BIOLOGICAL OPINION

ON THE

EFFECTS OF THE MONARCH WARREN COUNTY WIND TURBINE PROJECT

IN LENOX TOWNSHIP, WARREN COUNTY, ILLINOIS

ON THE FEDERALLY ENDANGERED INDIANA BAT (*Myotis sodalis*)

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Submitted to the
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office

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Introduction

This document represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) on the effects of the Monarch Wind Turbine Project (MWTP) on the federally endangered Indiana bat (*Myotis sodalis*). Monarch Wind Power (MWP), the operator of the MWTP and recipient of a Department of Energy (DOE) and Illinois Department of Commerce grant, in collaboration with GE Energy, is proposing to construct twelve 1.6-megawatt wind turbines, for a combined generation capacity of 19.2 megawatts, on approximately 600 acres of land leased in Warren County, Illinois.

This BO is based on our review of the Biological Assessment (BA) submitted by DOE on behalf of MWP. It will evaluate the project's effects to listed species and considers the direct and indirect impacts of turbine construction, operation, and maintenance on migratory Indiana bats for the life of the MWTP (up to 25 years).

Species Covered in this Consultation

This consultation covers the federally listed endangered Indiana bat (*Myotis sodalis*). During informal consultation, the Service concurred with DOE's determination that the project may adversely affect the Indiana bat and would have no effect on the eastern prairie fringed orchid (*Platanthera leucophaea*).

Consultation History

9 November 2010 - DOE submitted MWP information packet to the Service.

11 November 2010 - Conference call to discuss MWTP information packet.

9 December 2010 - Conference call between DOE and Service discussing outline for BA.

18 January 2011 - DOE submits Draft BA to the Service.

21 January 2011 - Service provides DOE with comments and recommendations on draft BA.

28 January 2011 - Conference Call with between DOE, Service, and MWP to discuss draft BA.

22 February 2011 - DOE submits final BA and provides a written request for formal consultation.

2 March 2011 - Service provides written acceptance of BA and initiates formal consultation.

21 April 2011 - Service provides draft BO to DOE

Biological Opinion

1. Description of the Proposed Action

The MWTP would involve the construction and installation of twelve 1.6-megawatt wind turbines. MWP has selected the GE 1.6xle model turbine, which has a rotor diameter of 271 feet and a tower height of 328 feet. The turbines would be installed on monopole steel towers and would have a maximum height of 463 feet from the bottom of the tower to the blade tip at its highest point. Underground cables would be installed to conduct electricity from the turbines to a new electrical substation. The facility would connect via the substation to a 69-kilovolt Ameren distribution line that intersects the site on the western side of U.S. Highway 67.

1.1 Project Site

The MWTP would be located on 600 acres of land in Lenox Township, Warren County, Illinois (Figure 1, p.24). The turbines would be located south and northeast of the intersection of U.S. Highway 67 and 140th Avenue (Figure 2, p.25), 4 miles south of Monmouth, Illinois. Seven turbines would be installed on land leased from private landowners and the remaining five would be installed on land leased from Warren County.

The project site consists of agricultural fields where corn and soybeans are usually grown. The site is bounded on the north by the Burlington Northern Santa Fe railroad line and surrounded by cultivated land in every direction. Route 67, a four-lane highway, intersects the site (Figure 2). Areas of ground disturbance would be limited to approximately 16 acres, including access roads and equipment staging/laydown areas. The approximate center point of the project area is 40º50’1” N, 90º39’29” W.

MWP will site all infrastructure within a previously disturbed landscape, particularly within tilled agricultural fields, and will site infrastructure more than 2.5 miles away from all suitable Indiana bat maternity habitat and more than 1,000 feet from potential bat habitat (i.e., wooded corridors, ponds, etc.).

1.2 Project Description

The description of the MWTP provided in the BA contains detailed information regarding construction and installation, aviation marking, operations and maintenance, and decommissioning of the facility. In general, the MWTP will undergo construction beginning the spring-summer 2011 and be fully operational within 12 months. This includes the construction of both above and below-ground infrastructure within the action area. MWP will operate and maintain all components of the wind energy facility throughout the duration of the project, 25 years, and be responsible for decommissioning and/or replacement of turbines that have reached the end of their functional lives.

1.3 Action Area

The project action area is defined as all areas to be affected directly or indirectly by the proposed project and not merely the area immediately adjacent to the project location. Therefore, the project action area includes the project footprint and geographic extent of area that could be affected by construction or operational activities either directly, indirectly, or through interrelated or interdependent actions.

As described above, about 16 acres of cultivated land would be disturbed within a 600-acre area during development of access roads and installation of the wind turbines, electrical cables, and substation (Figure 2). The Service concurs with the conclusion in the BA that an action area of one mile surrounding the 12 turbines is the maximum geographic extent of areas that will be affected by the construction and operation of the MWTP (Figure 3, p. 26). This action area includes all sites that would be temporarily or permanently disturbed during construction, as well as areas that may be affected during operations.

2. Status of the Species

2.1 Species Description

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter, and spends the summer in wooded areas. It is a medium-sized bat, having a wing span of 9 to 11 inches and weighing only one-quarter of an ounce. The fur is described as dull pinkish-brown on the back and somewhat lighter on the chest and belly. The ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). The Indiana bat closely resembles the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). It is distinguished from these species by its shortened feet and toe hairs and a slightly keeled calcar.

2.2 Regulatory Status

The Indiana bat was officially listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). In 1973, the Endangered Species Preservation Act was subsumed by Endangered Species Act and the Indiana bat was extended full protection under this law.

Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula, including 11 caves and two mines in six states, were listed as critical habitat including Blackball Mine in LaSalle County, Illinois.

2.3 Life History

In winter (typically October through April), Indiana bats hibernate in caves or mines, often with other species (USFWS 2007). In spring, males and non-reproductive females may migrate long distances to their summer habitat (Kurta and Rice 2002). Likewise, reproductive females may migrate long distances to summer habitat – (up to 357 miles based on data from Winhold and

Kurta 2006) or they may form maternity colonies only a few miles from their hibernaculum. Both males and females return to hibernacula in late summer or early fall to mate (swarm) and store up fat reserves for hibernation. By mid-November, male and female Indiana bats have entered hibernation. They typically reemerge in April, at which time they again seek their summer habitat. A brief chronology of the Indiana bat's life cycle is given in Figure 4 below and the Indiana Bat Draft Recovery Plan (USFWS 2007) provides a comprehensive summary of Indiana bat life history.

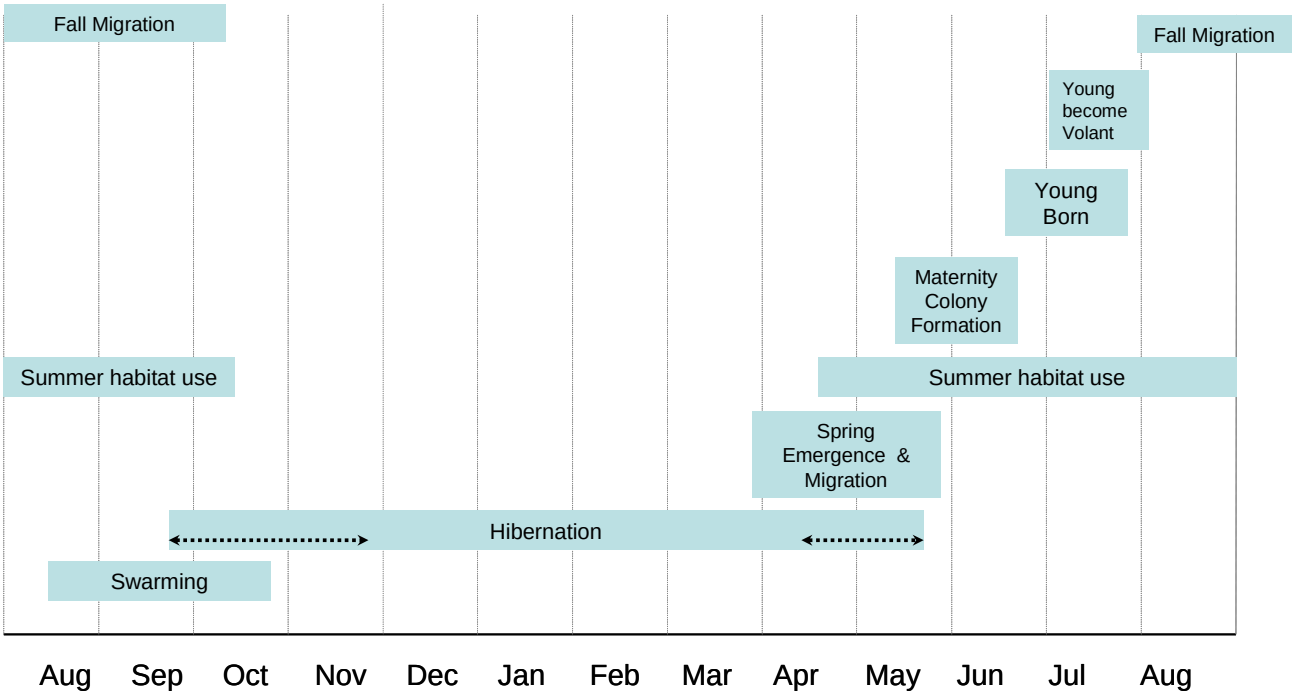

Figure 4. Indiana bat annual chronology.

After hibernation ends in late March or early April, most Indiana bats emerge, and forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting areas. Female Indiana bats emerge first from hibernation in late March or early April, followed by the males. The timing of annual emergence may vary across their range, depending on latitude and annual weather conditions. Shortly after emerging from hibernation, the females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (USFWS 2007). Most populations leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

Most bats migrate to the north for the summer, although other directions have been documented (USFWS 2007, Gardner and Cook 2002). A stronger homing tendency has been observed along a north-south axis, than the east-west direction in release studies. Females can migrate hundreds of miles north of the hibernacula. Less is known about the male migration pattern, but many

males summer near the hibernacula (Whitaker and Brack 2002, USFWS 2007).

Females arrive in summer habitat as early as April 1. Temporary roosts are often used during spring until a maternity roost with large numbers of adult females is established. Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas; that is, they return to the same summer range annually to bear their young. Trees in excess of 16 inches diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Cavities and crevices in trees may also be used for roosting. In Illinois, Gardner et al. (1991) found that forested stream corridors and impounded bodies of water were preferred foraging habitats for pregnant and lactating Indiana bats.

Most documented maternity colonies have 50 to 100 adult bats (USFWS 2007). Fecundity is low with female Indiana bats producing only one young per year in late June to early July. Young bats can fly between mid-July and early August, at about 4 weeks of age. Mortality between birth and weaning was found to be about 8% (Humphrey et al. 1977).

Many males stay near hibernacula (i.e., caves and mines) and roost individually or in small groups during the summer (Whitaker and Brack 2002). The later part of the summer is spent accumulating fat reserves (USFWS 2007). Males have been observed roosting in trees as small as 3 inch dbh.

Return to the hibernacula begins for some males as early as July. Females typically arrive later and by September numbers of males and females are almost equal. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain them through the winter (Cope et al. 1977, USFWS 1983). Swarming behavior typically involves large numbers of bats flying in and out of cave entrances throughout the night, while most of the bats continue to roost in trees during the day. Swarming continues for several weeks and copulation occurs on cave ceilings near the cave entrance during the latter part of the period (USFWS 2007). Adult females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from hibernation. Young female bats can mate in their first autumn and have offspring the following year, whereas males may not mature until the second year. Limited mating activity occurs throughout the winter and in late April as the bats leave hibernation (Hall 1962).

2.4 Species Range and Population Status

The species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The Indiana bat is migratory, and the above described range includes both winter and summer habitat. The winter range is associated with regions of well-developed limestone caverns. Major populations of this species hibernate in Indiana, Kentucky, and Missouri. Smaller winter populations have been reported from Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New York, North Carolina,

Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. More than 85% of the entire known population of Indiana bats hibernates in only nine caves.

The 2009 range-wide population estimate of Indiana bats is 387,835 based on winter hibernacula survey information compiled by the Service. The 2009 survey results show a 17.2 % population decline from the 2007 estimates, some of which is attributed to white-nose syndrome (WNS) (see "New Threats" section). Table 1 provides a detailed breakdown of the range-wide population estimates by Fish and Wildlife Service Region and by State from 2001 to 2009 (USFWS 2010). Illinois hibernacula support about 13.7 % of the entire population.

Recovery Unit	2001	2003	2005	2007	2009
Ozark – Central (AR, IL, MO, OK)	43,151	63,631	73,337	71,819	68,430
Midwest (AL, IN, KY, MI, OH, TN, SW. VA)	238,739	246,673	285,729	320,300	258,733
Appalacian Mtns. (E. TN, PA, NC, VA, WV)	16,384	19,659	23,672	22,295	27,458
Northeast (NY, NJ, VT)	30,252	34,097	42,667	53,767	33,214
Totals:	328,526	364,060	425,405	468,181	387,835

Table 1. Range-wide population total estimates, and breakdown of population by Recovery Unit.

The abundance of Indiana bats in the northeast has declined to 2003 population levels due to WNS, and the threat to the continued existence of the species from WNS remains high. Recovery efforts are primarily focused on the WNS investigation at this time and its source. As of the fall of 2009, the Service considers the overall Indiana bat population trend to be declining as WNS continues to spread.

The Ozark-Central Recovery Unit is the second largest of the Indiana bat recovery units and includes the project area. There were 71,819 bats estimated from hibernacula counts for 2009 for this recovery unit. WNS has not yet impacted population numbers in this recovery unit. However, the Service anticipates that future declines to the Ozark-Central Recovery Unit are likely as a result of WNS spreading into major hibernacula in Illinois and Missouri.

Blackball Mine is the fourth largest hibernaculum for Indiana bats (Table 2) in the Ozark-Central Recovery Unit. It is an abandoned dolomite limestone mine encompassing 211 acres and is owned by the Illinois Department of Natural Resources. Indiana bats migrating from Blackball Mine have been documented as using maternity sites to the southeast and to the southwest (Gardner and Cook 2002).

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	20011
1,562		1,648		1,804		2,513		2,513		

Table 2. Winter Population Estimate for Blackball Mine, LaSalle Co., IL 2001-2009. Mine was not surveyed in 2009, previous survey's results applied and projected red.

Known summer occurrences cover a broader geographic area than its winter distribution including southern Iowa, northern Missouri, much of Illinois and Indiana, southern Michigan, Wisconsin, western Ohio, and Kentucky.

2.5 Reasons for Listing

The original recovery plan (USFWS 1983) and the 2009 Five-Year Review (USFWS 2009) identified threats as natural hazards (i.e., flooding, freezing, mine ceiling collapse), human disturbance and vandalism at hibernacula, deforestation and stream channelization, pesticide poisoning, indiscriminate scientific collecting, handling and banding of hibernating bats by biologists, commercialization of hibernacula, exclusion of bats from caves by poorly designed gates, man-made changes in hibernacula microclimate (blocking or adding entrances and/or by poorly designed gates), and flooding of caves by reservoir developments.

Several of the original threats listed above have largely been addressed and are no longer adversely affecting the species to the extent they once had (i.e., human disturbance at hibernacula, indiscriminate scientific collecting, banding of hibernating bats, commercialization of hibernacula, and poorly designed cave gates). The 2007 agency draft recovery plan (USFWS 2007) identified additional threats including: quarrying and mining operations (summer and winter habitat), loss and degradation of summer, migration, and swarming habitat, loss of forest habitat connectivity, some silvicultural practices and firewood collection, disease and parasites, predation, competition with other bat species, environmental contaminants, climate change, and collisions with man-made objects (i.e., wind turbines, communication towers, airstrikes with airplanes, and roads). With few exceptions, all of these identified threats are still affecting the species to varying degrees.

2.6 New Threats

WNS is killing cave-dwelling bats in unprecedented numbers in the northeastern United States and is associated with the fungus *Geomyces destructans* (Gargas *et al*. 2009). It was first documented at four sites in eastern New York in the winter of 2006-07. The most obvious symptom of WNS is the presence of a white fungus on the face, wing, or tail membranes of many, but not all, affected animals. Behavioral changes are also indicative of WNS affliction, characterized by a general shift of animals from traditional winter roosts to colder areas, or to roosts unusually close to hibernacula entrances. Affected bats are generally unresponsive to human activity in the hibernaculum, and may even fail to arouse from torpor when handled. Bats at affected sites are regularly observed flying across the mid-winter landscape, and on occasion, carcasses of little brown bats by the hundreds to thousands have been found outside affected hibernacula with more found inside. Affected animals appear to be dying as a result of depleted fat reserves, and mortalities are first apparent months before bats would be expected to emerge from hibernation.

Overall mortality rates (primarily of little brown bats) have ranged from 81% to over 97% at several of the sites where data have been collected for at least two years (Hicks *et al*. 2008).

WNS has now been documented in 11 states, and the degree of impact to bats appears to vary greatly by site and species. Based on observations of continued mass-mortality at several sites in the Northeast and mid-Atlantic regions, we anticipate that WNS will continue to spread rapidly, moving into and through the Midwest, South and eventually Great Plains over the next couple of years. If current trends for spread and mortality at affected sites continue, WNS threatens to

drastically reduce the abundance of many species of hibernating bats in much of North America. Population modeling indicates a 99% chance of regional extinction of the little brown bat within the next 16 years due to WNS (Frick *et al*. 2010). The closely-related Indiana bat may be equally vulnerable due to its smaller range-wide population and social behavior traits that increase the risk of bat-to-bat transmission. European *myotis* species are apparently resistant to *Geomyces destructans*, which suggests some level of resistance has developed. This resistance in European bats may hold the key to preventing bat extinctions in North America due to WNS.

The proliferation of commercial-sized wind turbines across the landscape of the United States poses a new threat to the Indiana bat. An injunction by Federal court issued to Beech Ridge wind energy project underlined the need for project proponents to seriously consider impacts to the federally listed endangered bats when developing such projects. Many project developers, including MWP, are now reviewing project alternatives to minimize harm to bats from project operation.

2.7 Recovery Criteria and Recovery Units

Since the Indiana bat's initial listing, the recovery program has largely been focused on protection of important hibernacula (USFWS 1983). The proposed recovery program outlined in the draft Recovery Plan (USFWS 2007) has four broad components: (1) range-wide population monitoring at the hibernacula with improvements in survey techniques; (2) conservation and management of habitat (hibernacula, swarming, and summer); (3) further research into the requirements of and threats to the species; and (4) public education and outreach. This recovery program continues to have a primary focus on protection of hibernacula but also increases the focus on summer habitat and proposes use of Recovery Units.

The Service's proposed delineation of Recovery Units (RUs) relied on a combination of preliminary evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use (USFWS 2007). The Indiana Bat Draft Recovery Plan proposes four RUs for the species: Ozark-Central, Midwest, Appalachian Mountains, and Northeast (USFWS 2007).

MWTP falls within the proposed Ozark Central RU, which in the winter of 2008-2009 contained less than one fifth (18%) of the range-wide Indiana bat population (Table 2).

In 2009, there were 2,400 maternity colonies estimated rangewide for the Indiana bat. The 2,400 maternity colonies is an estimate based on 269 known locations. Thus, 11% of all estimated colonies are known. In addition, about 10% of all known maternity colonies are located in Illinois (USFWS 2009).

2.8 Environmental Baseline

The BA adequately describes the status of the Indiana bat in the project area. No known maternity colonies occur within the project area or within a two and one-half mile diameter outside the project circumference. Maternity colonies are known to occur in the county directly adjacent and west of the project area in Henderson County (FWS 2007). Thus, we do not

anticipate impacts to summering Indiana bats at this project site since there is no summering habitat in the project vicinity and Indiana bats tend to limit their foraging within two and one half miles of their maternity colony based on expert information provided to the Service.

However, the location of the known maternity colonies to the west of the project county may influence the presence of migrating Indiana bats in the vicinity of the project area. The project area appears to be within the general line of flight for Indiana bats using Blackball Mine as a hibernaculum and bearing young in maternity colonies to the south and west. Gardner and Cook (2002) reported Indiana bat migration from Blackball Mine to a Missouri maternity roost just west of Adams County, Illinois. Although the exact flight path is unknown, it is likely that similar migrations occur from Blackball Mine west and south to maternity colonies in suitable habitat along tributaries of the Mississippi River. Indiana bats migrating out of Blackball Mine have also been documented moving east and south to maternity habitat in west central Kentucky (Gardner and Cook 2002). Since no occupied maternity habitat is known north of Blackball Mine or south within one hundred miles, it appears that the most likely direction Indiana bats fly out of Blackball Mine seeking maternity habitat is west and southwest, and east and southeast. Thus, it is not unreasonable to assume that a proportion of the bats hibernating in Blackball Mine migrate near or through the project area during their biannual migrations between their summer and winter habitats.

Blackball Mine is listed as critical habitat and is located about 100 miles east northeast of the project site. Indiana bat use of Blackball Mine has almost doubled in the past ten years with an estimated 2,500 Indiana bats hibernating there in 2009. At this time, however, Blackball Mine remains a Priority 2 hibernaculum (FWS 2007) and its population contributes less than 4 % of the total estimated population of the Ozark Central Recovery Unit.

3. Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on listed species or critical habitat, together with the effects of other activities interrelated and interdependent with that action which will be added to the environmental baseline. The Endangered Species Act defines indirect effects as those caused by the proposed action and that are later in time, but are still reasonably certain to occur (50 CFR §402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Our effects analysis considered each of the five stages of the Indiana bat's annual cycle: hibernation, spring migration, summer period, fall migration, and swarming. No summer, winter, swarming habitat, or critical habitat are located within or adjacent to the project area, so no adverse effects are anticipated to these habitats from the MWTP. The effects of this action are direct effects, occurring while the turbines are in operation during bat migration periods. Below we have assessed the various project components and their anticipated effects on Indiana bats. Minimization measures are considered part of the proposed action, so the effects of these measures in reducing or partially offsetting effects on Indiana bats are considered as well.

3.1 Direct Effects

Direct effects are defined as the direct or immediate effects of the project. Direct effects include all immediate impacts (negative and beneficial) from project-related actions and those disturbances that are directly related to project elements that occur very close to the time of the action itself. It is important to note for the MWTP, the action area contains no suitable Indiana bat habitat within 2.5 miles and there are no known collection records for this county.

3.1.1 Project Construction

- Construction of the MWTP, including installation of the wind turbines, electrical distribution lines, substation, and other required infrastructure will not result in a modification of Indiana bat behavior. The construction of the MWTP will occur entirely during daylight hours within a cultivated agricultural landscape primarily used to grow corn and soybeans.

- The creation of airborne dust by construction equipment is likely to occur in all earth moving projects, but the magnitude is dependent on many factors, including humidity, wind velocities and direction, and location of soil disturbances. Dust will be created during autumn when Indiana bats will be traversing through the project area; however, this is not expected to exceed the dust created by routine autumn agricultural activities in this area of Illinois.

3.1.2 Project Maintenance and Operation

- Project maintenance is expected to include periodic maintenance of transmission lines, roads, turbines, turbine pads, transmission line right-of-ways, and road right-of-ways. Maintenance will occur during daylight hours throughout the life of the project. Daytime activities should have no adverse effect on the Indiana bat during any part of its life cycle.

- No air pollutants would be released during operation of the project and amounts of lubricants and other hazardous materials released into the environment during operation will likely be insignificant.

- Road use during project operation is not expected to harm Indiana bats because vehicle traffic will be restricted to the time between sunrise and sunset, when Indiana bats are inactive.

- Eight perimeter turbines will be outfitted with synchronized flashing red lights as required by the Federal Aviation Administration (FAA) and used during nighttime hours only. Studies indicate there is no statistical difference in bat mortality rates between turbines lit according to FAA standards and unlit turbines (Arnett *et al*. 2008, Horn *et al*. 2008).

3.1.3 Turbine Operation

- During the turbine operation phase of the MWTP, migrating Indiana bats could be killed or injured during their migration period by spinning turbine blades, as has been documented at other wind energy projects (e.g. Fowler Ridge Wind Farm).

- Migrating bats may be struck by the spinning blades or experience pulmonary hemorrhaging by the significant pressure difference surrounding an operating turbine, a condition known as barotrauma. Baerwald et al. (2008) found internal hemorrhaging in 92% of bats that were necropsied, indicating that internal injury is common at wind facilities.

- Traumatic injuries (sheared off wings, headless bodies, head injuries, gashes on the body, etc.) are consistently reported by researchers. At the Buffalo Mountain, Minnesota wind farm, for example, 43.3% of the 522 bodies had evidence of a major injury (Johnson et al. 2003, Johnson pers. comm.). Thus, data indicate that collision with moving turbine blades is a major contributor of bat fatalities.

- Project siting has avoided close proximity to summer, winter or swarming habitats. Thus, Indiana bats are not expected to be adversely affected by MWTP during these periods.

3.1.3.1 Mortality Risk

Operating wind turbines pose a risk of killing and injuring bats, including Indiana bats. Risk appears to be a complex interplay between turbine characteristics, environmental conditions, and bat behavior. Turbine characteristics that influence risk include turbine height, rotor diameter, and rotor swept area, all of which are positively correlated with bat mortality (Arnett *et al*. 2008). It is the spinning turbine blades that pose the mortality risk; no bat fatalities have been reported due to non-operational turbines (Arnett 2005, Kerns and Arnett 2005). Environmental factors that appear to influence risk include geographic location, wind speed, weather patterns, surrounding habitat, and insect activity (Arnett *et al*. 2008, Horn *et al*. 2008). Some Midwestern studies have documented significant levels of bat mortality (Drake *et al.* 2009, Johnson *et al.* 2009, BHE Environmental 2010, Johnson *et al.* 2010, Good *et al.* 2011). Additionally, mortality appears to be highest on low wind nights after storms (Kerns *et al*. 2005).

Bat behavior also appears to have a significant influence on mortality risk. While bats should be able to use echo-location to both detect and avoid collisions with wind turbines, this does not appear to be always the case. During studies at the Mountaineer wind facility with an average detection of 99 bats per night, bats were frequently observed near operating wind turbines, with the majority of bats foraging and flying at the range of altitudes at which the turbine blades were operating. Bats were also observed to investigate moving blades with repeated fly-bys, take evasive maneuvers near moving blades, succumb to being stricken by moving blades, and investigate and alight on turbine monopoles and stationary blades (Horn *et al*. 2008). Horn *et al*. (2008) noted that many of the instances of avoidance behavior involved multiple passes. Bats

often appeared to investigate the turbine blades after a near miss, rather than fly off quickly. This often resulted in several additional near misses in a row, with the bat appearing to be repeatedly buffeted by turbulence close to the blade surface. Bats exhibiting the above behavior were not identified down to the species level; and thus, it is not yet determined whether the behavior observed in this study represents Indiana bat behavior in response to wind turbines.

This tendency of bats to forage and fly within the rotor swept area, and to investigate monopoles and moving turbine blades, makes the bats highly susceptible to mortality through a direct strike by a moving blade or through the fatal effects of barotrauma. Studies have found that the pressure differential near spinning turbine blades is so significant that it causes pulmonary hemorrhaging (barotrauma) in bats (Baerwald *et al*. 2008). While direct contact with turbine blades was evident in about half of the examined bats, over 90% of the fatalities involved internal hemorrhaging consistent with barotrauma. Approximately 57% of the bats had internal hemorrhaging, but no external signs of injury (Baerwald *et al*. 2008).

The potential for interactions between operating wind turbines and Indiana bats is present on the MWTP during the bat's spring and fall migratory periods. Spring migration in northwest Illinois typically occurs during the entire month of April, a shorter time frame than fall migration. The shortened migration during spring may make bats less vulnerable to collision at the MWTP during this time period. To date, the number of fatalities during the spring migration period significantly lags behind those in reported in summer and fall (Arnett *et al.* 2008), and no known mortalities of Indiana bats have occurred during spring migration (Johnson *et al.* 2010, Good *et al.* 2011, and others).

Fall migration may start as early as late July (for males) to mid-August (females) and may extend through mid-October. Two Indiana bat fatalities have been documented at Fowler Ridge Wind Farm (northwest Indiana) in habitat types similar to the MWTP; and thus, it is reasonable to conclude the MWTP poses a similar mortality risk to Indiana bats during fall migration throughout its functioning life.

3.1.3.2 Estimating Mortality

The Service estimates the MWTP will cause bat mortality at rates similar to other wind developments in highly agricultural areas of the Midwest within the range of the Indiana bat. Two of the most complete and thorough studies conducted to date in the Midwest occurred at Fowler Ridge Wind Farm in west-central Indiana (Good *et al.* 2011), and Twin Groves Wind Farm in central Illinois (Johnson *et al.* 2010). The results of these studies were used to ascertain a baseline bat mortality prediction for this action because of landcover similarities between the MWTP and the above farms and, because the metrics and protocols used were nearly identical between studies. The most robust data sets attained from the Fowler Ridge (136 of 355 turbines surveyed) and Twin Groves (39 of 240 turbines surveyed) Wind Farms were collected in their second year of study, and documented 774 and 378 bat fatalities for this one year period, respectfully. Dividing the bat fatalities by the number of turbines studied yields an average bat mortality at these

sites to be 5.69 (Fowler Ridge Wind Farm) and 9.69 (Twin Groves Wind Farm) bats/turbine/study period. However, these data only represent the number of bat fatalities found near surveyed turbines during a limited period of searching time. Adjusted fatality estimates are necessary to account for the likelihood of scavenging, searcher efficiency, wounded individuals that may remove themselves from the search plot, bats that may fall outside the search plot, and fatalities that occur outside the study window. The final adjusted fatality estimates for the Fowler Ridge and Twin Groves Wind Farms, accounting for the above, are 22.20 and 19.47 bats/turbine/year, respectively.

The annual mortality rate per turbine for the MWTP will assumedly be near the mean of the Fowler Ridge Wind Farm and Twin Groves Wind Farm data, 20.84 bats. To calculate the average yearly mortality of bats at the MWTP we multiplied the predicted mortalities per turbine, 20.84, by the total number of turbines, 12. The anticipated number of mortalities of all bats per year at the MWTP is therefore 251 bats. Indiana bat take over the life of the project was projected by multiplying the yearly mortality rate of the MWTP by the life of the project (result: 6,275 bats), and then assuming Indiana bats comprise a small percentage of these mortalities.

Indiana bat occurrence was estimated by again using bat fatality data from the Fowler Ridge Wind Farm and Twin Groves Wind Farm. Out of 1152 (774 Fowler Ridge Wind Farm and 378 Twin Groves Wind Farm) total bat fatalities from the second year of study from both projects, one Indiana bat was killed. The resulting proportion of Indiana bat to non-Indiana bat fatalities was 0.087% (1/1152 = 0.00087). Given the that 251 bats are projected to be killed yearly at MWTP, we estimate 0.087% of these bats will be Indiana bats, or about one Indiana bat taken every five years, with a total projected take over the 25 year life of the MWTP of about six, all of which are assumed to be taken during the fall migratory period.

3.1.3.3 Risks to Local Bat Populations, Maternity Colonies, and Hibernacula

Indiana bats taken by the MWTP are presumed to be non-reproductive juveniles as well as adult female and male Indiana bats. Because both sexes of Indiana bats appear to be equally susceptible to risk of collision, the take of Indiana bats at wind turbines is assumed to be equal for males and females (USFWS 2007). In addition, there is no evidence that suggests either juveniles or adults are more susceptible to collision than the other. Thus, we assume that all fatalities will be evenly distributed across all age classes and sexes.

Given that migratory corridors for Indiana bats in the Midwest remain generally unknown, we believe that any females being taken as a result of this action are most likely to originate from differing maternity colonies at irregular intervals. Maternity colony size has been documented in literature as typically hosting fewer than 100 individuals with an average of 60-80 breeding females (Whitaker and Brack 2002, Kurta 2005, USFWS 2007). Although it is likely that Indiana bats migrating in through the project area will be from more than one hibernaculum and more than one maternity colony, we cannot predict with a high level of certainty from which hibernating populations or maternity colonies these bats will originate. We assume if a relatively

small number of bats abandoned a colony, that affected maternity colony would experience either no impacts or only a short-term reduction in reproductive output. In the event that all the female Indiana bat fatalities for MWTP originated from the same maternity colony, we estimate that the impact would not adversely affect the maternity colony as the take is not likely to exceed one individual in any five years and is not likely to exceed three females over the 25 year life of the project. Thus, the impact from take of Indiana bats at the MWTP is not expected to result in permanent loss of reproductive potential of a maternity colony or the maternity colony itself. In addition, the very low quantity of take is not expected to directly or indirectly cause an appreciable reduction in the reproduction, numbers or distribution of the Indiana bat as a species.

The estimated total amount of take (six Indiana bats) only represents 0.01% of the estimated 2009 winter population within hibernacula in the State of Illinois (53,276 Indiana bats). Loss of this small number of bats will not be sufficient to adversely impact any hibernating populations to which these individuals belong. It will also have no adverse impact on the Blackball Mine Critical Habitat hibernaculum since loss of no more than six individuals over a 25 year span will not impair population numbers and will not impact constituent elements of the critical habitat.

3.2 Indirect Effects

Indirect effects include those effects that are caused by or would result from the proposed project and are later in time, but are still reasonably certain to occur. Because there are no known hibernacula, maternity, roosting, or foraging habitats within or near the action area, no indirect take of Indiana bats is anticipated.

3.3 Effects of Interrelated and Interdependent Actions

Interdependent actions have no independent utility apart from the proposed project and interrelated actions are part of a larger action and depend on the larger action for their justification. No interdependent or interrelated actions are known to be associated with the proposed project.

The proposed project would be a single and complete action; therefore, no effects from interdependent or interrelated actions are anticipated.

3.4 Cumulative Effects

As defined under the implementing regulations of the Endangered Species Act, cumulative effects are those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation. There are no other planned non-Federal (or Federal) actions that are reasonably certain to occur within the action area shown in Figure 3. However, two additional wind projects are proposed for Warren County, each with 134 wind turbines and a capacity of 134 megawatts. The Coldbrook-Alexis Wind Farm would be located in Coldbrook Township, over 10 miles northeast of the proposed MWTP site. The EcoPoint Wind Farm would be located in Point Pleasant, Swan, and Sciota Townships, over 10 miles south and southwest of the MWTP.

No cumulative impacts within the action area are anticipated, as no other reasonably foreseeable projects are planned to occur within its boundaries. The potential exists for cumulative impacts to occur outside the action area from installation of wind turbines in the region.

3.5 Conclusion

The analysis of the possible effects indicates that Indiana bat take may potentially occur during the spring and fall migration period. However, the best available scientific information presented above indicates that the likelihood of take during spring migration is low due to the short duration of the migration period and the small number of turbines located in the project area. Take during the fall migration period remains likely though limited (no more than six Indiana bats over the 25-year life of the project) due to the small number (12) of turbines.

The proposed action will have minimal, short-term effects on these bats' respective maternity colonies and hibernating populations. It will have no adverse impact on the Blackball Mine Critical Habitat since, in the worst case where all Indiana bats taken were from the same hibernaculum, a loss of no more than six individuals over a 25 year span will not detectably reduce population numbers and will not impact constituent elements of any critical habitat. Similarly, loss of these individuals will have no adverse effect on the viability of any single maternity colony in the vicinity of the project area due to the low numbers predicted to be lost over a relatively long time period. Nor will this project result in a detectable difference in reproduction, numbers, or distribution of Indiana bats in the Ozark-Central Recovery Unit level or in the species' overall range.

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that granting funds for this project as proposed is not likely to jeopardize the continued existence of the Indiana bat or adversely modify critical habitat.

4. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by Fish and Wildlife Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Department of Energy so that they become binding conditions of the grant issued to MWP for the exemption in section 7(o)(2) to apply. The DOE has a continuing duty to regulate the activity covered by this incidental take statement. If the DOE: (1) fails to assume and implement the terms and conditions; or (2) fails to require the grantee adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse.

4.1 Extent of Take

We estimate direct take of Indiana bats will result incidental to operation of the MWTP. The take of Indiana bats will be difficult to detect because: (1) dead or injured bats are difficult to locate due to the bat's small body size and the scavenging rate of their carcasses is high; (2) the number of bats occupying a particular area at a particular time is highly variable and difficult to determine; and (3) the finding of dead Indiana bats among all bats killed at a wind farm is rare. For the MWTP, we estimate that six Indiana bats will be taken over the life of the project (25 years).

4.2 Effect of the Take

In the accompanying BO, the Service determines that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. Given that no reductions are anticipated in the reproduction, numbers, or distribution of Indiana bats within the Ozark-Central Recovery Unit or in the species' overall range, the action is not likely to jeopardize the continued existence of the Indiana bat.

5. Reasonable and Prudent Measures

The Service has concluded, based on the best information available, that Indiana bats may be present during the spring migration period, and will likely be present within the project area during fall migration. The likelihood of take during spring is low and during fall take is considered likely to occur. No take is expected to occur during the summer or winter due the absence of suitable seasonal habitat in and near the action area. Therefore, the minimization measures below focus on the fall migration period only.

The most effective way known to date to reduce the number of fatalities at wind turbine sites is through the implementation of operational curtailment. Recent studies that have raised cut-in speeds from the factory standards (typically 3.5 - 4.0 meters/second (m/s)) to 5.0 - 6.5 m/s during the fall migratory period (1 August – 1 October) have resulted in a 57-82% reduction in overall fatalities (Baerwald *et al.* 2009, Arnett *et al.* 2010) with relatively small impacts to energy production. The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Indiana bats.

5.1 Operational Curtailment

Raising cut-in speeds is the measure most likely to reduce Indiana bat mortality at wind farms. MWP will implement an operational curtailment regime of 5.0 m/s for the life of the project that will seek to reduce overall bat mortality and minimize take of Indiana bats. Bat mortality is projected to be reduced by 57-82% (Baerwald *et al.* 2009, Arnett *et al.* 2010) during the fall migration period and we assume that higher cut-in speeds are equally effective at reducing fatalities for Indiana bats. Turbine blades will be feathered until wind speeds capable of generating power are present, thus eliminating any potential for take from blade rotation at wind speeds lower than 5.0 m/s.

6. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the DOE or its grantee must comply with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are non-discretionary.

6.1 Raised Cut-in Speeds and Feathering

In an effort to obtain a significant reduction in bat fatalities at the MWTP, all turbines will operate using a raised cut-in speed of 5.0 m/s, during the fall migration period. To achieve the full effectiveness of higher cut-in speeds, MWP will also feather turbine blades to minimize the number of turbine rotations at lower wind speeds.

1. The MWTP will implement cut-in speeds of 5.0 m/s for the life of the project or until new information becomes available to adjust the curtailment regime with approval of this Service.

2. Turbine blades will be feathered at wind speeds below 5.0 m/s for the life of the project or until new information becomes available to adjust the curtailment regime with approval of this Service.

3. Raised cut-in speeds and blade feathering will be used from 0.5 hours before sunset until 0.5 hours after sunrise during the fall migration period, from August 1 to September 30 unless new information becomes available to adjust these times and dates.

4. Spring fatality monitoring will occur in operation years 1, 2, and 3 using protocols designed in conjunction with the Service and incorporating requirements outlined in Sections 6.1 and 6.2. If any Myotid bats are taken during these surveys, MWP will immediately coordinate with the Service to determine if addition years of spring fatality monitoring are necessary.

5. Fall fatality monitoring will occur in operation years 1, 2, 3, 8, 13, 18, and 23 using the protocol designed in conjunction with the Service and incorporating requirements outlined in Sections 6.1 and 6.2.

6. Any alteration to the proposed curtailment regime will be followed by an additional year fall mortality monitoring.

6.2 Requirements for Monitoring

The following is a list of surveying requirements necessary to ensure the anticipated take is not exceeded for this Federal action. This office should be contacted prior to each year's mortality search for coordination purposes. At a minimum, each survey should include the following parameters.

1. ***Frequency*** — Monitoring for all-bat and Indiana bat fatalities is required during the first 3 years of operation for the MWTP during the spring (April 1 – April 30) and fall (August 1 – September 30) migratory periods. Thereafter, mortality monitoring will be required during the fall migratory period only every fifth year unless otherwise agreed upon in writing by this office.

2. ***Intensity*** — Mortality searches should be conducted twice per week throughout the entire migratory season at each turbine within the MWTP complex. Surveys should begin one half-hour after sunrise and turbine survey order should be randomized to eliminate any avoidable searcher and field biases.

3. ***Number of Turbines*** — All 12 turbine sites should be surveyed during the same day, twice weekly.

4. ***Search Area and Protocol*** — Fall migratory period (pre-harvest): Prior to the fall crop harvest, the search area is limited to the immediate area surrounding the turbine and will contain the gravel turbine pad and access road, and other permanent auxiliary infrastructure near the turbine base. Fall (post-harvest) and spring migratory periods: If crops are harvested prior to the completion of the Indiana bat fall migratory period (August 1 – September 30) an 80 meter (m) x 80 m search plot should be established, searched in its entirety, and assigned its own visibility/detectability index. Likewise, an 80 m x 80 m plot should be established during the spring migratory period at those croplands that are cleared.

5. ***Field Bias and Error Assessment*** — Searcher efficiency and scavenger removal trials should be performed the first 3 years of operation only in conjunction spring and fall mortality searches to determine level of scavenging, searcher efficiency, wounded individuals that may remove themselves from the search plot, bats that may fall outside the search plot, and fatalities that occur outside the study window.

6. ***Specimens*** — Non-listed non-myotid bats, once documented as a fatality and removed from the survey area, may be re-used in searcher efficiency and scavenger removal trials.

7. ***Federally Listed Indiana bats, similar Myotids, and Migratory Birds*** — Any dead Myotid bats or migratory birds located at any time within the MWTP boundaries should be reported within 48 hours to the Rock Island Field Office (phone: 309-757-5800). Any

such dead specimens found should be placed in plastic bags and refrigerated as soon as possible following discovery. If fatality estimates for protected species are nearing the maximum permitted take specified in this BO, this office should be contacted and re-initiation of consultation may be necessary.

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities (50 CFR 402.14(i)(3)). In doing so, the Federal agency or its grantee must report the progress of the action and its impact on the species to the Service as specified below.

In addition to the immediate verbal report of any mortality, the DOE, or its grantee, must supply the Service with written reports, due by December 31 of each year. These reports should specify the progress and results of any terms and conditions that were required, identify the site-specific project, include the number of live or dead Indiana bats encountered, and age, sex, and reproductive status of the bats handled, provide locations and numbers of all-bat mortalities found, provide the appropriate field bias and error assessment for that year, and provide an overall fatality estimate for Indiana bats and all bats. Additionally, the required data (date, species, etc.) for fatality records should be submitted electronically in an Excel spreadsheet. Reports should also attempt to identify a positive correlation between weather patterns and bat movement, or any other weather dependent variable that has the potential to alter the proposed curtailment regime.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take (i.e., accidental death or injury) that might otherwise result from the proposed action.

The Service anticipates that no more than six individual Indiana bats will be incidentally taken as a result of this proposed action over the life of the project in the form of accidental death or injury. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

7. Re-initiation Notice

This concludes formal consultation with the DOE on the effects of the wind development project at MWTP on the federally endangered Indiana bat. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion (i.e., a significant increase in military training activity levels or significantly more night training vs. daytime); or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the

amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

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Figure 1. Location of the Monarch Wind Turbine Project in Warren County, IL

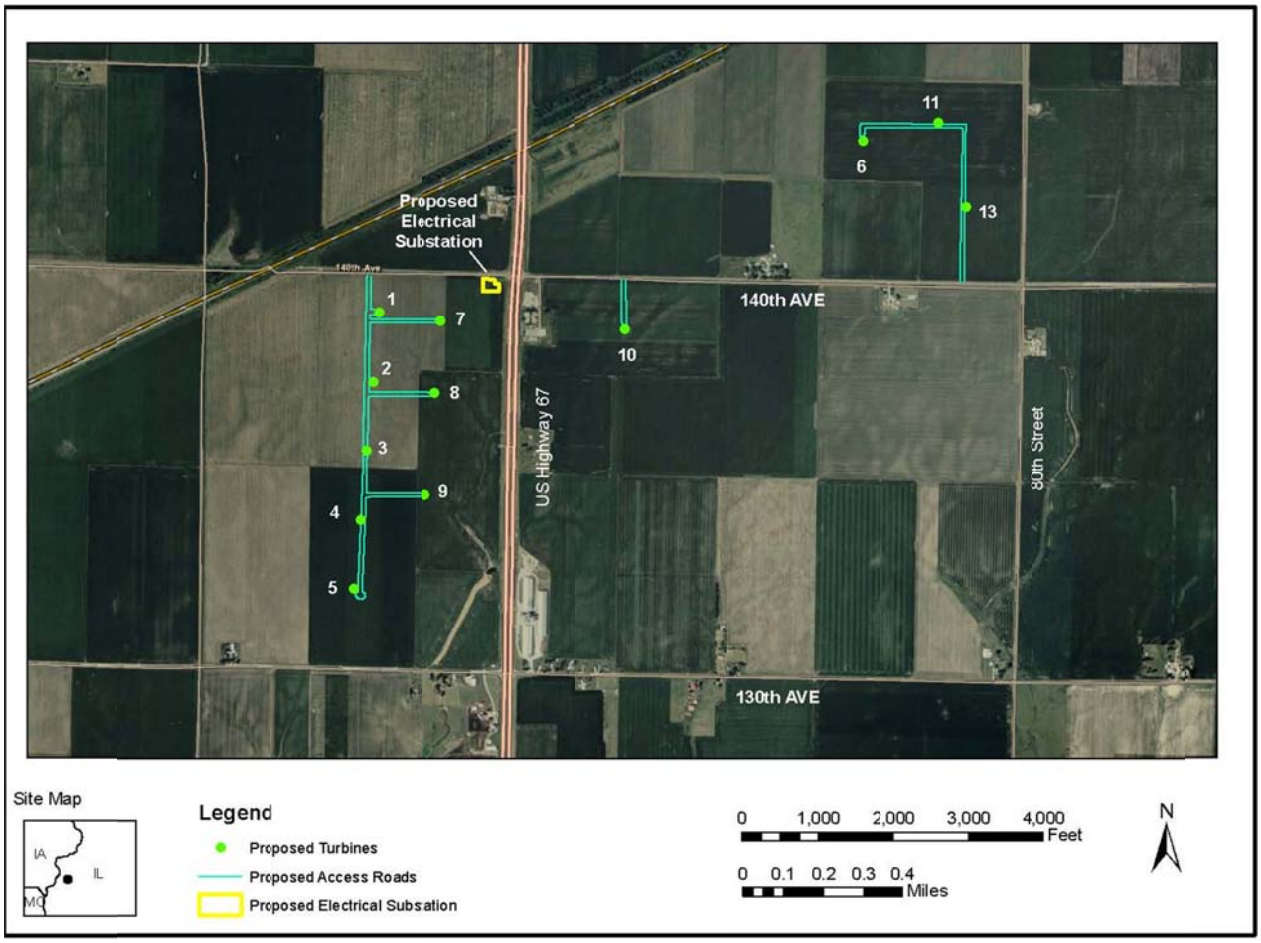

Figure 2. Monarch Wind Turbine Project site layout

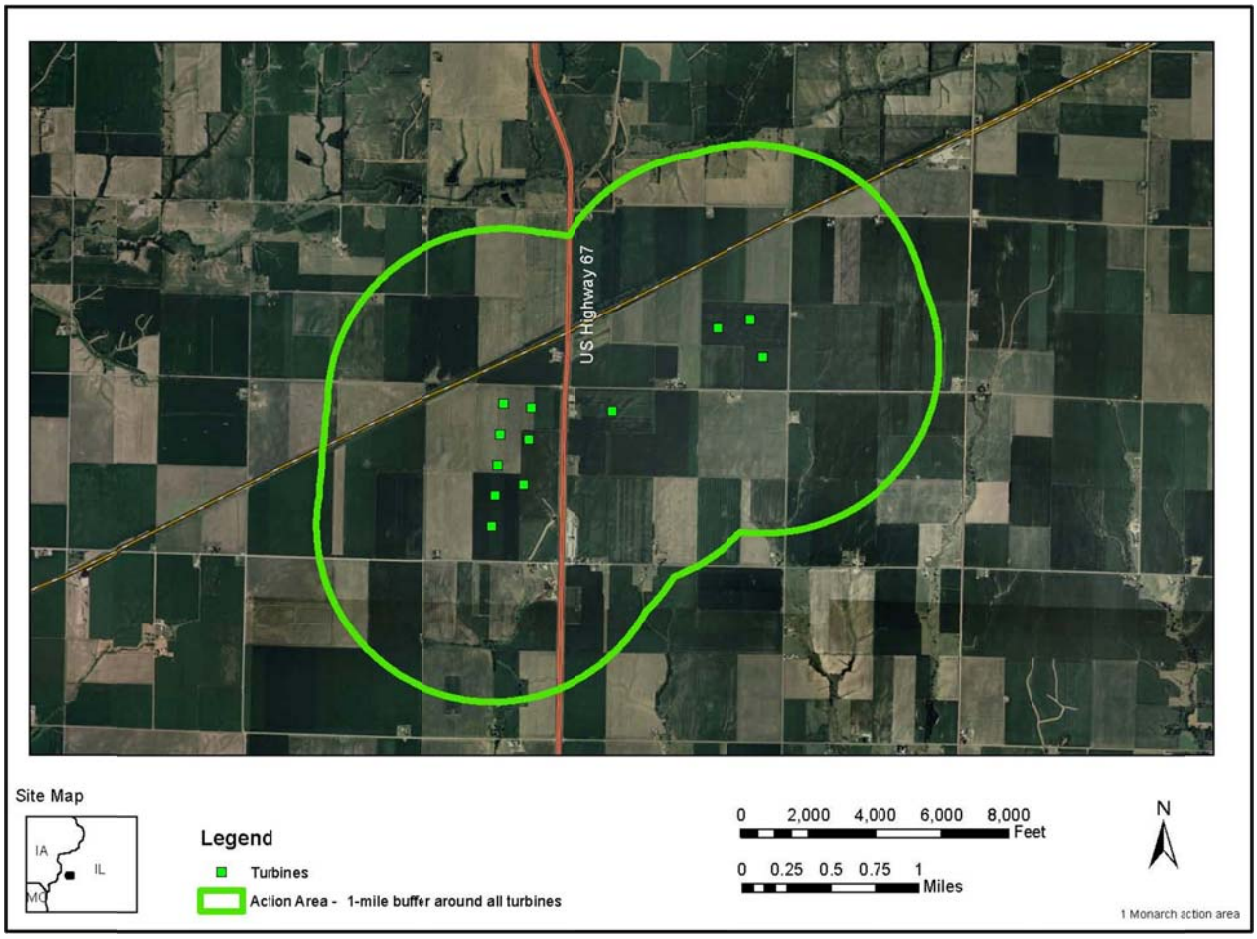

Figure 3. Action Area for the Monarch Wind Turbine Project