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<p><b>Pittsburgh Wildlife &amp; Environmental, Inc.</b>  Neil Bossart  853 Beagle Club Road  McDonald, PA 15057  (724) 796-5137  <a href="mailto:nbossart@windstream.net">nbossart@windstream.net</a></p>	<p><b>Redwing Ecological Services, Inc.</b>  Benjamin Deetsch  129 South Sixth Street  Louisville, KY 40202  (502) 625-3009  FAX (502) 625-3077  <a href="mailto:kfuchs@rewing.win.net">kfuchs@rewing.win.net</a></p>
<p><b>Lynn Robbins</b>  Southwest Missouri State University  Department of Biology  901 South National Avenue  Springfield, MO 65804-0095  (417) 836-5366  FAX (417) 836-4204  <a href="mailto:lwr704f@smsu.edu">lwr704f@smsu.edu</a></p>	<p><b>Stantec Consulting Services, Inc.</b>  Jeff Brown  11687 Lebanon Road  Cincinnati, OH 45241  (513) 842-8205 / FAX (513) 842-8250  <a href="mailto:jeff.brown@stantec.com">jeff.brown@stantec.com</a></p> <p>Bob Madej  1500 Lakeshore Drive, Suite 100  Columbus, OH 43204  (614) 486-4383 / FAX (614) 486-4387  <a href="mailto:robert.madej@stantec.com">robert.madej@stantec.com</a></p> <p>James Kiser  1901 Nelson Miller Parkway  Louisville, KY 40223  (502) 212-5000 / FAX (502) 212-5055  <a href="mailto:james.kiser@stantec.com">james.kiser@stantec.com</a></p>
<p><b>Merrill Tawse</b>  791 Woodland Road  Mansfield, OH 44906  (419) 756-1203 / cell (419) 989-2335  <a href="mailto:mtawsebats@yahoo.com">mtawsebats@yahoo.com</a></p>	
<p><b>Third Rock Consultants, LLC</b>  Rain Storm  2514 Regency Rd., Suite 104  Lexington, KY 40503  (859) 977-2000 / FAX (859) 977-2001  <a href="mailto:mforee@thirdrockconsultants.com">mforee@thirdrockconsultants.com</a></p>	<p><b>John Timpone</b>  427 Terrington Drive  Ballwin, MO 63021  (417) 894-5554  <a href="mailto:wanderingwolverine13@yahoo.com">wanderingwolverine13@yahoo.com</a></p>
<p><b>Tragus Environmental Consulting</b>  Mike Johnson  Endangered Species Consultants  37 North Highland Avenue  Akron, OH 44303  (330) 472-7013  <a href="mailto:mike@tragusinc.com">mike@tragusinc.com</a></p>	<p><b>Brianne Lorraine Walters</b>  Dept. of Ecology and Organismal Biology  Indiana State University  Terre Haute, IN 47809  (812) 237-8294 / FAX (812) 237-2526  <a href="mailto:bwalters2@isugw.indstate.edu">bwalters2@isugw.indstate.edu</a></p>

<b>Western Ecosystems Technology, Inc.</b> Stephen Brandebura 2003 Central Avenue Cheyenne, WY 82001 (307) 634-1756 / FAX (307) 637-6981 <a href="mailto:sbrandebura@west-inc.com">sbrandebura@west-inc.com</a>	<b>John O. Whitaker, Jr.</b> Department of Life Sciences Indiana State University Terre Haute, IN 47809 (812) 237-2383 / FAX (812) 237-2526 <a href="mailto:jwhitaker3@isugw.indstate.edu">jwhitaker3@isugw.indstate.edu</a>
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\*This list reflects permit data available as of December 13, 2010, and is subject to periodic revision to reflect permit changes



# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

## Ohio Division of Wildlife

Vicki J. Mountz, Acting Chief  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
Phone: (614) 265-6300

February 16, 2011

To all interested parties,

Based upon the updated project boundary map received on 8 February 2011, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these revised survey recommendations for Nordex's proposed project located in Seneca County.

Currently the project falls within regions that DOW has identified as needing extensive monitoring efforts. If the developer decides to amend the boundaries or based upon DOW site visit, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or [brian.mitch@dnr.state.oh.us](mailto:brian.mitch@dnr.state.oh.us)

Project	
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.
Raptor nest monitoring	There is 1 eagle nest located on or within the 2 miles of the proposed project; as well 2 additional nests are just past the 2 mile buffer. The pair within the 2 mile radius should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.



# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	11
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	22
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	1

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist  
Olentangy Wildlife Research Station  
Ohio Division of Wildlife  
8589 Horseshoe Road  
Ashley, OH 43003  
Office phone: 740-747-2525 x 26  
Cell: 419-602-3141  
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service  
Mr. Brian Mitch, Ohio Department of Natural Resources





DAVID MUSTINE, DIRECTOR

0 1 2 4 Miles









# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

## Ohio Division of Wildlife

Vicki J. Mountz, Acting Chief  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
Phone: (614) 265-6300

January 25, 2011

To all interested parties,

Based upon the project boundary map received on 24 January 2011, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for Nordex's proposed project located in Seneca County.

Currently the project falls within regions that DOW has identified as needing moderate (where applicable) monitoring efforts. If the developer decides to amend the boundaries, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or [brian.mitch@dnr.state.oh.us](mailto:brian.mitch@dnr.state.oh.us)

### Project

Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.
Raptor nest monitoring	There is 1 eagle nest located on or within the 2 miles of the proposed project. This pair should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.





# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTONE, DIRECTOR

Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	11
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	15
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	NS

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist  
Olentangy Wildlife Research Station  
Ohio Division of Wildlife  
8589 Horseshoe Road  
Ashley, OH 43003  
Office phone: 740-747-2525 x 26  
Cell: 419-602-3141  
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service  
Mr. Brian Mitch, Ohio Department of Natural Resources

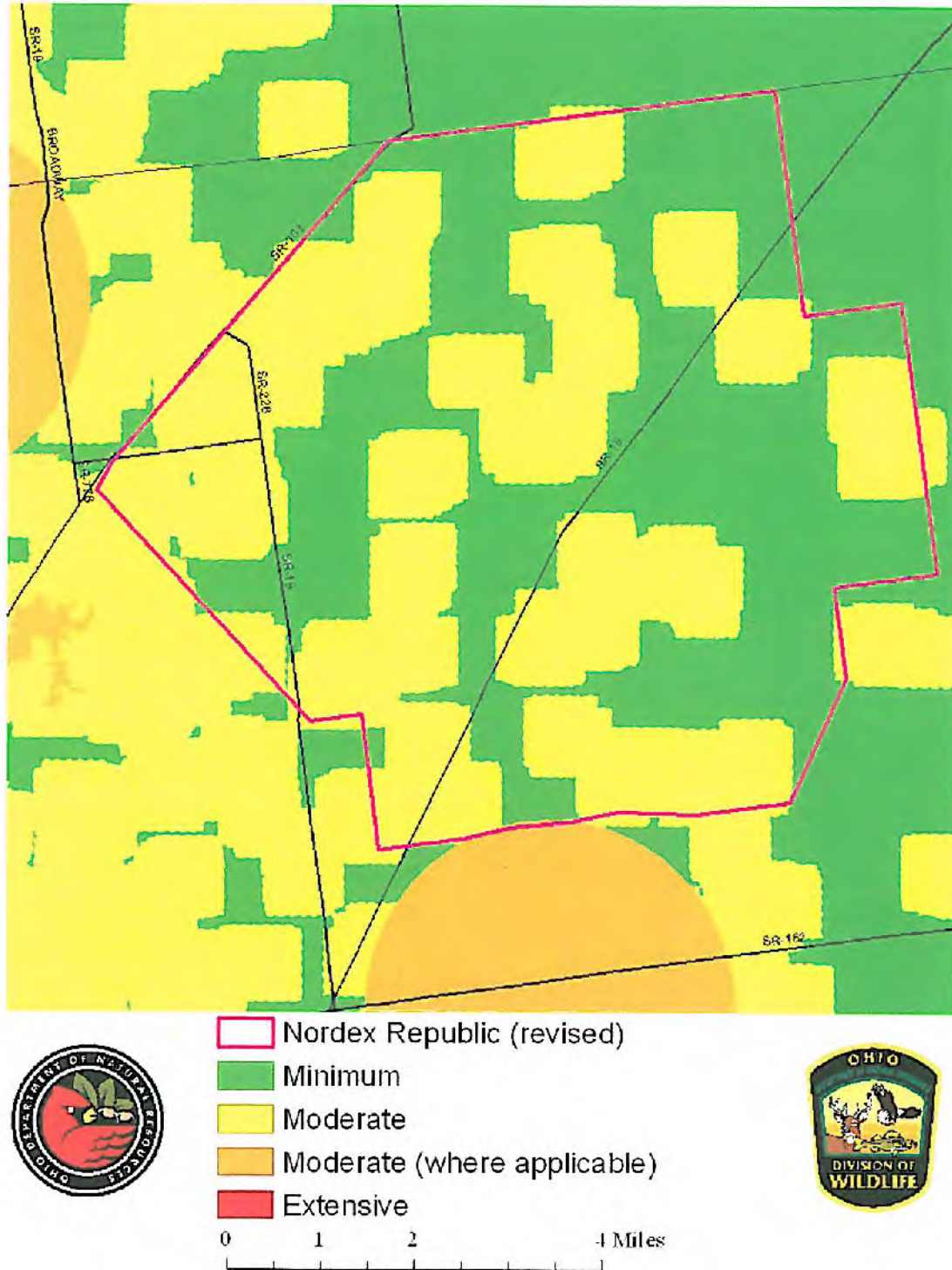


# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Figure 1. Survey effort map with revised boundary for Nordex's proposed Republic project.





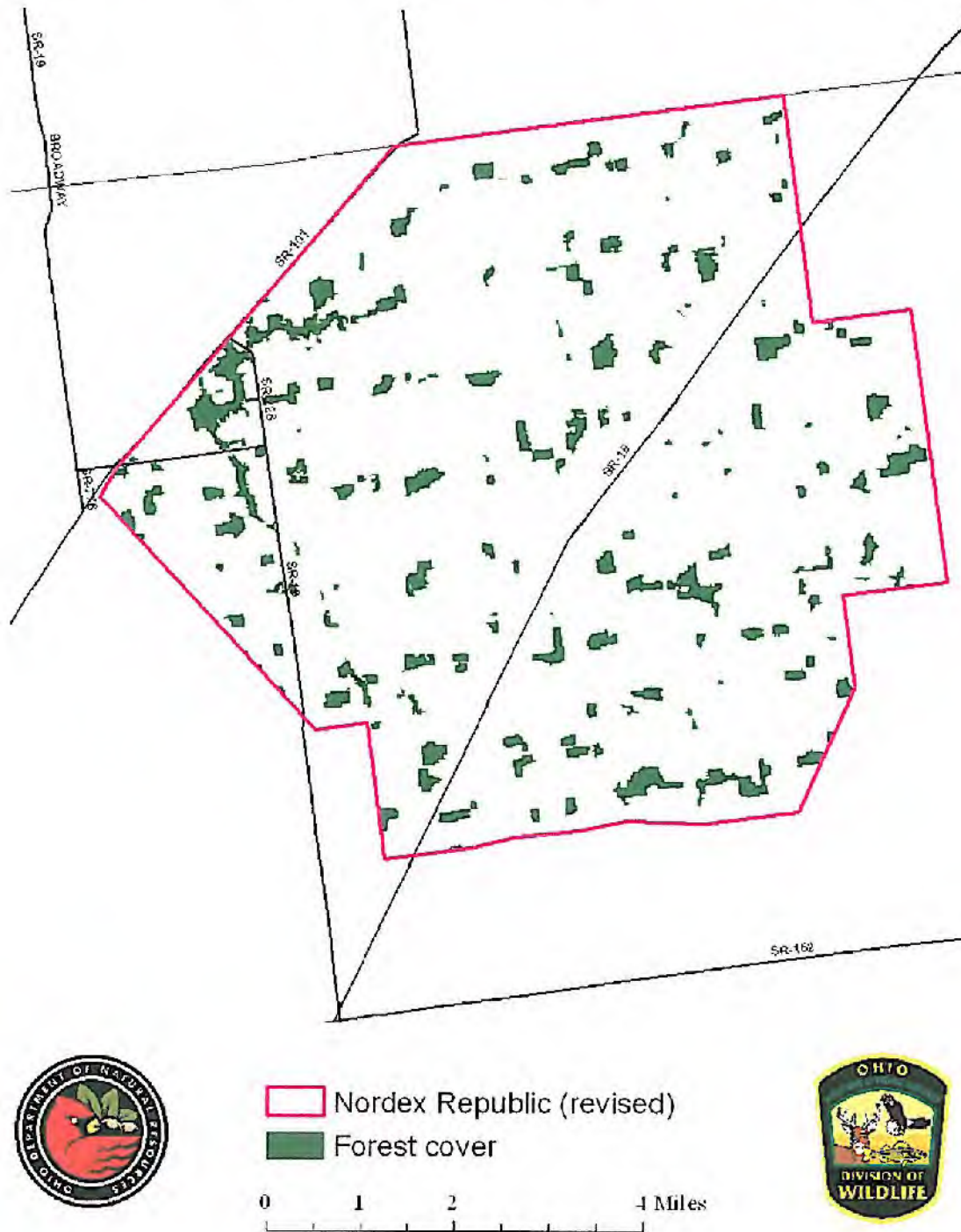


# Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Figure 2. Forest cover map with revised boundary for Nordex's proposed Republic project.





# Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR

SEAN D. LOGAN, DIRECTOR

Division of Wildlife  
*David M. Graham, Chief*  
2045 Morse Rd., Bldg. G  
Columbus, OH 43229-6693  
*Phone: (614) 265-6300*

April 2, 2010

To all interested parties,

Based upon the revised project boundary map received on 2 April 2010, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for the proposed Nordex wind energy project located in Seneca County. After reviewing the project area map provided and site visits conducted within that region, the DOW has determined that this proposed facility would be classified as a "moderate" site under the current monitoring protocols (Fig. 1).

The table below was created based upon the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

Project	
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.



Raptor nest monitoring	There are 2 eagle nests located on or within 2 miles of the proposed project. These pairs should be monitored to assess their daily movement patterns. Should additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.
Bat acoustic monitoring	Acoustic monitoring should be conducted at all meteorological towers.
Passerine migration (# of survey points)	16
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	1
Barn owl surveys	NS
Bat mist-netting (# of survey points)	32
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS

Radar monitoring locations	NS
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NS = Not required based on the lack of suitable habitat.

The DNR looks forward to working with you on this or any other proposed project in the future. If you have any questions, please feel free to contact me.

Keith

Old Woman Creek Nat'l Estuarine Research Reserve and State Nature Preserve  
Ohio Division of Wildlife  
2514 Cleveland Road East  
Huron, OH 44839  
Office phone: 419-433-4601  
Cell: 419-602-3141  
Fax: 419-433-2851

cc: Mr. Stuart Siegfried, Ohio Power Siting Board  
Ms. Megan Seymour, United States Fish and Wildlife Service

Figure 1.

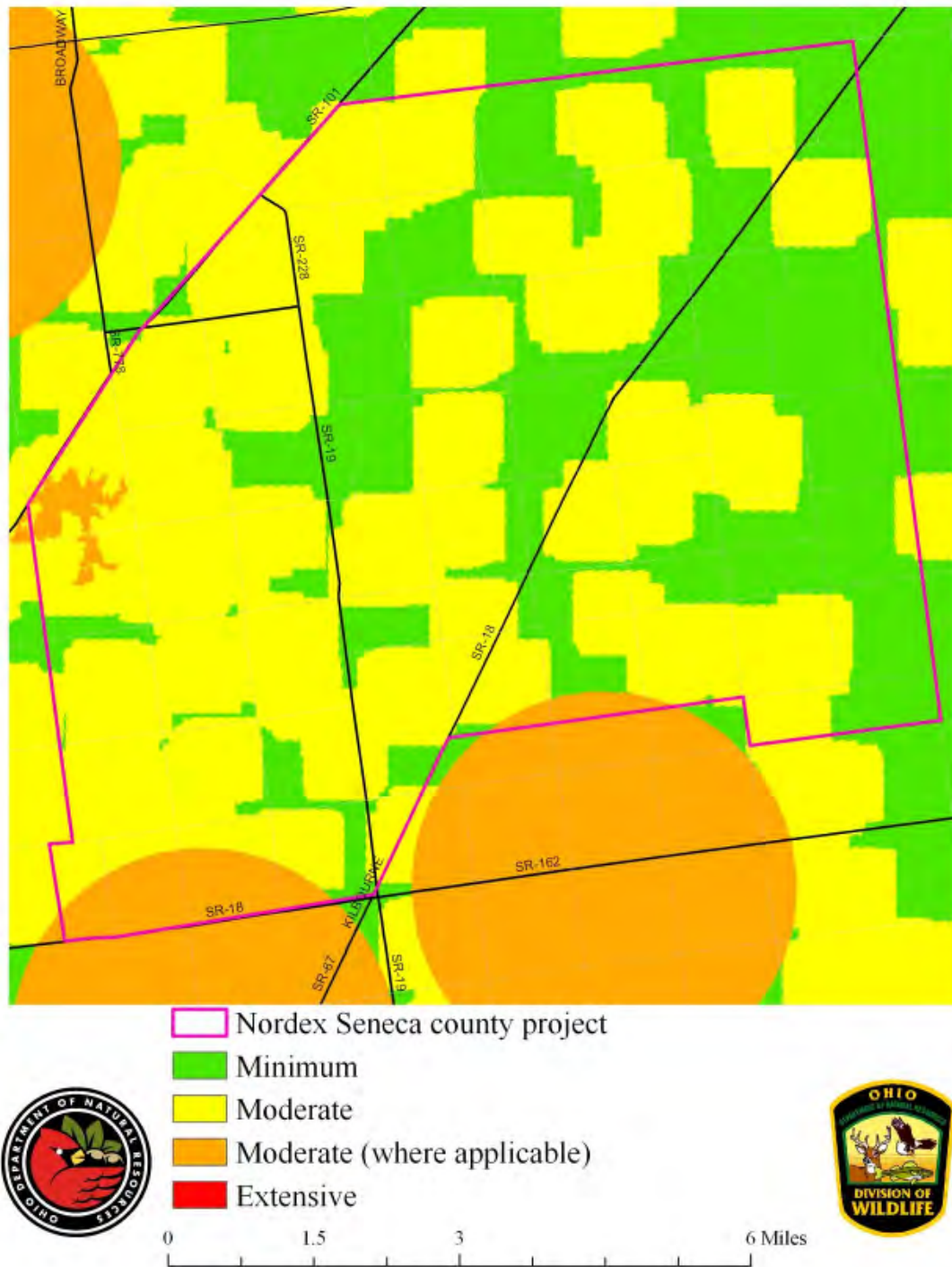
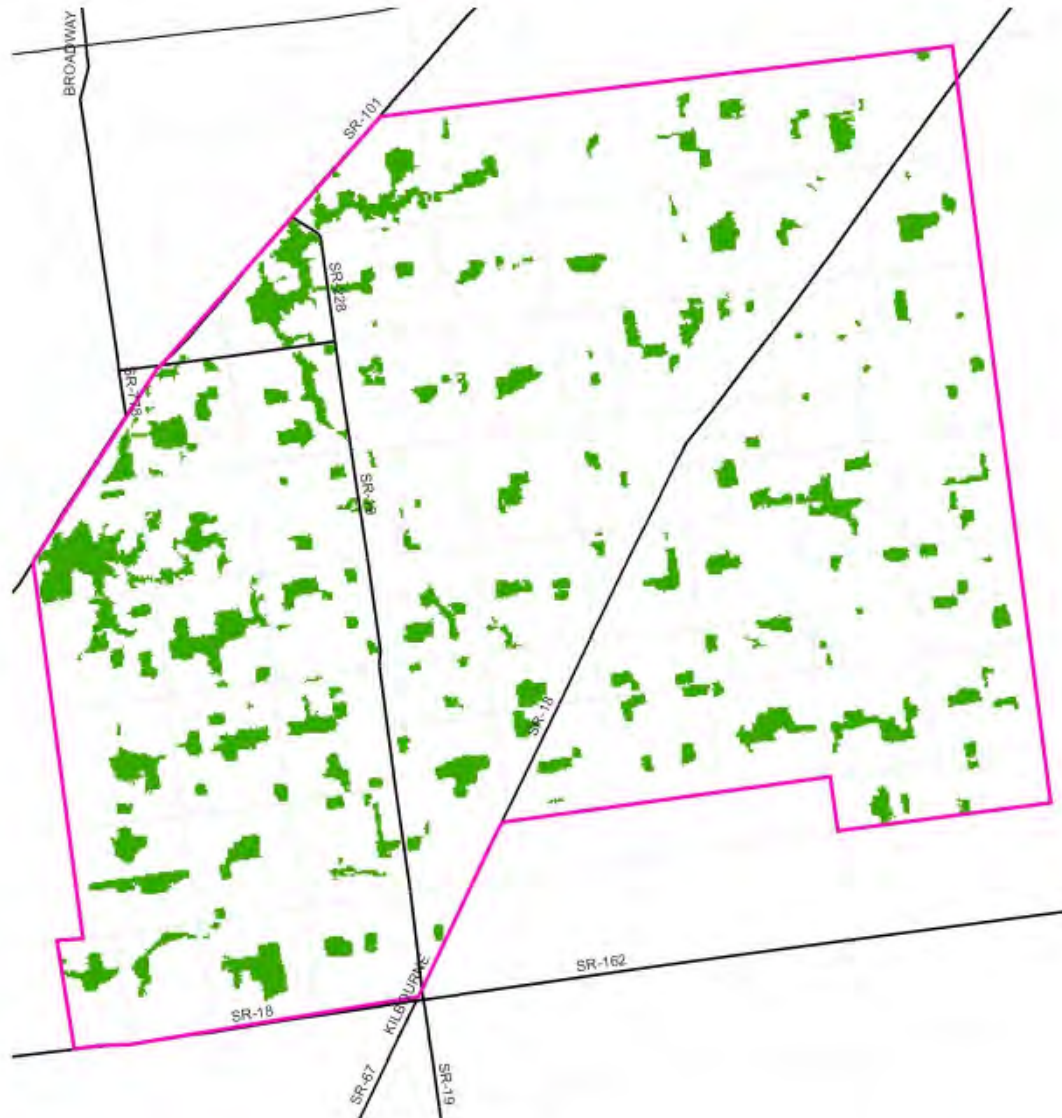




Figure 2.



 Nordex Seneca county project  
 Forest cover

0 1.5 3 6 Miles





**APPENDIX B**  
Site Photographs



Photo 1. Point 1, facing east.

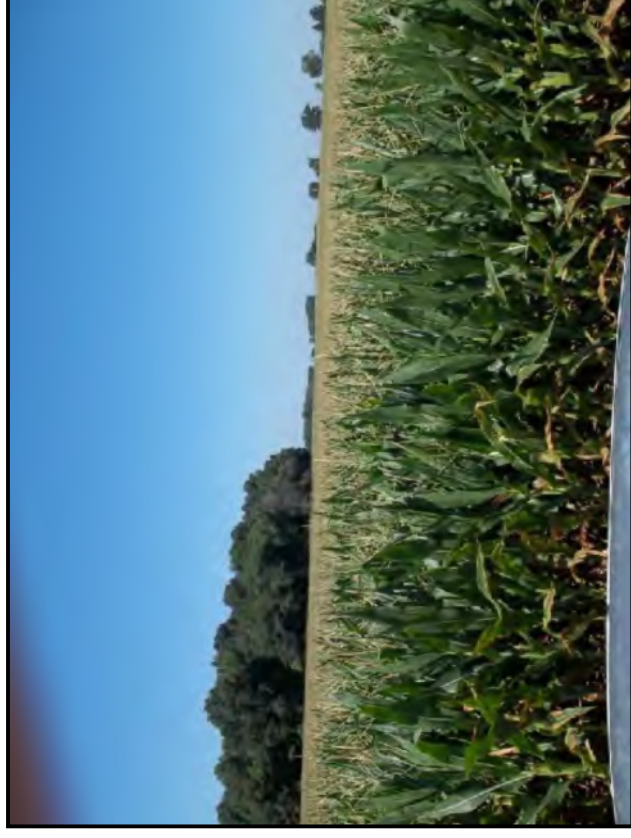


Photo 2. Point 1, facing west.

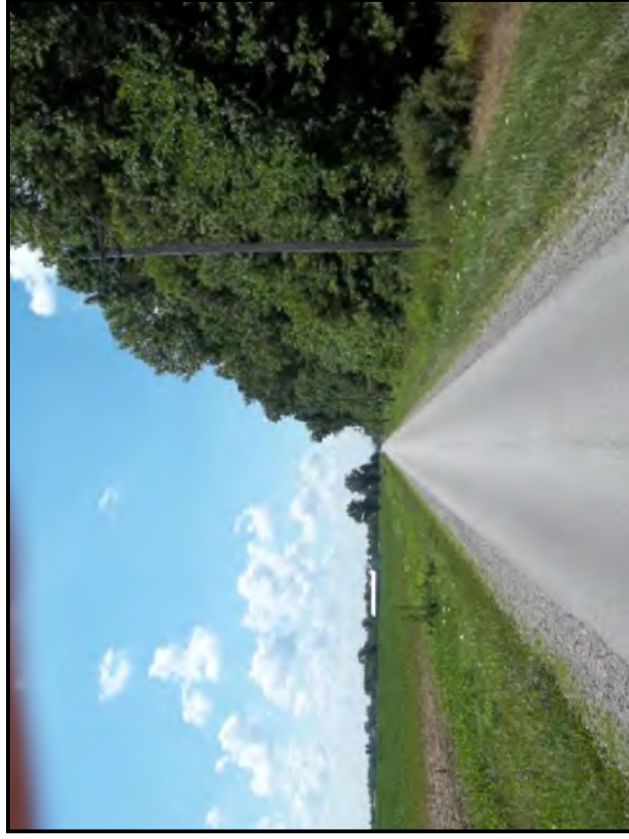


Photo 3. Point 2, facing south.



Photo 4. Point 2, facing west.



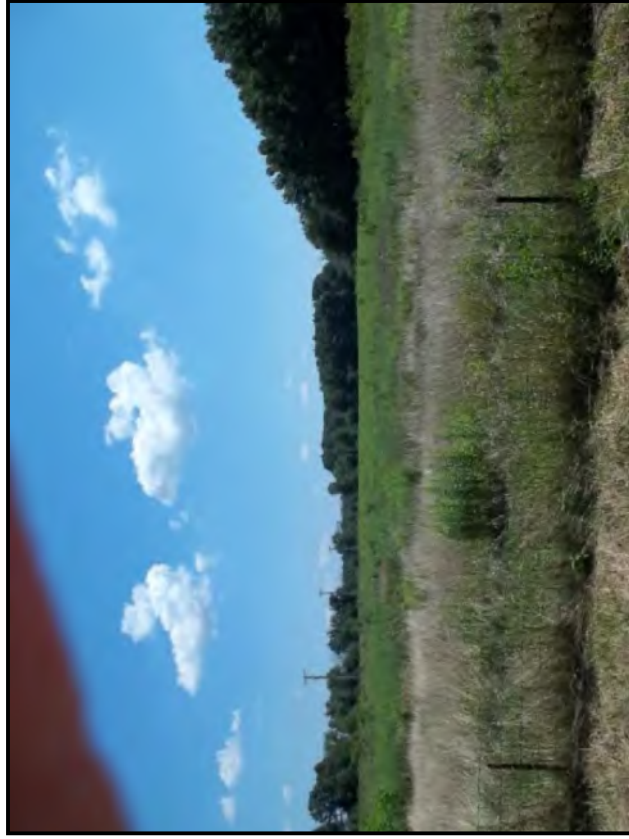


Photo 5. Point 3, facing east.



Photo 6. Point 3, facing west.



Photo 7. Point 4, facing north.



Photo 8. Point 4, facing south.





Photo 9. Point 5, facing north.

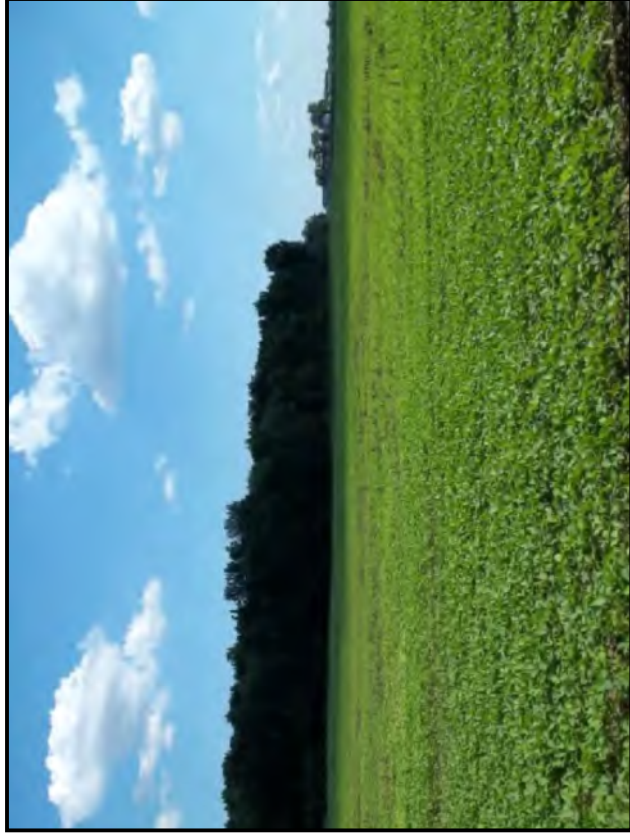


Photo 10. Point 5, facing south.



Photo 11. Point 6, facing east.



Photo 12. Point 6, facing west.





Photo 13. Point 7, facing south.



Photo 14. Point 7, facing west.



Photo 15. Point 8, facing north.



Photo 16. Point 8, facing south.



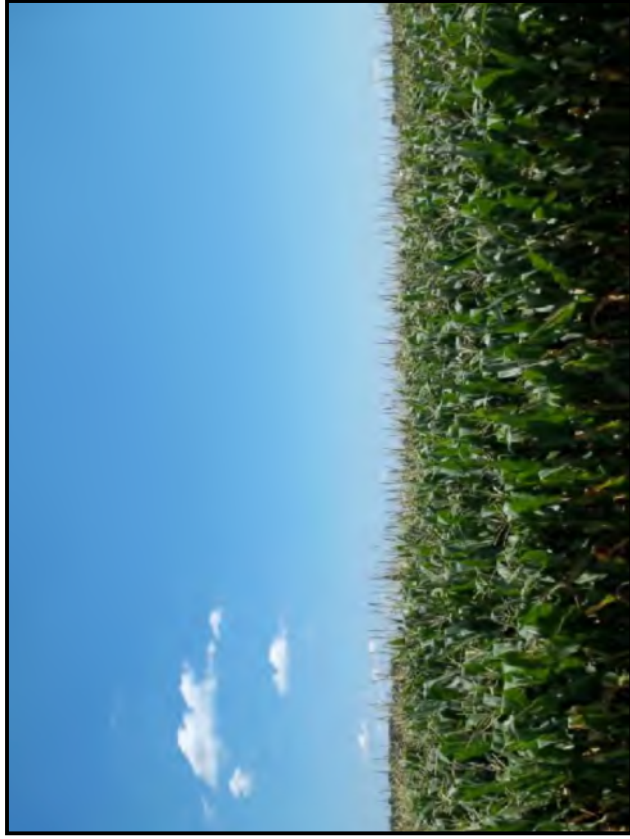


Photo 17. Point 9, facing east.

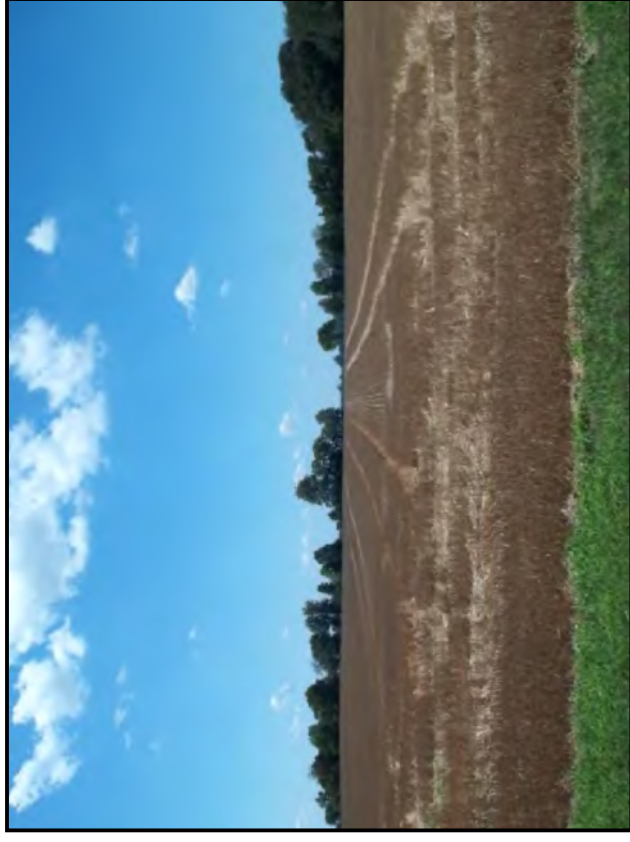


Photo 18. Point 9, facing west.



Photo 19. Point 10, facing north.



Photo 20. Point 10, facing south.



Photo 21. Point 11, facing east.



Photo 22. Point 11, facing west.

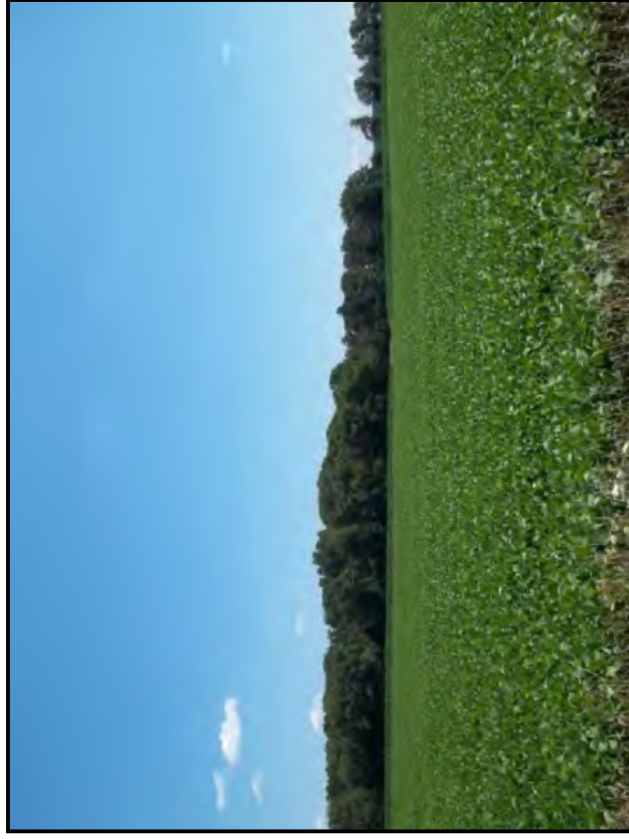


Photo 23. Point 12, facing east.



Photo 24. Point 12, facing west.



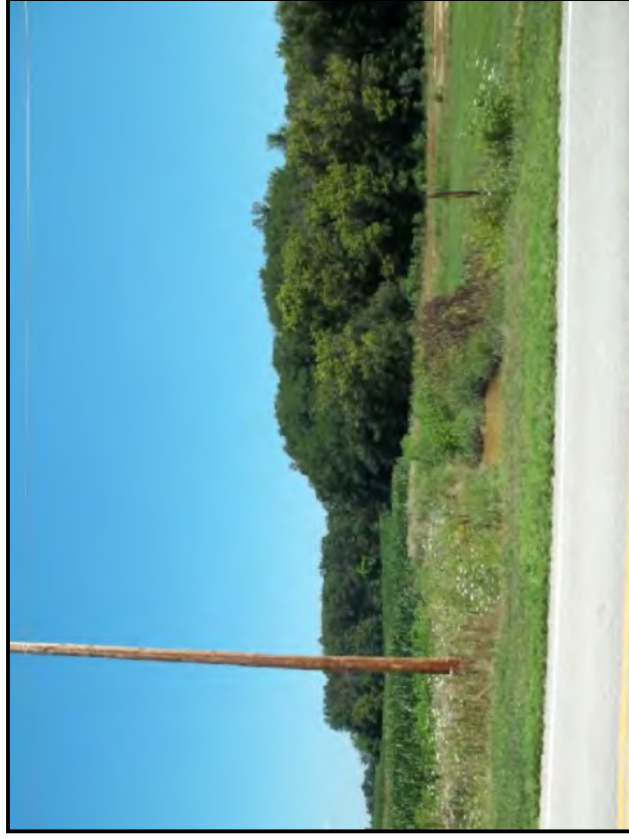


Photo 25. Point 15, facing east.



Photo 26. Point 15, facing west.



Photo 27. Point 16, facing north.



Photo 28. Point 16, facing south.





Photo 29. Point 17, facing east.



Photo 30. Point 17, facing west.



Photo 31. Point 18, facing north.



Photo 32. Point 18, facing south.





Photo 33. Point 19, facing east.



Photo 34. Point 19, facing west.



Photo 35. Point 20, facing east.



Photo 36. Point 20, facing west.





Photo 37. Point 21, facing north.



Photo 38. Point 21, facing south.



Photo 39. Point 22, facing east.



Photo 40. Point 22, facing west.



Photo 41. Point 23, facing east.



Photo 42. Point 23, facing west.



Photo 43. Point 24, facing south.



Photo 44. Point 24, facing west.





Photo 1. Point 1, facing north.



Photo 2. Point 1, facing south.

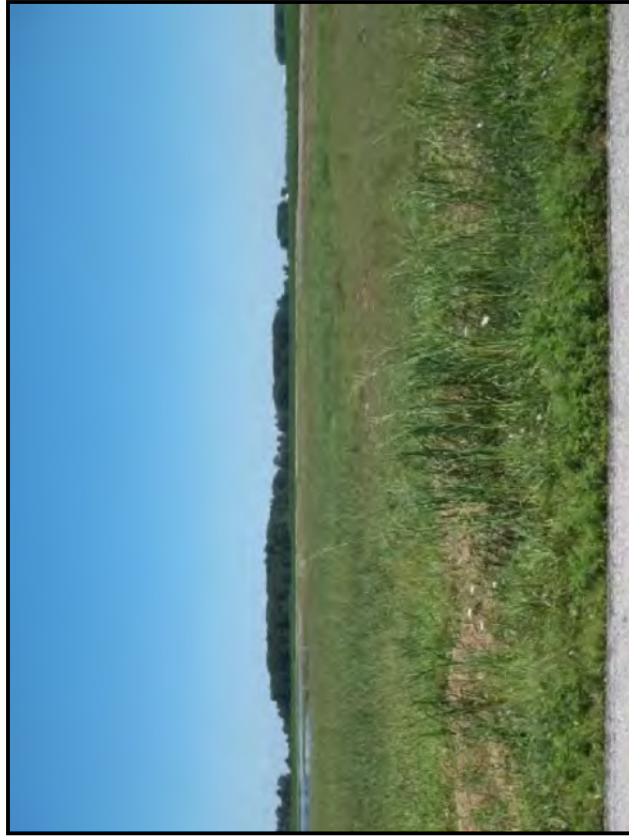


Photo 3. Point 2, facing north.



Photo 4. Point 2, facing south.



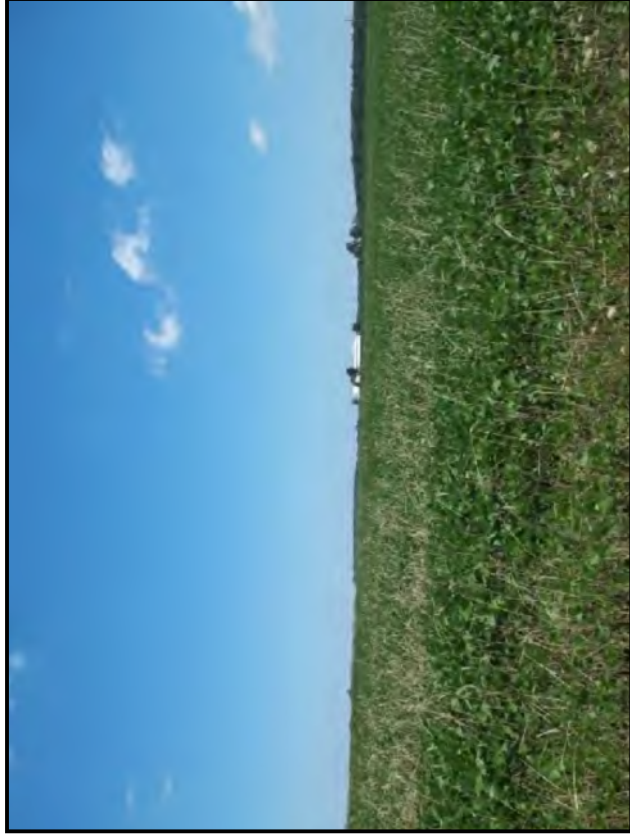


Photo 5. Point 3, facing north.

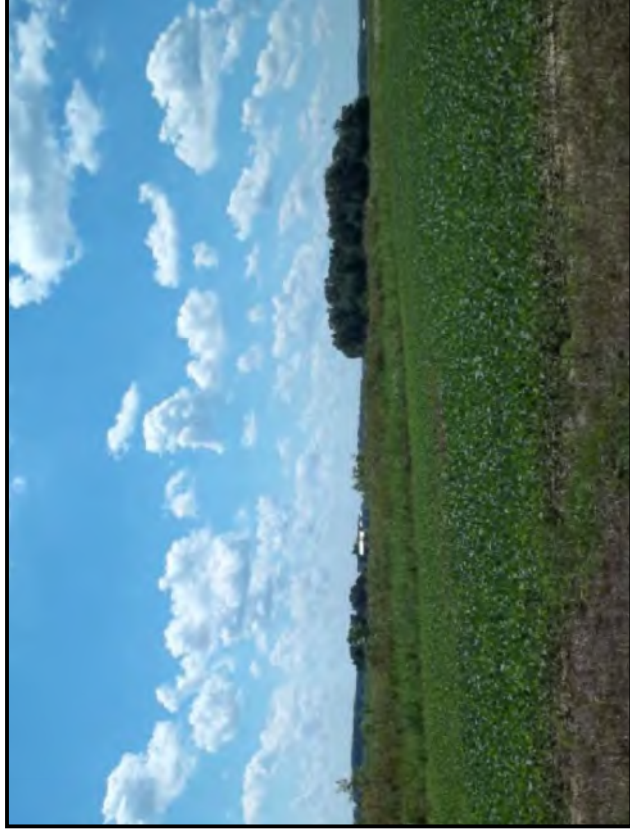


Photo 6. Point 3, facing south.



Photo 7. Point 4, facing north.



Photo 8. Point 4, facing south.



Photo 9. Point 5, facing north.



Photo 10. Point 5, facing south.



Photo 11. Point 6, facing east.



Photo 12. Point 6, facing west.





Photo 13. Point 7, facing north.

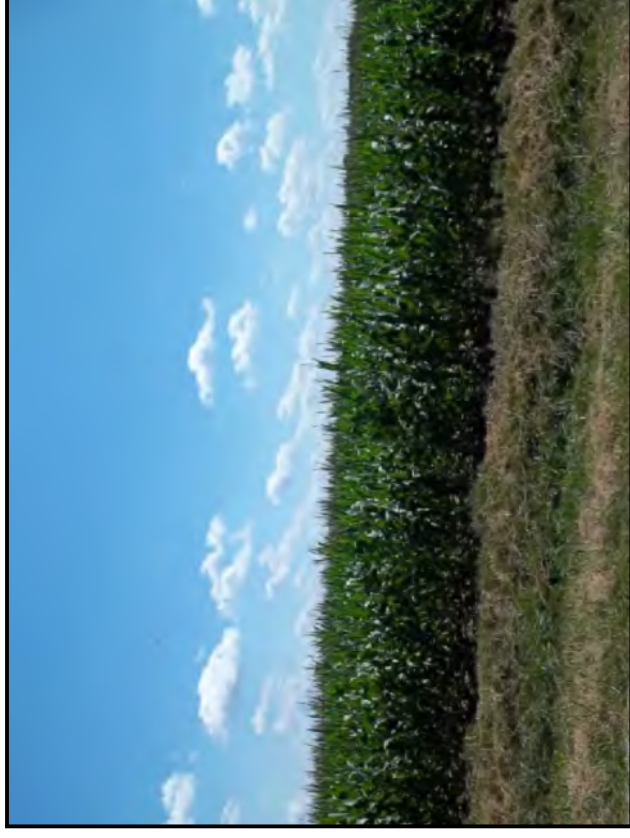


Photo 14. Point 7, facing south.

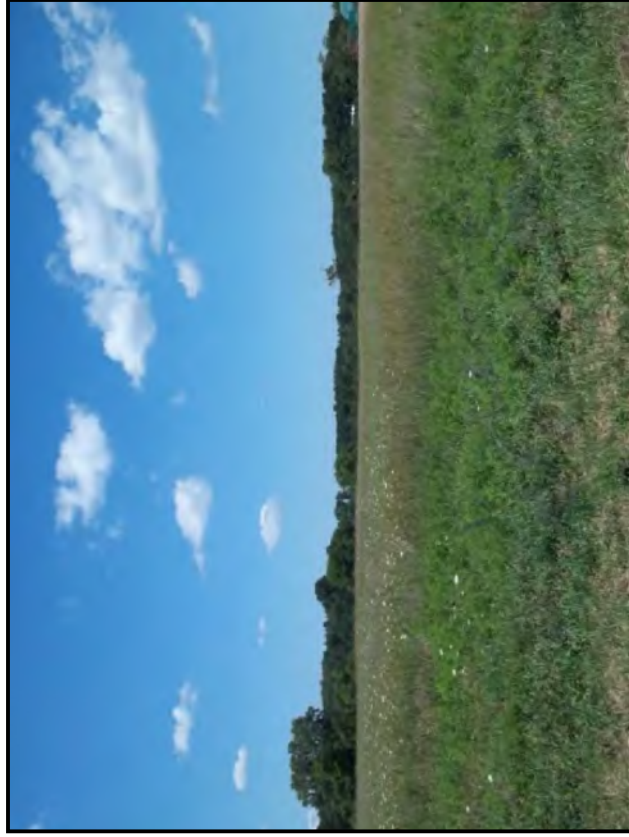


Photo 15. Point 8, facing north.



Photo 16. Point 8, facing south.



## **APPENDIX C**

Birds Observed at Republic Wind, LLC Project Area, Seneca and Sandusky Counties, Ohio,  
During Breeding Bird Surveys in May, June, and July 2011

Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
31-May-2011	1	MODO	Mourning Dove	100	North	2		537	546	9	2	35%
		HOLA	Horned Lark	60	Northeast	1						
		HOLA	Horned Lark	30	Northwest	1						
		AMRO	American Robin	50	South	1						
		AMGO	American Goldfinch	20	Southwest	4						
		MODO	Mourning Dove	50	South	1						
		INBU	Indigo Bunting	30	Northwest	1						
		COGR	Common Grackle	50	Northeast	5						
		RWBL	Red-winged Blackbird	90	Northwest	2						
31-May-2011	2	BHCO	Brown-headed Cowbird	5	West	2		555	604	9	0	30%
		FISP	Field Sparrow	60	Northeast	1						
		HOLA	Horned Lark	40	Southwest	1						
		RWBL	Red-winged Blackbird	20	Northeast	4						
		RBWO	Red-bellied Woodpecker	100	East	1						
		SOSP	Song Sparrow	10	North	1						
		INBU	Indigo Bunting	25	Northwest	1						
31-May-2011	3	COGR	Common Grackle	60	Northwest	1		616	625	10	2	25%
		GRCA	Gray Catbird	50	Northwest	1						
		NOCA	Northern Cardinal	50	West	1						
		NOFL	Northern Flicker	50	Southeast	1						
		ETTI	Tufted Titmouse	50	East	1						
		NOCA	Northern Cardinal	100	Northwest	1						
		COGR	Common Grackle	20	North	4						
		RWBL	Red-winged Blackbird	40	South	2						
		AMRO	American Robin	20	Southwest	1						
31-May-2011	4	AMRO	American Robin	50	North	1		636	645	10	0	25%
		AMCR	American Crow	100	Southwest	1						
		REVI	Red-eyed Vireo	50	Northeast	1						
		HOLA	Horned Lark	40	Southwest	1						
		RWBL	Red-winged Blackbird	40	Northeast	1						
		SOSP	Song Sparrow	30	West	1						
		EUST	European Starling	60	South	7						
		BRNS	Barn Swallow	15	West	2						
		COGR	Common Grackle	40	East	3						
31-May-2011	5	RWBL	Red-winged Blackbird	30	Southwest	2		656	705	11	0	20%
		COHA	Cooper's Hawk	30	South	1						
		COGR	Common Grackle	10	Southwest	1						
		GRCA	Gray Catbird	10	North	1						
		COGR	Common Grackle	30	North	2						
		BHCO	Brown-headed Cowbird	50	North	1						
		AMRO	American Robin	15	South	1						
		HOWR	House Wren	80	South/Southwest	1						
		HOFI	House Finch	20	North/Northwest	2						
31-May-2011	6	KILL	Killdeer	50	East	1		717	726	11	2	20%
		AMRO	American Robin	80	North	1						
		COGR	Common Grackle	90	East	4						
		SOSP	Song Sparrow	30	West	1						
		WOTH	Wood Thrush	90	North	1						
		SAVS	Savannah Sparrow	40	West	1						
		SAVS	Savannah Sparrow	30	North	1						
		HOWR	House Wren	20	West	1						
31-May-2011	7	RBGR	Rose-breasted Grosbeak	20	North	1		739	748	12	0	20%
		BLJA	Blue Jay	60	West	2						
		AMRO	American Robin	30	North	1						
		INBU	Indigo Bunting	20	South	1						
		WOTH	Wood Thrush	30	Northeast	1						
		EWPE	Eastern Wood Peewee	70	North	1						
		SOSP	Song Sparrow	10	South	1						
31-May-2011	8	HOSP	House Sparrow	50	North	5		757	806	12	2	20%
		WOTH	Wood Thrush	80	Northwest	1						
		RWBL	Red-winged Blackbird	50	West	1						
		VESP	Vesper Sparrow	30	West	1						
		RBWO	Red-bellied Woodpecker	20	North	1						
		RHWO	Red-headed Woodpecker	35	West	1						
		EUST	European Starling	25	West	6						
		FISP	Field Sparrow	60	Northwest	1						
		SAVS	Savannah Sparrow	50	Northwest	1						
31-May-2011	9	MODO	Mourning Dove	40	North	2		818	827	12	0	10%
		MODO	Mourning Dove	50	South	1						
		BHCO	Brown-headed Cowbird	50	North	1						
		EUST	European Starling	70	South	12						
		SAVS	Savannah Sparrow	20	South	1						
		HOLA	Horned Lark	30	East	2						
		HOSP	House Sparrow	60	North	4						
		RWBL	Red-winged Blackbird	50	Southwest	3						
		NOCA	Northern Cardinal	10	West	1						
31-May-2011	10	HOLA	Horned Lark	30	Northwest	1		837	846	12	7	10%
		BRNS	Barn Swallow	30	Northwest	2						
		CHSP	Chipping Sparrow	50	North	1						
		SOSP	Song Sparrow	50	Northwest	1						
		CHSW	Chimney Swift	20	North	2						
		AMCR	American Crow	100	Southwest	3						
		HOSP	House Sparrow	20	East	3						
		BCCH	Black-capped Chickadee	20	West	1						
		MODO	Mourning Dove	30	North	2						
31-May-2011	11	WOTH	Wood Thrush	110	West	1		858	907	14	2	10%
		RWBL	Red-winged Blackbird	80	Northwest	3						
		BOBO	Bobolink	70	South	1						
		SAVS	Savannah Sparrow	20	East	1						
		COGR	Common Grackle	70	Northwest	1						
		HOLA	Horned Lark	20	West	1						
		EAME	Eastern Meadowlark	20	East	1						
		EAME	Eastern Meadowlark	40	Southeast	1						
		EAME	Eastern Meadowlark	50	Southwest	1						
		GRSP	Grasshopper Sparrow	30	Northwest	1						
31-May-2011		RWBL	Red-winged Blackbird	50	South	1						
		RWBL	Red-winged Blackbird	30	East	4						

Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
31-May-2011	12	RBGR	Rose-breasted Grosbeak	30	Northwest	1		915	924	14	0	10%
		FISP	Field Sparrow	60	Northeast	1						
		HOLA	Horned Lark	20	Northeast	1						
		EABL	Eastern Bluebird	50	Northwest	1						
		BLJA	Blue Jay	60	East	1						
		AMCR	American Crow	40	Northeast	22						
2-Jun-2011	13	RBWO	Red-bellied Woodpecker	60	North	1		545	554	12	7	60%
		AMCR	American Crow	100	Southwest	2						
		KILL	Killdeer	30	Northeast	1						
		RWBL	Red-winged Blackbird	15	West	1						
		COGR	Common Grackle	30	East	2						
		SOSP	Song Sparrow	25	Northwest	1						
2-Jun-2011	14	COGR	Common Grackle	50	North	1		603	612	12	2	60%
		AMRO	American Robin	40	South	1						
		FISP	Field Sparrow	30	South	1						
		BHCO	Brown-headed Cowbird	20	South	2						
		SOSP	Song Sparrow	50	Southeast	1						
		AMCR	American Crow	100	Northwest	3						
2-Jun-2011	15	CHSP	Chipping Sparrow	20	Northwest	2		621	630	13	0	50%
		BAOR	Baltimore Oriole	60	Southwest	1						
		AMRO	American Robin	30	South	1						
		GRCA	Gray Catbird	15	Northwest	1						
		INBU	Indigo Bunting	40	West	1						
		REVI	Red-eyed Vireo	40	West	1						
2-Jun-2011	16	RBWO	Red-bellied Woodpecker	40	East	1		642	651	13	2	50%
		AMCR	American Crow	90	Northwest	1						
		SOSP	Song Sparrow	50	Northwest	1						
		NOFL	Northern Flicker	40	West	1						
		WOTH	Wood Thrush	80	South	1						
		EABL	Eastern Bluebird	50	North	2						
2-Jun-2011	17	INBU	Indigo Bunting	25	South	1		701	720	14	0	40%
		SOSP	Song Sparrow	30	Southwest	1						
		CHSP	Chipping Sparrow	40	West	1						
		AMCR	American Crow	80	Northwest	3						
		RWBL	Red-winged Blackbird	20	South	4						
		SCTA	Scarlet Tanager	30	West	1						
2-Jun-2011	18	BCCH	Black-capped Chickadee	20	Southwest	1		729	738	14	0	30%
		ETTI	Tufted Titmouse	30	South	1						
		GCFL	Great Crested Flycatcher	50	West	1						
		BAOR	Baltimore Oriole	80	Northeast	1						
		AMCR	American Crow	90	South	3						
		AMGO	American Goldfinch	30	West	3						
2-Jun-2011	19	INBU	Indigo Bunting	30	West	1		747	756	14	2	30%
		AMRO	American Robin	40	Northeast	1						
		RWBL	Red-winged Blackbird	50	Northwest	6						
		KILL	Killdeer	20	Southeast	1						
		HOLA	Horned Lark	30	West	1						
		AMRO	American Robin	40	West	1						
2-Jun-2011	20	SAVS	Savannah Sparrow	20	North	1		803	812	15	0	25%
		SOSP	Song Sparrow	30	Northwest	1						
		MODO	Mourning Dove	70	East	1						
		HOSP	House Sparrow	50	South	3						
		HOLA	Horned Lark	20	South	7						
		AMCR	American Crow	50	West	1						
2-Jun-2011	21	CHSP	Chipping Sparrow	30	East	2		821	830	15	2	25%
		AMRO	American Robin	50	Southeast	1						
		COGR	Common Grackle	20	Southwest	1						
		AMRO	American Robin	15	South	1						
		AMCR	American Crow	20	West	1						
		BCCH	Black-capped Chickadee	20	North	1						
2-Jun-2011	22	SOSP	Song Sparrow	40	West	1		838	847	15	0	25%
		AMRO	American Robin	15	Northwest	1						
		COGR	Common Grackle	25	Southwest	1						
		HOFL	House Finch	50	West	5						
		CHSP	Chipping Sparrow	30	North	1						
		SOSP	Song Sparrow	20	Northeast	1						
2-Jun-2011	23	INBU	Indigo Bunting	50	West	1		858	907	16	0	20%
		BLJA	Blue Jay	80	North	1						
		RWBL	Red-winged Blackbird	50	Southwest	1						
		SAVS	Savannah Sparrow	30	South	1						
		HOWR	House Wren	30	Southeast	1						
		AMRO	American Robin	50	North/Northeast	1						
2-Jun-2011	24	AMGO	American Goldfinch	20	South	1		915	924	16	2	20%
		BLJA	Blue Jay	50	East	1						
		COGR	Cooper's Hawk	20	North	1						
		INBU	Indigo Bunting	20	East	1						
		AMRO	American Robin	60	Southwest	1						
		RWBL	Red-winged Blackbird	40	Southwest	1						
2-Jun-2011	24	RWBL	Red-winged Blackbird	70	North	5		915	924	16	2	20%
		COGR	Common Grackle	15	South	1						
2-Jun-2011	24	HOLA	Horned Lark	20	Northwest	1		915	924	16	2	20%
		BLJA	Blue Jay	30	Northwest	1						



Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
13-Jun-2011	1	HOLA	Horned Lark	30	Northeast	2		530	539	11	2	95
		HOWR	House Wren	100	North	1						
		HOLA	Horned Lark	50	Southeast	1						
		AMRO	American Robin	110	Northwest	1						
		MODO	Mourning Dove	100	North	1						
		SOSP	Song Sparrow	70	South	1						
		AMRO	American Robin	70	Southeast	1						
		AMGO	American Goldfinch	40	Southwest	3						
		AMRO	American Robin	30	South	1						
		MODO	Mourning Dove	50	South	1						
13-Jun-2011	2	SOSP	Song Sparrow	5	North	1		544	553	12	2	85%
		INBU	Indigo Bunting	20	Northwest	1						
		AMRO	American Robin	100	North	1						
		AMGO	American Goldfinch	20	South	1						
		FISP	Field Sparrow	70	Northwest	1						
		HOLA	Horned Lark	50	Northwest	1						
		COGR	Common Grackle	70	Northwest	1						
		RBWO	Red-bellied Woodpecker	120	East	1						
		HOLA	Horned Lark	40	Southwest	1						
		MODO	Mourning Dove	100	North	1						
13-Jun-2011	3	AMRO	American Robin	30	West	1		558	607	12	2	85%
		EATO	Eastern Towhee	40	Southeast	1						
		NOCA	Northern Cardinal	50	West	1						
		NOCA	Northern Cardinal	90	Northwest	1						
		ETTI	Tufted Titmouse	40	East	1						
		GRCA	Gray Catbird	60	Northwest	1						
		NOFL	Northern Flicker	50	East/Southeast	1						
		SOSP	Song Sparrow	50	Northeast	1						
		RTHA	Red-tailed Hawk	60	Northeast	1						
13-Jun-2011	4	EATO	Eastern Towhee	30	Northeast	2		611	620	12	2	40%
		HOLA	Horned Lark	40	Southwest	2						
		REVI	Red-eyed Vireo	60	Northeast	1						
		RWBL	Red-winged Blackbird	50	Northeast	1						
		AMCR	American Crow	110	Southwest	3						
		SOSP	Song Sparrow	30	West	1						
		HOLA	Horned Lark	30	South	2						
		BRNS	Barn Swallow	10	West	1						
		EUST	European Starling	70	South	4						
		COGR	Common Grackle	30	East	2						
13-Jun-2011	5	GRCA	Gray Catbird	5	North	1		624	633	12	40	
		COGR	Common Grackle	5	West	1						
		AMRO	American Robin	20	East	1						
		COGR	Common Grackle	50	Southwest	1						
		HOWR	House Wren	70	South	1						
		COGR	Common Grackle	15	North	1						
		AMRO	American Robin	10	South	2						
		COGR	Common Grackle	15	South	2						
		BHCO	Brown-headed Cowbird	10	West	2						
		HOFI	House Finch	10	North	3						
13-Jun-2011	6	SOSP	Song Sparrow	30	West	1		638	647	12	2	60%
		AMRO	American Robin	90	North	1						
		AMRO	American Robin	80	East	1						
		WOTH	Wood Thrush	100	Northwest	1						
		SAVS	Savannah Sparrow	40	West	1						
		KILL	Killdeer	60	East	1						
		COGR	Common Grackle	100	East	5						
		RWBL	Red-winged Blackbird	40	North	1						
13-Jun-2011	7	WOTH	Wood Thrush	25	Northeast	1		652	701	12	2	65%
		AMGO	American Goldfinch	20	East	1						
		INBU	Indigo Bunting	15	South	1						
		SOSP	Song Sparrow	10	South	2						
		BLJA	Blue Jay	70	West	2						
		BHVI	Blue-headed Vireo	50	West	1						
		AMRO	American Robin	40	North	1						
13-Jun-2011	8	RHWO	Red-headed Woodpecker	40	West	1		706	715	13	0	70%
		VESP	Vesper Sparrow	30	West	1						
		RWBL	Red-winged Blackbird	20	South	2						
		WOTH	Wood Thrush	90	Northwest	1						
		KILL	Killdeer	50	Northwest	1						
		EUST	European Starling	40	Northeast	1						
		HOSP	House Sparrow	70	North	7						
		FISP	Field Sparrow	60	Northwest	1						
		SAVS	Savannah Sparrow	40	Northwest	1						
		RWBL	Red-winged Blackbird	50	West	1						
		EUST	European Starling	30	West	2						
13-Jun-2011	9	SAVS	Savannah Sparrow	15	South	2		719	728	13	2	65%
		GBHE	Great Blue Heron	70	West	4						
		GRSP	Grasshopper Sparrow	20	Southeast	1						
		MODO	Mourning Dove	50	South	1						
		MODO	Mourning Dove	30	North	1						
		HOLA	Horned Lark	25	East	2						
		HOSP	House Sparrow	70	North	3						
		BHCO	Brown-headed Cowbird	40	North	1						
		SOSP	Song Sparrow	50	South	1						
		RWBL	Red-winged Blackbird	40	Southwest	2						
		EUST	European Starling	80	South	18						
13-Jun-2011	10	BRNS	Barn Swallow	10	North	2		734	743	13	0	50%
		EUST	European Starling	15	West	1						
		MODO	Mourning Dove	20	North	1						
		WBNU	White-breasted Nuthatch	30	West	1						
		AMCR	American Crow	150	South	2						
		HOSP	House Sparrow	10	East	3						
		CHSP	Chipping Sparrow	60	North	1						
		SOSP	Song Sparrow	50	Northwest	1						
13-Jun-2011	11	EAME	Eastern Meadowlark	30	Northeast	1		748	757	14	0	60%
		RWBL	Red-winged Blackbird	10	East	1						
		SAVS	Savannah Sparrow	15	East	1						
		HOLA	Horned Lark	15	West	1						
		RWBL	Red-winged Blackbird	70	Northwest	2						

Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
13-Jun-2011	11	COGR	Common Grackle	70	North	1		748	757	14	0	60%
		RWBL	Red-winged Blackbird	80	South	1						
		GRSP	Grasshopper Sparrow	25	Northwest	1						
		TUVU	Turkey Vulture	100	South	2						
		BOBO	Bobolink	70	South	2						
		RWBL	Red-winged Blackbird	50	Southwest	2						
13-Jun-2011	12	BLJA	Blue Jay	40	West	1		804	813	14	0	60%
		BLJA	Blue Jay	70	East	1						
		HOLA	Horned Lark	30	Northeast	1						
		FISP	Field Sparrow	50	Northeast	1						
		AMRO	American Robin	60	North	1						
		EABL	Eastern Bluebird	50	Northwest	1						
		SAVS	Savannah Sparrow	40	North	1						
		RBWO	Red-bellied Woodpecker	90	Northwest	1						
14-Jun-2011	13	KILL	Killdeer	20	West	1		534	543	9	11	100%
		RWBL	Red-winged Blackbird	10	West	1						
		RWBL	Red-winged Blackbird	10	East	2						
		AMCR	American Crow	120	Southwest	4						
		COGR	Common Grackle	40	East	3						
		KILL	Killdeer	40	Northeast	1						
		AMRO	American Robin	100	South	1						
		SOSP	Song Sparrow	30	Northwest	1						
14-Jun-2011	14	ETTL	Tufted Titmouse	110	Southeast	1		554	603	9	12	100%
		GRCA	Gray Catbird	10	North	1						
		AMRO	American Robin	40	South	1						
		BHCO	Brown-headed Cowbird	5	South	1						
		FISP	Field Sparrow	30	South	1						
		AMCR	American Crow	100	Northwest	1						
		SOSP	Song Sparrow	60	Southeast	1						
		BAOR	Baltimore Oriole	70	Southwest	1						
		WITU	Wild Turkey	50	South	1						
		EAKI	Eastern Kingbird	30	East	1						
		CANG	Canada Goose	10	West	37						
		CHSP	Chipping Sparrow	15	Northwest	2						
14-Jun-2011	15	CHSP	Chipping Sparrow	20	North	1		614	623	9	7	100%
		EABL	Eastern Bluebird	60	North	2						
		RBWO	Red-bellied Woodpecker	40	East	1						
		RWBL	Red-winged Blackbird	5	East	2						
		REVI	Red-eyed Vireo	50	East	1						
		SOSP	Song Sparrow	20	East	1						
		NOFL	Northern Flicker	50	West	1						
		WOTH	Wood Thrush	80	Southeast	1						
		REVI	Red-eyed Vireo	50	West	1						
		ACFL	Acadian Flycatcher	40	West	1						
		AMCR	American Crow	100	Northwest	1						
		INBU	Indigo Bunting	40	West	1						
		SOSP	Song Sparrow	50	Northwest	1						
14-Jun-2011	16	SCTA	Scarlet Tanager	5	West	1	Female feeding young	635	644	10	7	100%
		RWBL	Red-winged Blackbird	15	South	7						
		AMCR	American Crow	90	North	1						
		NOCA	Northern Cardinal	60	East/Northeast	1						
		SOSP	Song Sparrow	25	Southwest	1						
		EWPE	Eastern Wood Peewee	40	East/Southeast	1						
		CHSP	Chipping Sparrow	30	West	1						
14-Jun-2011	17	HOLA	Horned Lark	5	West	1		653	702	10	2	100%
		COGR	Common Grackle	5	Southwest	1						
		AMRO	American Robin	25	North	1						
		AMCR	American Crow	120	Southwest	2						
		KILL	Killdeer	15	Southeast	1						
		INBU	Indigo Bunting	50	West	1						
		AMGO	American Goldfinch	40	West	2						
		BAOR	Baltimore Oriole	90	East/Northeast	1						
		GCFL	Great Crested Flycatcher	60	West	1						
		RWBL	Red-winged Blackbird	40	Northwest	1						
		WIFL	Willow Flycatcher	50	Northeast	1						
		COYE	Common Yellowthroat	60	East/Northeast	1						
14-Jun-2011	18	RHWO	Red-headed Woodpecker	10	Southwest	2		717	726	11	0	100%
		RBGR	Rose-breasted Grosbeak	5	Southwest	2						
		AMGO	American Goldfinch	10	Southwest	2						
		KILL	Killdeer	60	East	2						
		COGR	Common Grackle	20	West	1						
		EUST	European Starling	20	West	22						
		EABL	Eastern Bluebird	15	Southwest	2						
		EUST	European Starling	30	West	2						
		HOLA	Horned Lark	40	North	1						
		AMRO	American Robin	50	Southwest	1						
		AMCR	American Crow	60	Southwest	1						
		CHSP	Chipping Sparrow	40	Northwest	1						
14-Jun-2011	19	KILL	Killdeer	15	North	1		737	746	11	13	100%
		COGR	Common Grackle	25	Northwest	1						
		RWBL	Red-winged Blackbird	30	West	1						
		HOLA	Horned Lark	30	East	1						
		SAVS	Savannah Sparrow	10	North	2						
14-Jun-2011	20	AMCR	American Crow	20	East	24		755	804	11	7	90%
		HOLA	Horned Lark	30	West	1						
		HOSP	House Sparrow	50	South	6						
		MODO	Mourning Dove	80	South	5						
		CHSP	Chipping Sparrow	40	Southeast	1						
		SAVS	Savannah Sparrow	25	East	1						
14-Jun-2011	21	AMRO	American Robin	80	South/Southeast	1		819	828	11	7	100%
		NOCA	Northern Cardinal	50	Southwest	1						
		AMRO	American Robin	50	South	1						
		SOSP	Song Sparrow	30	Southeast	1						
		HOLA	Horned Lark	40	North	1						
14-Jun-2011	22	EAME	Eastern Meadowlark	5	Northeast	1		839	848	12	0	90%
		AMRO	American Robin	5	East	1						
		AMRO	American Robin	20	Southwest	1						
		BCCH	Black-capped Chickadee	10	West	1						
		SOSP	Song Sparrow	55	East	1						
		CHSP	Chipping Sparrow	30	Northwest	1						
14-Jun-2011		SOSP	Song Sparrow	25	Southeast	1						

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								Start	Stop	Temp °	Wind	Cloud
14-Jun-2011	22	NOCA	Northern Cardinal	25	Northwest	1		839	848	12	0	90%
		HOFI	House Finch	50	Northeast	1						
		COGR	Common Grackle	30	West	1						
		INBU	Indigo Bunting	50	North	1						
		COYE	Common Yellowthroat	60	Northeast	1						
14-Jun-2011	23	COGR	Common Grackle	20	North	1		839	848	12	0	90%
		COGR	Common Grackle	30	North	1						
		HOWR	House Wren	25	Southeast	1						
		CHSW	Chimney Swift	10	East	1						
		AMGO	American Goldfinch	15	South	1						
		SOSP	Song Sparrow	25	South	1						
		AMRO	American Robin	60	North	1						
		RWBL	Red-winged Blackbird	55	North	1						
		BLJA	Blue Jay	90	West	1						
		RWBL	Red-winged Blackbird	60	Southwest	1						
14-Jun-2011	24	HOSP	House Sparrow	30	Southeast	4		900	909	13	2	90%
		NOFL	Northern Flicker	100	Northwest	1						
		TUVU	Turkey Vulture	30	South	1						
		AMRO	American Robin	50	Southwest	1						
27-Jun-11	1	RWBL	Red-winged Blackbird	60	Northwest	1		538	547	50	2	5%
		REVI	Red-eyed Vireo	70	Southwest	1						
		AMRO	American Robin	90	Northwest	1						
		HOWR	House Wren	80	West	1						
		AMRO	American Robin	70	South	1						
		SAVS	Savannah Sparrow	40	Southeast	1						
		HOSP	House Sparrow	5	South	3						
		AMGO	American Goldfinch	80	West	3						
		HOLA	Horned Lark	30	East	2						
		DICK	Dickcissel	30	South	1						
27-Jun-11	2	INBU	Indigo Bunting	70	South	1		557	606	12	0	5%
		INBU	Indigo Bunting	60	South	1						
		SOSP	Song Sparrow	70	Northeast	1						
		SAVS	Savannah Sparrow	40	Southeast	1						
		NOCA	Northern Cardinal	120	South/Southeast	1						
		RTHA	Red-tailed Hawk	30	Southwest	1						
		AMRO	American Robin	30	West	1						
		AMCR	American Crow	70	Southwest	1						
		ETTI	Tufted Titmouse	40	Southwest	1						
		CARW	Carolina Wren	20	South	1						
27-Jun-11	3	EATO	Eastern Towhee	30	South/Southwest	1		617	626	12	0	5
		BRTH	Brown Thrasher	30	South	1						
		AMCR	American Crow	100	East	2						
		AMRO	American Robin	50	Northeast	1						
		FISP	Field Sparrow	60	Southwest	1						
		SOSP	Song Sparrow	40	East	1						
		RBWO	Red-bellied Woodpecker	60	Southeast	1						
		EABL	Eastern Bluebird	50	Northeast	9						
		COYE	Common Yellowthroat	60	East	1						
		GRCA	Gray Catbird	40	East	1						
27-Jun-11	4	BRNS	Barn Swallow	5	West	2		637	646	12	0	5
		FISP	Field Sparrow	10	West	1						
		FISP	Field Sparrow	10	Southwest	1						
		HOLA	Horned Lark	50	West	1						
		ETTI	Tufted Titmouse	120	South	1						
		RBGR	Rose-breasted Grosbeak	120	Southeast	1						
		ETTI	Tufted Titmouse	40	Northwest	1						
		BLJA	Blue Jay	50	Southwest	1						
		AMRO	American Robin	120	Southeast	1						
		AMRO	American Robin	50	East	1						
		COGR	Common Grackle	100	West	36						
		EWPE	Eastern Wood Peewee	50	Northwest	1						
		KILL	Killdeer	90	East/Southeast	1						
27-Jun-11	5	COGR	Common Grackle	20	South	1		655	704	13	0	5
		MODO	Mourning Dove	40	East	1						
		SOSP	Song Sparrow	5	North	1						
		WAVI	Warbling Vireo	30	Northeast	1						
		HOSP	House Sparrow	40	Northwest	7						
		AMGO	American Goldfinch	20	East	2						
		COGR	Common Grackle	10	South	1						
		BRTH	Brown Thrasher	30	West	1						
		NOCA	Northern Cardinal	50	Northwest	1						
		GRCA	Gray Catbird	100	Southwest	1						
		EUST	European Starling	30	South	1						
		COGR	Common Grackle	20	West	1						
27-Jun-11	6	KILL	Killdeer	5	North	1		717	726	15	2	10
		HOSP	House Sparrow	10	South	4						
		RWBL	Red-winged Blackbird	10	South	1						
		AMRO	American Robin	10	South	1						
		RWBL	Red-winged Blackbird	30	Northwest	1						
		AMRO	American Robin	50	West	1						
27-Jun-11	7	REVI	Red-eyed Vireo	30	Northwest	1		736	745	16	0	5
		AMGO	American Goldfinch	20	West	2						
		WBNU	White-breasted Nuthatch	20	Northwest	1						
		AMCR	American Crow	30	Southwest	1						
		ACFL	Acadian Flycatcher	40	Southwest	1						
		MODO	Mourning Dove	60	East	1						
27-Jun-11	8	AMRO	American Robin	5	West	2		758	807	17	2	40
		SOSP	Song Sparrow	5	East	2						
		SOSP	Song Sparrow	20	Southwest	1						
		AMRO	American Robin	5	East	1						
		SAVS	Savannah Sparrow	30	Southwest	1						
		GRCA	Gray Catbird	30	South	1						
		HOSP	House Sparrow	30	South	3						
		TUVU	Turkey Vulture	100	North	1						
		HOLA	Horned Lark	40	North	1						
		FISP	Field Sparrow	60	South	1						
		SAVS	Savannah Sparrow	10	West	1						



Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
27-Jun-11	9	RWBL	Red-winged Blackbird	20	South	1		816	825	18	0	40
		SOSP	Song Sparrow	40	South	1						
		HOLA	Horned Lark	30	West	1						
		HOLA	Horned Lark	40	Southeast	1						
		SAVS	Savannah Sparrow	50	Northeast	1						
		BHCO	Brown-headed Cowbird	40	Southwest	1						
		EABL	Eastern Bluebird	30	Northeast	1						
		AMRO	American Robin	40	South/Southwest	1						
27-Jun-11	10	GRSP	Grasshopper Sparrow	20	Northwest	1		837	846	18	0	30
		COGR	Common Grackle	5	North	1						
		HOSP	House Sparrow	15	West	5						
		EUST	European Starling	10	South	3						
		HOSP	House Sparrow	20	East	6						
		AMRO	American Robin	15	West	1						
		AMGO	American Goldfinch	10	South	1						
		SOSP	Song Sparrow	20	West	1						
27-Jun-11	11	MODO	Mourning Dove	25	West	1		856	905	20	0	30
		HOLA	Horned Lark	5	South	2						
		SAVS	Savannah Sparrow	AO	South	1						
		GRSP	Grasshopper Sparrow	5	Southeast	1						
		EAME	Eastern Meadowlark	40	Southeast	1						
		ETTI	Tufted Titmouse	120	Southeast	1						
		ETTI	Tufted Titmouse	100	West	1						
		COGR	Common Grackle	20	North	2						
27-Jun-11	12	RWBL	Red-winged Blackbird	30	Southwest	1		914	923	20	0	25
		BLJA	Blue Jay	50	Northwest	1						
		FISP	Field Sparrow	40	Northeast	1						
		REVI	Red-eyed Vireo	60	West	1						
		INBU	Indigo Bunting	60	North/Northwest	1						
		COGR	Common Grackle	40	Northwest	1						
		GCFL	Great Crested Flycatcher	70	Northwest	1						
		WOTH	Wood Thrush	70	West	1						
28-Jun-11	13	ETTI	Tufted Titmouse	100	East	1		540	549	16	0	0
		KILL	Killdeer	40	East	1						
		AMCR	American Crow	100	North	4						
		INBU	Indigo Bunting	35	West	1						
		RWBL	Red-winged Blackbird	15	West	3						
		SOSP	Song Sparrow	30	Northwest	1						
		COGR	Common Grackle	40	East	3						
		KILL	Killdeer	50	West	1						
28-Jun-11	14	CHSP	Chipping Sparrow	20	Northwest	1		553	602	16	0	0
		GRCA	Gray Catbird	10	Northwest	1						
		COGR	Common Grackle	25	Northwest	7						
		BHCO	Brown-headed Cowbird	15	South	2						
		AMCR	American Crow	100	Northwest	3						
		AMRO	American Robin	40	South	1						
		SOSP	Song Sparrow	60	Southeast	1						
		FISP	Field Sparrow	40	South	1						
28-Jun-11	15	CHSP	Chipping Sparrow	30	South	1		607	616	17	0	0
		AMCR	American Crow	40	East	5						
		INBU	Indigo Bunting	50	West	1						
		WOTH	Wood Thrush	80	South/Southeast	1						
		AMCR	American Crow	100	Northwest	2						
		NOFL	Northern Flicker	50	West	1						
		SOSP	Song Sparrow	30	East	1						
		REVI	Red-eyed Vireo	40	West	1						
28-Jun-11	16	RBWO	Red-bellied Woodpecker	40	East	1		621	630	17	0	0
		EABL	Eastern Bluebird	50	Northwest	2						
		AMRO	American Robin	40	Northwest	1						
		RWBL	Red-winged Blackbird	10	East	3						
		AMCR	American Crow	90	Northwest	4						
		SCTA	Scarlet Tanager	20	West	1						
		RWBL	Red-winged Blackbird	20	South	5						
		SOSP	Song Sparrow	40	Southwest	1						
28-Jun-11	17	NOCA	Northern Cardinal	50	Northeast	1		621	630	17	0	0
		ETTI	Tufted Titmouse	30	South	1						
		WBNU	White-breasted Nuthatch	30	Southwest	1						
		INBU	Indigo Bunting	40	West	1						
		HOLA	Horned Lark	20	West	1						
		AMCR	American Crow	100	Southwest	2						
		BAOR	Baltimore Oriole	70	Northeast	1						
		RWBL	Red-winged Blackbird	50	Northwest	3						
28-Jun-11	18	AMRO	American Robin	30	North	1		635	644	18	0	0
		GCFL	Great Crested Flycatcher	60	West	1						
		KILL	Killdeer	20	Southeast	1						
		AMGO	American Goldfinch	40	West	2						
		WIFL	Willow Flycatcher	50	Northeast	1						
		EUST	European Starling	25	West	9						
		RHWO	Red-headed Woodpecker	15	South	2						
		RBGR	Rose-breasted Grosbeak	10	Southwest	1						
28-Jun-11	19	KILL	Killdeer	50	East	1		648	657	18	0	0
		CHSP	Chipping Sparrow	40	Northwest	1						
		EABL	Eastern Bluebird	20	Southwest	2						
		AMRO	American Robin	40	Southwest	2						
		HOLA	Horned Lark	50	Northwest	1						
		EUST	European Starling	40	North	25						
		COGR	Common Grackle	30	West	9						
		HOLA	Horned Lark	40	East	2						
28-Jun-11	20	RWBL	Red-winged Blackbird	40	West	4		703	722	19	0	0
		SAVS	Savannah Sparrow	20	North	1						
		COGR	Common Grackle	25	Northwest	2						
		BHCO	Brown-headed Cowbird	30	North	1						
		AMRO	American Robin	20	South	1						
		SOSP	Song Sparrow	40	South	1						
		CHSP	Chipping Sparrow	50	Southeast	1						
		SAVS	Savannah Sparrow	30	East	1						
28-Jun-11	21	MODO	Mourning Dove	60	Southeast	5		736	745	20	0	0
		HOSP	House Sparrow	50	South	5						
		HOLA	Horned Lark	30	West	1						
		AMRO	American Robin	40	West	1						
		AMCR	American Crow	30	East	4						
		AMRO	American Robin	80	Southeast	1						
		CHSP	Chipping Sparrow	50	Southeast	1						
		SAVS	Savannah Sparrow	30	East	1						

Date	Point Number		Species	Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions						
								Start	Stop	Temp @	Wind	Cloud				
28-Jun-11	21	NOCA	Northern Cardinal	40	Southwest	1		751	800	20	0	0				
		HOLA	Horned Lark	50	North	1										
		EAME	Eastern Meadowlark	20	Northeast	1										
		AMRO	American Robin	40	Southwest	2										
		AMCR	American Crow	60	North	4										
		INBU	Indigo Bunting	25	Southeast	1										
28-Jun-11	22	INBU	Indigo Bunting	50	North	1		807	816	21	0	0				
		GRCA	Gray Catbird	15	Northwest	1										
		AMRO	American Robin	20	Southwest	1										
		SOSP	Song Sparrow	35	East	1										
		HOFI	House Finch	50	Northeast	4										
		AMRO	American Robin	20	East	1										
		BCCH	Black-capped Chickadee	20	West	1										
		ETTI	Tufted Titmouse	30	Northeast	1										
		NOCA	Northern Cardinal	30	Northwest	1										
		COGR	Common Grackle	80	North	17										
CHSP	Chipping Sparrow	30	North	1												
28-Jun-11	23	HOWR	House Wren	30	Southeast	1		821	830	21	2	0				
		BLJA	Blue Jay	70	West	2										
		AMGO	American Goldfinch	20	South	3										
		COGR	Common Grackle	30	North	3										
		INBU	Indigo Bunting	25	East	1										
		SAVS	Savannah Sparrow	30	South	1										
		RWBL	Red-winged Blackbird	50	North	2										
		BLJA	Blue Jay	40	Southeast	1										
		AMRO	American Robin	50	Northeast	1										
		HOSP	House Sparrow	30	Southeast	5										
28-Jun-11	24	RWBL	Red-winged Blackbird	70	North/Northwest	3		835	844	22	0	5				
		REVI	Red-eyed Vireo	70	Southwest	1										
		BLJA	Blue Jay	40	Northwest	1										
		COGR	Common Grackle	20	Southwest	2										
		HOLA	Horned Lark	20	Northwest	1										
		RTHA	Red-tailed Hawk	40	North	1										
		AMRO	American Robin	50	Southwest	2										
7-Jul-11	1	AMRO	American Robin	40	East	2		545	554	20	2	15				
		RWBL	Red-winged Blackbird	10	East	1										
		NOCA	Northern Cardinal	30	Northeast	1										
		HOLA	Horned Lark	10	South	3										
		DICK	Dickcissel	30	West	1										
		AMCR	American Crow	50	West	7										
		MODO	Mourning Dove	30	West	9										
		GRSP	Grasshopper Sparrow	40	Northwest	1										
		HOWR	House Wren	70	North	1										
		COGR	Common Grackle	50	South	9										
		FISP	Field Sparrow	20	North/Northwest	1										
		AMGO	American Goldfinch	30	South	1										
		DICK	Dickcissel	20	Northwest	1										
		EUST	European Starling	10	South	3										
		VESP	Vesper Sparrow	60	Southwest	1										
HOSP	House Sparrow	50	Southeast	6												
7-Jul-11	2	MODO	Mourning Dove	30	East	33		559	608	20	0	15				
		GRYE	Greater Yellowlegs	50	West/Southwest	1										
		GRYE	Greater Yellowlegs	10	Southwest	2										
		KILL	Killdeer	10	Southwest	3										
		WODU	Wood Duck	30	North	1										
		MALL	Mallard	30	North	5										
		SAVS	Savannah Sparrow	60	Southwest	1										
		AMCR	American Crow	120	Northeast	1										
		RWBL	Red-winged Blackbird	20	West/Southwest	1										
		HOLA	Horned Lark	20	South	1										
		DICK	Dickcissel	30	Southeast	2										
		AMRO	American Robin	40	West/Southwest	1										
		LESA	Least Sandpiper	30	Northwest	1										
		AMCR	American Crow	100	North	5										
		7-Jul-11	3	BRNS	Barn Swallow	20	West						5		613	622
RWBL	Red-winged Blackbird			5	East	2										
FISP	Field Sparrow			30	Southeast	1										
SOSP	Song Sparrow			15	Southeast	2										
HOLA	Horned Lark			40	Southwest	1										
SOSP	Song Sparrow			30	South	1										
COYE	Common Yellowthroat			30	South	1										
HOWR	House Wren			70	West/Northwest	1										
7-Jul-11	4	GBHE	Great Blue Heron	40	South	2		627	636	21	0	10				
		RWBL	Red-winged Blackbird	10	West	8										
		COYE	Common Yellowthroat	20	Southwest	2										
		EAME	Eastern Meadowlark	40	East	1										
		SOSP	Song Sparrow	30	Southeast	1										
		COYE	Common Yellowthroat	50	Southeast	1										
		GBHE	Great Blue Heron	30	South	1										
		RWBL	Red-winged Blackbird	50	South	2										
WOTH	Wood Thrush	100	South	1												
7-Jul-11	5	FISP	Field Sparrow	40	North	1		644	653	22	0	10				
		ETTI	Tufted Titmouse	70	North	1										
		COYE	Common Yellowthroat	50	West	2										
		SOSP	Song Sparrow	40	West	1										
		YBCU	Yellow-billed Cuckoo	100	North	1										
		VESP	Vesper Sparrow	50	Northwest	1										
		SOSP	Song Sparrow	70	Northwest	1										
AMCR	American Crow	80	Northwest	2												
7-Jul-11	6	COYE	Common Yellowthroat	30	East	1		703	712	24	0	5				
		COYE	Common Yellowthroat	45	Southeast	1										
		SOSP	Song Sparrow	50	Southeast	1										
		RWBL	Red-winged Blackbird	25	Southeast	1										
		FISP	Field Sparrow	60	Southeast	1										
		REVI	Red-eyed Vireo	90	South/Southwest	1										
		HESP	Henslow's Sparrow	60	North/Northeast	1										
		RWBL	Red-winged Blackbird	90	North/Northeast	1										
		AMCR	American Crow	100	East	4										
		SAVS	Savannah Sparrow	50	East	1										
		HOLA	Horned Lark	40	Northwest	5										

Date	Point Number	Species		Estimated Distance (m)	Direction (Bearing)	Flyover # in Flock	Behavior/notes	Survey Time		Survey Weather Conditions		
								Start	Stop	Temp °	Wind	Cloud
7-Jul-11	7	CHSP	Chipping Sparrow	5	North	1		725	734	24	0	0
		RWBL	Red-winged Blackbird	20	North	3						
		DOWO	Downy Woodpecker	5	North	1						
		SOSP	Song Sparrow	20	Northwest	1						
		EUST	European Starling	40	Northwest	6						
		HOSP	House Sparrow	5	North	8						
		GRCA	Gray Catbird	20	North	1						
7-Jul-11	8	DICK	Dickcissel	20	North	1		749	758	25	0	0
		SOSP	Song Sparrow	30	Northwest	1						
		SOSP	Song Sparrow	40	East	1						
		BRNS	Barn Swallow	50	North	1						
		SAVS	Savannah Sparrow	40	Northeast	1						
		GRSP	Grasshopper Sparrow	30	East	1						
		COYE	Common Yellowthroat	60	North	1						



## **Exhibit P. Acoustic Bat Survey**



## **Bat Acoustic Monitoring Survey Report - 2011**

### **Republic Wind Farm, Seneca County, Ohio**



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**December 2011**

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## **1.0 INTRODUCTION**

### **1.1 Project Overview**

Republic Wind, LLC proposes to develop the Republic Wind Farm (Project) near Belleview, Ohio (Figure 1-1). The Project site is located in Seneca and Sandusky County in north central Ohio. Land use in the proposed Project area comprises agricultural fields interspersed with forested riparian habitat that follows streams and storm water drainage. This report presents baseline (pre-construction) bat acoustic monitoring data collected during the spring, summer, and fall 2011 migration season at the Project's meteorological tower (met tower) (Figure 1.1).

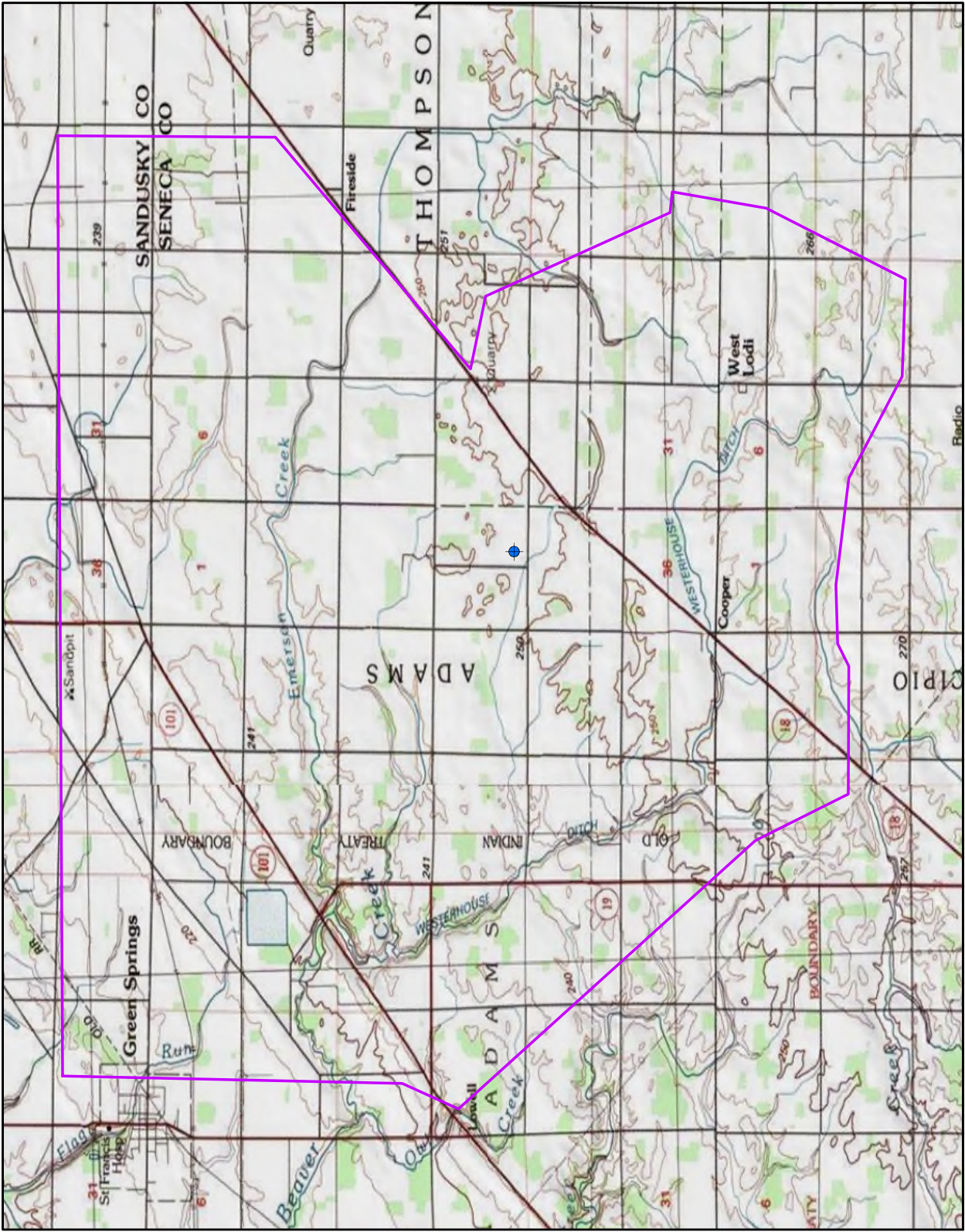
### **1.2 Goals and Objectives**

The goal of the bat acoustic monitoring survey was to assess bat phenology within the Project area, for an extended period, between March 16 and November 16, 2011. The objectives of the bat survey were to:

- 1) identify the peak activity periods for bats;
- 2) determine the bat species composition in the Project area (near the bat detectors); and,
- 3) determine an index of bat activity at different heights above ground level.

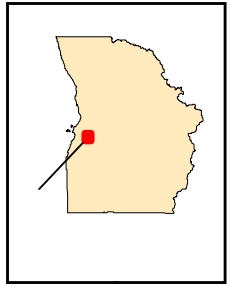
**Figure 1.1.** Republic Bat Acoustic Monitoring Sites – 2011.






**Legend**

- Bat Acoustic Detectors
- Project Area



**Figure 1.1. 2011 Met Tower and Bat Detector Location.**

Prepared For:		Republic Wind, LLC	
Prepared By:		Date:	12/2011
		Source: NGS, Topo US 2D, Detector location data provided by Tetra Tech.	
		Coordinate System: WGS84.	



## 2.0 METHODS

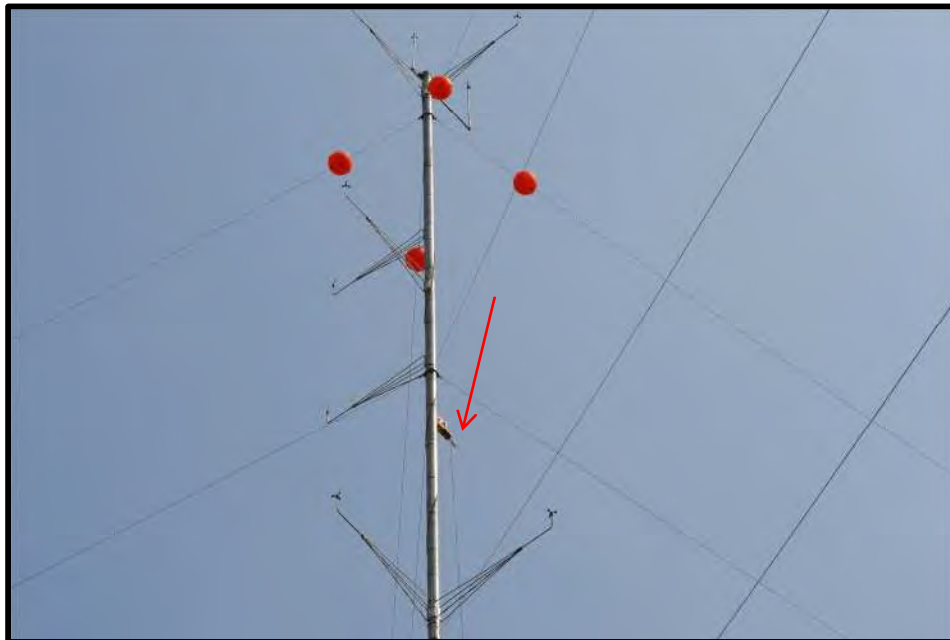
### 2.1 Data Collection

Tetra Tech conducted bat acoustic surveys at the Project area in the spring, summer, and fall of 2011. The surveys conformed to the ODNR-On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio (May 2004).

Bat activity was monitored using ultrasonic acoustic recorders (Anabat SD-2, Titley Scientific, Inc.) at the Project's met tower. The area around the met tower was an agricultural field, that was used to grow corn. The nearest forested area was approximately 670 meters northeast of the met tower. This section presents the cumulative results of 245 nights of bat activity monitoring during the spring migration, summer residency period, and fall migration in 2011.

Two bat acoustic detectors were deployed at the met tower. The two detectors were suspended from the tower on March 16, 2011, at heights of 45 meters (m) and 5 m above ground level; these detectors will be referred to as the 'High' and 'Low' detectors, respectively (Figure 2.1 and 2.2). Each of the two detectors remained in the same location throughout the survey period. To ensure that the greatest period of bat activity was surveyed each night, detectors were programmed to begin recording 30 minutes before sunset and stop recording 30 minutes after sunrise. Each detector was calibrated to detect a 40 kHz tone at a distance of 20 m using a Bat Chirp (Tony Messina, Nevada Bat Technology). Acoustic monitoring at the met tower was continuous throughout the survey period.

Each detector station consisted of an Anabat SD-2 bat acoustic detector powered by a 10-watt solar panel and a 12-volt battery encased in a waterproof housing (Figure 2.1 and 2.2). A pre-amplified microphone cable, pre-amplified microphone, and bracket were used to suspend the Anabat microphone from the tower. A plastic deflector shield angled at 45 degrees below the microphone facilitated recording of the airspace above and adjacent to the detector. Each detector was manually checked by trained technicians approximately every 2 weeks during the survey period.



**Figure 2.1.** Photograph of the High detector suspended from the met tower guy wire array – Republic Wind Farm, 2011. The red arrow indicates the detector location.



**Figure 2.2.** Photograph of the Low detector suspended from a specialized met tower pulley system – Republic Wind Farm, 2011. The red arrow indicates the detector location.

## 2.2 Data Analysis

Potential bat call files were extracted from data files using CFCread<sup>®</sup> software (Titley Electornics, Inc.). CFCread<sup>®</sup> software screens all data recorded by the bat detector and extracts call files using a filter. The default settings for the CFCread<sup>®</sup> software were used during the file extraction process to ensure comparability among datasets. These settings include a maximum time between calls (TBC) of 5 seconds, a minimum pulse fragment line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to the degree that adjacent data points are averaged. The higher the smoothing factor, the less restrictive the filter, resulting in more noise files and poor quality call sequences retained within the dataset. A call is defined as a single pulse of sound produced by a bat. A call sequence is defined as a combination of two or more pulses recorded in a single call file. Call sequences with less than 2 pulses were not analyzed.

A qualitative visual comparison was made between recorded bat call sequences and established reference libraries of calls. This technique allowed for relatively accurate identification of bat species (O'Farrell et al. 1999; O'Farrell and Gannon 1999). All call sequences were also run through a series of conservative filters based on call sequence characteristics outlined in Szweczak et al. (2008) and from known species call sequences (hand released and zip-line individuals) from a regional call library. A call sequence was considered of suitable quality and duration to be included in data analysis if the individual

call pulse(s) exhibited the full spectrum of frequency modulation produced by a bat (i.e., consisting of sharp, distinct lines) with a minimum of two pulses.

In addition to the qualitative visual analysis, all bat calls recorded during the monitoring period were processed using an Indiana bat specific call filter. Call sequences can be difficult to definitively classify due to overlap in call pulse characteristics across species. Species such as hoary bat (*Lasiurus cinereus*) emit calls that are distinct in slope, duration, characteristic frequency, and frequency range (i.e., parameterizations). However, for other species, particularly those of the *Myotis* genus, it is difficult to accurately differentiate among species based on call sequence characteristics due to the similarities in call parameters. Nevertheless, it is often possible to make accurate classification inferences based on good quality calls of species including Indiana bat, little brown bat (*Myotis lucifugus*), and northern long-eared bat (*Myotis septentrionalis*). Call sequences of eastern red bat (*Lasiurus borealis*) and tri-colored bat (*Perimyotis subflavus*) are typically unique but occasionally appear similar to each other or *Myotis* species, especially if the recording is of poor quality. Classification is often complicated by the presence of static or incomplete call pulses within a recording. Fragments and poor quality calls are prevalent in recordings from passive detectors monitoring for a long duration.

Relative abundance, or the magnitude of each species' contribution to spatial and temporal use, was determined by calculating an Index of Activity (IA) modified from Miller (2001). The method is based on the presence/absence of a species call sequence within one-minute time increments. Thus, IA was the sum of minute-increments with a species presence divided by the unit effort ( $IA = \# \text{ minutes} / \text{detector-nights} * 100$ ). The IA calculations allows for samples with different levels of effort (i.e., different total number of detector-nights) to be accurately compared, thereby reducing the potential bias associated with differences in study effort. IA calculations follow those employed by Miller (2001) and O'Farrell and Shanahan (2006).

### **3.0 RESULTS**

The 2011 bat acoustic monitoring survey started on March 16 and ended on November 16, 2011 (Table 2.1). During the 245-night survey period detectors operated for 490 detector-nights (number of detectors multiplied by the number of nights that detectors were operational). A total of 534 bat call sequences were recorded within 531 one-minute intervals of bat activity (number of minutes with bat call sequences present) yielding an overall IA of 108.4 (Table 3.1).

The highest IA rate ( $\# \text{ of one minute intervals of bat activity} / \text{detector-nights} * 100$ ) was recorded by the Low detector (IA = 197.1). The smallest IA rate (19.6) was recorded by the High Detector, which detected 50 call sequences within 48 minutes of activity (Table 3.1).



**Table 3.1.** Summary results of acoustic monitoring survey effort by detector – Republic Wind Farm, 2011.

Detector	Period of Operation	Detector-Nights	Number of Minutes with Bat Activity	Total Number of Call Sequences Recorded	Overall Index of Activity
High (45 m)	Mar. 16 - Nov. 16	245	48	50	19.6
Low (10 m)	Mar. 16 - Nov. 16	245	483	484	197.1
<b>Total</b>		<b>490</b>	<b>531</b>	<b>534</b>	<b>108.4</b>

Bat call sequences were identified to the lowest possible taxonomic level (Table 3.2). Sixty-six (66) percent of recorded calls were classified to species ( $n = 354$ ). Calls were then combined into five categories based on similarities in call sequence structure: Low Frequency Species, Middle Frequency Species, High Frequency Non-Myotis Species, High Frequency Myotis Species, and Unknown (Table 3.2). Some call sequences did not meet the parameters required for species level identification ( $n = 132$ ) and were classified based on the frequency modulation exhibited in the call sequence. Some of these calls ( $n = 4$ ) were classified as Unknown because they consisted of feeding buzzes that could not be accurately attributed to any single species or guild, and therefore could not be labeled as either a middle or high frequency calls [it is likely that most of these were evening bat (*Nycticeius humeralis*) calls].

Seven species were identified from the call sequences recorded during the 2011 acoustic monitoring effort. A total of 248 calls (46.4 percent of all calls recorded), were attributed to migratory bats including the hoary bat, silver-haired bat, eastern red bat, and evening bat. The greatest number ( $n = 125$ ) of recorded call sequences attributable to a single species was from silver-haired bat. Silver-haired bat produce call sequences with relatively unique characteristics that can generally be accurately identified to species level, and tend to be lower in frequency than other species, and therefore do not attenuate as quickly in the atmosphere. A number of hoary bat ( $n = 54$ ), eastern red-bat ( $n = 48$ ), and evening bat ( $n = 21$ ) were also recorded.

IA values were calculated for each species by detector. The greatest IA was for silver-haired bat at the low detector (IA = 43.7). For each of the species recorded IA values were greatest at the Low detector (Figure 2.4). Hoary bat was the second most active species overall (as measured by IA), and was the most active species at the High detector (IA = 9.4) (Figure 3.1).

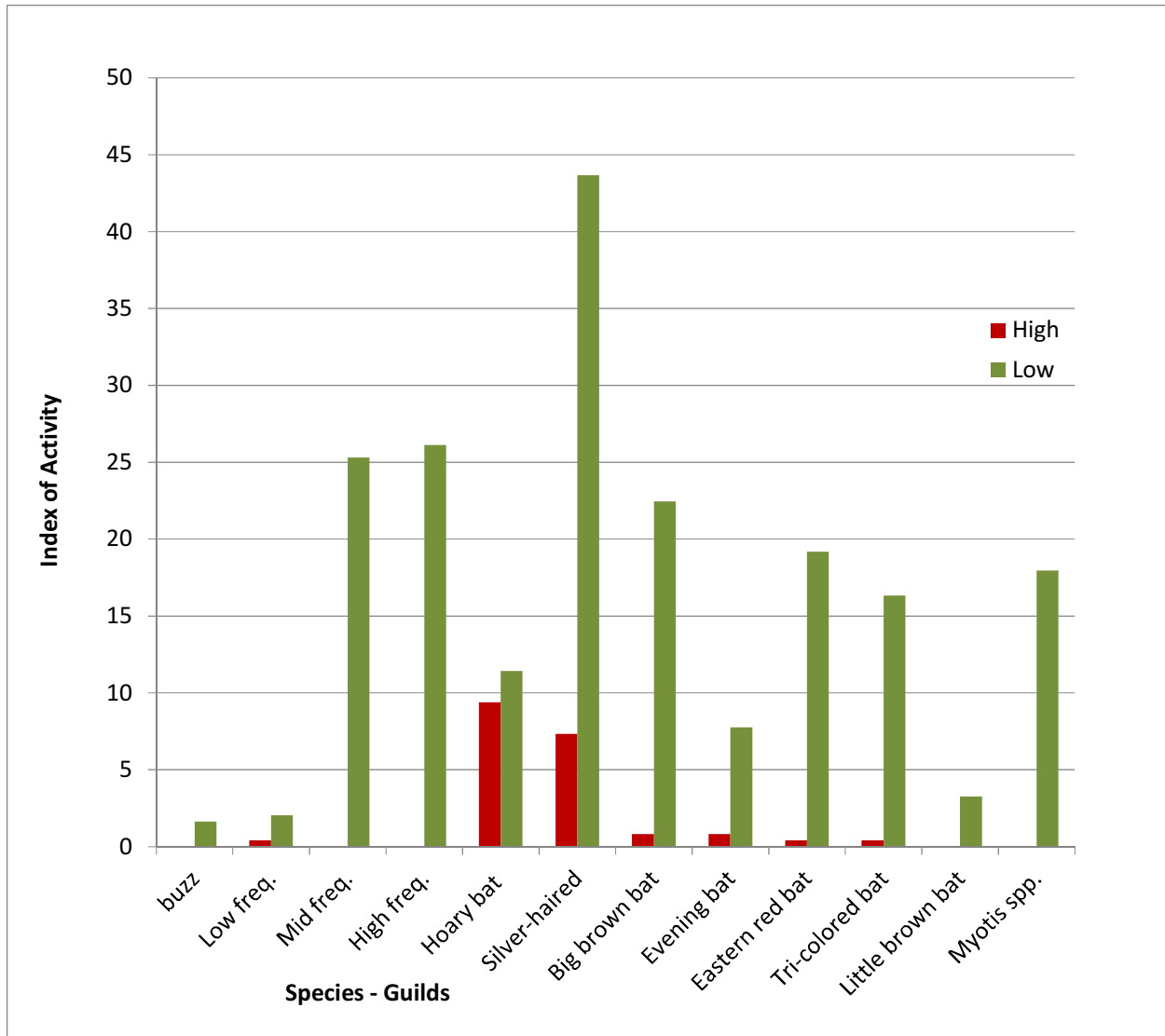
No calls of federally listed bat species were positively identified during the survey. Indiana bats are known to occur in the vicinity of the Project area, and species classifications for many *Myotis* calls recorded during the 2011 surveys ( $n = 44$ ) was not feasible; therefore it is possible that Indiana bats were recorded but not identified in the dataset. Although none of the 44 *Myotis* calls identified during the passive acoustic monitoring surveys at the met tower exhibited characteristics typical of Indiana bat calls. In addition, the overall low levels of *Myotis* species activity recorded may indicate that the type of habitat around the met tower is not frequented by *Myotis*. The distance from wooded areas (approximately 670 m) may make the likelihood of Indiana bat occurrence lower near the met tower. Avoidance of large open areas by Indiana bat, especially agricultural land with little forested habitat, has been documented (Murray and Kurta 2004).

Bat activity varied throughout the monitoring period (Figures 3.2). Overall, there was no bat activity recorded before April 10, 2011. Bat activity increased slightly around April 20 but declined again in mid-May. Activity began to increase in early August until peak activity was recorded on August 13. Activity declined after August, although bats were active throughout September, and until October 12, 2011.

**Table 3.2.** Summary of total number of call sequences recorded per species – Republic Wind Farm, 2011.

Group	Characteristic Frequencies*	Species	Total Call Sequences
Low Frequency	12 kHz–24 kHz	Hoary bat	54
		Unknown low frequency call seq.	6
Middle Frequency	24 kHz–38 kHz	Big brown bat	57
		Silver-haired bat	125
		Evening bat	21
		Unknown middle frequency call seq.	62
High Frequency (Non-myotis species)	44–45 kHz	Tri-colored bat	41
		Eastern red bat	48
High Frequency (Myotis species)	46–52 kHz	Little brown myotis	8
		Unknown <i>Myotis</i> species	44
		Unknown high frequency call seq.	64
Unknown		Buzz	4
* Characteristic frequency (Fc) is generally defined as the frequency of the call pulse at the lowest slope, or the lowest frequency of the consistent frequency modulation sweeps. Fc represents the single most useful parameter for species identification.			





**Figure 3.1.** Index of Activity of migratory bat species by detector – Republic Wind Farm, 2011.

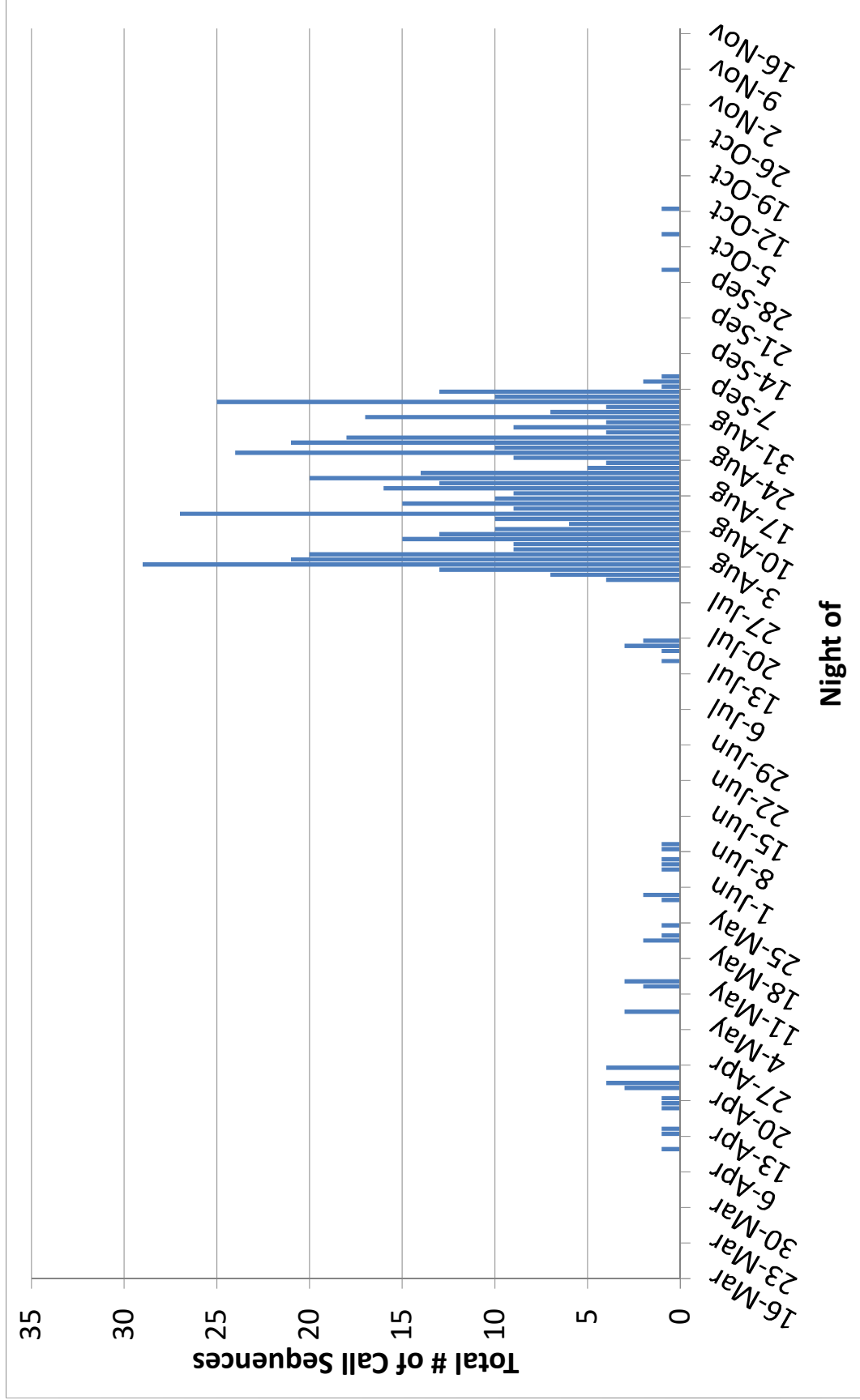


Figure 3.2. Total number of call sequences recorded per night for all detector pooled – Republic Wind Farm, 2011.

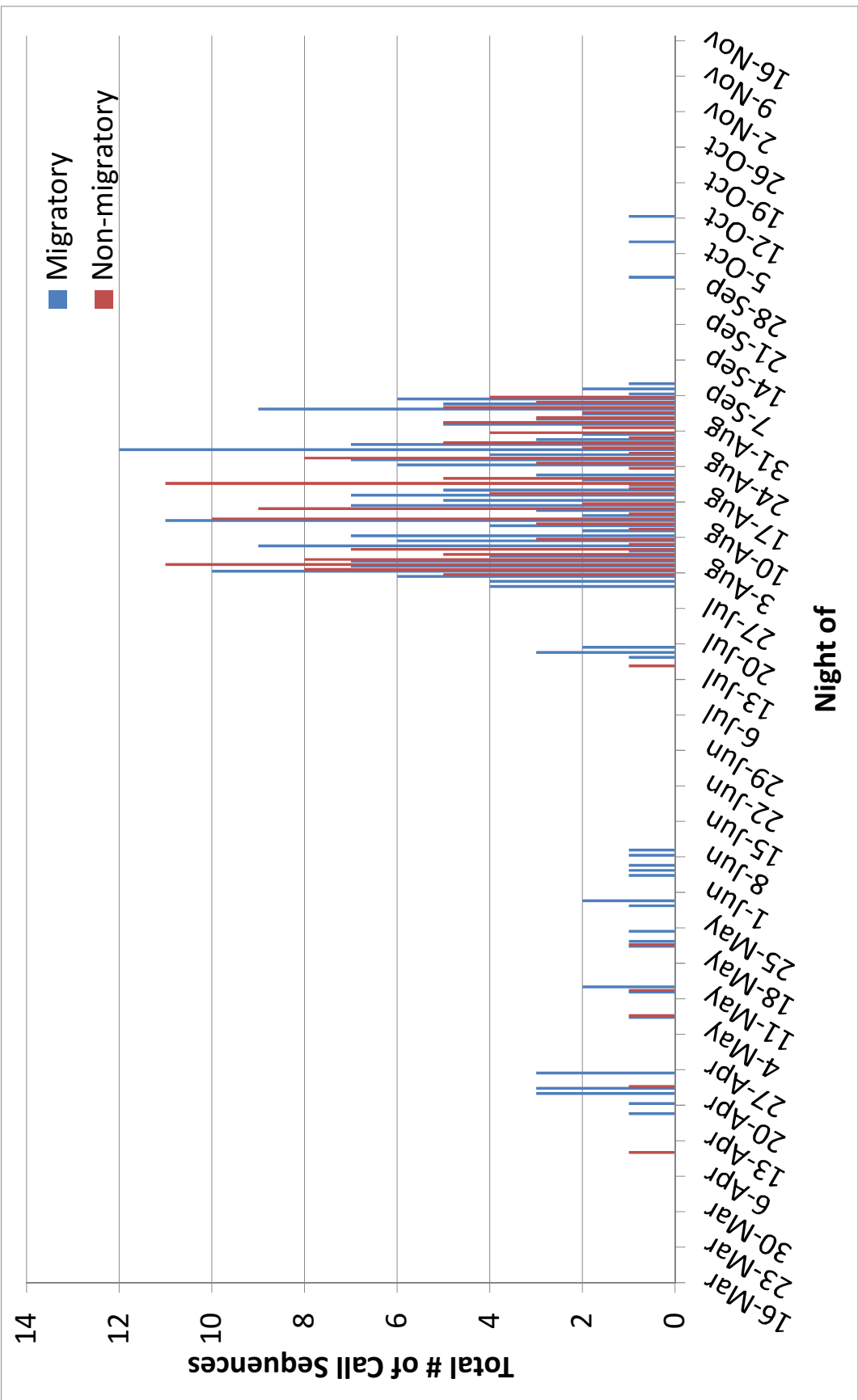


Figure 3.3. Total number of migratory species and non-migratory species call sequences – Republic Wind Farm, 2011.



#### 4.0 DISCUSSION

The migratory species, hoary bat, silver-haired bat, eastern red bat, as well as evening bat, were positively identified from recordings made during the 2011 survey period. Overall, there was more migratory species activity than non-migratory species activity recorded in the Project area. These results are consistent with recent research demonstrating that tree and tree-crevasse roosting migratory bats are the predominant species found during post-construction mortality studies at operational wind farms in North America (Arnett et al. 2008). Results from these mortality studies show the three bat species most commonly encountered during ground searches were long-distance (Lasiurine) migratory bats: hoary bat, silver-haired bat, and eastern red bat (Kunz et. al 2007, Arnett et al. 2008).

Non-migratory species recorded during the 2011 surveys (big brown bat, tri-colored bat, and *Myotis* species) were only slightly more active during August and September than were migratory species recorded (hoary bat, silver-haired bat, eastern red bat, and evening bat). Migratory species were active in August and September, as well as in the spring and fall (Figure 3.3). Overall activity of non-migratory and migratory species was highest during August and September, which is considered the “swarming period”, when bats group together prior to hibernation and/or migration, and often mate (Parsons et al. 2003). The occurrence of migratory bat species during the summer demonstrates that there were likely some long-distance migratory tree and tree crevasse roosting bats spending the summer residency period at the Project area. There also appeared to be few long-distance migrants moving through the Project area during the spring and fall, as evidenced by the low number of calls recorded during those periods.

IA values for all bat species were lowest at the High detector. This indicates that bat activity nearest the rotor swept zone (RSZ) of typical modern wind energy turbines was low compared to bat activity levels below the RSZ and nearest ground level. Migratory species (hoary bat, silver-haired bat, eastern red bat, and evening bat) we recorded primarily just above ground level by the Low detectors. *Myotis* species exhibited low levels of activity, as measured by IA, and were not recorded at the High detector.

The ratio between the total number of call sequences recorded at each detector, and the total number of one-minute intervals with bat activity may be used as an indicator of the “concentration” of bat activity throughout time. For example, the High detector recorded 50 call sequences over the course of 48 minutes of activity. This near one to one ratio (0.96) is a function of low concentrations of bat activity at the High detector; activity events were spread out over time and rarely were two calls recorded in the same one-minute interval. Similarly the ratio between call sequences and minutes of activity at the Low detector was also slightly less than one to one (0.99). Based on these observations it seems that bat activity at the met tower was largely episodic in nature, and that extended periods of constant activity did not occur. Instead, it appears that periods of diffused and inconsistent activity occurred at both detectors. These patterns of activity are not consistent with what would be expected if the met tower location provided significant foraging habitat, or was located within a migration or transit corridor. If the area was important for foraging or migration we would expect to see high numbers of bat calls recorded during limited temporal periods. For example Racey and Swift (1985) demonstrated that foraging bats may trap-line areas where food resources are concentrated, returning to the same foraging areas nightly. High numbers of calls recorded over a short period of monitoring would be more indicative of high use by bats. Bat activity at an important migration corridor might also be more concentrated, with high numbers of passes occurring in rapid succession, as would expected if multiple individuals moved through the area during migration of transit between foraging sites.

Patterns of activity in the Project area do not suggest the presence of a large bat migration corridor in the vicinity of the met tower. If a substantial migration corridor did exist over the Project area, the data should show a higher ratio of minutes of bat activity to detector nights. The sporadic and diffused occurrence of long-distance migratory species in the recording indicates that few individuals use the open area near the met tower. There did not appear to be an episode of dramatic fluctuation in recorded activity that could be definitively attributed to large-scale migration, although an observable increase in activity during August and September was apparent; however this increase was minimal and was not indicative of a large number of bats moving through the Project area (Cryan and Veilleux 2007).

Weather conditions, including mean nightly temperature and wind speed, probably contributed to the patterns of activity recorded by the acoustic detector sets. The increase in bat call sequences recorded in August may have resulted from the following: (1) increased foraging activity near the detectors due to a rise in mean nightly temperatures (Racey and Swift 1985, O'Donnell 2000, Kusch et al. 2004); (2) increases in food resource concentrations near the detectors, (3) an episode of bats leaving a roost and transiting to an established area of concentrated food resource passing the detectors *en route*; or, (4) bat swarming near the met tower. The increase in activity of hoary bat, silver-haired bat, and eastern red bat at the met tower detectors during September was almost certainly attributable to migration and/or pre-migration staging (Cryan and Veilleux 2007).

There is inherent difficulty in attempting to interpret the number of recorded call sequences as an indication of activity levels; however, detection rates, recorded minutes of activity and IA values do provide a relative measure of bat activity near sampling locations. The limited maximum range of a single Anabat detector (approximately 30 m [100 ft]) makes the characterization of landscape-scale movements, such as migration, difficult to assess. However, a comparative assessment of the results from detectors arrayed within a tower at different elevations can facilitate the characterization of spatial distribution and phenology of bat activity.

The total number of bat call sequences and minutes of activity recorded each night by a given detector may or may not reflect the absolute level of bat activity present in the Project area, although some studies have suggested that there may be a relationship between the relative numbers of calls recorded and absolute bat activity levels (Gorresen et al. 2008). The bias in passive acoustic surveys of this type stems from the unknowns that are intrinsic to automated monitoring. For example, a single foraging individual may produce a large number of call sequences that are within the range of a given detector set. Conversely, a large number of individual bats may pass the detector set and produce an equally large number of call sequences. It is also important to note that the survey results are a sample of bat activity in the airspace surrounding the detectors and are not necessarily indicative of bat activity throughout the entire Project area.

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