Comments - Environmental Permit Review
Maine Department of Inland Fisheries and Wildlife

Inland Fisheries and Wildlife Division Comments **Bureau of Resource Management Comments – Regions G, F**	
Applicant's Name: Number Nine Wind Farm, LLC	
Project #: L-26502-2F-G-N; -24-H-N; -IW-I-N; -L6-J-N; -VP-K-N; -TH-L-N.	**Regulatory Agency:** MDEP
Project Type: Windpower Facility	**Project Manager:** Jessica Damon
Comments Due Date:	**Date Comments Sent:** 11-16-2015
Project Location	
Towns: T10 R3 WELS; E Township; T9 R3 WELS; TD R2 WELS; T8 R3 WELS; Saint Croix Township	**County:** Aroostook
Waterbodies: Meduxnekeag River watershed; Prestile Stream watershed; St. Croix Stream watershed; Mattawamkeag River watershed	
Biologists (review coordinators): John Perry, Bob Stratton **Biologists (Fisheries Division):** Frank Frost, Jeremiah Wood, Nels Kramer, Kevin Dunham **Biologists (Wildlife Division):** Danielle D'Auria, Erynn Call, Mark Caron, Amanda DeMusz, Shawn Haskell, Rich Hoppe, Cory Mosby, Allen Starr, Beth Swartz, Charlie Todd	

After review of the application and consideration of the proposal's probable effect on the environment, and on our agency's programs and responsibilities, we provide the following comments:

Project Description: The Number Nine Wind Farm (Project) Turbine Area consists of a proposed 119-turbine wind energy project (out of 129 proposed locations) in Aroostook County. The Project turbines will have an installed capacity of 250 megawatts (MW) of electricity and includes both 17 Gamesa G114-2.0 MW and 102 Gamesa G114-2.1 MW model turbines. The Turbine Area also consists of up to 4 permanent and 4 temporary meteorological (MET) towers. Further, the Project includes an approximately 26.2-mile long North Generator Lead Line and an approximately 25.4-mile long Bridal Path Generator Lead Line.

Consultation summary: The Applicant first contacted MDIFW staff in late August, 2013 regarding raptor studies and raptor migration study protocols. The Applicant and their consultant (WEST) formally introduced the Project to MDIFW and MDEP staff during a conference call on October 1, 2013. It was explained at that time that the Project was initiated several years prior (ca. 2006 – 2010), at which time several baseline environmental studies were conducted and data collected (i.e. raptor migration, vernal pool surveys, acoustic monitoring and nocturnal migration, among others) but that the project was subsequently discontinued. The general concept of the current Project proposal was described and there were general discussions regarding the use of older survey data and the need to update and collect further data. At that time, MDIFW provided very preliminary comments on the scope and provided our Agency's list of recommended pre-construction studies. At the close of the meeting, EDPR indicated that another meeting would be held in November 2013, but that meeting was subsequently delayed until March 5, 2014. However, on October 10, 2013, MDIFW sent a follow-up email to EDPR and WEST to make them aware as soon as possible in the Project planning phase that,

based on drastically declining bat populations, MDIFW would be recommending curtailment of at least 6.0 m/s during the dates and times indicated, with no temperature clause, for all turbines. Since then, MDIFW staff have met with EDPR and its consultants on multiple occasions, including several site visits to the Project area, pre-application meetings, and periodic check-ins between the Applicant and the MDIFW Environmental Review Coordinator to convey updates in Project status as well as statuses of various environmental pre-construction baseline studies.

MDIFW envisions the following relationship between pre-construction studies, facility design and operational practices, and post-construction monitoring. Pre-construction studies are designed and conducted to identify habitats and species of concern for use in facility siting and design, as well as development of facility operational measures to avoid/minimize impacts to resources of concern. Facility design and operational practices, such as areas of development, stream crossing designs, physical layout, turbine placement, minimum curtailment procedures, etc., are developed and implemented from pre-construction studies, as well as from IFW's recommendations based on site specific, statewide, and regional concerns. Post-construction monitoring is designed to verify recommendations and assumptions, detect mortality and risks, address any data gaps, provide for long-term monitoring of issues of concern, and inform an iterative process in which operational practices are reviewed and modified if necessary.

For over two years, the Maine Department of Inland Fisheries and Wildlife (MDIFW) staff has engaged with the applicant and its consultants in written and verbal communications, meetings, site visits, and to review and discuss materials pertaining to the proposed Number Nine Wind Farm. We have provided guidance on appropriate preconstruction studies to assess potential risks, highlighted anticipated Project impacts on wildlife and fisheries resources, and provided recommendations on design and operational methods to avoid or minimize unreasonable impacts to resources.

MDIFW finds that the proposed Number Nine Wind Farm's facility design and operational practices do not adequately avoid or minimize impacts to wildlife and fisheries resources and therefore constitute unreasonable adverse impacts to wildlife and fisheries. Therefore, MDIFW recommends that the project as currently proposed be denied. The following provides greater detail on MDIFW's review.

Cumulative Impacts

Throughout the review of this Project, MDIFW staff utilized the best available scientific resources combined with staff experiences from other wind project reviews. We considered Project impacts in view of both Maine State Law (12 MRSA, §10051) and MDIFW's mandate "*…to preserve, protect, and enhance the inland fisheries and wildlife resources of the State; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for effective management of these resources*", and consistent with the guidance provided under the Site Location of Development Law:

> ***15. Protection of Wildlife and Fisheries***
>
> ***A. Preamble****. The Board recognizes the need to protect wildlife and fisheries by maintaining suitable and sufficient habitat and the susceptibility of certain species to disruption and interference of lifecycles by construction activities.*

***B. Scope of Review**. In determining whether the developer has made adequate provision for the protection of wildlife and fisheries, the Board should consider all relevant evidence to that effect, such as evidence that:*

…..

(2) Proposed alterations and activities <u>will not adversely affect wildlife and fisheries lifecycles</u>.

As proposed with 129 turbines, this Project represents the largest wind power Project ever proposed in Maine, approximately double the current largest project in the State, Bingham Wind, with its 62 turbines. If permitted, the Project would represent a scale of cumulative impacts that is unprecedented at wind power facilities not only in Maine but also in the Northeast. It would present both acute and chronic direct and indirect impacts to the varied habitats in the Project area, including the Gen Lead Line and Bridal Path, and to the wildlife and fisheries resources inhabiting the Project area, including State and Federally-listed wildlife species. The center of MDIFW's concerns, as has been represented to the applicant on multiple occasions, is the turbine sizing and corresponding number of turbines proposed to meet the Applicant's desired production goal. As has been our Agency's position during the pre-application phase of this project, the Applicant has not demonstrated adequate avoidance and minimization efforts in their project design or proposed operational practices, which has resulted in an accumulation of anticipated impacts that is unprecedented at wind power projects in Maine. The proposed number of turbines and sprawling nature of the Project result in a series of impacts which, may theoretically be able to be individually mitigated for but, cumulatively, make it impossible for our Agency to make a positive recommendation.

In an attempt to illustrate the scale of impacts at the Project, the following table compares characteristics and relative impacts to wetlands between the proposed Number Nine Project and the Bingham Wind Project, which is currently the largest wind power project in Maine and in the Northeast.

			Wetland Impacts		
Project	**No. of turbines**	**Total MW**	**Permanent Fill**	**Temporary Fill**	**Cover Type Conversion/Clearing**
Number Nine	119	250	9.2 acres	22.0 acres	207.8 acres
Bingham[1]	62	206	1.34 acres	6.32 acres	26.75 acres

[1] from Bingham Wind Project Permit, September 2014

These comparisons appear to validate MDIFW's often stated opinion that by using turbines with larger generating capacities, the total number of turbines can be reduced and still meet the applicant's power production desires (250 MW) with significantly fewer impacts to resources. Our Agency has consistently recommended this for this project. During our early discussions (October 2013, March 2014), MDIFW requested plans indicating proposed areas of development, turbine footprints, roads, generator lines, etc., however they were not available because the layout had not yet been finalized. In July 2014, and in subsequent communications, we specifically discussed utilizing larger turbines with increased generating capacity, such as are included at all other recently proposed wind projects in Maine, in order to reduce the number of turbines and the associated impacts on natural resources from Project sprawl. In July 2014, EDPR indicated the belief that such a modification would only reduce turbine pad footprints, as roadways would still be present. MDIFW informed EDPR that such modifications could be expected to significantly reduce impacts on birds, bats, raptors, other forms of wildlife, and aquatic and terrestrial habitats, while not affecting its desired total Project output.

For example, by utilizing 3.0 MW turbines, the total number of turbines is reduced from 119 turbines to approximately 83 turbines. This translates to an approximate 30% reduction of the Project's Turbine Area footprint. Reduction of impacts can be even more pronounced with the use of 3.5 MW turbines (approximately 72 turbines or approximately 40% less Turbine Area footprint). It should be noted that this does not necessarily translate into a direct relationship of reduction of wetland impacts, as this is dependent on individual turbine sites and associated roads, as well as associated larger clearing of turbine pad areas necessary for the use of larger turbines. However, it follows that a significant reduction in the number of turbines would equate to a significant reduction in resource impacts in the Turbine Area, not only to wetlands, streams, and vernal pools, but also to wildlife and fisheries species in general. This reduction in resource impacts will inherently minimize impacts to the fish and wildlife species dependent on these resources for their various life history requirements. For the resident and transient wildlife species in the Turbine Area, without further minimization efforts, there will be direct loss of habitat resulting from the conversion of vegetated areas to turbine pads and newly constructed and widened roads. In addition, while potential indirect effects in the Turbine Area may not significantly impact general wildlife use in an area that has experienced a long history of rapid habitat changes related to timber management activities, the indirect impacts from 119 spinning turbines and associated vibrations, low frequency infrasound, and shadow flicker on the local fauna is unknown. Ongoing research is showing, however, that continuous anthropogenic noise does have an impact.

Impacts to vulnerable bat species

As has been consistently stated in our Agency's reviews of wind power projects since October 2013, including for this Project, the precipitous decline of Maine's bat populations from white nose syndrome with additive losses from other sources, such as wind turbines, is increasingly alarming. This decline has led to the listing of two *Myotis* bats, the little brown bat and northern long-eared bat, as State Endangered species, and the third *Myotis* bat, the eastern small-footed bat, as State Threatened species under the Maine Endangered Species Act (MESA; 12 M.R.S., §12801, et seq.). Furthermore, due to this population decline being observed by these species across their known ranges, the northern long-eared bat has been listed as a Threatened Species under the Federal Endangered Species Act (ESA), while the little brown bat is currently being reviewed by the US Fish and Wildlife Service for potential listing under the ESA.

It must be emphasized that our Agency's concern is not only for the three State-listed species of *Myotis* in Maine but also for the other five resident bat species, four of which are currently listed as Species of Special Concern in Maine. Wintering populations of cave bats in Maine have declined by over 90%, and the few surviving bats that are potentially resistant to the disease likely comprise the only possibility to rebuild these populations. These bats, along with our other resident species, continue to face increasing threats from expanding wind energy development in Maine. At 119 turbines, the proposed Number Nine Wind Project is the largest wind power facility proposed in Maine, with each individual turbine representing a risk to bats that, in the view of this Agency, necessitates proactive and protective siting and operational measures in light of already catastrophically reduced populations.

Despite the drastic population declines, the Applicant's preconstruction acoustic monitoring data identified the presence of little brown bats in the Project area. Furthermore, while no other *Myotis* bats were identified through the acoustic analysis process, high frequency calls were identified throughout

the survey area. While the high frequency calls could be tri-colored bats or eastern red bats, these two species tend to be more easily identified in acoustic software programs than myotid bats. Therefore, due to the ease of identifying these species with acoustic equipment, and the difficulty associated with identifying myotid bats through acoustic software, our staff cannot rule out *Myotis* (including but not limited to little brown) bats in the lumped designation of high frequency bat calls provided in the preconstruction monitoring reports. Furthermore with northern long-eared bats being considered common in this part of the state pre-white nose syndrome, the fact that they are still being detected in this part of the State (in Caribou and elsewhere, Maine Department of Transportation unpublished data, 2015) combined with the difficulty in detecting them with acoustic software, this Agency must assume that northern long-eared bats are also present in the Number Nine Project area.

The Department does not support the opinion that bat fatalities at individual wind projects are considered low or within the "regional context". Wind energy continues to adversely impact Maine's bat populations, especially to those species on the possible brink of extinction. As we are dealing with extreme declines, even a small number of bat mortalities is having real, adverse effects on local populations as well as the species as a whole. If bat populations do eventually recover from white nose syndrome, wind turbine development without full curtailment will continue to be detrimental to recovering local bat populations.

The Applicant has proposed a Post-Construction Research and Monitoring Protocol study that would "study the direct impact of the wind farm on birds and bats" and "research the effectiveness of different turbine operational protocols" in reducing bat and bird mortality. The Applicant proposes to examine various levels of operational curtailment practices at a subset of turbines in relationship to turbines that are operated under manufacturer's cut-in speeds without curtailment. MDIFW does not consider this monitoring exercise to be a "study" in the scientific sense. For a true study, we would recommend multiple teams searching each turbine daily as part of a university-grade research effort to better understand the impacts from wind facilities. With respect to the consultant, direct impacts of wind projects on bats and birds are well documented and simply stated, the Applicant's proposed operational practices are not designed to avoid or minimize impacts to bats. Since October 2013, MDIFW has consistently informed the applicant that our recommendation for curtailment would be at least 6.0 meters per second (m/s) at this site, with no temperature clause, and for the full season of bat activity. While the exact level of curtailment that is necessary to be fully protective of bats is not know at this time due to the presence of many site specific and regional variables, our Agency will continue to recommend curtailment measures to be as fully protective as possible given the listing of three *Myotis* bats under the MESA and the status of four others as Special Concern. What is known, however, is that the higher the curtailment, the fewer bat fatalities are reported. And, that bats are consistently killed at manufacturer's cut-in speeds. For example, two years of research was conducted at the 355-turbine Fowler Ridge Wind Farm in Indiana. In 2010, "*An approximate 50% reduction in overall bat mortality was observed by raising the cut-in speed from 3.5-5.0 m/s, while an approximate 78% reduction in overall bat mortality was realized by raising the cut-in speed from 3.5-6.5 m/s.*" Note that the manufacturer's cut-in speeds of the turbines in this study are 0.5 m/s higher than the proposed Number Nine Project turbines with cut-in speed of 3.0 m/s. In addition, "*two hundred fifty-two bat carcasses were determined to have occurred at turbines while under normal operational cut-in speeds of 3.5 m/s (control). This compares to 63 dead bats at turbines with cut-in speeds raised to 5.0 m/s and 27 dead bats found at turbines with cut-in speeds raised to 6.5 m/s.*" Furthermore in 2011 "*a total of 105 bat carcasses were determined to have occurred at turbines while operating under normal operational cut-*

in speeds of 3.5 m/s (control) throughout the fatality searches. This compares to 66, 42, and 25 bat carcasses found at turbines where blades were feathered below 3.5 m/s, 4.5 mg/s, and 5.5 m/s, respectively." Finally, the report concludes with "*The Fowler Ridge study is the first to demonstrate that bat fatality rates were not only significantly different between control and treatment turbines, but that bat fatality rates were significantly different between cut-in speeds raised to 5.0 m/s versus turbines with cut-in speeds raised to 6.5 m/s*" (Arnett et al., 2013).

In another example, at the 16-turbine Sheffield Wind Facility in Vermont in 2012 it was reported that "*total fatalities at fully operational turbines were estimated to be 2.6 (95% CI: 1.4, 4.8) times greater than at (6.0 m/s) curtailed turbines, resulting in an estimated 60% (95% CI: 29%, 79%) reduction in bat fatalities* (when curtailed at this level)*."* It is worth noting that these results were observed even with a minimum ambient temperature curtailment threshold contained in Sheffield's permit, which is not viewed as adequately protective at Maine facilities.

Finally, at the 67-turbine Beech Ridge Wind Farm in West Virginia in 2013, *"…the cut-in speed for all turbines was raised (from the nominal cut-in speed of 3.5 m/s) to 6.9 m/s all night long throughout the entire study period. Turbines were feathered so that they did not rotate at wind speeds below 6.9 m/s*" with the result that "*The bat fatality rate at the Project was approximately 89% less than the average for other annualized West Virginia projects*."

Certainly, there are other studies that indicate different results. One of which is for the 23-turbine Casselman Wind Power Project in Pennsylvania, for which Arnett et al. (2011) reported, "*There was no difference between the number of fatalities for the 5.0 and 6.5 m/s treatments*" in 2008 and 2009. However, for full context, it should be noted that Arnett et al (2010) stated, "*Average wind speed at the site was between 5 and 6.5 m/s only 10% of the study period*". Thus, the conclusion of no statistical difference between curtailment treatments may be overly broad.

Our Agency agrees with the findings that "*Indeed, several previous or concurrent studies have shown that raising turbine cut-in speeds*" "*from the manufactured speed (usually 3.5-4.0 m/s for modern turbines) by 1.5-3.0 m/s (total 6.5-7.0 m/s) results in significant reductions in bat fatalities compared to normally operating turbines (Baerwald et al 2009, Arnett et al 2011)*" and that "*Currently, only operational mitigation (<u>stopping turbine blades from spinning</u>,* emphasis added*) during predictable high risk periods has demonstrated effective reductions of fatalities of bats." (Arnett et al. (2013).* Clearly, higher curtailment significantly reduces bat mortality.

As our Agency continues to work with wind developers and their consultants statewide, and as ours and the scientific community's understanding of impacts from wind projects has increased, our recommendations have been consistently based on the best available science for the protection of species at significant risk. It is MDIFW's position that the *only* adequate protection for bats at this time is turbine curtailment and <u>the absence of appropriate curtailment practices represents a significant adverse impact.</u> Given the large scale of this Project and considering that the Applicant's pre-construction data confirms the presence of *Myotis* bats in the Project area, as our species at risk get rarer, the protection of remaining *individuals* becomes that much more critical. Given all of these factors, MDIFW recommends that <u>minimum</u> operational practices for a facility of this magnitude would entail:

All the proposed turbines operate only at cut-in wind speeds exceeding 6.5 meters per second each night (from at least ½ hour before sunset to at least ½ hour after sunrise) during the period April 20 – October 15. Cut-in speeds are determined based on mean wind speeds measured at hub heights of a turbine over a 10-minute interval. Turbines will be feathered during these low wind periods to minimize risks of bat mortality. These cut-in speeds are independent of ambient air temperature.

Note that this recommendation is subject to future change with State or Federal listing of bats as well as the continuing evolution of new guideline development with bat population changes and resulting regional guidance for the wind industry in the Northeast.

Impacts to nocturnal avian migration

The Number Nine Wind Project poses significant risk to nocturnal migrants in two ways. First, a significant percentage of the targets passing this Project fly at altitudes which put them at risk for collision with turbines. Secondly, the scale of this Project is larger than any seen to date in Maine and nocturnal migrants are at greater risk at this Project site than at others simply because there are more structures for potential collision. Given the significant portion of passing migrants flying at or below the maximum turbine height coupled with the extensive footprint of the Project as proposed, MDIFW has great concern for chronic, cumulative risk to nocturnal migrants posed by the Number Nine Project.

To evaluate site-specific risk, MDIFW commonly requests a detailed suite of assessments to be performed prior to permitting. Risks to migrating birds and bats are evaluated with nocturnal radar studies conducted over several weeks during spring and fall migration periods. Because radar data cannot distinguish between birds and bats, results are typically presented as the average number of "targets" during a single migration season (spring or fall), although the majority of targets are believed to be birds (songbirds in particular). Furthermore, to better understand our Agency's concerns, pre-construction radar data at the proposed Number Nine Wind Project site needs to be placed in context with data from nearby wind projects and at other projects across Maine, New Hampshire, and Vermont. We interpret results from radar studies in the context of other wind power projects across northern New England taking advantage of similarities in latitude and thus migration volume, timing, and broad front movements.

Although the reported overall spring mean passage rate of 402 targets per kilometer per hour (t/km/hr) falls within the reported ranges of wind projects in the northeast (14th out of 28, based on MDIFW records), the risk at this rate must be put into context given the Project's scale in comparison to other projects in the northeast *that operate with significantly fewer turbines*. It must be noted that this rate is based on only one season of monitoring and, given the seasonal variability of passage rates documented at other wind projects in Maine and elsewhere, this number could be lower or higher in any given year due to a number of variables. Ideally, we would have several seasons of monitoring to assess to get a better estimate of the seasonal passage rate at this site, which is why we are now recommending at least three years of radar monitoring (i.e., 6 seasons) on all future projects.

With only one year (2 seasons) of passage rate estimates at the Number Nine Project area, we reviewed data from two nearby wind projects as supplemental information. Staff compared the Number Nine spring and fall passage rates with data from both the Mars Hill and Oakfield wind projects (Table 1). To

summarize, the single season Number Nine spring data (402 t/km/hr) was approximately midway between the 2006 Mars Hill rate (338 t/km/hr) and 2008 Oakfield rate (498 t/km/hr). However, the fall data for both Mars Hill (512 t/km/hr) and Oakfield (501 t/km/hr) are twice as high when compared with only 247 t/km/hr at the Number Nine Project area. This reduced fall rate could be due to several factors including 2014 being a low production year, the site could be less important for fall migrants, or there was such limited sampling effort (just one season) that we are not seeing a true reflection of fall migration at this site. Based on this review and the Project's proximity to the Mars Hill and Oakfield wind projects, we would expect fall passage rates at Number Nine to be more closely aligned with these other sites, suggesting that the low fall 2014 rate was an anomaly.

Table 1 – Summary of passage data from 3 Aroostook County wind projects

Project	Season/Year	Passage Rate (t/km/hr)	Range (t/km/hr)	Flight Height[1]	Targets Below Rotor Swept Zone[2]
Number 9	Spring 2014	402	296 – 1,056	25%	100
	Fall 2014	247	47 - 806	21%	52
Mars Hill	Spring 2006	338	76 - 674	14%	47
	Fall 2006	512	60 – 1,092	8%	41
Oakfield	Spring 2008	498	132 - 899	21%	105
	Fall 2008	501	116 - 945	18%	90

[1] Percent of targets flying below maximum turbine height
[2] Mean numbers of targets passing below maximum turbine height

Although the passage rates recorded at Number Nine are roughly consistent (Spring 2014) or below (Fall 2014) those recorded at nearby approved sites, the flight height data, specifically the proportion passing at or below the maximum turbine height is of concern for a project of this scale. At the Number Nine Project, 21% (Fall 2014) and 25% (Spring 2014) passed the radar site below the maximum height of the turbines, whereas at Mars Hill those percentages were significantly lower at 8% (Fall 2006) and 14% (Spring 2006). So, even though risk appears roughly similar between the proposed Number Nine Project and Mars Hill based solely on passage rate, *over twice as many birds are at risk at the proposed Number Nine Project site for a project of similar size as Mars Hill* simply due to the lower average flight heights through the Project area. Based on the percentages provided in Table 5 of Appendix A of the 2014 Nocturnal Radar Survey Report, the percent of targets passing at or below the tallest point of the turbine at Number Nine ranks relatively high (6^{th} --tie[1]) on a list of 34 Projects on the east coast; relatively high (6^{th} --tie) out of 27 Projects in northern New England; and relatively high (5^{th} --tie) out of 18 projects in Maine alone. Based on a single year of data (2014), even though the overall number of targets estimated to pass are within ranges of other wind projects in Maine, the overall risk to those targets is higher due to the relatively high percentage (approximately a quarter of the targets) that tend to pass through this area at lower altitude. And, more significantly, the Number Nine Project as proposed would entail approximately twice as many turbines (119) for those birds to encounter than the next largest in Maine (62).

Table 2 below is intended to help better explain our Agency's concern by comparing the top seven wind projects with the highest percent of targets flying below maximum turbine height. Given that two of the

[1] While we are considering the results from Number Nine (25%) to be equivalent to the Kibby Range 2 results (25%), it should be noted that only 7 surveys were conducted at Kibby compared with 20 nights at Number Nine.

projects have not been constructed (for separate reasons), the Number Nine Project jumps to the 4th project on the list with the highest percent of targets flying below maximum turbine height in northern New England. Most importantly, as noted above, the risk is further magnified when comparing the sheer number of turbines being proposed at the Number Nine Project with the other projects listed in Table 2; none of the Projects on the list compare in scale with the Number Nine Project. In fact, the total number of turbines (85) for the other four projects in the table combined is still less than that proposed for Number Nine.

Comparison of percent of targets (average) flying below maximum turbine in northern New England (ME-NH-VT), 2005-present

Rank	Project Site	Percent of Targets Below Turbine Height	Number of Turbines
1	Bull Hill, T16 MD, ME (2010)	38%	19
2	Antrim, Hillsborough County, NH (2011)	30%	9
3	Passadumkeag, Grand Falls Township, ME	28%	13
4	Bowers, Carroll Plantation, ME	26%	(denied)
5	Highland, Somerset County (location 1—2009)	26%	44 (withdrawn)
6	Number Nine Wind Farm	25%	119
6	Kibby, Franklin County, ME (Range 2)	25%[1]	44

Based on a single year of data at the proposed Project, the percentage of targets (25%) passing below maximum turbine height at the proposed Number Nine Project are at much greater risk (i.e., a 119-turbine facility) than the targets passing the Antrim, New Hampshire wind project. Although the Antrim Project has a high percent of targets (30%) passing below maximum turbine height, these targets pass through a 9-turbine project. Similarly, while the percentage of targets below the maximum turbine height at the 13-turbine Passadumkeag Project (currently under construction) is relatively high at 28%, the overall risk to these targets also is much lower when compared the proposed 119-turbine Number Nine Project.

Even with a moderate passage rate across the Project area, the lower flight height data coupled with a 119-turbine wind facility poses risk to nocturnal migrants. Given the scale of this Project with nearly twice as many turbines as the next largest wind project in Maine, risks at the individual turbine or turbine string scale will be greatly multiplied across the Project area. It is our position that if it is constructed as proposed, the Number Nine Wind Project will cause chronic bird mortality at a per turbine rate higher than seen at nearby Mars Hill and other facilities in the northeast due to the differences in flight height data and number of turbines being proposed.

Impacts to great blue heron

The great blue heron is a State Species of Special Concern due to a 64% decline in the coastal breeding population observed from 1983 to 2009. Since 2009, MDIFW has been monitoring the statewide population to determine if the decline seen along the coast is also occurring statewide. There is an active heron colony (WBC0823) located approximately 0.7 miles south of Turbine String M, which

consists of 8 turbines. This in an actively expanding colony, having grown from a single nesting pair in 2014 to three nesting pairs in 2015. Given that there are only 13 known nesting pairs and 5 colonies in all of Aroostook County makes it important to this Agency that the colony is protected. Based on the proximity of the proposed turbines to the colony, it is MDIFW's position that there is significant risk to the future of this colony from Turbine String M. Therefore, if a modified project design were to be considered, it is our recommendation that this string be removed from consideration.

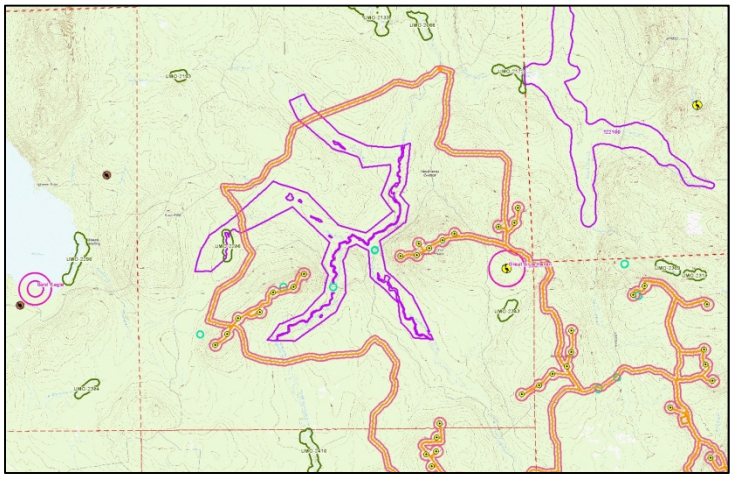
Impacts to Deer Wintering Areas

MDIFW has an established protocol when evaluating Deer Wintering Areas (DWAs) with landowners, or large-scale projects such as windpower. MDIFW evaluates the existing conforming deer wintering cover, and also future cover which includes mid-story and younger regeneration stands that, if left to grow, will become future conforming cover adding to and/or replacing the existing conforming cover. Softwood and softwood dominated mixed stands are included in this evaluation process. In addition, hardwood and hardwood dominated mixed stands are also evaluated as they provide important browse availability adjacent to the conforming cover thus reducing energy expenditure when deer forage for browse. At any one time MDIFW's objectives and goals are to have the DWA Complex in 50% or greater deer wintering cover (i.e. not just softwood cover, but deer wintering cover under MDIFW's definition of DWAs). For example, if an area that was harvested 15 years ago but today is 12-feet tall and consisting primarily of softwood, or a mixture of softwood and hardwood (softwood >50 and hardwood <50), it would not yet be considered deer wintering cover by definition. However, within the next 20 years it would have the potential to grow into deer wintering cover and ultimately add to the total percentage of cover and/or replace exiting cover that could be harvested or has fallen out.

Turbine Area

While we appreciate the efforts that the Applicant went through to relocate the proposed crane access road that would have diminished functionality in portions of the DWA complex in the northwest section of the Project area, we continue to have concerns with indirect impacts from turbine strings DD (7 turbines) and M (8 turbines) to the large DWA complex (Figure 1 below). Turbine String M is the same string which also puts active heron colony WBC0823 at risk. Specifically, we have concerns with indirect impacts from turbine strings DD (7 turbines) and M (8 turbines) to the large DWA complex in the northwest section of the Project area (Figure 1 below). Specifically, we have concerns what indirect impacts will be realized with a series of two turbine strings, totaling 15 turbines, will have on wintering deer. This Agency is aware of research and anecdotal information regarding noise impacts on wildlife, but to our knowledge there is no published research specific to effects of wind farms on deer, and specifically overwintering deer. While we acknowledge that deer do become accustomed to some types of anthropogenic noises such as heavy traffic, we do not have data on effects of the continuous low-frequency noise and vibrations may have on deer attempting to overwinter in these areas. However, we are aware of general wildlife displacement research associated with operating wind farms, and we have literature regarding low frequency infrasound and there appears to be cause for concern. Given the productivity of this DWA and the value assigned to DWAs in general in this part of Maine, MDIFW recommends that turbine strings DD and M be removed or relocated away from the DWA, if a modified project design were to be considered.

Figure 1. Large DWA complex in northwest section of project



Bridal Path Line

As stated in our October 2014 pre-application comments, MDIFW strongly recommended avoidance of the two mapped DWAs (DWA 100068 and DWA 100075) which the proposed Bridal Path would intersect. Portions of both the DWAs were part of a larger Cooperative Deer Wintering Area Agreement with then-owner Fraser Paper and are still considered areas of importance with the current land owner, which reinforces the importance of these DWAs to wintering deer. As proposed, clearing within the Bridal Path corridor would severely limit deer's ability to get across the right-of-way (ROW) to the other side of the DWA, and would likely be a complete barrier during significant snow. Even with the Applicant's proposed minimization efforts, at 150-feet wide feathering, the edges will not create the type of corridor the deer will need to get across the ROW. Simply, this can be expected to create an area too wide, of snow too deep, for deer to traverse. While we understand that the Applicant is exploring the possibility of trying to key in on some low lying areas in the ROW, where an opportunity to leave some trees may create travel corridors across the ROW, to date we have not reviewed these options. Other options to explore could involve much larger structures to span the DWAs, thus allowing their vegetative cover and their value to remain intact, shrinking the available area for winter shelter.

As proposed, there will be 30 areas of permanent impact (clearing) to the two DWAs in the Bridal Path. However, the impact is *more* than its areal extent since the clearing intersects constricted travel corridors that will severely limit the adjoining bisected portions. There is real potential to completely eliminate use of DWA sections isolated by such activity.

While we understand the Applicant's desire to use the existing Bridal Path ROW, throughout the pre-application stage of this Project, MDIFW has emphasized that avoidance of the DWAs should be the first step when designing the Project, especially given the historical use and surveys of DWAs in this part of the State. Our Agency is not convinced that the applicant has adequately demonstrated avoidance of impacts to the DWAs. At other proposed wind projects, Applicants have provided strong evidence of itemized constraints that limit alternative routes and avoidance measures, including specific information that abutting landowners of proposed ROWs through deer wintering areas have been contacted, and subsequently rejected, the Applicant's desire to purchase easements of abutter's lands. To date, our Agency has not seen such evidence for this Project.

If the Applicant can demonstrate impact avoidance and minimization to the extent possible to our Agency's' satisfaction, then MDIFW will discuss mitigation in the form of identification, land acquisition, and land transfer over to MDIFW. Ideally, this Deer Wintering Area Mitigation Parcel will be associated with MDIFW Wildlife Management Areas (firstly) or other lands currently under conservation easement and active management for deer habitat (secondly). The exact ratio of mitigation has yet to be determined, but due to the critical life history function these habitats supply, it is our Agency's position that impacts to a DWA should be weighted more heavily, as are impacts to Significant Vernal Pools, for example.

Impacts to coldwater fisheries

Not surprisingly for a Project of this magnitude, numerous streams were delineated within the Project area including perennial, intermittent, and ephemeral streams (per LUPC definition). As a result, there will be a tremendous amount of clearing associated with the Project that encounters streams, much of it associated with the proposed 51.6-mile long North Generator Lead Line/Bridal Path corridor. With clearing limits for the corridor designed to be up to 150-feet wide, this will entail up to 300 linear feet of cover lost per stream crossing within MDIFW's recommended 100-foot buffer for the Turbine Area and along the 51.6 miles of corridor, for a total of 127 acres of lost buffer habitat to coldwater fisheries.

Salmon Habitat Stream Buffers, consisting of 100 feet on each side of the stream, are proposed by the Applicant for all streams within the designated Critical Habitat of the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon. Many of the streams in the Project area were characterized as intermittent/ephemeral, and many of the streams in general are likely first-order streams. Regardless of whether they are perennial or ephemeral in nature, and regardless of whether or not they are in the Atlantic salmon DPS, these waters provide critical linkages to downstream resources for many species, including brook trout. Movement by instream migrants links headwaters with downstream and terrestrial ecosystems, as do exports such as emerging and drifting insects. Evidence suggests that headwater streams are critically important to downstream ecosystems and that small streams, including intermittent streams, can provide crucial rearing habitat, cold water for thermal refugia, and abundant food for juvenile salmonids on a seasonal basis and therefore should be protected. Maintaining buffers along coldwater fisheries is critical to the protection of water temperatures, water quality, and inputs of coarse woody debris necessary to support conditions required by brook trout.

Therefore, if a modified project design were to be considered, MDIFW recommends that the 100-foot buffer be maintained along *all* streams, including intermittent and ephemeral streams, within the Project area. To be effective, these 100-foot buffers should be measured from the upland edge of stream or associated fringe and floodplain wetlands. As proposed, however, without the protection of 100-foot buffers at all streams the quality of fisheries and habitat in these watersheds will be impaired.

Road crossings and proposed culvert mitigation sites

In addition to the proposed clearing within the MDIFW recommended 100-foot stream buffer, as proposed, there will be some impacts to coldwater fisheries resulting from temporary and permanent fill. To the Applicant's credit, the use of existing logging roads has drastically minimized the amount of linear impacts to streams (total of 2,219 linear feet, including both temporary and permanent fill).

Regarding the proposed culvert replacements to be used as mitigation: as discussed during the October 21, 2015 site visit, only one (Culvert C812) of the eight culverts (Section 7B, Table 7B2-2) proposed as mitigation is actually suitable as mitigation. The remaining seven culverts all must be either replaced and/or extended as part of the Project, and therefore do not qualify as mitigation. Moreover, the stream segments at these particular locations do not provide fisheries habitat value—the value comes from the sources of cold water they likely provide to downstream resources.

MDIFW recommended several other crossings that would be valuable as mitigation, including two multi-culverted crossings of Number Nine Stream as well as several tributaries to Number Nine Stream. In addition, MDIFW again recommended the full replacement of the undersized and currently blocked culvert at Stream Location #3 at the October 21, 2015 site visit. MDIFW staff previously recommended full replacement of this structure during the July 2014 site visit, but has not yet received a response on these proposals.

Regardless, it is apparent that use of existing roads and culverts built during previous forestry operations are now a partial responsibility to the Project applicant through their changes in composition and use. The current infrastructure of roads and culverts require attention to avoid or minimize potential cumulative impacts. The replacement of crossings with appropriately-sized structures will restore lost stream connectivity and significantly enhance life history requirements in these streams. MDIFW recommends, if a modified project design were to be considered, that all new, modified, and replacement stream crossings be sized to span 1.2 times the bankfull width of the stream. In addition, we generally recommend that stream crossings be open bottomed (i.e. natural bottom), although embedded structures which are backfilled with representative streambed material have been shown to be effective in not only providing habitat connectivity for fish but also for other aquatic organisms. The following additional recommendations are dependent on the dimensions of the proposed structure:

- Box culverts should be embedded up to 2 feet below the streambed elevation, and then backfilled with “streambed-like” material to streambed elevation.
- To ensure that backfilled material remains in the structure, we recommend the addition of sediment retention sills along the invert. The sills should be approximately 6-8 inches in height.
- We recommend backfilling with natural “streambed-like” material, possibly including the addition of larger 2-3 foot boulders scattered through invert of the box to help anchor in the substrate (depending on existing substrate conditions at the site.)
- To ease the effort of backfilling, one option to consider is a 3-sided, open-top concrete box. Open structures are generally much easier to backfill, as opposed to trying to negotiate equipment/vehicles through a 4-sided structure, especially with sediment retention sills installed. The top of the structure would get attached after backfilling is complete (essentially becoming a 4-sided structure.)
- If riprap scour protection aprons are being proposed, we recommend that the aprons be set below streambed elevation (~4-6 inches) and then have the riprap filled in to streambed elevation with streambed-like gravel. This will fill the voids and help prevent a fish passage barrier during low flows.

All proposed replacement structures should be reviewed and approved by MDIFW fisheries staff prior to installation.

Work Window

For the protection of coldwater fisheries, all instream and all adjacency work within 100 feet should be conducted between July 15 and September 30, and all riparian vegetation should be allowed to grow back to the maximum extent possible.

Additional Agency Concerns

Our Agency has additional concerns with the Project as proposed, including significant concerns with the methodologies described in the Applicant's proposed post-construction monitoring plan. The following is a partial list and not a complete one for the purpose of brevity at this time.

Impacts to northern bog lemming

Our Agency's traditional view of northern bog lemmings, a State Threatened Species under MESA, is that they typically occur in moist, wet meadows or boggy areas, often in conjunction with artic or alpine tundra and spruce-fir forests at elevations >2,700 feet. However, new encounters from northern Maine have changed our understanding of the distribution and habitat requirements of the species. Those data indicate lush sphagnum peatlands at almost any elevation are sometimes used. In addition, research in New Brunswick indicates that northern bog lemming may not only be restricted to wetlands with sphagnum mats; northern bog lemmings have been found in New Brunswick associated with riparian areas with no sphagnum present. Based on this information the species may be found in Maine at any riparian area with abundant streamside herbaceous vegetation at elevations around 1,000 feet. Therefore, based on our data from northern Maine and nearby New Brunswick, there is a real likelihood the northern bog lemming are present within the Project area.

MDIFW relayed this new information during the March 2014 pre-application meeting with the Applicant and their consultants, and we recommended focused surveys to document the presence or absence of the species in the Project area. However, despite our recommendations it is our understanding that surveys for the species were not conducted. This is especially concerning, given the recent announcement by the US Fish and Wildlife Service that a formal "twelve-month" review of the status of northern bog lemming will begin for consideration of listing under the Federal Endangered Species Act.

MDIFW continues to recommend that surveys for northern bog lemmings are necessary to determine what impacts the Project may have on this listed species, if any. Without surveys, MDIFW is unable to make an informed recommendation in this area.

Impacts to Canada lynx

Canada lynx are listed as a Species of Special Concern in Maine and are known to be in the Project area. It is presumed that a wind farm of this magnitude could have some impacts to Canada lynx, either through habitat alteration detrimental to lynx or of its preferred prey species, the snowshoe hare. It is

also possible that there may be indirect effects from operating turbines (e.g. possible displacement from continuous and/or shadow flicker), but to our knowledge no research has been conducted on the effects of wind farms on Canada lynx.

As we can only speculate as to possible impacts to the species, and considering that Canada lynx are listed as a Threatened species under the Federal Endangered Species Act, MDIFW will defer recommendations to the U.S. Fish and Wildlife Service.

Impacts to Significant Vernal Pools

As proposed, our Agency understands that there will be impacts to Significant Vernal Pools and their critical terrestrial habitats as a result of this Project. Staff have reviewed over 350 vernal pool forms for the Project area and is currently awaiting additional information and clarification from the Applicant. Therefore, we are not able to provide informed recommendations on impacts to Significant Vernal Pools at this time.

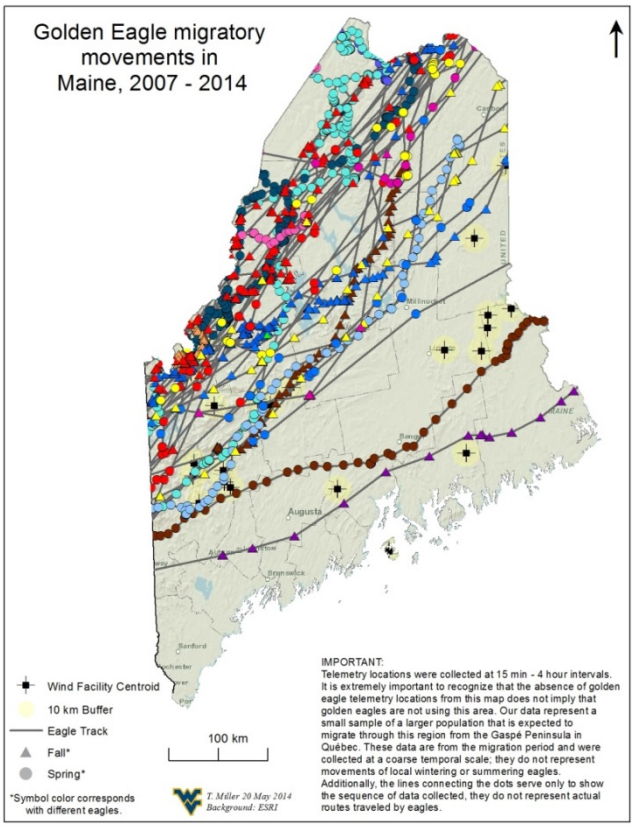
Brook floater

The brook floater and yellow lampmussel, both Maine Threatened species, are small to medium-sized freshwater mussels that have experienced significant declines throughout their ranges, with many populations being extirpated due to low population densities, fragmented distributions, and limited or no evidence of recruitment. Because these species require clean, free-flowing riverine habitat, they are especially vulnerable to impacts from pollution, sedimentation, dams, and surrounding land use practices that degrade or alter their aquatic habitat. If a modified project design were to be considered, we would recommend that riparian buffers remain intact to at least 100-feet wide at the Bridal Path crossings of the East and West Branches of the Mattawamkeag River. Within these 100-foot buffers:

only capable species >8-10 feet tall would be cut (i.e., no other vegetation is cut);
herbicide use would not be allowed;
avoid and minimize pole placement;
prohibit equipment in the stream channels (i.e., must cross on temporary bridges)

Golden Eagle

At present, there is no definitive evidence of golden eagle nesting activity in the Project area or elsewhere in Maine. While most documented golden eagle sightings have occurred in northwestern Maine, a small number of transients may visit or pass through the Project area in any season, and individuals have been documented in the Project vicinity via radio telemetry (see figure below). Golden eagle activity likely peaks during fall and spring migrations. A few golden eagles overwinter in Maine, although none are known within the Project area. Reports of sightings during the spring/summer breeding season occur, but are rarely validated. The difficulties include the immense home range (approximately 2,000 square miles) of breeding eagles, the highly mobile nature of subadult eagles, widespread misidentification of juvenile bald eagles, and the certainty that golden eagles are a very rare bird in Maine.



1. Golden eagles (residents and visitors) have been designated as an Endangered species in Maine since 1986, pursuant to the Maine Endangered Species Act (MESA). The currently transient nature of golden eagles in the Project area (and Maine generally) precludes a meaningful judgment of potential impacts of this Project.

2. This MDIFW review provides no assurances to the applicant from liabilities related to the Bald Eagle – Golden Eagle Protection Act and associated "Eagle Conservation Plan – Wind Energy Guidance." The U.S. Fish and Wildlife Service, Division of Migratory Bird Management has sole authority for oversight and implementation of this law; see:
http://www.fws.gov/northeast/EcologicalServices/eagleact.html and
http://www.fws.gov/migratorybirds/PDFs/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf

Bald Eagle

Both resident and transient bald eagles utilize the Project area. Although there is some risk to injury or death to individual bald eagles from impact with wind turbines, there are few incidents documented in North America, with none reported in Maine to date. Wind energy projects consult with the U.S. Fish and Wildlife Service (USFWS) regarding policies and liabilities for incidental harm under the nexus of the federal Bald Eagle – Golden Eagle Protection Act. MDIFW recognizes bald eagles as a Species of Special Concern.

1. This MDIFW review provides no assurances to the applicant from liabilities related to the Bald Eagle and Golden Eagle Protection Act and associated "Eagle Conservation Plan – Wind Energy Guidance." The U.S. Fish and Wildlife Service, Division of Migratory Bird Management has sole authority for oversight and implementation of this law; see:
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http://www.fws.gov/migratorybirds/PDFs/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf

2. The current abundance and distribution of Maine's population suggest no significant adverse impacts are likely at present as a result of the construction and operation of the Project. Research is underway in Maine to improve quantitative risk assessments of incidental deaths / injuries of individual bald eagles.

MET Tower Recommendations

If a modified project design was to be considered, all temporary and permanent MET towers should have bird diverters installed on the guy wires. The diverters should be of the "flapper" variety, which research has shown to be effective at reducing avian collisions. The diverters should be placed at the manufacturer's suggested rate and spacing for each guy wire. During placement of these diverters, the technician should stagger them on the guy wires so they are not directly under the prior one. As bird diverters can be prone to damage or loss from ice build-up, as a condition of the permit MDIFW also recommends that the bird diverters be annually maintained and replaced, if necessary, for the life of the tower. The diverters should be installed and properly functioning during both the Spring (April 1 to June 7) and Fall (August 7 – November 7) migration periods, and inspected prior to each migration season to ensure they are functioning properly during these periods. These dates capture approximately 90% of the annual avian migration volume.

As entanglement and death of a moose was documented at one of the Project's MET towers in November 2014, MDIFW recommends that the sleeves over all guy wires extend from the ground level up to approximately 12-15 feet in vertical height. The intent is to make sure that there is adequate coverage of plastic sleeve on the guy wires that would account for ground slope and snowpack to reduce the risk of entanglement. Depending on the angle of the wires, this could necessitate 30 feet or more of length of sleeve per wire. All loops of excess wire should be eliminated, but if excess wire is required for future application then loops of excess wire should be tied off at a height of 20-25 feet above the ground (well above snowpack) instead of near ground level to isolate it from wildlife. These recommendations are made to aid wildlife in detection of wires and help to prevent or reduce entanglement of mammalian wildlife, especially ungulates (see photo below). Additionally, we recommend that all construction materials (i.e., cable, rope, loose fencing) is either cleaned up and removed from the site, or adequately stored and secured to further prevent/reduce entanglement of wildlife.

Post-construction Monitoring Recommendations

A cursory review of the Applicant's proposed Post-Construction Mortality Monitoring Plan (PCMM) indicates that it does not meet our Agency's most recent recommendations for post-construction monitoring at other wind power projects in Maine, as well our most recent policy changes which continue to evolve as our understanding of wind power impacts grows. It should be noted that in order to avoid the perception of potential biases and interpretations in monitoring methodologies, analyses, reporting, and especially statistical modeling when determining amounts of fatality at a given wind project, MDIFW recommends that MDEP require the developer to hire an independent 3rd Party PCMM Contractor for all post-construction monitoring activities. Conceptually, the 3rd Part PCMM Contractor would function similarly to MDEP's current 3rd Party Inspector Program. Specific details still need to be worked out, but our Agency feels it is important that a proper research-grade study be conducted at this project, the largest of its kind in the State.

MDIFW's post-construction monitoring recommendations *do not* mitigate MDIFW concerns for significant adverse impacts. To better fully assess the impacts of the proposed Number Nine Wind Project operations on both birds and bats we recommend that the following post-construction monitoring recommendations be conditions of the final permit. Note that the revised monitoring schedule below is due to MDIFW's greatly elevated concerns for bats and birds at individual project sites, as well as the cumulative impacts of an ever-expanding industry. MDIFW recommends that the Applicant be required to submit post-construction monitoring plans to MDEP and MDIFW for review and final approval prior to implementation (by December 31 of the year prior to initiation of operations); and that subsequent PCMM results and suggested modifications to the plan be submitted to MDEP and MDIFW by December 31 of the year prior to initiation of monitoring activities.

MDIFW also recommends that as a condition of the MDEP permit, MDIFW staff be allowed full access to the Project to assess the effectiveness of mitigation strategies on species at risk.

Finally, MDIFW recommends that as a condition of any permit that might ultimately be issued, it should be clearly stipulated that continuing impacts to State-listed species, or species at risk (e.g. nocturnal migrants), ongoing Significant Mortality Events, or yet-to-be discovered techniques that are shown to significantly reduce impacts of Project operations on species at risk, may result in re-opening the MDEP permit to take corrective measures (i.e. adaptive management) at the Project. Corrective measures could include, but not be limited to, increased curtailment for the protection of bats; incorporating new operational and/or mechanical strategies for the protection of species at risk; additional post-construction monitoring methodologies; monetary penalties; and decommissioning of problem turbine(s).

The PCMM plan should incorporate the following:

1. A total of 65 out of 119 turbines at the Number Nine Wind Project should be searched for bird and bat mortalities. MDIFW's recommendation is to search all turbines for projects with less than 10 turbines, and for larger projects (in excess of 10 turbines) to search at least 10 turbines plus 50% of the difference in excess of 10 turbines. For this Project, this result is calculated as follows: 10 + [(119-10) x 0.50] = 64.5 (rounded to 65 turbines). In addition, all permanent and temporary MET towers associated with the Project should be searched during the bird and bat mortality searches.

2. That daily (5 days/week) mortality searches for birds be conducted during peak migration periods (tentatively April 15 - June 1 and August 1 – October 15, subject to slight adjustment in response to new data) during years 1, 2, and 3 of Project operations. Similarly, we recommend surveys be conducted twice a week (2 times/7 days) for the non-migratory period, which should be timed to coincide with weather conditions to likely cause collisions with the structure. All feather spots/clumps of unidentifiable feathers should be included as an unknown bird species and included in the mortality estimate, which has been a consistent recommendation by MDIFW for other wind projects.

3. Unless logistically impossible due to field conditions such as snow depth or mud, carcass searches should continue through mid-December to cover the period when golden eagles would be migrating through the area. MDIFW has telemetry data that supports this timeline for Maine. This is the only aspect of the monitoring that can be conducted by properly trained Project Maintenance and Operations personnel.

4. That daily (5 days/week) mortality searches for bats be conducted from April 15 – October 15, subject to adjustment in response to new data, during years 1, 2, and 3 of Project operations. All observed bat carcasses should be documented, photographed, collected, frozen, and delivered to the nearest MDIFW Regional Office as soon as possible (within one month of discovery.)

5. That all incidental bird and bat carcasses be reported at any time of the year.

6. That nocturnal radar be used concurrently with bird mortality searches to collect data for use in correlating observed mortality with nightly passage rates. Radar studies should be conducted at times that maximize nightly data collection. Records should include weather variables. To ensure that applicants sample nights with representative migration activity, we often request comparisons to other

studies or to Nexrad data. We also recommend the use of X-Band radar systems. If radar units are placed at sites with more than 30% ground clutter, site selection must be pre-approved by MDIFW staff often following a site visit. For verification purposes, it is essential that an image of the radar screen during a high migration event and a series of photos showing surrounding landscape/ground clutter be submitted with any report.

7. Acoustic monitoring should be used concurrently with bat mortality searches to collect data for use in correlating observed mortality with nightly bat activity. Acoustic monitoring should be conducted at all turbines being searched for bat mortalities. MDIFW recommends that the latest, state of the art acoustic detectors be utilized to enable monitoring of the largest range possible. Assuming use of the previously described detectors, one acoustic detector per location should suffice at a height that maximizes coverage in the rotor swept zone. MDIFW anticipates the detector height to be at least 30 meters, but will entertain a recommendation based on the capabilities of its detectors.

8. It is essential that raw data be provided to MDIFW (not just summary information) for review. This includes mortality data, searcher efficiency data, persistence data, and search area data.

9. Searcher Efficiency Trials. To accurately assess the efficacy of the searchers, we recommend that a minimum of 10 carcasses be used for each size class, per searcher, per season of survey (spring migration, summer, and fall migration). A list of the carcasses to be used should be provided to MDIFW prior to trial implementation. A minimum of 15 searcher efficiency trails should be conducted per searcher throughout the study period, with a minimum of 5 searcher efficiency trials for each season.

10. Carcass persistence trials should be used to provide corrections for searcher efficiency and scavenger removal rates. We recommend a minimum of three carcass persistence trials with at least 25 carcasses per trial, and one trial for each season of searches (spring migration, summer, and fall migration.) Carcass persistence should be monitored on days 1, 2, 3, 4, 5, 6, 7, 10, 14, 21, and 30 during the trial period.

11. That any Significant Mortality Event, constituting 3 or more fatalities at a single turbine, or a total of 15 or more fatalities Project-wide in an event, be reported within 1 week to both MDIFW and MDEP. Any mortality event which includes a state or federally-listed Endangered or Threatened Species must be reported to MDIFW and MDEP within 24 hours of discovery.

12. That the applicant collaborate with MDIFW to develop a complete, agreed-upon post-construction raptor migration monitoring protocol by December 31 of the year prior to initiation of monitoring activities. This document should include details on data collection, analysis, reporting, with associated data sheets, documentation and references. Data will facilitate:

- Comparisons of pre- and post-construction overall abundance, passage rates, and species composition
- Documentation of migrating behavior relative to the new turbines (avoidance, flight path, flight height).
- Correlation between post-construction raptor migration surveys (species frequency of observation) and mortality monitoring

13. That daily records include weather and turbine operation variables.

14. That a fourth year of mortality monitoring occur during years 5 - 7 of operations. In addition, monitoring should continue for the life of the Project at the following schedule:

5th year of mortality monitoring during years 8-10 of operations;
6th year of mortality monitoring during years 11-13 of operations;
7th year of mortality monitoring during years of 14-16 of operations; etc.

This monitoring pattern schedule should be followed for the life of the Project. If, at any time of the license a Significant Mortality Event, repeated Significant Mortality Events, or Take of a State-listed species are documented, additional monitoring events may be required in addition to the schedule above. *Note that monitoring conditions to determine Project impacts on bats are subject to change* (i.e. become more intensive, such as annual monitoring for life of the Project) based on future population trends and species needs.

Any changes to monitoring techniques during these periods should be submitted to MDIFW and MDEP for review and final approval prior to implementation.

Please feel free to contact my office if you have any questions regarding this information, or if I can be of any further assistance.

Best regards,

John Perry
Environmental Review Coordinator