 2004). Though this species used to be very common, late maturation, low fecundity, habitat loss, and pressure from development have all led to declines in Wood turtle populations across the northeast.

8.1.1 Methodology Review

No inventories for either of these species within the Project area was performed by the Applicant. Rather, based on previous records of these species in the area, the Applicant assumed their presence.

8.1.2 Impact Assessment

In order to avoid or minimize potential impacts to these species, the Applicant developed a set of wildlife protection measures. These include:

- Installation of the perimeter fence with a 6" gap at the bottom to allow for turtle ingress and egress.
- Construction of silt barrier fence around the project to exclude turtles during construction. Barrier fence would be installed after turtle hibernation and before turtle emergence in spring. This would include ramps to allow turtles to leave if they became trapped inside the fence.
- Employing an environmental monitor to inspect the construction barrier fence daily for the presence of any turtles.
- Designing stormwater basins with gently sloping side to allow for turtle ingress and egress.

- Conducting environmental training for construction personnel on the need to avoid impacts to turtles.

These measures have been developed by the Applicant and shared with NH Agency officials in email correspondence. It is our understanding that some details of these measures are still being developed and they have not yet been incorporated into formal commitment by the Applicant. Lacking the final version to review, it is difficult to give a complete independent assessment of these mitigation measures.

8.1.3 Conclusions

The measures that have been presented at this time appear to address the major issues related to potential Blanding's and Wood turtle impacts. More specific details are needed to ensure that these measures are effective and should be incorporated into the final protection plan. These should include: specific dates for construction of the barrier fence, protocol for training construction personnel, time limits (post-construction) for removal of the barrier fence and specifications on slope gradients in stormwater basins. In addition, firm commitments to implement these measures from the Applicant should be obtained. If these measures are undertaken, it is our opinion that the Project will not result in unreasonable, adverse impacts to these species.

8.2 RTE Plants

Rare, threatened or endangered plants are protected under the NH Native Plant Protection Act (RSA 217-A). The New Hampshire Natural Heritage Bureau maintains a list of all plants that are considered rare, threatened or endangered. NHB also maintains a list of all plant species that are ranked as "State Watch" or "Indeterminate" species. State Watch species are those that are uncommon and "vulnerable to becoming threatened." Indeterminate species are those that are under review for listing but whose status, rarity, or taxonomy are not clearly understood.

8.2.1 Methodology Review

No inventories for rare plants were conducted by the Applicant as part of the environmental assessment of the Project. The New Hampshire NHB determined that there were no known historical occurrences of rare plants within or near the Project site. In addition, they determined that the site did not offer likely habitat for rare species that historically occurred in the surrounding area. Given these conclusions, the New Hampshire NHB did not request that a rare plant inventory be conducted for this Project.

It is our opinion that, for a project of this scale, a rare plant inventory should have been conducted for the following reasons. First, our knowledge of the distribution and abundance of rare plant species in New Hampshire is incomplete. Therefore, using this knowledge as the basis for determining if an inventory is necessary will inherently result in underreporting of rare species. Second, the assumption that rare plants will only occur near other, known populations of that species is faulty and not supported by the scientific literature (Wagner 1972; Raven 1972) . Third, rare plants are occasionally found in areas that are unusual based on their known ranges or habitat. These surprise findings add valuable knowledge about the ecology of rare species and would not have been detected if an inventory were not conducted because of our incomplete knowledge of the species.

During a presentation to the Fitzwilliam Town on January 15, 2019, the Applicant claimed that a "rare plant ... assessment" was conducted as part of the environmental assessment. According to the Applicant's materials reviewed for this Project, this statement is false. In addition, during his prefiled testimony, Mr. Valleau states that "TRC did not identify any…rare plants as a result of its surveys or during agency consultations." This statement is similarly false since no actual surveys were conducted.

8.2.2 Impact Assessment

An inventory of rare plants was not conducted at the Project site, and therefore, potential impacts to this resource are unknown.

8.2.3 Conclusions

The Applicant has conducted no inventories for rare plant species on the Project site. Claims by the Applicant that such inventories were conducted or that no rare species were found are false or misleading. Since no rare plant inventories were conducted, it is our opinion that the Applicant has not met the burden of proof that the Project will not have an unreasonable adverse impact on rare plant species.

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Appendix A: Impact Assessment of The Chinook Solar Project on Bats

Impact Assessment of

The Chinook Solar Project

on Bats

report prepared by:

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North
East
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01 July, 2020

EXECUTIVE SUMMARY

The Chinook Solar Project ('Chinook Project') requests a Site Evaluation Committee (SEC) Certificate to construct a 30-MW solar energy generation facility in Fitzwilliam, New Hampshire. NEES was retained by Arrowwood Environmental, on behalf of the Department of Justice (the Counsel for the Public) to provide analysis and opinion on the potential of the Chinook Project to have an unreasonable adverse effect on bat populations within the Project area. By the SEC criteria of significant wildlife species, this includes the Federally Threatened northern long-eared bat (*Myotis septentrionalis*) and NH State Endangered eastern small-footed bat (*Myotis leibii*), little brown bat (*Myotis lucifugus*), and tricolored bat (*Perimyotis subflavus*), as well as the NH Species of Greatest Conservation Need, including the big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*).

Chinook Solar LLC ('The Applicant') engaged TetraTech to conduct a pre-construction acoustic survey targeted at the northern long-eared bat. The pre-construction survey was limited to acoustic monitoring across the 595-acre project footprint. The total sampling effort was calculated based on the USFWS Guidelines for minimum survey effort. Using this methodology, the Applicant documented 'No Presence' for northern long-eared bat populations within the Project site. The Applicant has proposed limiting indirect impacts from tree-removal activities to the non-active season (November 01 – March 31). The Applicant has also committed to designing the Project "to maintain forested corridors connecting suitable bat foraging habitat".

I have reviewed all the relevant material submitted by the Applicant and conducted a field survey of the Project site. I have identified four primary concerns related to the scope or extent of surveys, the appropriateness of proposed impact minimization plans, and the adequacy of the mitigation proposals. In addition, I have strong concerns about the failure of the Applicant to address the concerns of multiple wildlife agencies, particularly with regard to the development of research and monitoring plans.

Ultimately, habitat loss at the Project site is extensive and unrelated to the Chinook Project. Recent and historical logging at the Project site has resulted in the loss of substantial forested habitat but has also created a habitat mosaic that has created both commuting and foraging habitat for bats. In general, habitat loss is not the primary threat to any of the significant bat species being addressed by the SEC process. Given the current state of the Project site, it is my opinion that there is relatively little risk that development of the Chinook Project would have a detrimental impact on any of the state Species of Concern. However, failure of the Applicant to meet the minimum sampling requirements of the USFWS Guidelines prevents a determination of 'absence' for the northern long-eared bat at the Project site. The Applicant's proposal to conduct tree removal during the non-active season (November 01 – March 31) is consistent with the USFWS 4(d) ruling for this species (USFWS, 2016), so if construction activities are conducted in accordance with these best management practices, the project is unlikely to have population-level impacts on the northern long-eared bat.

The absence of appropriate sampling for the eastern small-footed bat, especially given its' known proximity to the Project site, raises concern about the potential impact of construction and blasting impacts on this species. I therefore recommend the development of blasting monitoring plan to ensure that any construction activities address potential impacts to crevice-roosting small-footed bats. The development of this plan should be a condition of any SEC approval.

INTRODUCTION

The Chinook Solar Project ('Chinook Project') is a proposed 30-MW solar energy generation facility on seven parcels (595 acres) of forested habitat in Fitzwilliam, New Hampshire. North East Ecological Services ('NEES') was retained by Arrowwood Environmental, on behalf of the Department of Justice (the Counsel for the Public), to provide analysis and opinion on the potential for the Chinook Project to have an unreasonable adverse effect on bat populations within the Project area. Every species of bat found in New Hampshire meets the SEC criteria of "significant wildlife species", because each species is listed as endangered, threatened, or a species of concern (Table 1).

Table 1: Conservation Status of Bat Species in New Hampshire (NHFG, 2020)

Common Name	Species	FE	FT	SE	SGCN	SC
Northern long-eared bat	*Myotis septentrionalis*		**X**	**X**		
Little brown bat	*Myotis lucifugus*			**X**		
Eastern small-footed bat	*Myotis leibii*			**X**		
Tricolored bat	*Perimyotis subflavus*			**X**		
Big brown bat	*Eptesicus fuscus*				**X**	
Silver-haired bat	*Lasionycteris noctivagans*				**X**	**X**
Eastern red bat	*Lasiurus borealis*				**X**	**X**
Hoary bat	*Lasiurus cinereus*				**X**	**X**

FE = Federally-Endangered, **FT** = Federally-Threatened, **SE** = State-Endangered, **SC**=Species of Special Concern, **SGCN** = Species of Greatest Conservation Need

White-nose Syndrome

The primary threat to bats in New Hampshire is unquestionably White-nose Syndrome ("WNS": Blehert et al., 2009; Frick et al., 2010a). WNS is a cutaneous fungal disease caused by *Pseudogymnoascus destructans*, an emergent psychrophilic ("cold-loving") fungus that was first identified from a hibernaculum in western New York in 2006 (Blehert et al., 2009). WNS has been documented in almost all species of hibernating bats in the eastern United States (Locke, 2008; Reeder & Turner, 2008), including all of the hibernating bats known to occur in New Hampshire. Although the exact mechanisms of mortality are still uncertain, bats infected with WNS appear to have difficulty maintaining homeostasis during hibernation and generally die in early spring as a result of electrolyte imbalance, dehydration, and starvation (Cryan et al., 2010; Turner et al., 2011). Within two years of being detected at a site, WNS typically causes from 40% - 99% mortality within the hibernaculum (Langwig et al. 2015). Since first being documented in 2006, WNS has spread across 41 states and five provinces in Canada, causing the mortality of an estimated six million bats (USFWS, 2014) and population reductions of up to 98% in northern long-eared bat (Turner et al., 2011) and 92% in little brown bats (O'Regan et al. 2015).

Prior to the emergence of WNS, the NHFG had conducted multiple surveys of the hibernating bat population within the state and all the evidence suggested a robust and growing population across all species. Since the outbreak of WNS in New Hampshire in 2009, the population of hibernating bats has experienced a 99.8% decline, with bats extirpated from three of our eight known hibernacula, and two of the remaining hibernacula having only a single bat as of 2015 (Reynolds, unpublished data).

Primarily in response to similar levels of decline throughout their range, the northern long-eared bat was listed as a federally threatened species under the U.S. Endangered Species Act on April 02, 2015, with a final ruling released in January 2016 under the authority of section 4(d) of the ESA that establishes prohibitions with limited exceptions that are specific to this species [50 CFR 17.40(o): USFWS, 2016].

SIGNIFICANT WILDLIFE SPECIES - BATS

According to Section Site 102.50 of the SEC (2020), 'significant wildlife species' means (a) any species listed as threatened or endangered by the U.S. Fish and Wildlife Service ('USFWS'); or (b) any species listed as threatened, endangered, or of Special Concern by the New Hampshire Department of Fish and Game ('NHFG'). Section Site 102.49 identifies 'significant habitat' as any habitat used by a wildlife species for critical life cycle functions (SEC, 2020).

Northern Long-eared Bat

The northern long-eared bat (*Myotis septentrionalis*) is currently the only Federally listed species in New Hampshire. The northern long-eared bat was in a mild decline prior to the onset of WNS (Ingersoll et al. 2013), possibly due to habitat loss throughout the northeast region. However, this decline is insignificant in the context of WNS, as regional populations have declined over 98% based on winter population counts (Turner et al. 2011) and 95% based on summer capture rates (Reynolds et al. 2016). Northern long-eared bats were common species at Pisgah State Park (15 miles west: Veilleux et al., 2008) and New Boston Air Force Station (25 miles northeast: Reynolds et al. 2016). Historically, northern long-eared bats were known from each of the eight winter hibernaculum tracked by the NH Fish and Game; only a single northern long-eared bat from one hibernaculum in Lyman has been documented in New Hampshire since 2015 (Figure 1, Reynolds, unpublished data).

The northern long-eared bat ranges throughout the eastern United States and much of the lower Canadian provinces (Caceres & Barclay, 2000). During summer, females form small maternity colonies (usually less than 30 bats) within tree hollows, crevices, or under exfoliating bark (Foster and Kurta, 1999; Menzel et al., 2002; Owen et al., 2003). Tree species used as roosts are highly variable, but generally are taller and wider than randomly selected trees (Sasse & Pekins, 1996; Owen et al., 2002; Ford et al., 2006a; Perry & Thill, 2007a). Owen et al. (2003) found that the majority of roost trees used by *M. septentrionalis* were located in intact forests (70-90-year-old forests with no timber harvest activity within 10-15 years), and they are often close to open water (Larson et al., 2003). Less is known about the summer ecology of the males, although they are known to use tree roosts (more likely under exfoliating bark than in cavities: Perry & Thill, 2007a), bat houses (Whitaker et al., 2006) and caves (Whitaker & Rissler, 1992) during the summer period. Northern long-eared bats show a strong preference for foraging in and near forested habitats (Ford et al., 2005). They are commonly captured in managed forests along the edges (Hogberg et al., 2002), but are also found foraging over ponds and streams (Caceres & Barclay, 2000).

Little brown bat

The little brown bat (*Myotis lucifugus*) occurs throughout most of North America (Fenton and Barclay, 1980), and has historically been one of the most common species encountered throughout its range. Little brown bats are generally considered a 'commensal' species that forms maternity roosts in human structures (e.g. barns, attics, bat houses). These roosts are typically small (under 100 individuals), but may reach several thousand bats, with the largest known colony in the eastern United States (located in Pennsylvania) estimated at approximately 20,000 bats (Butchkoski & Hassinger, 2002). Little brown bats are found in a wide variety of habitats, but are most commonly seen along streams, lakes, and ponds (Fenton & Bell, 1979), and will even use woodland vernal pools (Francl, 2005). Given the flexibility of little brown bats in their prey selection, they have a relatively small foraging home range (30 ha) and seldom travel far from their roosts to foraging areas (Henry et al., 2002). Little brown bats migrate seasonally from their summer home range to their hibernacula, travelling up to 455 km (Humphrey, 1971).

Historically, little brown bats were the most common species in southern New Hampshire. Prior to WNS, hundreds of little brown bat colonies were documented from Hillsborough, Merrimack, and Cheshire counties, with five known colonies in Fitzwilliam and dozens more in adjacent towns in Worcester

County (Reynolds, unpublished). The best information on the population growth and demographics of this species came from a long-term study of a colony from Peterborough, NH, 10 miles northeast of the Project site (Figure 1, Reynolds, 1999; Frick et al., 2010b). The little brown bat was added to the state Endangered list on March 24, 2017 but was listed as a Species of Concern prior to 2016.

Eastern small-footed bat

The eastern small-footed bat (*Myotis leibii*) has an extensive distribution (from Ontario to New England, southward to Georgia and Westward to Oklahoma), although it is not considered common anywhere within its range. Confusion about it's species status prior to 1984 (van Zyll de Jong, 1984), has likely played a significant role in the lack of federal protection afforded to this species, considering the eastern small-footed bat is one of the rarest bats in North America (Griffin, 1940) and 'without doubt the least known of all northeastern bat species' (Thomas, 1993). Although *M. leibii* is not federally protected, it has special status in most of the states within its' range, and it has been listed as Endangered in New Hampshire for over 30 years.

Summer capture data suggest that small-footed bats tend to use rocky hillsides as maternity roosts (Fenton et al., 1980; LaGory et al., 2008). Although this is typical habitat in mountainous regions, they appear to be more versatile throughout their range, using rock slabs, rocky outcrops, talus slopes, earthen dams, hollow trees, abandoned tunnels, and even human structures (Thomas, 1993; Best & Jennings, 1997; LaGory et al., 2008). Summer populations of small-footed bats appear to be patchy throughout their range, and summer activity is often concentrated around hibernacula (Thomas, 1993; Johnson & Gates, 2008; Reynolds et al., 2016). In fact, the two best-known long-term monitoring summer monitoring projects for this species, including the first location to document reproductive females in the state, are located in New Boston (25 miles northeast: LaGory et al., 2008) and Surry (18 miles northwest: Moosman et al. 2007). Most of the research suggests that eastern small-footed bats travel short distances between winter hibernacula and summer roost areas, with individuals remaining in the same vicinity year-round as long as they have access to both roosting and foraging habitat (Reynolds et al. 2016). Eastern small-footed bats have been documented hibernating in multiple sites in the region (Figure 1), including Mascot Mine (Coos County, NH: Reynolds, unpublished), Chester Mine (55 miles southwest in Hampshire County, MA: Veilleux, 2007), along a talus slope at the New Boston Air Force Station (25 miles northeast: Reynolds et al., 2016), and most likely hibernating at the Surry Dam complex (18 miles northwest: Veilleux, unpublished). Eastern small-footed bats are one of two species of hibernating bats that continue to persist in the presence of WNS (Langwig et al. 2012). Due to the severe decline of the other myotine bat species, the eastern small-footed bats have become one of the more common myotine bat species in the northeast, and the only myotine species still known to hibernate in the state. Due to their continued persistence and their highly specialized roosting requirements, eastern small-footed bats should be considered a top conservation priority throughout their range.

Eastern tricolored bat

The eastern tricolored bat (*Perimyotis subflavus*), formerly known as the eastern pipistrelle (Hoofer et al., 2006), occurs throughout much of the eastern United States, north to southeastern Canada, and south through Honduras (Fujita & Kunz, 1984). There are data suggesting that the tricolored bat has seen a recent range expansion both to the north and west as artificial hibernacula (mines) have become more available (Geluso et al., 2005; Kurta et al., 2007). During summer months, female tricolored bats typically form small maternity colonies (under 10 individuals) in hardwood trees, usually using both dead leaf clusters and live foliage (Veilleux et al., 2003). Like most tree-roosting bats, tricolored bat roosts are in trees that are taller and wider than the surrounding trees (Perry & Thill, 2007b). Radiotracking of individuals suggests that tricolored bats prefer roost trees in both upland forests and riparian woodlands (Veilleux et al., 2003). Summer foraging habitat of the tricolored bat is predominantly low elevation riparian habitat, although they are also found in pine stands and upland hardwoods (Carter et al., 1999;

Veilleux et al., 2003; Ford et al., 2005). Historically, tricolored bats have been documented in small numbers six of the eight winter hibernaculum tracked by the NH Fish and Game; the most recent survey of hibernacula from the 2014-2015 winter season failed to document any tricolored bats within the state (Reynolds, unpublished data). The eastern tricolored bat was added to the state Endangered list on March 24, 2017 but was listed as a Species of Concern prior to 2016.

Big brown bat

The big brown bat occurs throughout most of North America where suitable roosting habitat exists (Kurta & Baker, 1990). During summer, populations of big brown bats are generally commensal, roosting within human structures (attics, barns, bat houses, bridges: Whitaker & Gummer, 1992; Feldhamer et al., 2003; Whitaker et al., 2006). Some individuals particularly males, will also roost in trees (Betts, 1996; Willis & Brigham, 2004), rock outcrops (Lausen & Barclay, 2002), and other natural roosts (Kurta & Baker, 1990). In the east, maternity roosts range in size from several dozen up to 600 bats (Whitaker & Hamilton, 1998). Most maternity colonies are located near water (Mills et al., 1975). Big brown bats are classified as true habitat generalists, utilizing almost every available habitat within its range (Furlonger et al., 1987; Agosta, 2002). Summer research shows that big brown bats are commonly captured over water (Francl, 2008), along woodland edges, within woodlands, and are frequently the dominant species in rural and urban areas (Everette et al., 2001; Duchamp et al., 2004; Gehrt & Chelsvig, 2003). During winter, big brown bats hibernate in cave and mines, as well as in buildings (Whitaker & Gummer, 1992; Whitaker & Gummer, 2000; McAlpine et al., 2002), and rock crevices (Andre et al., 2003; Lausen & Barclay, 2006; Neubaum et al., 2006).

Historically, big brown bats were the one of the most common species in southern New Hampshire, particularly Rockingham, Hillsborough, and Cheshire counties. Since the arrival of WNS, big brown bats have seen the lowest level of decline of all the hibernating bat species (Butchkoski & Bearer, 2016), and they are one of only two species that are still documented as hibernating in New Hampshire (Reynolds, unpublished).

Silver-haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) occurs throughout much of the majority of southern Canada and the United States (Kunz, 1982). The silver-haired bat is a tree-roosting species and during summer months roosts in tree hollows and under exfoliating bark (e.g. Vonhof, 1996; Betts, 1998; Crampton & Barclay, 1998). In terms of landscape level choice, Betts (1998) found most roosts used by silver-haired bats are found in mature stands, particularly in coniferous forests (Perkins & Cross, 1988; Jung et al., 1999). Arnett (2007) found that silver-haired roosting habitat was highly associated with high snag density and low elevation, whereas Campbell et al. (1996) found roost sites concentrated near riparian areas and moderately-sloped habitat. Like most tree-roosting bats, the roost trees of silver-haired bats are diverse in species but are typically taller and wider than random trees used for comparison (Campbell et al., 1996; Vonhof, 1996; Betts, 1998). Barclay (1985) found that the silver-haired bat used similar foraging habitat as hoary bats, with the highest level of activity found in forested habitat, particularly when in proximity to ponds or streams (Schmidly, 2004). Silver-haired bats generally do not hibernate, although there are multiple records of individuals winter roosting in caves (Beer, 1956; Martin & Hawks, 1972; Izor, 1979), houses (Gosling, 1977; Clark, 1993; Sherwood & Kurta, 1999) and rock crevices (Perry et al., 2010).

Eastern red bat

Eastern red bats (*Lasiurus borealis*) are one of the most common migratory tree bats and found throughout much of the United States, Central and South America (Shump & Shump, 1982a). During summer months, eastern red bats roost in the foliage of hardwood trees (Shump & Shump, 1982a;

Whitaker & Hamilton, 1998). Despite the diversity of tree species, red bat roost trees are almost always deciduous and found within mature forest stands (Ford et al., 2006b; Perry et al., 2007; Perry et al., 2008). The research is also consistent in the fact that roost trees are typically taller, larger, and have a higher crown base than random trees (Menzel et al., 2000; Perry et al., 2007). Red bats are flexible in their roosting habitat requirements and can be considered habitat generalists (Ford et al., 2005; Elmore et al., 2005) as long as the roost trees are located close to permanent water sources (Hutchinson & Lacki, 2000). Historically, red bats have been one of the most common bats in the eastern United States (Lewis, 1940), but there are some data to suggest that populations have declined substantially since the late 1970's (Winhold et al., 2008). In the wake of WNS, red bats are frequently one of the most abundant species of bat captured in surveys throughout the northeast (Reynolds, unpublished). In the spring, they migrate into the northeast from more southern latitudes. Although red bats do not hibernate to the extent of the cave bats, they have been documented foraging in their summer range during the winter (Easterla, 1967; Dunbar & Tomasi, 2006; Dunbar et al., 2007; Reynolds et al. 2016).

Hoary Bat

The hoary bat (*Lasiurus cinereus*) occurs throughout much of North and South America (Cryan, 2003). Large-scale population surveys suggest that hoary bats are found in a variety of habitats, but they appear to be more commonly found foraging in riparian habitats than upland forests (Hart et al., 1993; Heady & Frick, 1999; Menzel et al., 2005; Ford et al., 2005). Hoary bats are tree-roosting bats that suspend from foliage in the upper canopy of both deciduous and coniferous trees (Perry & Thill, 2007c; Veilleux et al., 2009) but are associated with coniferous forests at higher frequency than other tree-roosting bats (McClure, 1942; Perkins & Cross, 1988). As with most tree-roosting species, roost trees are typically taller and wider than random trees used for comparison (Perry & Thill, 2007c; Miller & Miles, 2008). The foraging habitat of hoary bats is quite diverse; Hart et al. (1993) found hoary bats utilizing forested and aquatic habitats in greater proportions than non-forested and non-aquatic habitats. Cryan and Veilleux (2007) suggested that hoary bats concentrate their activity in forested habitats (nearly 70%), with less foraging occurring in open fields (17%) or wetlands (15%). Hoary bats are commonly caught in edge habitat (Furlonger et al., 1987). Hoary bats in general do not hibernate; rather, they migrate south in the winter, often in groups (Provost & Kirkpatrick, 1952) and in episodic waves across the landscape (Findley & Jones, 1964).

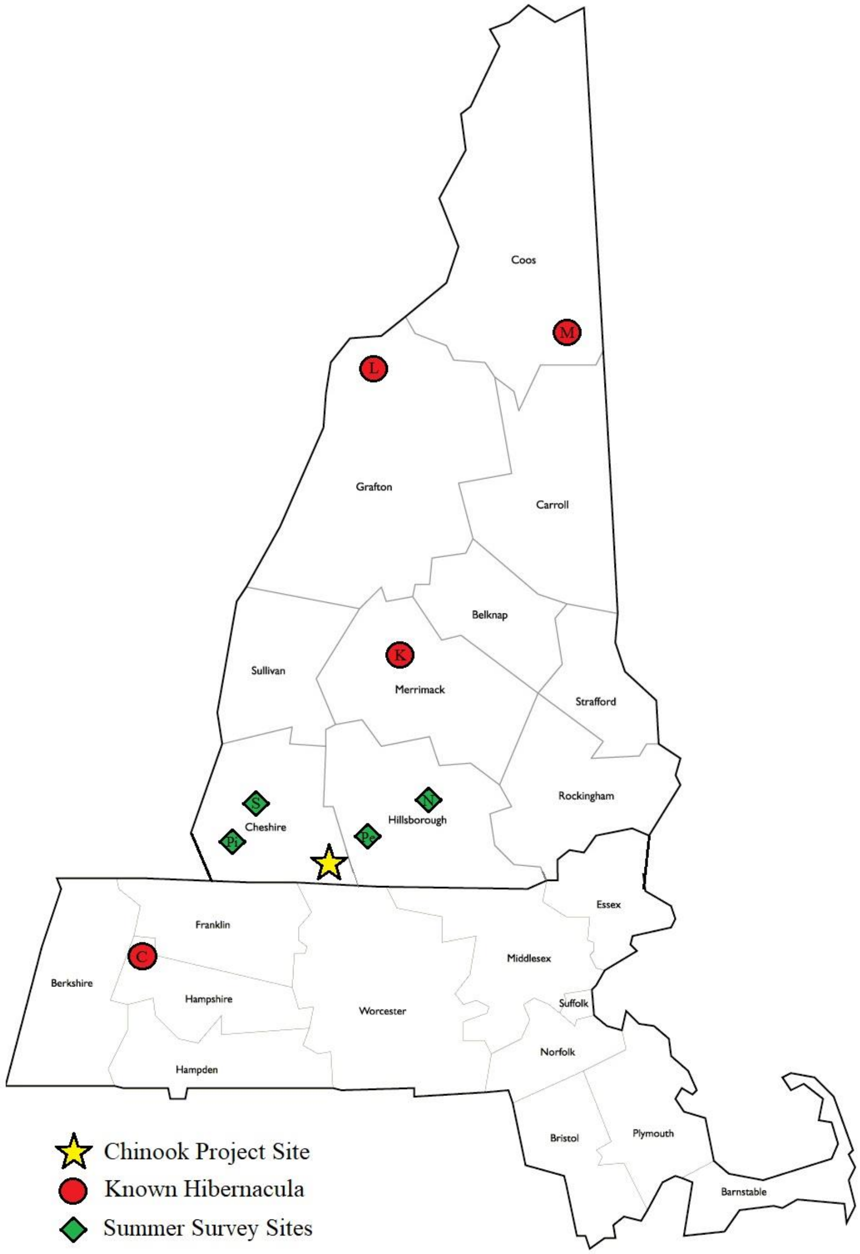

Figure 1. Map of New Hampshire and Massachusetts with key sites identified*: C= Chester Mine, K= Kearsarge Mine, L= Lyman Mine, M=Mascot Mine, N=New Boston Air Force Station, Pe = Peterborough colony, Pi = Pisgah State Park, S = Surry Dam*

REGULATORY FRAMEWORK SUMMARY

To reach my opinion on the potential for unreasonable adverse effect on significant bat species and bat habitat, I used the criteria set forth by the SEC (2020) and itemized below:

1. The significance of the resource or affected species;

2. The nature of the impact on the specific wildlife species or resource (including the nature, extent, and duration of the impact);
3. The impact on significant terrestrial or aquatic habitat or migration corridors;
4. A review of the analyses and recommendations of relevant agencies, including the USFWS and NHFG;
5. A review of the effectiveness of proposed avoidance, minimization, and mitigation measures for the specific resource (e.g. do they represent best practical measures?)
6. A review of the effectiveness of proposed avoidance, minimization, and mitigation for the significant habitat or migration corridor; and
7. Are specific conditions needed for post-construction monitoring and reporting, or for adaptive management, to address unpredictable potential adverse impacts (SEC, 2020).

In evaluating the significance of the affected species, it is critical to understand the dire status of North American bat populations due to the impact of White-nose Syndrome, and the potential regional impact of habitat loss and renewable energy development on persisting bat populations in southern New Hampshire.

METHODOLOGY

To make a determination of the potential for unreasonable adverse effect, NEES relied on information provided in the Applicant's SEC Application ('The Application'; Chinook Solar, 2019), the Bat Presence/Absence Survey Report ('Bat Survey'; TetraTech, 2019), and materials supplied by the SEC and the Applicant through the Data Request process ('Applicant Responses', April 01, 2020) and the on-line Technical Session (April 08, 2020). This information was evaluated with specific regard to the criteria identified by the SEC Guidelines to evaluate the potential for unreasonable adverse effect. Specifically,

(1) Description of how the applicant identified significant wildlife species potentially affected by construction and operation of the proposed facility;
(2) Identification of critical wildlife habitat and significant habitat resources potentially affected by construction and operation of the proposed facility;
(3) Assessment of potential impacts of construction and operation on significant wildlife species, and on critical wildlife habitat and significant habitat resources, including fragmentation or other alteration of terrestrial or aquatic significant habitat resources;
(4) Description of the measures planned to avoid, minimize, or mitigate potential adverse impacts of construction and operation on wildlife species, and on critical wildlife habitat and significant habitat resources, and the alternative measures considered but rejected by the applicant; and
(5) Description of the status of the applicant's discussions with the New Hampshire Department of Fish and Game, the New Hampshire Natural Heritage Bureau, the United States Fish and Wildlife Service, and any other federal or state agencies having permitting or other regulatory authority over fish, wildlife, and other natural resources.

In addition, NEES conducted an on-site evaluation of the Project Site to assess the field-based methodology employed by TetraTech. This evaluation was conducted on June 17, 2020 in conjunction with Michael Lew-Smith (Arrowwood Environmental), with the assistance of TRC personnel. During the site survey, I reviewed the majority of the project area, obtained a better understanding of the general habitat, and evaluated all the sampling locations used during the Bat Survey.

In addition, NEES re-analyzed the acoustic data collected by TetraTech to evaluate their findings using different automated identification software (EchoClass v3.1 and BCID v2.7c) that are, in my opinion, more reliable for northeast bat species.

METHODOLOGICAL REVIEW

Sampling Effort

The Bat Survey submitted by TetraTech (Appendix 15E of the Application) states that the entire "Project Area (595 acres) was determined to be possible suitable habitat as it consists forest habitat interspersed with clearings and associated edge habitat that could be utilized as foraging areas by NLEB (Hogberg et al. 2002)". The Bat Survey report also stated that the acoustic survey was conducted in accordance with the 2016 Range-Wide Indiana Bat Summer Survey Guidelines for Indiana Bat and Northern Long-eared Bat ('USFWS Guidelines')". The total minimum sampling effort stipulated by the 2016 USFWS Guidelines was four detector-nights of sampling per 123-acres of suitable habitat; at 595 acres, that would yield 19.4 detector-nights. This means that the proposed sampling effort (16 detector-nights) and the actual sampling effort (14 detector-nights) were 17.5% and 27.8% below the minimum requirements to meet the USFWS Guideline protocol. If the survey were to be repeated under the current 2019 USFWS Guidelines, the minimum effort would be 38.7 detector-nights, meaning that a new survey would require almost triple the sampling effort that TetraTech conducted for the Chinook survey. Therefore, the sampling effort would clearly be considered inadequate now, and was in fact inadequate at the time the survey was conducted.

An inadequate sampling effort can often result in underreporting the number of bats in an area. In 2017, NEES was engaged to conduct a wetlands habitat survey in Rindge, NH by the Rindge Conservation Commission. These sampling habitats were within 2.5 miles of the Chinook Project site. NEES utilized a survey protocol consistent with the 2016 USFWS Guidelines, including a desktop habitat analysis and the micro-siting of sampling points to maximize the likelihood of documenting bat activity. Even though the total habitat area was less than 100 acres, NEES deployed 8 detector-nights ("dn") of sampling and recorded 906 calls. This sampling effort represents 57% of the sampling effort conducted by TetraTech, despite a habitat footprint that was less than 15% of the Chinook project site. It is also worth noting that myotine bat activity was tentatively documented at each of the four sampling sites, and that total bat activity was 113.3 calls/dn compared with 61.5 calls/dn at the Chinook project site (Reynolds, 2017).

Site Selection Criteria

The 2016 USFWS Guidelines state that acoustic surveys "should be conducted in the best suitable habitat possible … to increase the likelihood of detecting [bats]". Some pre-construction surveys also prioritize "potential for impact" in their site selection, focusing on sampling points within the project footprint as well as optimal or representative habitat. However, it is not apparent that either of these goals were pursued for this project. It is clear that the development footprint was not considered a sampling priority, as only two sampling points were even within the Development Area as identified in Figure 2 of the Bat Survey. But it is not clear that optimal or 'best suitable habitat' was a priority either.

As just stated, the 2016 USFWS Guidelines state that acoustic surveys should be conducted in the best suitable habitat to maximize the likelihood of detecting bats. TetraTech states that acoustic detectors were "micro-sited in suitable habitat within the Project Area to ensure that potential habitats were sampled in accordance with the Guidelines". Therefore, the sites selected should have been in the "best suitable habitat" and in locations that maximize the potential to detect bats. But in the Bat Survey Report, TetraTech stated that the project layout "avoids more favorable habitat along Scott's Brook", clearly identifying Scott's Brook as potential 'best suitable habitat'. However, only one sampling point (NHCK-03) was within 0.4 km of the brook. My visit to this site was consistent with the photograph provided in the Bat Survey Report (Photo 06) that showed an open canopy but dense understory and mid-story vegetation and no connecting corridor to the adjacent wetland and brook habitat. Although NHCK-03 was the detector that failed to work, and thus no data were collected, it is unlikely that this site would have documented high levels of bat activity, and extremely unlikely that this site would have characterized bat activity along Scott's Brook. Similarly, even though the survey employed sampling points that were over

1.0 km outside of the development area (NHCK-01), none of the sampling points were within 1.2 km of Scott's Pond, an area likely to have high levels of bat activity in general, and myotine bat activity in particular.

Other sites, particularly NHCK-03, NHCK-04, NHCK-06, and NHCK-07 were all small interior forest canopy openings that had no clear access points for bats in the mid-story or understory. Although understory vegetation is likely to have changed in the last four years, the mid-story vegetation is not. These sites were essentially deforested cul-de-sacs that were most likely harvester trails that terminated at a set of trees that were removed to create the opening (often less than 30 ft wide). Even if bats were able to enter these sites in 2016, it is unclear why they would be considered good habitat to detect bats. Sites NHCK-06 and NHCK-07 were both within 100 ft of better sampling habitat, including older (pre-2016 survey) skidder trails that would have captured commuting bats effectively. There was even a late-stage emergent snag within 100 ft of NHCK-07 that was on a forested trail that would have been an ideal sampling point.

It was obvious from the site survey that there have been a lot of habitat changes since the survey was conducted in 2016. For example, NHCK-02 was "within canopy flyway near intermittent drainage" and had an "open understory" in 2016. At the time of my site survey, it was in a relatively open space adjacent to a much larger early successional field. Given the change that has occurred at this site, it is unclear why NHCK-02 only detected four bats over two nights. Other sites, such as NHCK-05 appear to be relatively unchanged. Based on my site visit, NHCK-05 is an ideal sampling point; it is a log landing with forested trailheads entering from multiple directions. It is likely that regardless of which way the microphone was oriented, bat activity would be documented at this site. And in fact, this site accounted for 72% of the total documented bat activity, whereas the four sites interior forest canopy openings above accounted for less than 14% of the total documented bat activity.

It is also important to note that sampling for the eastern small-footed bat should have been incorporated into the Bat Survey protocol, as it is a state Endangered species with unique habitat requirements. Given that TRC had identified all stone walls, rock piles, and rocky outcrops on the Project site (Dana Valleau, *pers. comm.*), it would have been feasible and appropriate to sample for this species. In particular, a large south-facing boulder pile (Feature 168) along a forest edge created the opportunity to sample a fairly unique and species-specific critical habitat while also sampling ideal commuting habitat for the entire bat community. This boulder pile was within a few hundred feet of NHCK-07, one of four interior forest openings that were sampled at the Project site.

Data Analysis

According to TetraTech, acoustic detectors were deployed in accordance with the Guidelines, and data were analyzed using a federally approved software package (Kaleidoscope Pro v3.1.7) and manually vetted for species identification by a qualified biologist. My analysis of the data files collected by TetraTech resulted in similar overall levels of bat activity based on both EchoClass and BCID East (Table 2). BCID East had similar levels as KaleidoScope Pro in terms of total calls assigned to species (648 vs 861) and total calls assigned to myotine bats (24 vs 27). EchoClass identified more files to species than KaleidoScope Pro (950 vs 861), but fewer calls were assigned to myotine species (17 vs 27). These differences are intrinsic to the algorithms used by each software package, and do not reflect any biases or errors on the part of TetraTech.

Table 2. Summary of Bat Activity at Chinook Project Site using three auto-classifier software packages (number of calls assigned to Myotis species).

	KaleidoScope	**EchoClass**	**BCID**
NHCK-1	79 (4)	88 (3) *	59 (4)
NHCK-2	4 (1)	5 (1)	1 (1)
NHCK-4	8 (2)	9 (1) *	2 (0)
NHCK-5	624 (6)	693 (2)	444 (3)
NHCK-6	16 (1)	18 (5) *	15 (1)
NHCK-7	93 (4)	98 (1) *	81 (4)
NHCK-8	37 (9)	39 (4) *	34 (11)
TOTAL:	861 (27)	950 (17)	648 (24)

* at least one call identified as either northern long-eared bat or Indiana bat

Each of these programs have similar levels of species identification error. I am always circumspect in reviewing acoustic data from bats within the genus *Myotis* (‘myotine bats’) because there is such a high overlap in the echolocation signature of these bats, and thus a high potential for misclassification (Jones et al., 2004). This is particularly true in cluttered forest habitats where ecomorphological constraints of ultrasound become more dominant factors in the signature than phylogeny. Species identification software do not increase the accuracy of this task, but merely increase the repeatability of the methodology and the precision of the errors. This is why the USFWS Guidelines recommend manually vetting of potential myotine calls by a qualified expert. I am not familiar with either of the TetraTech biologists who conducted this survey, so I do not have specific concerns about their technical qualifications. It is encouraging that the biologist who conducted the manual review (Clinton Parrish) was also the biologist who conducted the field survey, since direct knowledge of the sampling conditions has an impact on the ability to distinguish myotine bats from each other, and from other species (particularly red bats and big brown bats).

According to Table 3 of the Bat Report, KaleidoScope Pro documented a total of 861 bat passes across the seven sites, with no calls identified from the northern long-eared bat and 34 calls initially classified as little brown bats. Manual vetting of these 34 calls by TetraTech suggested that most of the myotine calls were in fact little brown bats. EchoClass and BCID agreed with the general findings of KaleidoScope Pro, but EchoClass found evidence for the presence of northern long-eared bat at five of the seven sampling points. EchoClass also concluded that many of these calls were consistent with little brown bats. Given that all three of these software packages are approved by the USFWS Guidelines, it would be difficult to resolve these differences through quantitative analysis. In reality, the best way to increase the confidence of the species identification, regardless of which software are utilized, is to collect more data to increase the statistical power (Britzke, 2005). Given the inadequate total sampling effort and the low level of bat activity compared to a similar project less than three miles from the Project site, there are insufficient data to make an assumption of “absence” for either the northern long-eared bat or the eastern small-footed bat.

IMPACT ASSESSMENT

Northern Long-eared bat

The Application states that the USFWS was contacted to obtain a list of federally threatened and endangered species that may occur in the Project area, and this list identified the northern long-eared bat as potentially occurring in the Project area. The northern long-eared bat was also apparently the focus of conservation effort in consultation with the NH Fish & Game. Data collected by TetraTech suggest that northern long-eared bats are not located in the Project area, but the lack of data make this assumption premature. Because the Applicant did not meet the Presence/Absence sampling criteria set forth in the 2016 USFWS Guidelines, they cannot make the determination of absence. Specifically, they failed to meet the minimum sampling requirements set forth by the 2016 USFWS Guidelines, and, in my opinion, failed to sample in a manner that maximized the likelihood of detecting this species. That being said, the Applicant has proposed to conduct tree removal during the non-active season (November 01 – March 31) to minimize the risk of incidental take without compromising the conservation or recovery of this species. In this regard, the impact minimization proposed by the Applicant is consistent with the USFWS 4(d) ruling for the northern long-eared bat (USFWS, 2016), and if tree removal and construction activities are conducted in accordance with best management practices, the project is unlikely to have population-level impacts on the northern long-eared bat.

Little brown bat

At the time of agency consultation, the big brown bat was not a "significant wildlife species" as specified by the SEC Guidelines, and therefore no specific sampling or mitigation requirements would have been identified. In 2017, little brown bats were added to the State Endangered list, the highest level of mitigation and conservation need available to a state wildlife agency. Data collected by TetraTech suggest that little brown bats are one of the most common species in the Project area, a result that was similar to what I found in Rindge in 2017, but is otherwise extremely unusual for the northeast following the impact of WNS. In fact, little brown bats were the only bat species identified at every sampling site, suggesting they are persisting in the Fitzwilliam region at a higher rate than most other northeastern areas. It is unlikely that this project would contribute to the regional decline of this species, but it is possible that well-designed conservation and habitat enhancement strategies specific to the little brown bat could enhance the conservation and recovery of the little brown bat.

Eastern Small-footed bat

Section C.5 of the Application states that Fitzwilliam has "substantial granite outcroppings", one of the primary summer roosting habitats of the eastern small-footed bat. TRC biologists documented that location of rock features, including rocky outcrops, stone walls, and large boulders that could potentially provide roosting habitat for small-footed bats, but it is unclear whether TetraTech used these data in their habitat analysis. The Application further states that blasting may be required at some locations, and states that "all activities related to blasting shall follow Best Management Practices (BMPs) to prevent contamination of groundwater including preparing, reviewing and following an approved blasting plan". Blasting, drilling, and vibration are all likely to have negative impacts on this species, but the Applicant makes no reference to blasting in the context of significant habitat or critical wildlife habitat, and the BMP guidelines as they are stated in the Application are limited to the preservation of water quality and safety.

I do not think the Applicant adequately addressed the potential presence of this species in the Project area, given that the majority of significant known summer locations of this species in the state are within 25 miles of the Project area. Given their unique roosting requirements, it is also unlikely that a monitoring survey designed for the northern long-eared bat (a forest-roosting species) would adequately represent the presence of the eastern small-footed bat (a saxicolous species dependent on rocky outcrops and talus). In my opinion, construction activity in general, and blasting in particular, could have an impact on this species. Even though there were only a few exposed rock outcroppings observed in the Project area, none of them were addressed in the Bat Survey. Moving rock piles or stone walls during the summer months could significantly impact roosting bats, causing both direct mortality and indirect disturbance. Any such activity should be preceded by appropriate efforts to determine whether bats are roosting within these sites prior to their removal. Therefore, pre-construction monitoring should be performed prior to any relocation or disturbance to rock features within the Project area. In addition, any blasting plan developed as part of this project should incorporate impact mitigation and habitat conservation and enhancement for this species. Because the blasting plan is not going to be developed until after an SEC Certificate has been issued, it is my opinion the Applicant should establish a Programmatic Agreement with the NHFG for the eastern small-footed bat that would address appropriate pre-construction survey methods and require agency approval for a Blasting and Stone Feature Alteration Plan.

Tricolored bat

The Application states that the USFWS was contacted to obtain a list of federally threatened and endangered species that may occur in the Project area. However, there is no information that shows a similar list was requested for New Hampshire's threatened or endangered species, including the tricolored bat. Data collected by TetraTech suggest that tricolored bats are in the Project area (NHCK-4) but are unlikely to be a common species. Although the Applicant did not address this species as required by the SEC Guidelines, they worked under the assumption that survey efforts and mitigation efforts concentrated on the northern long-eared bat would be similarly effective at identifying and protecting tricolored bats. I generally agree with this premise, although I re-iterate my concern about the quality of the sampling sites. Assuming the low level of activity documented in the Project area is representative of their true abundance, it is unlikely that this project would have any population-level impact on the tricolored bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

Big brown bat

At the time of agency consultation, the big brown bat was not a "significant wildlife species" as specified by the SEC Guidelines, and therefore no specific sampling or mitigation requirements would have been identified. In 2017, big brown bats were added to the Species of Concern and Species of Greatest Conservation Need by the state of New Hampshire, and thus they should be afforded consideration in terms of mitigation and conservation. Data collected by TetraTech suggest that big brown bats are the most abundant species in the Project area; these data are consistent with other population surveys throughout the region. It is my opinion that this project would have no population-level impact on the big brown bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

Silver-haired Bat

The Application states that the USFWS was contacted to obtain a list of federally threatened and endangered species that may occur in the Project area. However, there is no information that shows a similar list was requested for New Hampshire's Species of Concern, including the silver-haired bat. Data collected by TetraTech suggest that silver-haired bats are the second-most common species of bats in the Project area. This is most likely an inaccurate assessment of their abundance, as big brown bats are commonly misidentified as silver-haired bats by automated software packages. This critique is not specific to Kaleidoscope Pro software they relied upon, but it does prevent an accurate estimate of the potential distribution of this species across the Project area. Although the Applicant did not address this species as required by the SEC Guidelines, they worked under the assumption that survey efforts and mitigation efforts concentrated on the northern long-eared bat would be similarly effective at identifying and protecting silver-haired bats. I generally agree with this premise, and it is unlikely that this project would have any population-level impact on the silver-haired bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

Eastern Red Bat

The Application states that the USFWS was contacted to obtain a list of federally threatened and endangered species that may occur in the Project area. However, there is no information that shows a similar list was requested for New Hampshire's Species of Concern, including the eastern red bat. Data collected by TetraTech suggest that red bats are likely to be one of the most common species of bats in the Project area; these results are consistent with many other population surveys in the region. Although the Applicant did not address this species as required by the SEC Guidelines, they worked under the assumption that survey efforts and mitigation efforts concentrated on the northern long-eared bat would be similarly effective at identifying and protecting red bats. I generally agree with this premise, and it is unlikely that this project would have any population-level impact on the eastern red bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

Hoary Bat

The Application states that the USFWS was contacted to obtain a list of federally threatened and endangered species that may occur in the Project area. However, there is no information that shows a similar list was requested for New Hampshire's Species of Concern, including the hoary bat. Data collected by TetraTech suggest that hoary bats are likely to be one of the most common species of bats in the Project area; these results are slightly unusual, but given the low sampling effort and the fact that 70% of the calls came from a single location, these data are likely non-representative of the entire Project area. Although the Applicant did not address this species as required by the SEC Guidelines, they worked under the assumption that survey efforts and mitigation efforts concentrated on the northern long-eared bat would be similarly effective at identifying and protecting hoary bats. I generally agree with this premise, and it is unlikely that this project would have any population-level impact on the hoary bat if tree removal and construction activities are conducted in accordance with best management practices outlined by the Applicant.

CONCLUSION

NEES has identified four primary concerns regarding the efforts of the Applicant to evaluate the impact of the Chinook Project on bats. These concerns relate to i) the failure to evaluate the specific potential impact of the Project on six species of bats that meet the SEC significant wildlife criteria, ii) failure to address the potential impact of the Project for the eastern small-footed bat, which has unique habitat requirements, iii) the failure to meet the requirement of "best suitable habitat" in establishing a sampling protocol that adequately characterizes the bat activity at the Project site, and iv) an inadequate sampling effort that failed to meet the minimum requirements for determining the presence or absence of any of the federally Threatened or state Endangered species potentially at the Project site.

i) According to the definition of significant wildlife species, the Application should have contained species-specific impacts, mitigation, and conclusions for the five species of bats that met the SEC Guidelines criteria in 2016. The Application, instead, only considered one bat species (the federally Threatened northern long-eared bat) to develop the survey methodology, as well as the habitat conservation and mitigation measures. No effort was made to acknowledge the state Endangered species or Species of Concern. Given that the first step of the process for evaluating the potential for unreasonable adverse effect is to describe how significant wildlife species were identified (SEC, 2016), this omission is a relevant deficiency of the Application.

ii) The Application failed to acknowledge the unique habitat requirements, and thus sampling requirements, of the eastern small-footed bat in the survey protocol. The eastern small-footed bat has been a state Endangered species for almost three decades, and existing data (including multiple peer-reviewed journal articles) highlights their relative abundance in this area. The Applicant thus failed to incorporate unique impact mitigation and habitat conservation and enhancement into the Application. Specifically, the impact of blasting and construction activities on this species should be incorporated into a Blasting and Stone Feature Alteration Plan that is approved by the NH Fish & Game prior to construction.

iii) The Bat Survey site selection protocol, in my opinion, did not meet the "best suitable habitat" requirement of the 2016 USFWS Guidelines. Key critical habitat identified by the Applicant and TetraTech (Scott's Brook, Scott's Pond, forested trail corridors, perennial streams, boulder piles) were not sampled, and the interior forest canopy openings that were sampled were marginal bat habitat, as evidenced by the low level of bat activity documented at these sites. The fact that over 70% of the data comes from a single sampling point highlights the lack of project-wide representation. Better site selection would have, in all likelihood, substantially improved both the quality and quantity of the data, provided a more comprehensive evaluation of the bat community, and improved our the ability to make an informed impact assessment for the Project site.

iv) Given the resources engaged in evaluating the Project site and the fact that all seven bat species in the state meet the SEC Guidelines for Significant Wildlife Species, more effort should have been undertaken to ensure adequate information was available to make an informed impact assessment. This is particularly true for bats, where we often lack basic population estimates despite our knowledge that over half the species are undergoing severe population decline throughout the region. The Bat Survey conducted by TetraTech failed to meet the minimum sampling requirements of the 2016 USFWS Guidelines, and thus cannot be used to assert presence or absence of Significant Wildlife Species. Thus, the Bat Survey is both qualitatively and quantitatively inadequate to provide an informed impact assessment for the Project site.

THE LIKELIHOOD OF UNREASONABLE ADVERSE EFFECT

Bats represent a significant wildlife resource to the state of New Hampshire, and their conservation is clearly within the mandate of the SEC process. In fact, all seven species of bats found in the state of New Hampshire have shown population declines in the last decade and have been granted state or federal conservation status. That being said, bats are very different from many of the other species under consideration by the SEC. First, the threats to bat conservation are generally not related to habitat loss, and therefore habitat management and habitat conservation are not likely to substantially stabilize or recover these species. Second, our general level of knowledge on bat populations is relatively low because there has been little effort at the state or federal level to conduct basic biological research on this group of mammals. Therefore, the range of best management practices is often limited, and we must rely on our knowledge of their biology, physiology, and ecomorphology to predict the likely impacts of any development on these species.

The primary threat to the four foliage-roosting bats (eastern red bat, hoary bat, silver-haired bat, and tricolored bat) with regard to the Project is direct mortality and indirect impacts caused by tree-removal activities during the summer breeding season. If the Applicant maintains their commitment to limit tree removal to the non-active season (November 01 – March 31), it is my opinion there is relatively little risk that the Project would have a detrimental impact on these species and thus generate an unreasonable adverse effect.

The primary threat to the four hibernating bat species that meet the SEC criteria of significant wildlife species (northern long-eared bat, eastern small-footed bat, big brown bat, and tricolored bat) is White-nose Syndrome. Although the Project could be perceived as a cumulative threat to these already imperiled species, it is the opinion of the US Fish and Wildlife Service that such additional sources of mortality will have no impact on the risk of extinction or the rate of recovery for these species (USFWS, 2016). I concur with this opinion in principle. If the Applicant maintains their commitment to limit tree removal to the non-active season (November 01 – March 31), and ensures the Project "maintain[s] forested corridors connecting suitable bat foraging habitat", it is my opinion there is relatively little risk that the Project would have a detrimental impact on these species and thus generate an unreasonable adverse effect.

The remaining Significant Wildlife Species (eastern small-footed bat) is the only species where we lack adequate information to assess the likelihood of impact. First, they are the only hibernating bat species in the region that appears to have a stable or slowly declining population trajectory that warrants review of other potential cumulative effects. Second, they have the most restrictive habitat requirements of all the bat species under review by the SEC, relying almost exclusively on rocky outcrops and talus slopes for their roosting habitat. Third, there is clear evidence that the Project will require blasting and other construction-related impacts on rock piles, stone walls, and rocky outcrops. Therefore, I believe that the development of a Blasting and Stone Feature Alteration Plan needs to be developed that is based on site-specific information and the best science available. This Plan should include impact assessment and mitigation, as well as habitat conservation and enhancement for the small-footed bat. This Plan should require the approval of the NH Fish & Game prior to construction. If the Applicant produces and executes such as plan, it is my opinion there is relatively little risk that the Project would have a detrimental impact on the eastern small-footed bat, and thus the Project would not have an unreasonable adverse effect on this species.

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