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Memorandum

To	Ashtabula Wind, LLC
Subject	Ashtabula I Wind Energy Center Improvement Project Supporting Documentation Certification Pursuant to North Dakota Century Code § 49-22-03(3)(a)
From	AECOM
Date	July 15, 2019

Ashtabula Wind, LLC (Ashtabula Wind) submits this documentation in support of a certification pursuant to North Dakota Century Code (NDCC) Section 49-22-03(3)(a) for the Ashtabula I Wind Energy Center (Ashtabula I WEC) (Figure 1) improvement project (Project) (Figure 2). AECOM analyzed the Project with respect to environmental, cultural, and natural resources as well as sound and shadow flicker and any appropriate mitigation that may be required. The following Memorandum and appendices detail the results of this analysis and Table 1 summarizes the results.

Description of the Project – Ashtabula Wind proposes to complete the Project entirely within the Commission’s previously approved site boundary and the Project will utilize prior construction easements. The Project activities include the addition of new gearboxes and rotors (*i.e.*, blade assembly), but the Project will not result in changes to other Ashtabula I WEC infrastructure, such as existing turbine locations, towers, nacelles, roads, electric collection systems, substations, the operations and maintenance building, and meteorological tower.

Socioeconomics – The Project will have positive impacts on socioeconomics within the Project Area, by extending the life of Ashtabula I WEC and the timeframe over which landowners will receive payments. The Project will also create temporary construction jobs during the anticipated three-month construction period.

Land Use – Because the Project will be constructed entirely within the previously certified site with turbine locations remaining the same, land use will remain unchanged. The Project will result in certain minimal temporary impacts to previously disturbed areas within the permitted Ashtabula I WEC site boundary, such as turning radii and laydown areas. Temporarily impacted areas will be restored in compliance with PU-08-32 Order paragraphs 11 (restoration of township and county roads), 13 (reclamation, fertilization and reseeding), 14 (reclamation and maintenance throughout the life of the facility), 17 (repair/replacement of fences and gates removed/damaged), 18 (repair/replace damaged drain tiles), and 19 (prohibition of staking areas or equipment in cultivated lands without consent of landowner).

Public Services – A temporary increase in truck traffic will occur during construction. The capacity of any route and level-of-service to the traveling public will not be significantly affected. Ashtabula Wind will implement speed limits and appropriate traffic control during construction.

The Project will continue to comply with Barnes County land use, zoning, building rules, regulations and ordinances will occur as result of the Project. The Project will be compliant with PU-08-32 Order paragraphs 11 (restoration of township and county roads), 12 (suspension of construction if weather conditions may cause irreparable damage), 23 (traffic control), and 29 (mitigation of television and radio interference, if occurs).

Human Health and Safety – At the time the Ashtabula I WEC was constructed, the Commission did not have a standard for wind energy conversion facilities regarding shadow flicker impacts. Ashtabula Wind conducted a voluntary shadow flicker analysis for the Project to determine potential impacts under realistic conditions. The results of this analysis showed that there are three residences where shadow flicker is modeled to exceed 30 hours per year. Ashtabula Wind has obtained waivers from these landowners. The results of the shadow flicker assessment are included in Appendix A.

Ashtabula Wind submitted Form 7460-1 to the Federal Aviation Administration (FAA) for each wind turbine to determine whether the Project layout and lighting will impact navigable airspace or communications technology used in aviation operations. The FAA issued Determinations of No Hazard for the Project on July 3, 2019.

The Project will be compliant with PU-08-32 Order paragraphs 8 (compliance with National Electric Safety Code), 11 (restoration of township and county roads), 23 (traffic control), and 29 (mitigation of television and radio interference, if occurs).

Sound – At the time the Ashtabula I WEC was constructed, the Commission did not have a regulation for wind energy conversion facilities regarding acoustic standards. During initial siting, Ashtabula Wind did however predict the distance of sound levels for a single GE model 1.5sle wind turbine (Docket No. 5, Figure 10) and used the generally accepted acoustic standard of less than 50 dBA at any occupied residence. The setback distance to achieve 50 dBA or less was calculated at 1,400 feet. As described above, no turbine locations will change as a result of the Project.

The Project's operational sound has been predicted and assessed against the decibel (dB) standard presented in the Order (Docket No. 27 – Findings of Fact No. 27), the Barnes County sound limits of 75 dB during the day and 65 dB at night (Barnes County 2019), and the Commission's current 50 A-weighted sound level (dBA) sound limit. Ashtabula Wind obtained waivers from the four residences where 50 dBA is modeled to be exceeded. The results of the acoustic assessment are included in Appendix B.

Cultural Resources – As discussed, Ashtabula Wind proposes to complete the Project entirely within the Commission's previously approved site boundary and the Project will utilize prior construction easements. However, for due diligence purposes, Ashtabula Wind restudied cultural resources within the site boundary as an update to Ashtabula I WEC's original cultural resource studies (Application, Appendix C in PU-08-32 Docket No. 5). AECOM coordinated with the State Historical Society of North Dakota (SHSND) on the appropriate scope and level of survey. At the request of the SHSND, AECOM completed a Class I Literature Search and a Class III Intensive Cultural Resources Inventory. The Class I Literature Search included a one-mile study area surrounding the Project Area. A desktop review of previously recorded architectural sites was also completed at the request of the North Dakota State Historic Preservation Office (NDSHPO) to determine if the Project had the potential to impact the National Register of Historic Places (NRHP) eligibility of previously evaluated eligible architectural sites within a two-mile area surrounding the Project.

The Class I Literature Search identified six previous cultural resource inventories conducted within the one-mile study area. No previously recorded resources were located within the Project Area. Within the one-mile study area, there are 13 previously recorded archaeological resources, four archaeological site leads, four architectural sites, and six architectural site leads. The Project is not expected to impact the NRHP eligibility of any previously recorded architectural sites within two miles of the Project Area. The Class III Intensive Cultural Resources Inventory recorded 12 prehistoric isolated finds, 14 historic isolated finds, 10 historic sites, and one prehistoric site lead. The Class III Intensive Cultural Resources Inventory Report was submitted to the SHSND for review and concurrence. Ashtabula Wind will file the NDSHPO's concurrence regarding the Project as soon as it is received.

Ashtabula Wind will avoid all documented sites recommended as eligible or unevaluated within the Project footprint; therefore, no impacts to archaeological or historic resources are anticipated.

Recreational Resources – The Project will not create any new impacts to recreational resources, and therefore, no mitigation is necessary.

Land-Based Economics – The Project will not permanently take any acreage out of cropland or hayland production. Minimal cropland, hayland, and grassland will be impacted during construction. These impacts will be temporary and restored to their original condition unless otherwise directed by a landowner. No permanent impacts to cropland and hayland production will occur. No impacts to livestock are expected. Ashtabula Wind will compensate landowners for any temporary cropland loss.

Soils – Soil-disturbing activities, including grading for access road widening, have the potential to contribute to soil erosion through the exposure of soils that were previously vegetated and stable. The Project will use areas previously sited by the Commission for construction of the Project, including temporary impacts to previously disturbed laydown yards and turning radii. Minimal land will be temporarily impacted by the Project. No permanent soil impacts will occur as a result of the Project as all temporarily disturbed areas will be restored to preconstruction conditions, and coordinated with the North Dakota Department of Transportation and/or Barnes County, as applicable.

To minimize soil impacts, Ashtabula Wind will implement best management practices (BMP), which may include the separation of topsoil and subsoil, use of silt fences, erosion blankets, temporary seeding, and straw wattles during construction, as well as permanent seeding and noxious weed control. Vehicle speed will also be limited on Project roads to minimize dust during construction and operation. Ashtabula Wind will implement a Storm Water Pollution Prevention Plan (SWPPP) during construction to mitigate disturbed soils and prevent erosion and contamination of surface waters.

The above minimizations and mitigations comply with PU-08-32 Order paragraphs 4 (compliance with local, state, and federal regulations), 12 (suspension of construction if weather conditions may cause irreparable damage), 13 (reclamation, fertilization and reseeding), 14 (reclamation and maintenance throughout the life of the facility), 16 (trees and vegetation replacement), 18 (repair/replace damaged drain tiles), and 21 (restoration of construction area).

Geologic and Groundwater Resources – The Project is not expected to disturb any geologic or groundwater resources. Minor land changes will occur during construction and groundwater withdrawals will not be necessary. Mitigation measures are unwarranted.

Surface Water, Wetlands, and Floodplain Resources – The Project is not anticipated to result in adverse permanent impacts to surface water, wetlands, or floodplain resources. The Project will temporarily impact land during construction and have the potential to indirectly impact surface water resources via stormwater runoff. Coverage under the North Dakota Department of Health's (NDDH) National Pollutant Discharge Elimination System (NPDES) general construction permit will be obtained and filed with the Commission prior to the start of construction, and sediment runoff into surface waters will be minimized and/or avoided through the implementation of BMPs outlined in the accompanying SWPPP.

Ashtabula Wind restudied wetlands and other waters (collectively, "waters") as an update to PU-08-32 Docket No. 308. Other waters can include, but are not limited to, streams, ponds, impoundments, prairie potholes, and lakes. Wetland delineations for the Project followed the methodology from the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Great Plains Region (Version 2.0) (USACE 2010). Field surveys were conducted within the Project Area in May 2019. Due to record high precipitation in May 2019, which caused overland flooding in agricultural fields, field delineations were modified using aerial photography from the last ten years. A total of 94 wetlands and seven streams were delineated within the Project Area. No wetlands or streams will be permanently

impacted by Project infrastructure. Maps depicting the delineated wetlands and streams are included in Figure 3.

Ashtabula Wind will avoid permanent impacts to all wetlands or water bodies. Construction of the Project will occur in previously disturbed construction areas, and therefore temporary impacts to wetlands or water bodies are expected to be minimal and consistent with the initial construction of the Ashtabula I WEC. Any minimal temporary impacts will be restored following Project construction. Ashtabula Wind coordinated with the USFWS Valley City Wetland Management District (WMD) to obtain USFWS easements within the Project area. Since the construction of the Ashtabula I WEC, the USFWS has added easements around the Project as seen between AT106 and AT107 (Figure 3, map 21). As stated in Docket No. 25 Ashtabula Wetlands Summary, the locations of USFWS easement basins were reviewed onsite with the WMD in order to confirm that no impacts occur from Ashtabula I WEC construction activities.

Vegetation – Temporary impacts to vegetation will occur in areas that were previously impacted during the initial construction of the Ashtabula I WEC. Any temporarily impacted vegetation will be restored to its current use. Therefore, no permanent impacts to vegetation will occur.

Following construction, impacts to temporarily disturbed grassland areas will be mitigated by reseeding with a weed-free seed mixture consistent with the surrounding vegetation and landowner's agreement. Proper BMPs will be used for successful revegetation. Areas currently in cropland or hayland will be replaced in coordination with landowner agreements. Once revegetated, these areas will be available to return to their present use. No trees or shrubs are anticipated to be removed during construction.

The above minimizations and mitigations comply with PU-08-32 Order paragraphs 4 (compliance with local, state, and federal regulations), 13 (reclamation, fertilization and reseeding), 14 (reclamation and maintenance throughout the life of the facility), 16 (trees and vegetation replacement), and 21 (restoration of construction area).

Wildlife – Impacts to designated threatened and endangered species are not anticipated. No designated critical habitat for threatened or endangered species exists within the Ashtabula I WEC site boundary. Potential impacts from the Project to avian and bat species include collisions with wind turbines; however, these impacts are no greater than previously anticipated for the Ashtabula I WEC. As the Ashtabula I WEC was developed prior to the USFWS issuing the 2012 voluntary wind energy guidelines, Ashtabula Wind will voluntarily develop a Wildlife Conservation Strategy (WCS), which includes an adaptive management approach, so that information gathered can be used to inform future management decisions at the Project. Ashtabula Wind will continue to implement the Wildlife Response and Reporting System (WRRS). The reporting system includes protocols from field technicians during routine maintenance and operations to report and document any avian impacts. Ashtabula Wind will also continue to implement an Adaptive Management Plan, which was developed for both construction activities and post-construction operations and details appropriate responses for various types of avian sightings.

The Project will not impact waterfowl production areas administered by the USFWS beyond what was permitted during the initial construction of the Ashtabula I WEC. The Project will continue to be compliant with PU-08-32 Order paragraph 24 (extraordinary events-large mortality of birds and/or bats).

The USFWS Information for Planning and Conservation (IPaC) tool (USFWS 2019), indicated that three Threatened and Endangered species could potentially occur within the Project Area. These species include the whooping crane (*Grus Americana*) (endangered), northern long-eared bat (NLEB, *Myotis septentrionalis*) (threatened), and Dakota skipper (*Hesperia dacotae*). The Project is located outside the whooping crane migration corridor and the Project is consistent with the previous assessment for whooping cranes (Docket No. 5, Section 7.16). The Project's surrounding land use is primarily agriculture land dedicated to growing crops.

In November 2014, after the Commission's issued the Ashtabula I WEC siting certificate, the USFWS listed the Dakota skipper threatened under the Endangered Species Act. However, there is no designated critical Dakota skipper habitat present in Barnes County (80 FR 59247-59384). The Project utilizes existing infrastructure and will result in only minimal temporary disturbances to previously disturbed areas. Adverse impacts to Dakota skipper are not anticipated.

Subsequently, in April 2015, the USFWS listed the NLEB as threatened under the Endangered Species Act. Ashtabula I is within the geographic range of the NLEB, and thus Ashtabula Wind assessed the potential for NLEB to occur. Suitable NLEB habitat consists of forested areas that are used for summer roosting as well as spring staging and fall swarming were located near hibernacula. Based on a desktop review and site visits, the expected use and occurrence of the NLEB is low due to lack of suitable habitat within and in the vicinity of the Ashtabula I. Since operations began, no NLEB have been reported through the WRRS. Adverse impacts to the NLEB are not anticipated.

The Project will continue to be compliant with PU-08-32 Order paragraphs 9 (threatened and endangered species, critical habitat, and bald/golden eagles) and 24 (extraordinary events-mortality events of threatened or endangered species; large mortality of birds and/or bats).

Permits and Approvals

As part of the initial permitting process, Ashtabula Wind received a Conditional Use Permit (CUP) from Barnes County for the Ashtabula I WEC. Ashtabula Wind amended the CUP to include changes from the Project and obtained county authorization on June 18, 2019. Ashtabula Wind will obtain, as applicable, all necessary permits or approvals prior to engaging in construction activities for which said permit or approval is required, including those from the Commission, SHSND, NDDH, North Dakota Highway Patrol, and North Dakota Department of Transportation, and will file copies with the Commission pursuant to PU-08-32 Order paragraph 4.

Factors Considered

The preceding sections and attached appendices discuss the potential Project effects on public health and welfare, natural resources, and the environment. As discussed, the Project will continue to have minimal adverse effects as those currently in existence for the Ashtabula I WEC, and will continue to comply with the provisions of the Order.

Table 1. Summary of Environmental Resource Impact Analysis and Mitigation in Determining Consistency with Ashtabula Wind Energy Center Findings of Fact, Conclusions of Law and Order (PU-08-32).

Resource	Impact	Mitigation
Socioeconomics	Positive economic and social consequences.	None proposed.
Land Use	Utilizes previously disturbed areas and only land needed will be temporarily impacted.	Will restore temporarily impacted areas.
Public Services	Temporary increases in construction truck traffic will occur during construction period.	None proposed.
Human Health and Safety	Turbine lighting will continue to meet FAA requirements. Shadow flicker is predicted to be more than 30 hours per year at three residences.	Waivers obtained for shadow flicker exceedances.
Sound	The sound within 100 feet of an inhabited residence is predicated to exceed 50 A-weighted sound level (dBA) at four residences.	Waivers obtained for sound exceedances.
Cultural Resources	No impacts to cultural resources are anticipated.	Will prepare an unanticipated discoveries plan prior to construction and filed with the Commission.
Recreational Resources	No impacts to recreational resources.	None proposed.
Land Based Economics	Minimal cropland, hayland, and grassland will be temporarily impacted during construction.	Will restore temporarily impacted areas.
Soils	Temporary land disturbance may cause soil surface to become more prone to wind and water erosion.	Will implement Best Management Practices (BMP) in association with the Storm Water Pollution Prevention Plan (SWPPP) for erosion and sediment to minimize wind and water erosion at the site, and will restore temporarily impacted areas.
Geologic and Groundwater Resources	No impacts to geological and groundwater resources are anticipated.	None proposed.
Surface Waters, Wetlands, and Floodplain Resources	All construction activities will occur in a manner that no additional impacts are anticipated.	Will avoid impacts implement BMPs in association with the SWPPP to minimize erosion and sedimentation. Construction compliance team will ensure avoidance of wetlands in close proximity to construction activities.

Resource	Impact	Mitigation
Vegetation	No impact to native prairie and woodland resources beyond what was expected in the original application beyond minimal temporary vegetation impacts.	Restoration of temporarily impacted areas, and avoidance of all trees and shrubs.
Wildlife and Natural Resources	<p>No impact to designated critical habitat for threatened or endangered species. Adverse impacts to threatened and endangered species are not anticipated.</p> <p>Continued compliance with waterfowl production area setback pursuant to Order paragraph variance for Turbine 128.</p> <p>No significant changes are anticipated The Project will not result in further impacts to native prairie, woodland resources, wetlands, migratory birds, and threatened and endangered species beyond what was expected in the initial application.</p>	Develop and implements a Wildlife Conservation Strategy and maintain the current Wildlife Response and Reporting System during operations.

References

Barnes County. 2019. Development Code, Zoning – Subdivision Regulations. Barnes County, North Dakota 2019. Accessed April 11, 2019. Available online at: <http://www.co.barnes.nd.us/dept/zoning/2019%20Development%20Code.pdf>

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

USACE (U.S. Army Corps of Engineers). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USFWS (U.S. Fish and Wildlife Service). 2018. 2018 Dakota Skipper (*Hesperia dacotae*) North Dakota Survey Protocol. Accessed April 11, 2019. Available online at: https://www.fws.gov/mountain-prairie/es/protocols/2018_FINAL%20Dakota%20Skipper%20Survey%20Protocol_4202018.pdf.

USFWS. 2019. Information for Planning and Consultation (IPaC). Accessed April 11, 2019. Available online at: <https://ecos.fws.gov/ipac/>.

Attachments

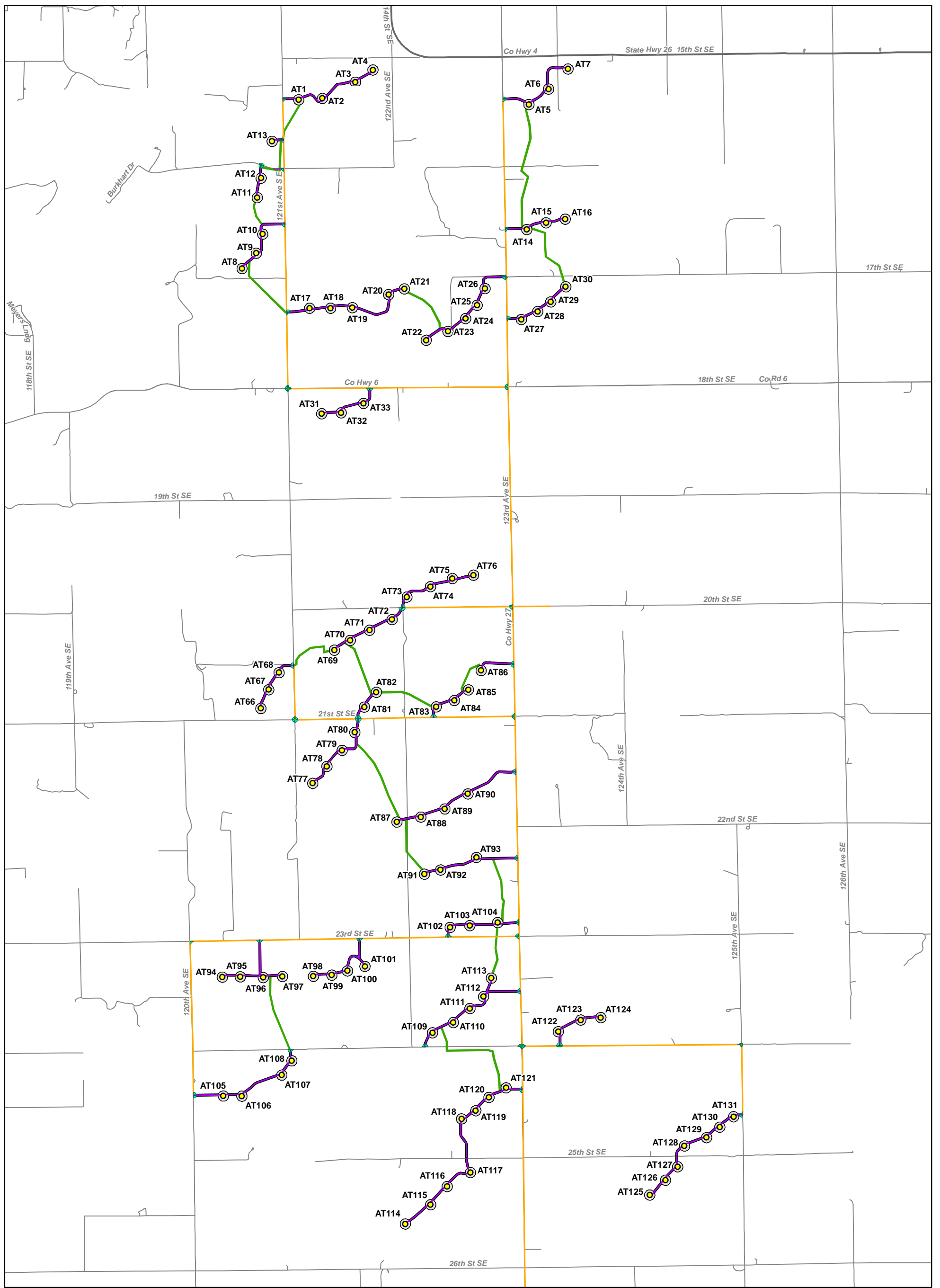
Figure 1. Location Map

Figure 2. Wind Turbine Diagram

Figure 3. Wetland and Other Waters Delineations Map

Appendix A – Shadow Flicker Assessment Results

Appendix B – Acoustic Assessment Results

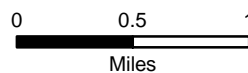


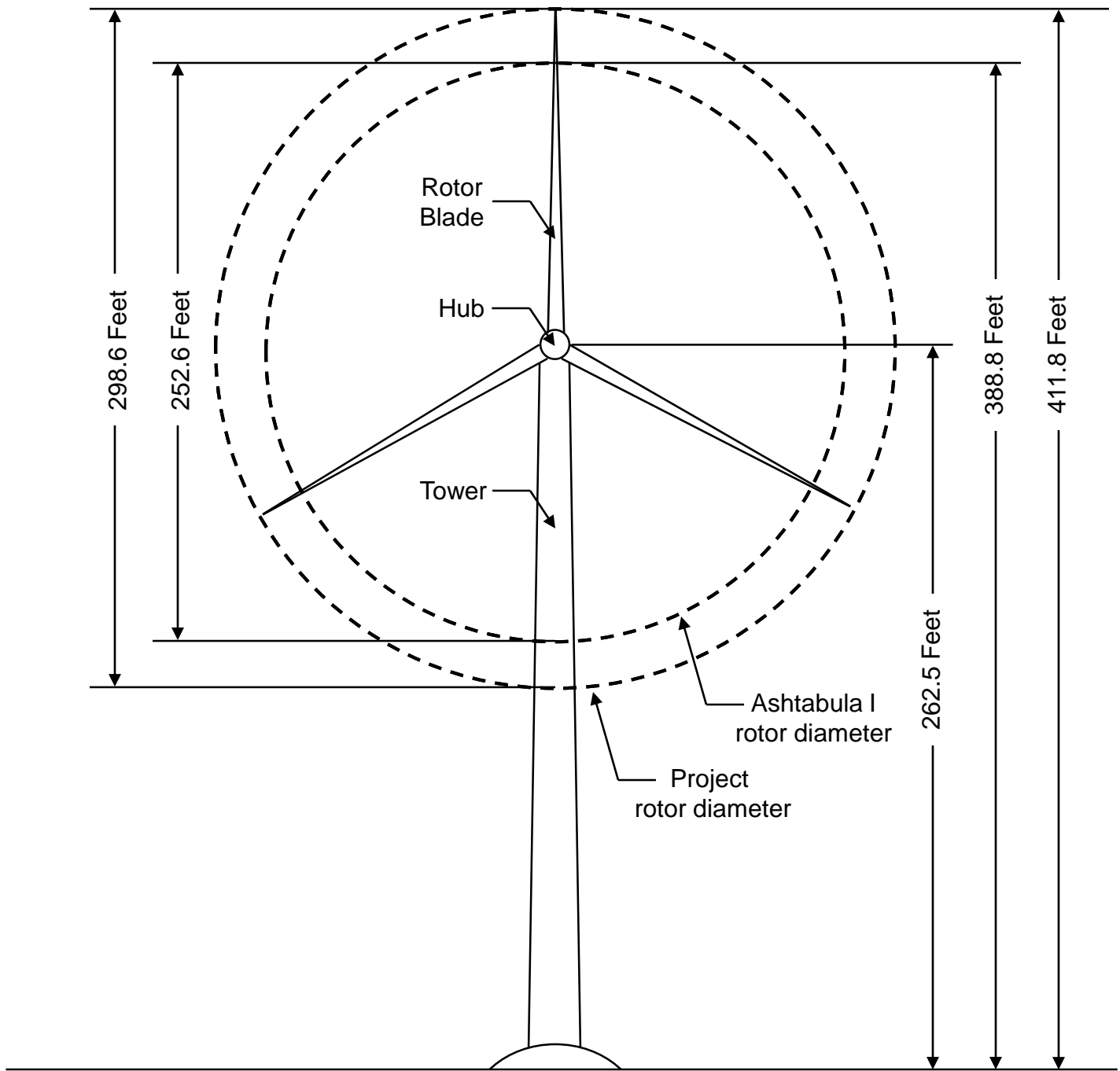
**ASHTABULA I
WIND ENERGY
CENTER
BARNES COUNTY
NORTH DAKOTA**

**Figure 1
Project Location**

LEGEND

- Turbine
- Haul Route
- Crane Path
- Access Road
- Construction Easement
- Turning Radius
- Existing Roads
- State Highway
- Other Roads










Not To Scale

Figure 2. Wind Turbine Diagram
Ashtabula I Wind Energy Center
Improvement Project

Change in rotor diameter from the existing
General Electric 1.5 SLE wind turbine
to the proposed General Electric 1.62 wind
turbine

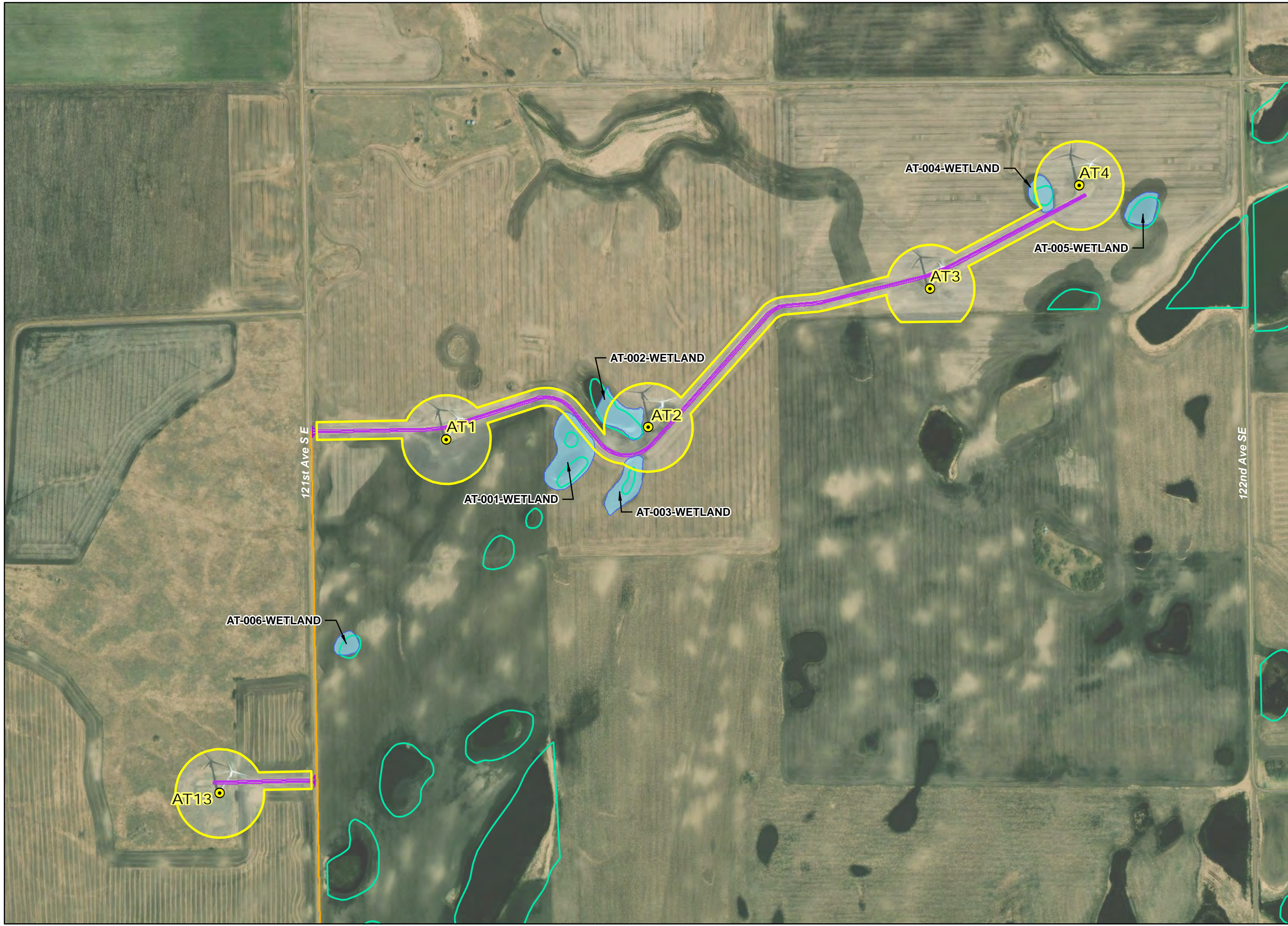
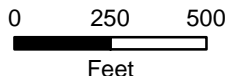
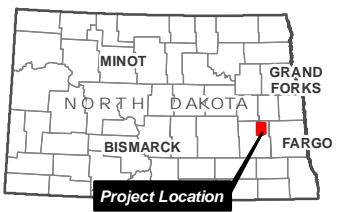
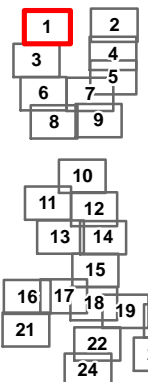
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 1 OF 24





**FIGURE 3
Wetland and Other
Waters Delineation Map**

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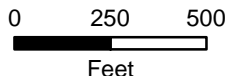
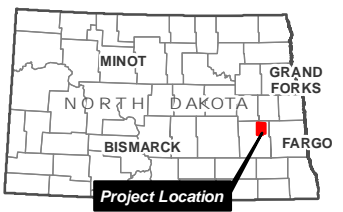
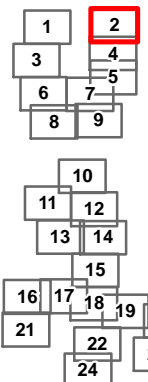
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
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LEGEND

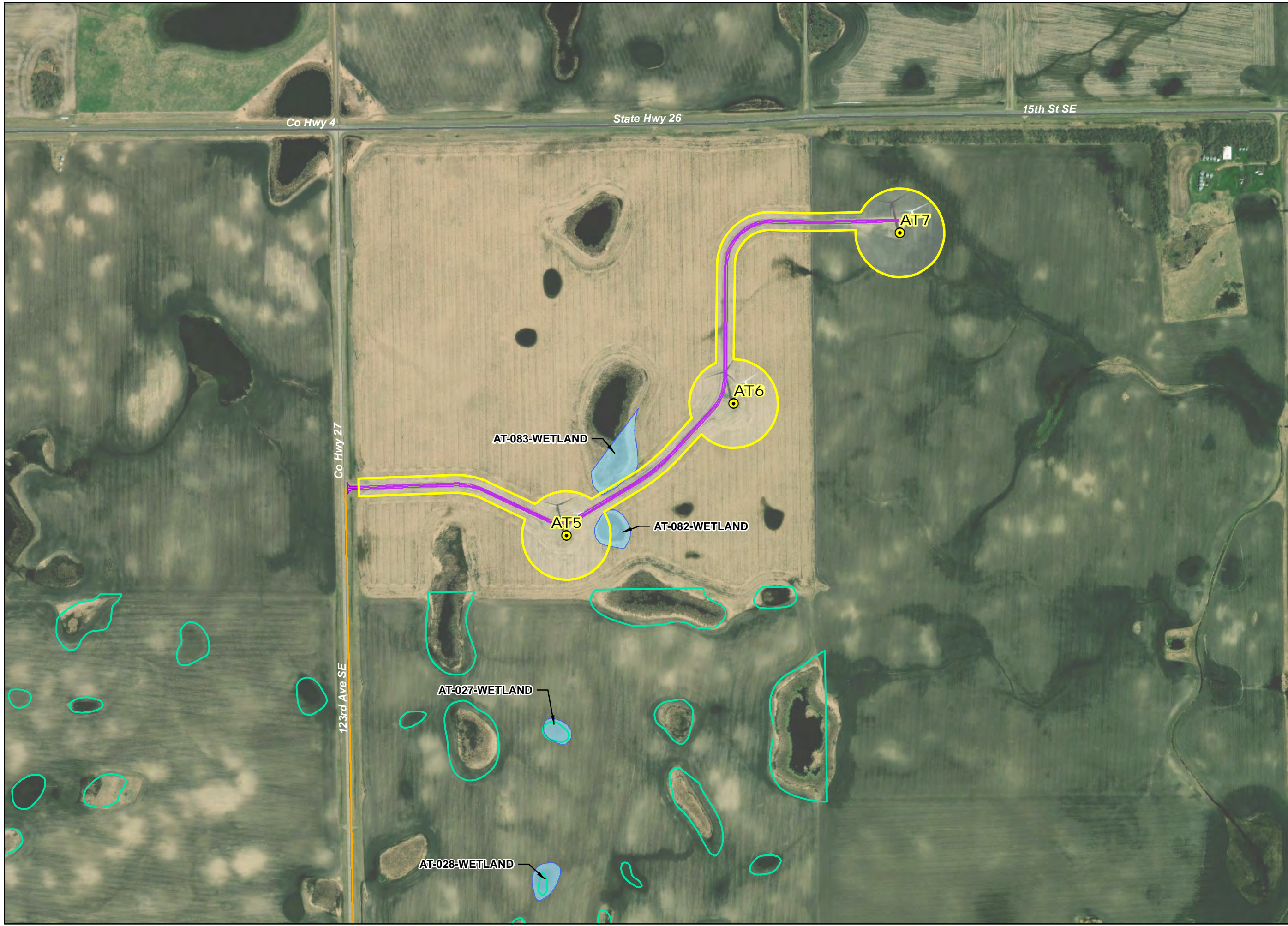
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Some USFWS Easements added after completion of Ashtabula I.

MAP 2 OF 24





**FIGURE 3
Wetland and Other
Waters Delineation Map**



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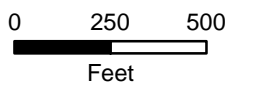
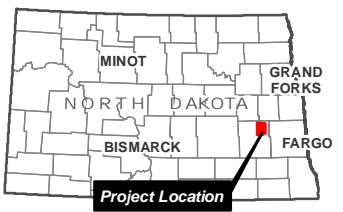
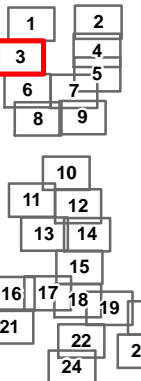
**ASHTABULA I
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LEGEND

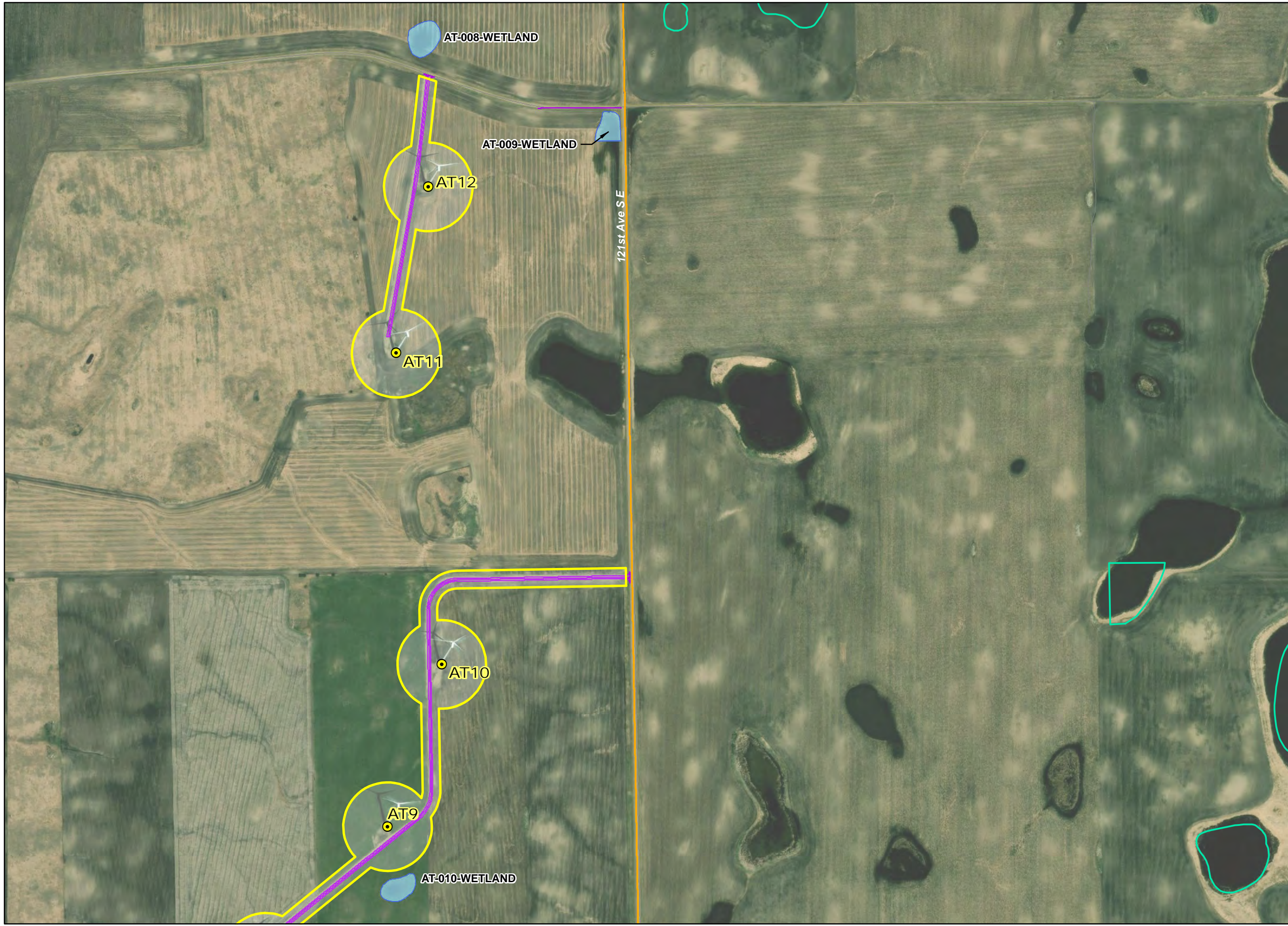
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Some USFWS Easements added after completion of Ashtabula I.

MAP 3 OF 24






**FIGURE 3
Wetland and Other
Waters Delineation Map**



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**ASHTABULA I
WIND ENERGY CENTER
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NORTH DAKOTA**

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MAP 4 OF 24

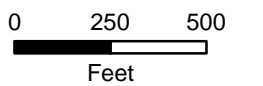
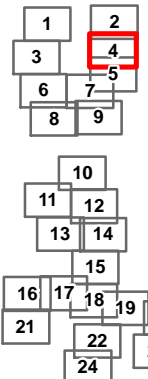
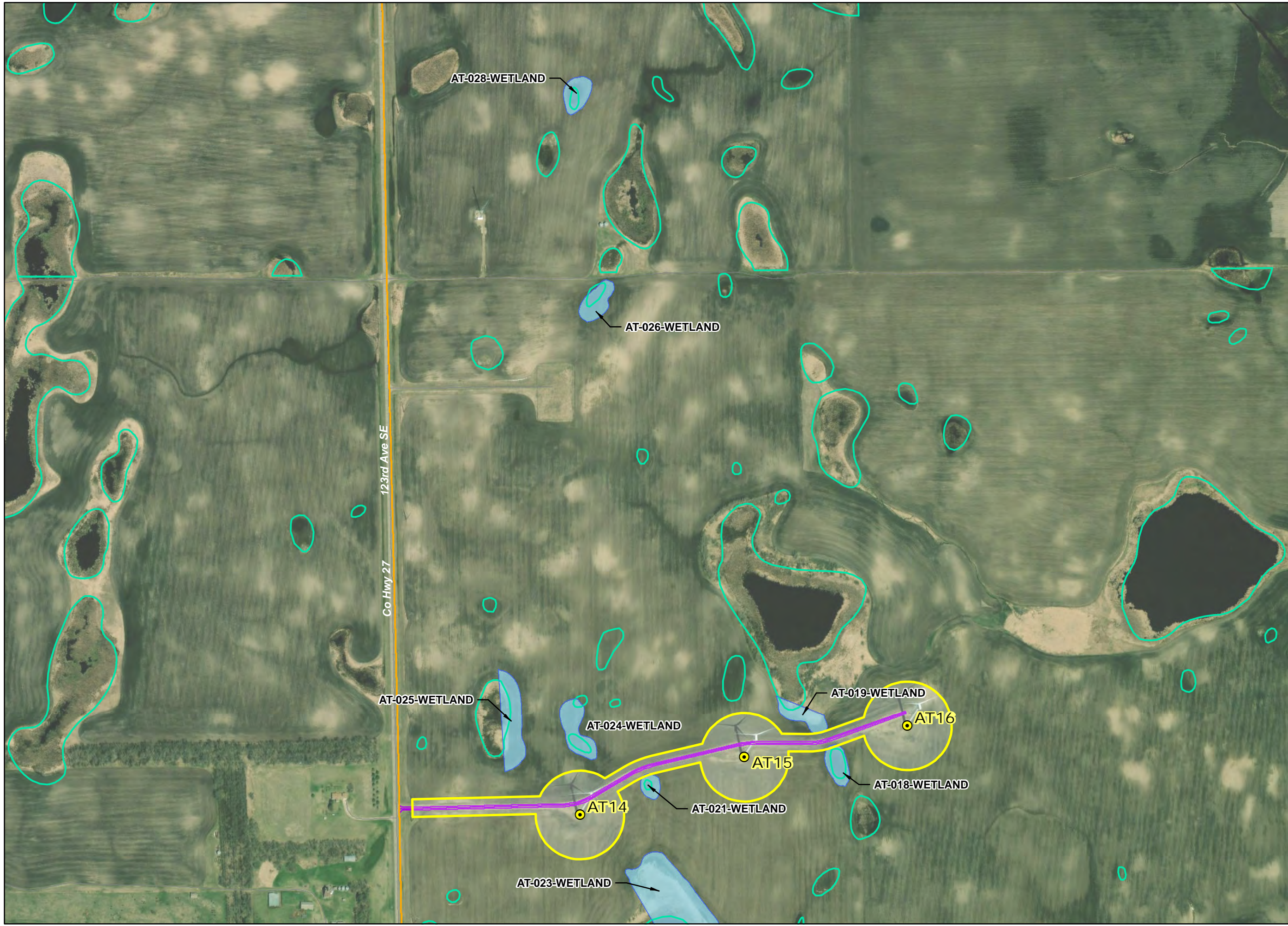


FIGURE 3

Wetland and Other Waters Delineation Map



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MAP 5 OF 24

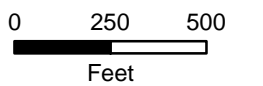
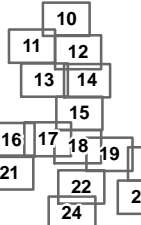
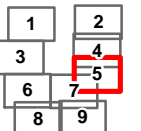


FIGURE 3






Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 6 OF 24

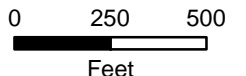
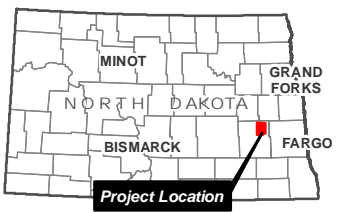
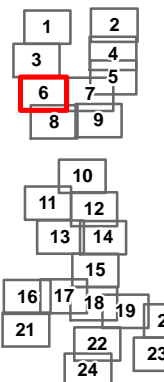







FIGURE 3
Wetland and Other Waters Delineation Map



M:\Denver_GIS\Projects\60578296_Ashstabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 7 OF 24

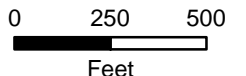
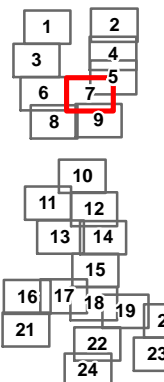




FIGURE 3
Wetland and Other Waters Delineation Map

M:\Denver_GIS\Projects\60578296_AshTabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
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-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 8 OF 24

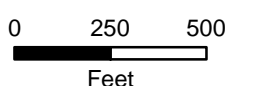
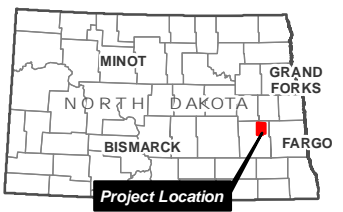
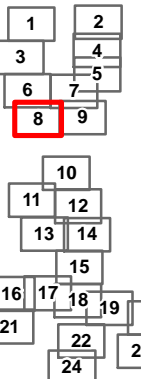
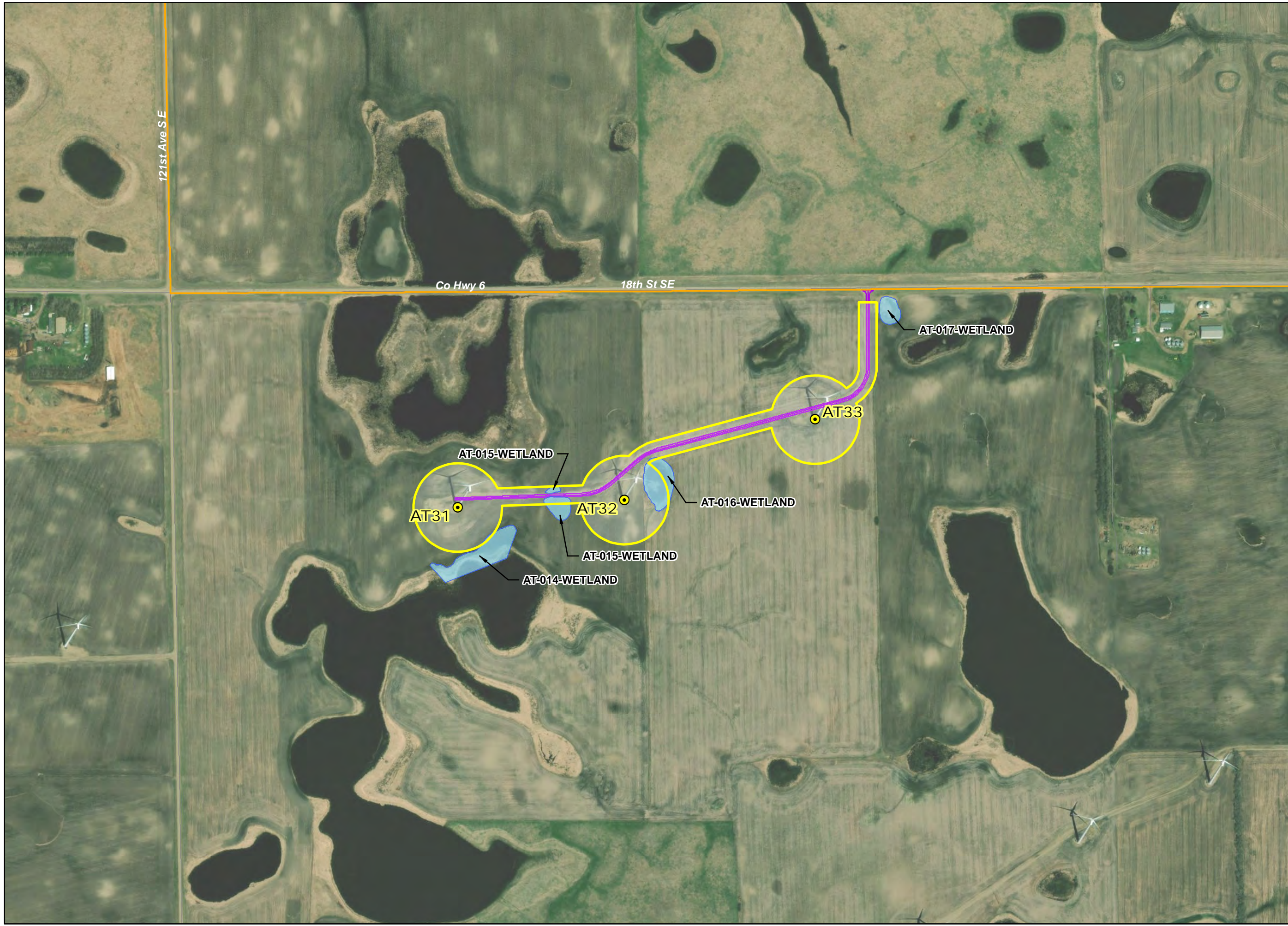



FIGURE 3
Wetland and Other Waters Delineation Map



M:\Denver_GIS\Projects\60578296_AshTabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

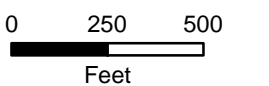
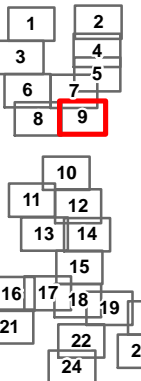
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
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-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 9 OF 24







**FIGURE 3
Wetland and Other
Waters Delineation Map**



M:\Denver_GIS\Projects\60578296_AshTabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

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-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 10 OF 24

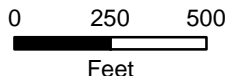
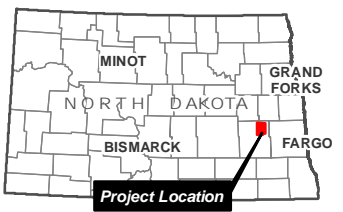
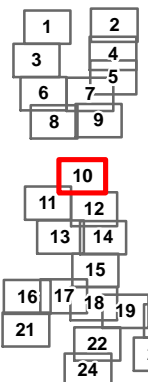


FIGURE 3








Wetland and Other Waters Delineation Map



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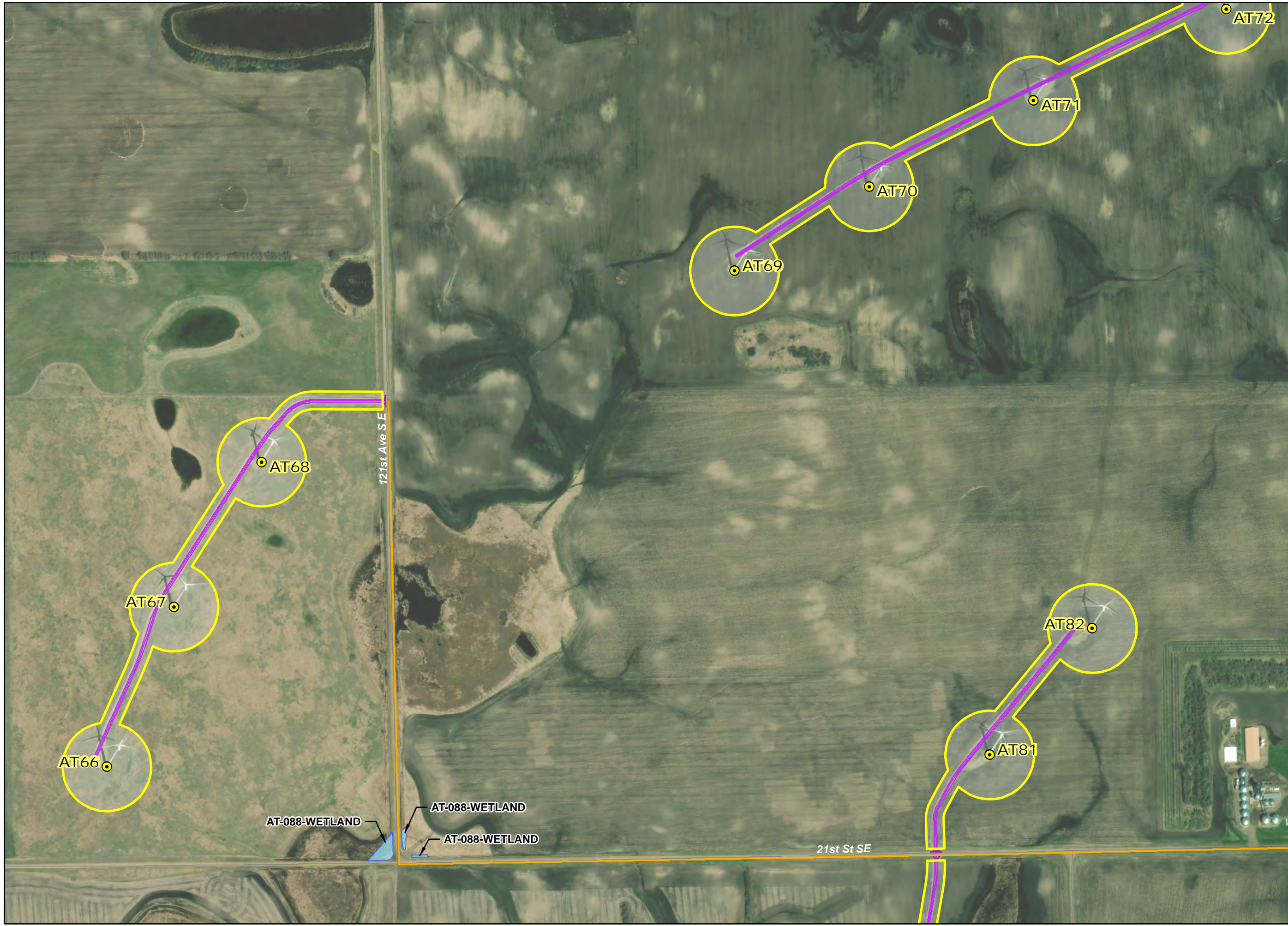
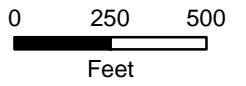
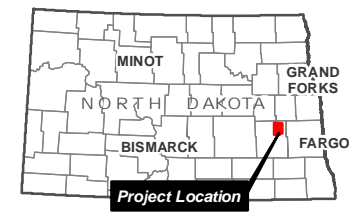
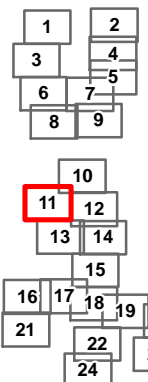
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 11 OF 24






**FIGURE 3
Wetland and Other
Waters Delineation Map**



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 12 OF 24

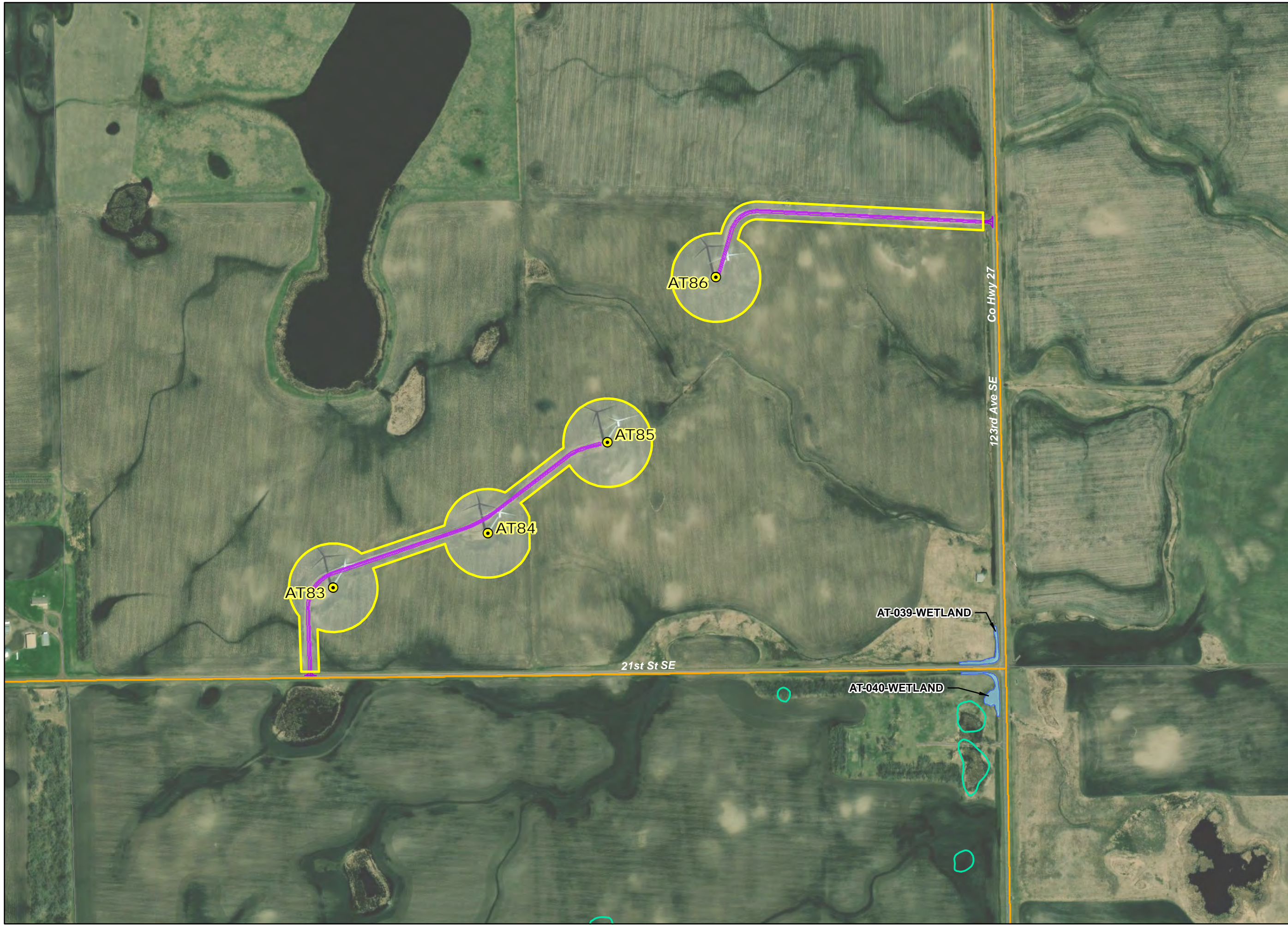
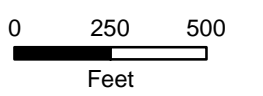
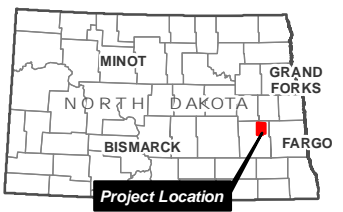
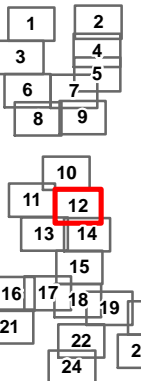


FIGURE 3






Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 13 OF 24

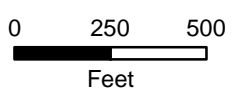
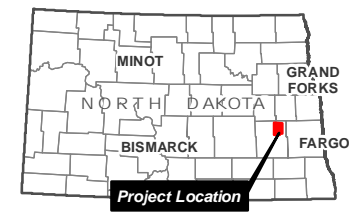
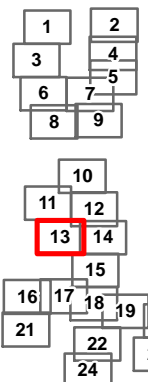


FIGURE 3








Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 14 OF 24

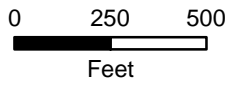
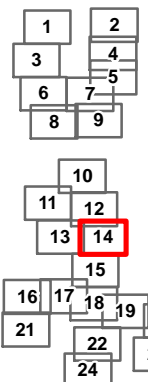


FIGURE 3






Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
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-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 15 OF 24

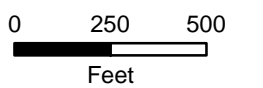
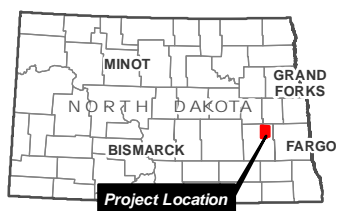
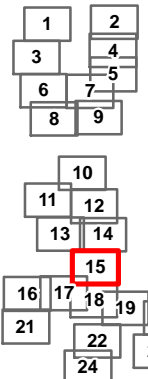
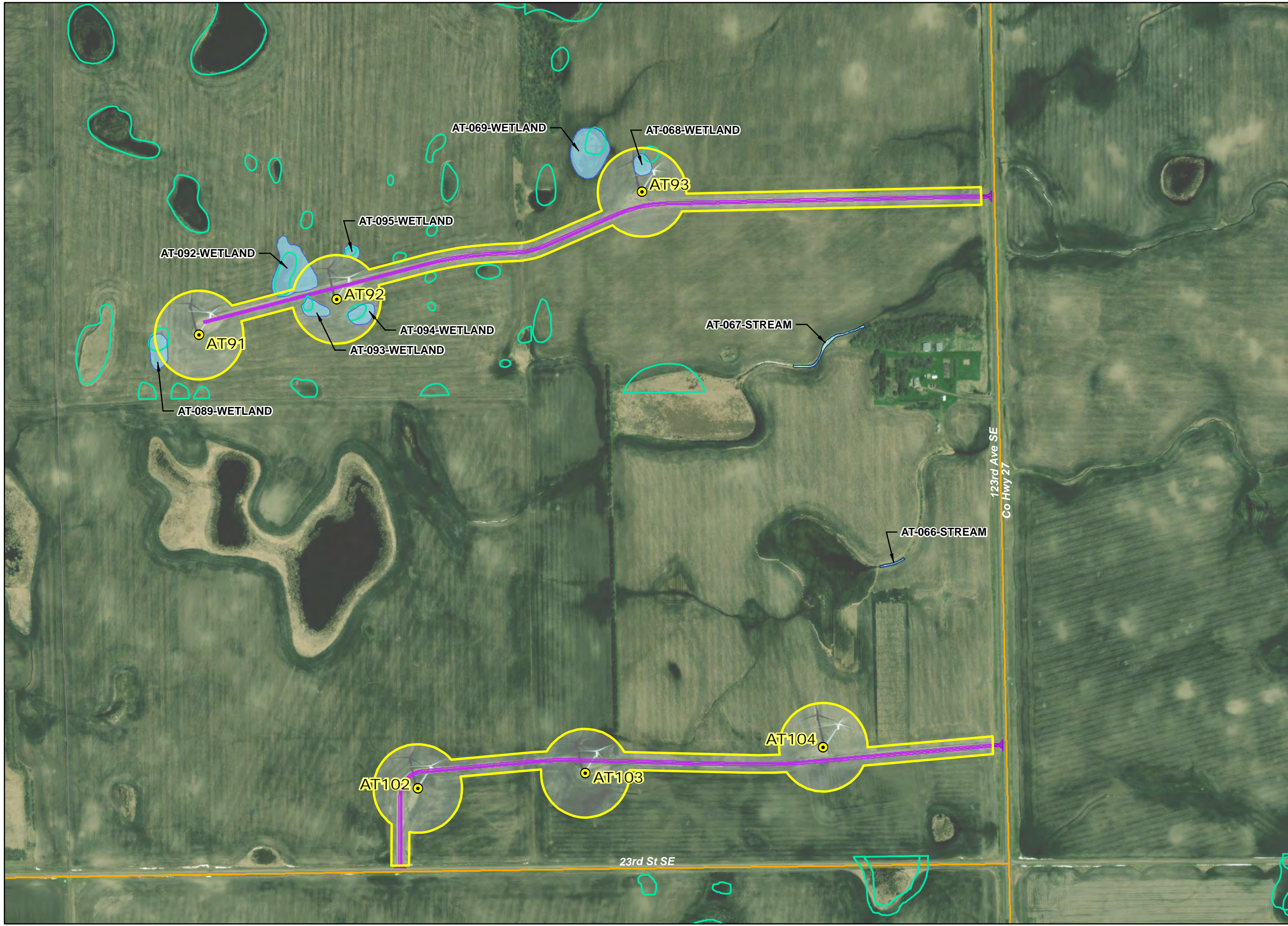


FIGURE 3






Wetland and Other Waters Delineation Map



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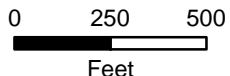
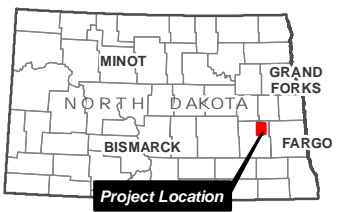
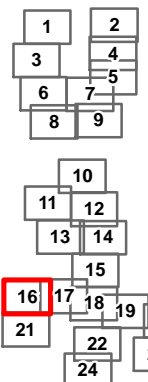
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

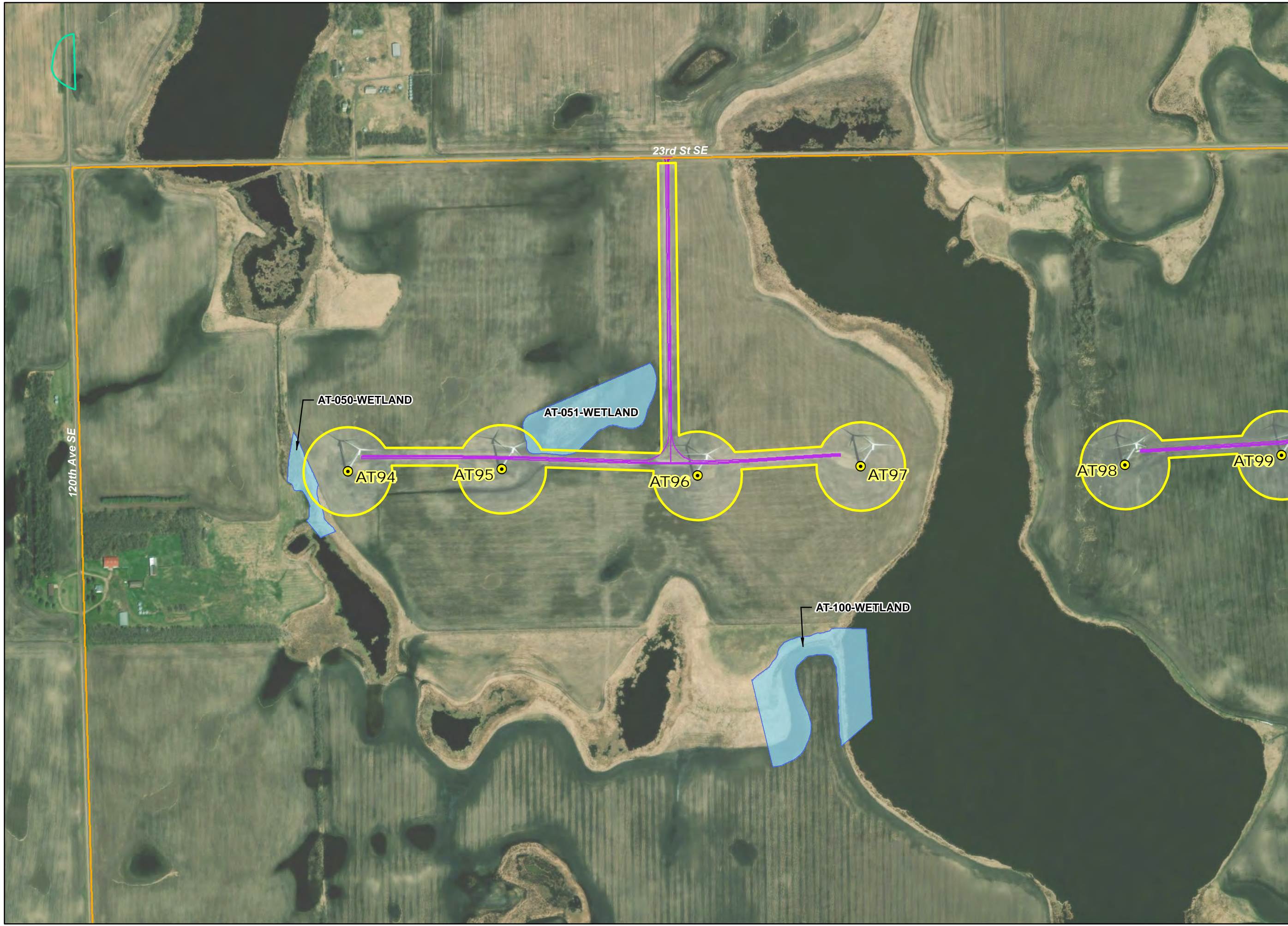
-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 16 OF 24







**FIGURE 3
Wetland and Other
Waters Delineation Map**



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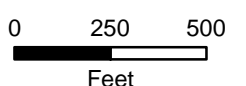
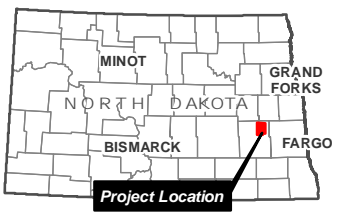
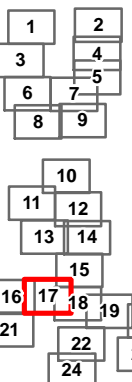
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

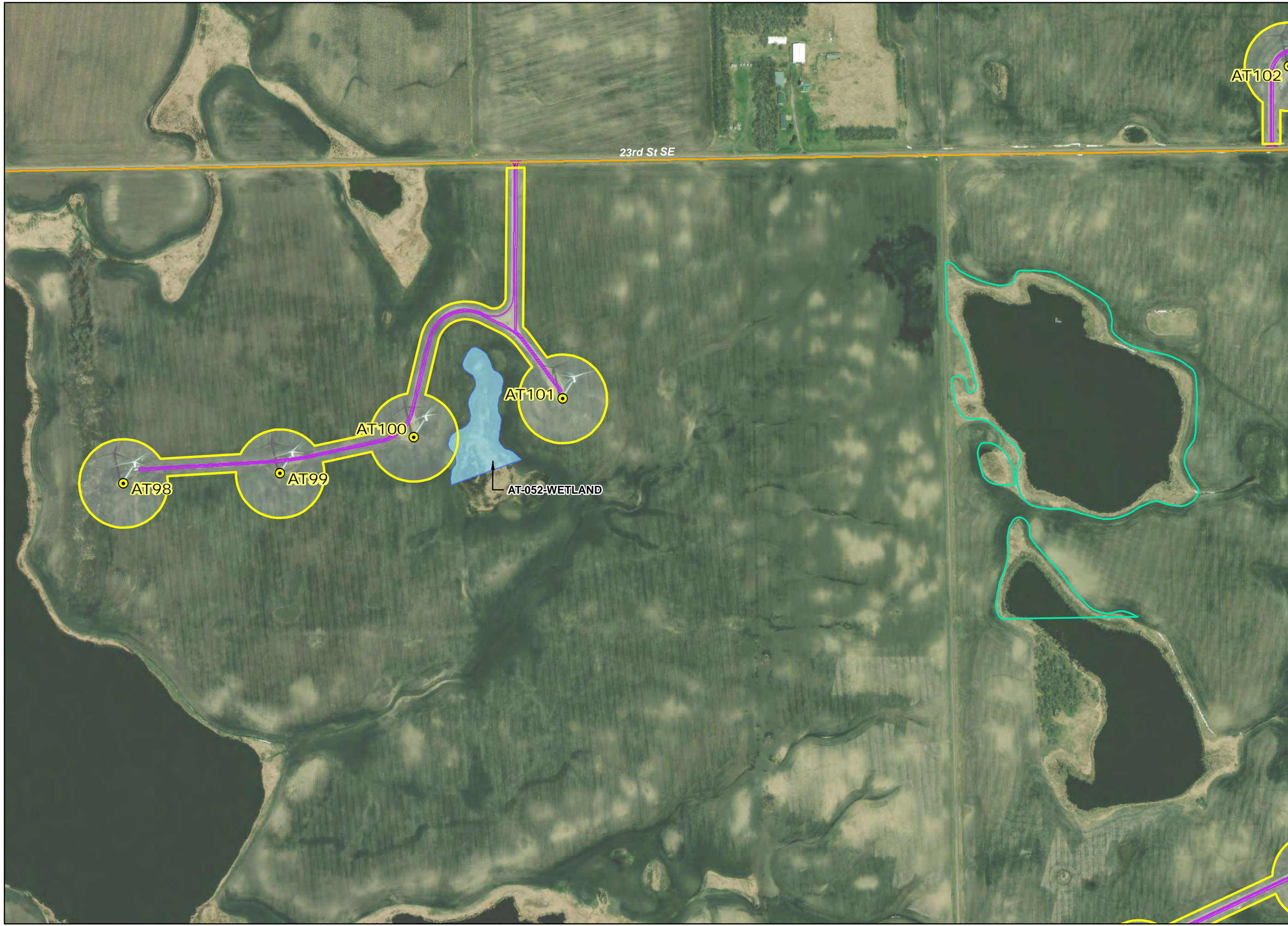
-  Turbine
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-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 17 OF 24








**FIGURE 3
Wetland and Other
Waters Delineation Map**



M:\Denver_GIS\Projects\60578296_Ashstabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

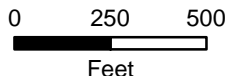
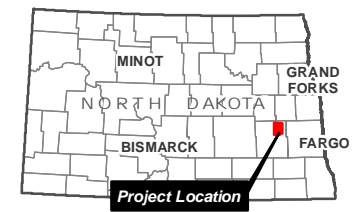
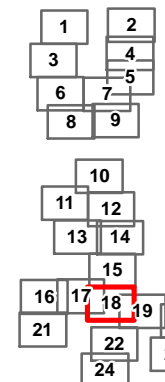
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

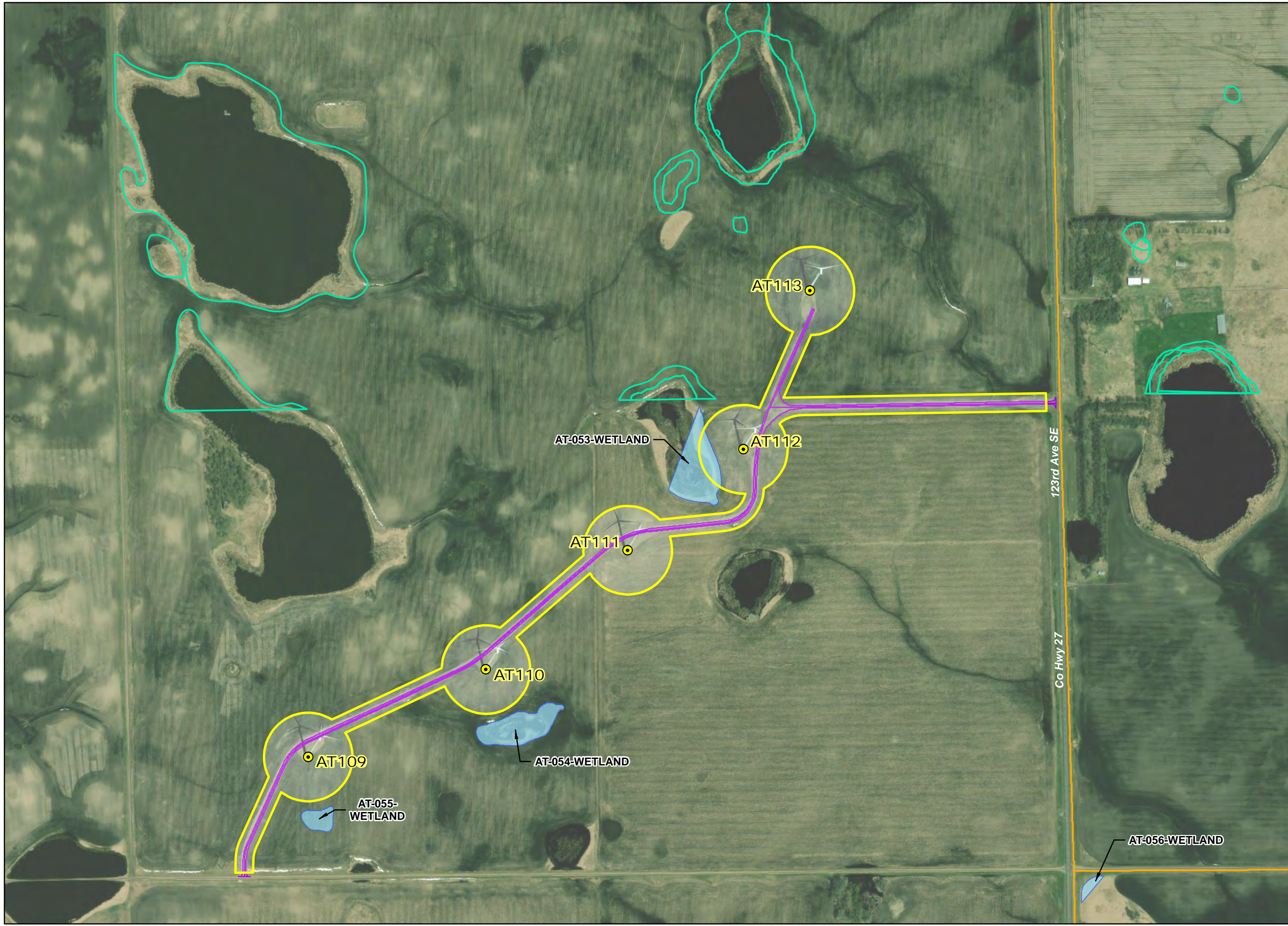
-  Turbine
-  Construction Easement
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-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 18 OF 24






**FIGURE 3
Wetland and Other
Waters Delineation Map**



M:\Denver_GIS\Projects\60578296_Ashstabula_I_Repower\Figures\Fig_03_00_Wetland_Map_Series.mxd 7/10/2019

**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

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MAP 19 OF 24

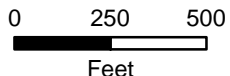
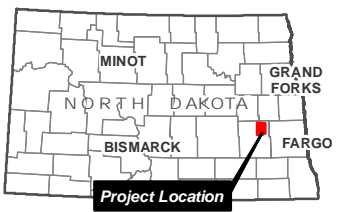
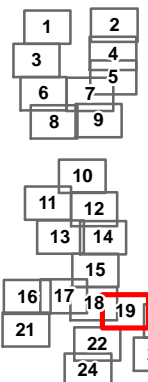


FIGURE 3







Wetland and Other Waters Delineation Map



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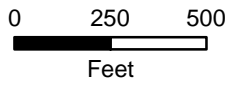
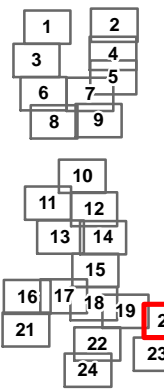
**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

LEGEND

-  Turbine
-  Construction Easement
-  Access Road
-  Haul Route
-  Field Delineated Wetland
-  Field Delineated Stream
-  USFWS Easement

Some USFWS Easements added after completion of Ashtabula I.

MAP 20 OF 24










**FIGURE 3
Wetland and Other
Waters Delineation Map**



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

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MAP 21 OF 24

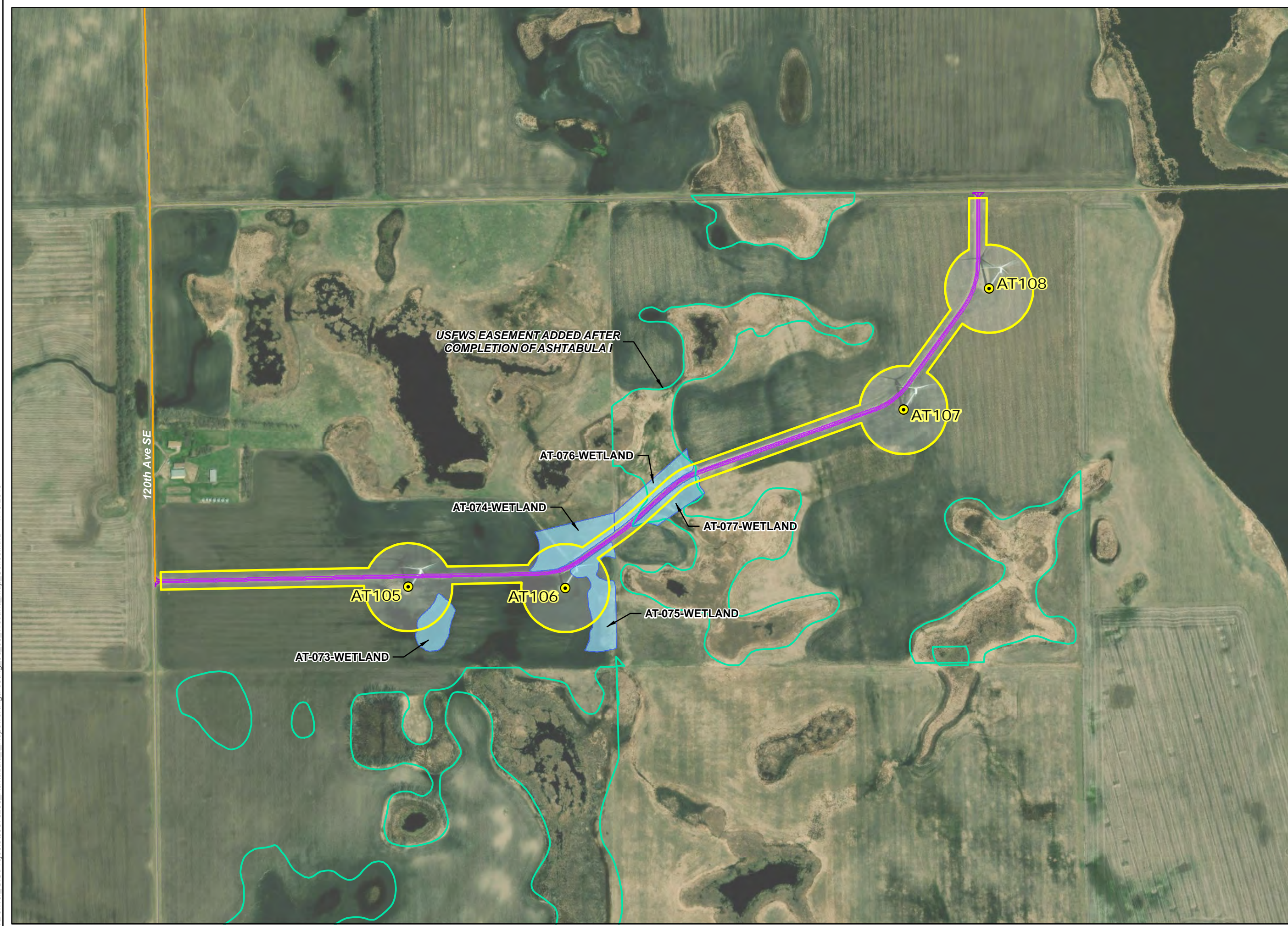
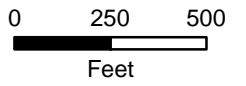
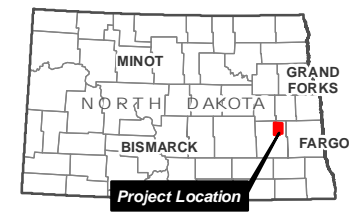
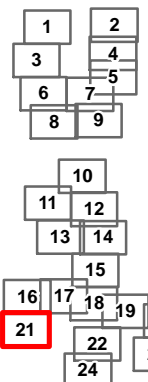





FIGURE 3
Wetland and Other Waters Delineation Map

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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

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-  Field Delineated Stream
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Some USFWS Easements added after completion of Ashtabula I.

MAP 22 OF 24

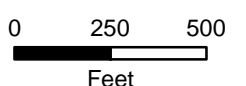
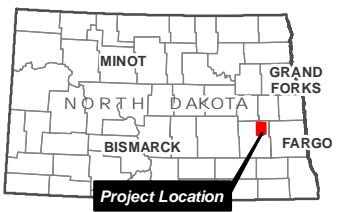
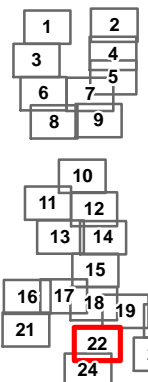
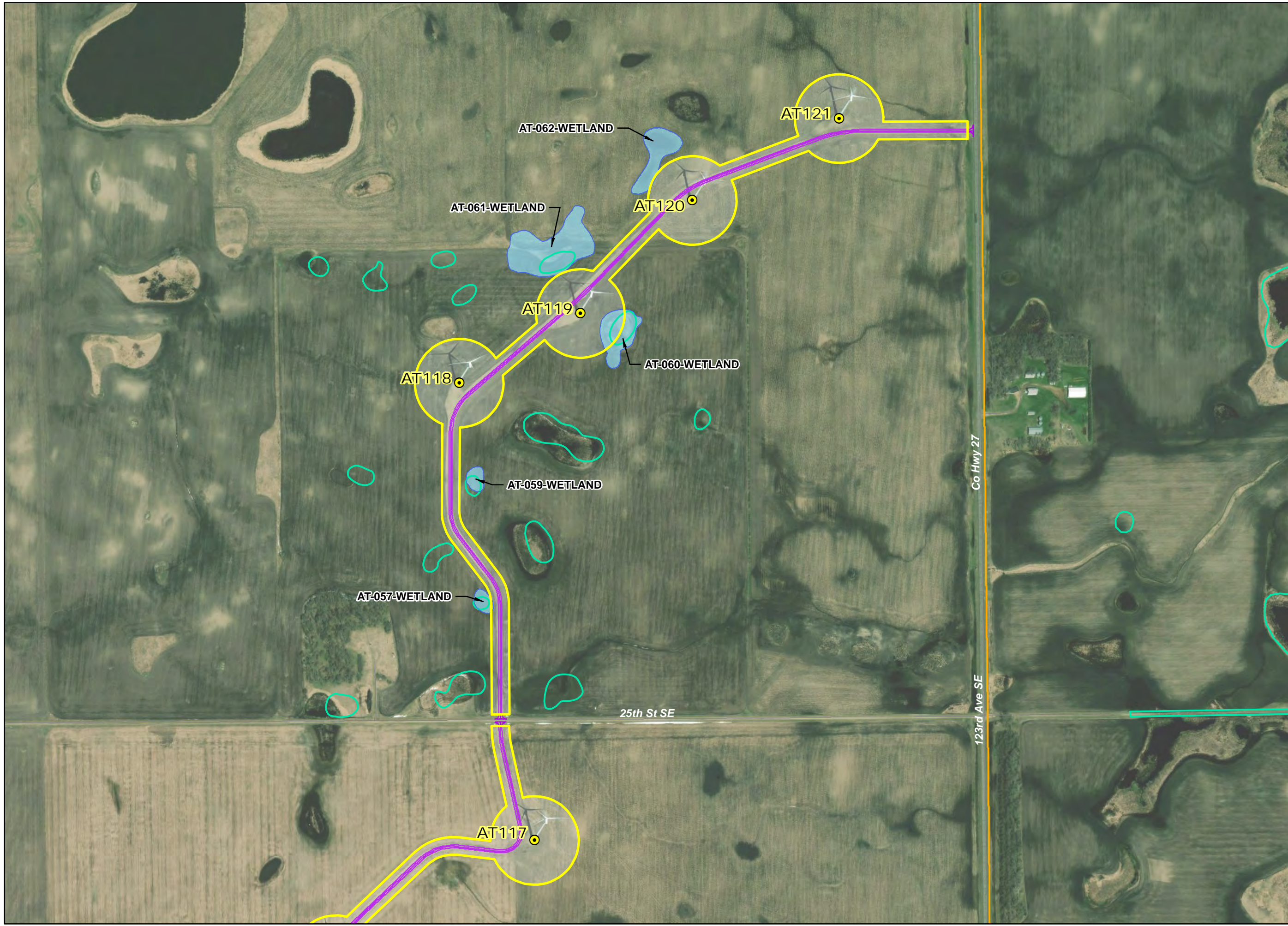


FIGURE 3





Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
NORTH DAKOTA**

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Some USFWS Easements added after completion of Ashtabula I.

MAP 23 OF 24

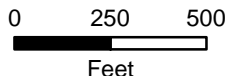
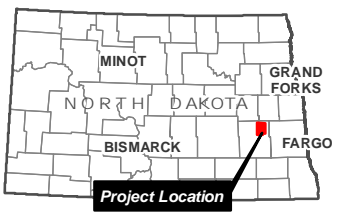
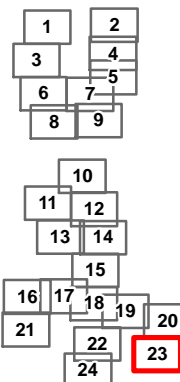
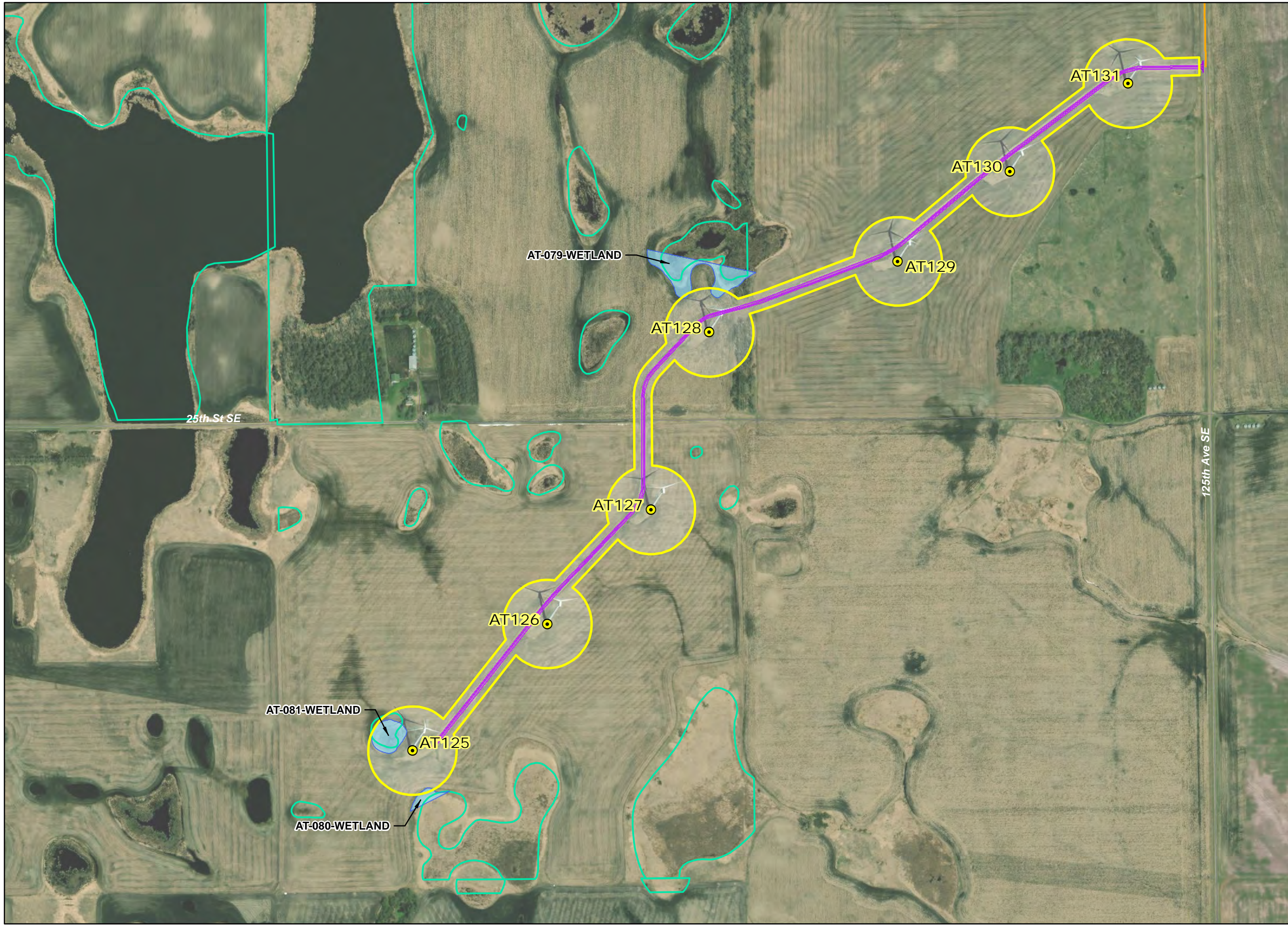


FIGURE 3







Wetland and Other Waters Delineation Map



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**ASHTABULA I
WIND ENERGY CENTER
BARNES COUNTY
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Some USFWS Easements added after completion of Ashtabula I.

MAP 24 OF 24

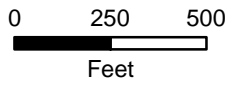
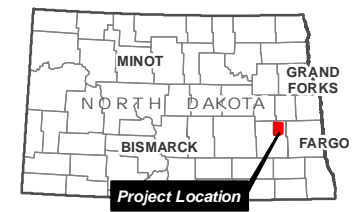
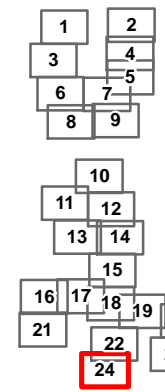


FIGURE 3
Wetland and Other Waters Delineation Map



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Appendix A

Shadow Flicker Assessment Results

Ashtabula I Wind Energy Center Improvement Project
Shadow Flicker Assessment Results

Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH001	NO	AT7	10333	584954	5230548	0.0	0.0	0.0	0.0
ASH002	NO	AT7	6714	584162	5229454	0.0	0.0	0.0	0.0
ASH005	YES	AT7	2700	584069	5228143	0.0	0.0	13.0	13.0
ASH007	YES	AT7	2055	585104	5227541	5.8	8.1	5.8	8.1
ASH008	NO	AT16	10057	587509	5225152	0.0	0.0	0.0	0.0
ASH010	NO	AT30	11452	587673	5222895	0.0	0.0	0.0	0.0
ASH011	NO	AT30	10682	587400	5222858	0.0	0.0	0.0	0.0
ASH012	YES	AT76	3656	583706	5220951	0.0	0.0	0.0	0.0
ASH013	YES	AT76	3433	583692	5220879	0.0	0.0	0.0	0.0
ASH014	NO	AT90	7053	585114	5217288	0.0	0.0	0.0	0.0
ASH015	NO	AT90	4396	584353	5216930	0.0	0.0	0.0	0.0
ASH016	NO	AT104	4066	584692	5214846	0.0	0.0	0.0	0.0
ASH017	NO	AT131	5264	586876	5213680	0.0	0.0	0.0	0.0
ASH018	YES	AT121	1813	583871	5212031	5.0	8.6	5.0	8.6
ASH020	NO	AT131	6911	588611	5210828	0.0	0.0	0.0	0.0
ASH022	NO	AT126	5482	586982	5209860	0.0	0.0	0.0	0.0
ASH022a	NO	AT126	5526	587004	5209861	0.0	0.0	0.0	0.0
ASH023	NO	AT115	7581	583918	5208985	0.0	0.0	0.0	0.0
ASH024	NO	AT125	9813	584400	5208229	0.0	0.0	0.0	0.0
ASH025	NO	AT114	8938	583800	5208376	0.0	0.0	0.0	0.0
ASH026	YES	AT114	2052	581752	5209985	0.0	0.0	0.0	0.0
ASH026a	YES	AT114	2098	581780	5209951	0.0	0.0	0.0	0.0
ASH027	NO	AT114	2493	581833	5209793	0.0	0.0	0.0	0.0
ASH028	NO	AT114	2501	581851	5209784	0.0	0.0	0.0	0.0

Ashtabula I Wind Energy Center Improvement Project
Shadow Flicker Assessment Results

Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH030	NO	AT114	3750	581641	5209458	0.0	0.0	0.0	0.0
ASH031	NO	AT114	10734	579830	5208150	0.0	0.0	0.0	0.0
ASH032	NO	AT114	6110	580343	5209890	0.0	0.0	0.0	0.0
ASH033	NO	AT114	6146	580324	5209912	0.0	0.0	0.0	0.0
ASH034	YES	AT115	2283	582013	5211309	9.4	13.6	9.4	13.6
ASH035	YES	AT115	2409	581991	5211341	2.9	11.0	7.1	11.0
ASH036	YES	AT115	2473	581960	5211339	5.2	12.9	9.1	12.9
ASH037	NO	AT105	6943	578179	5210676	0.0	0.0	0.0	0.0
ASH038	NO	AT105	8610	577443	5210670	0.0	0.0	0.0	0.0
ASH039	YES	AT106	2530	579842	5211620	0.0	0.0	0.0	0.0
ASH040	YES	AT105	1556	579026	5212624	17.1	23.8	17.1	23.8
ASH041	YES	AT94	1565	578986	5213919	25.4	33.0	25.4	33.0
ASH042	YES	AT94	1821	578902	5213917	18.7	30.0	23.2	30.0
ASH044	YES	AT101	1984	581886	5214753	1.7	18.3	1.7	18.3
ASH045	YES	AT93	1892	583616	5215547	0.0	1.5	0.0	1.5
ASH046	NO	AT94	6787	578554	5216003	0.0	0.0	0.0	0.0
ASH048	YES	AT82	1458	582050	5218058	17.8	35.1	26.1	35.1
ASH049	YES	AT66	2357	579265	5218097	4.5	11.8	4.5	17.8
ASH050	NO	AT66	8435	577429	5217768	0.0	0.0	0.0	0.0
ASH051	NO	AT66	8937	577270	5218306	0.0	0.0	0.0	0.0
ASH053	YES	AT75	1204	582982	5219653	19.4	29.1	19.4	29.1
ASH054	YES	AT71	2066	581162	5219682	7.5	15.8	11.5	15.8
ASH055	YES	AT31	6233	579432	5221146	0.0	0.0	0.0	0.0
ASH056	YES	AT33	1896	582043	5222696	7.0	9.6	12.8	15.3

Ashtabula I Wind Energy Center Improvement Project
Shadow Flicker Assessment Results

Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH057	YES	AT31	2521	580172	5222694	4.4	5.8	4.4	6.3
ASH058	YES	AT31	2685	580128	5222718	0.0	5.0	3.8	5.0
ASH059	YES	AT8	3647	578613	5224312	0.0	0.0	0.0	0.0
ASH060	YES	AT14	1371	583466	5225111	18.2	24.9	18.2	24.9
ASH060a	YES	AT14	1478	583475	5224889	24.3	29.6	24.3	29.6
ASH061	YES	AT4	3779	582191	5226417	0.0	0.0	0.0	0.0
ASH062	YES	AT13	1956	579729	5226798	15.9	26.4	15.9	26.4
ASH063	YES	AT4	3088	581811	5228343	0.0	0.0	36.3	36.3
ASH064	NO	AT4	5663	581359	5229125	0.0	0.0	0.0	0.0
ASH065	NO	AT4	7321	581016	5229566	0.0	0.0	5.6	5.6
ASH066	NO	AT4	7391	580340	5229269	0.0	0.0	0.0	0.0
ASH067	NO	AT4	9186	581766	5230216	0.0	0.0	19.5	19.5
ASH068	NO	AT76	8221	585563	5219549	0.0	0.0	0.0	0.0
ASH069	YES	AT126	1478	585679	5211529	30.3	46.0	30.3	46.0
ASH070	NO	AT11	7196	577738	5225539	0.0	0.0	0.0	0.0
ASH071	NO	AT11	6651	577911	5225718	0.0	0.0	0.0	0.0
ASH072	NO	AT11	6517	577957	5225770	0.0	0.0	0.0	0.0
ASH073	NO	AT11	6453	577979	5225790	0.0	0.0	0.0	0.0
ASH074	NO	AT11	6306	578031	5225839	0.0	0.0	0.0	0.0
ASH075	NO	AT11	6199	578073	5225892	0.0	0.0	0.0	0.0
ASH076	NO	AT11	6058	578133	5225969	0.0	0.0	0.0	0.0
ASH077	NO	AT11	5921	578192	5226031	0.0	0.0	0.0	0.0
ASH077a	NO	AT12	5839	578219	5226046	0.0	0.0	0.0	0.0
ASH077b	NO	AT11	5824	578220	5226022	0.0	0.0	0.0	0.0

Ashtabula I Wind Energy Center Improvement Project
Shadow Flicker Assessment Results

Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH078	NO	AT12	5372	578407	5226268	0.0	0.0	0.0	0.0
ASH079	NO	AT13	4907	578675	5226630	0.0	0.0	0.0	0.0
ASH080	NO	AT13	4882	578688	5226658	0.0	0.0	0.0	0.0
ASH081	NO	AT13	4876	578693	5226674	0.0	0.0	0.0	0.0
ASH082	NO	AT13	4855	578706	5226704	0.0	0.0	0.0	0.0
ASH083	NO	AT13	7281	578007	5226955	0.0	0.0	0.0	0.0
ASH084	NO	AT13	7185	578038	5226958	0.0	0.0	0.0	0.0
ASH085	NO	AT13	7161	578050	5226973	0.0	0.0	0.0	0.0
ASH086	NO	AT13	6946	578131	5227015	0.0	0.0	0.0	0.0
ASH087	NO	AT13	6852	578168	5227036	0.0	0.0	0.0	0.0
ASH088	NO	AT13	6747	578230	5227114	0.0	0.0	0.0	0.0
ASH089	NO	AT13	6583	578315	5227189	0.0	0.0	0.0	0.0
ASH090	NO	AT13	6581	578363	5227288	0.0	0.0	0.0	0.0
ASH091	NO	AT13	6781	578355	5227401	0.0	0.0	0.0	0.0
ASH092	NO	AT13	6945	578351	5227492	0.0	0.0	0.0	0.0
ASH093	NO	AT13	6992	578361	5227534	0.0	0.0	0.0	0.0
ASH094	NO	AT13	7613	578365	5227858	0.0	0.0	0.0	0.0
ASH095	NO	AT13	7763	578347	5227908	0.0	0.0	0.0	0.0
ASH096	NO	AT1	7671	578410	5227951	0.0	0.0	0.0	0.0
ASH097	NO	AT1	7875	578355	5227980	0.0	0.0	0.0	0.0
ASH098	NO	AT1	7947	578357	5228036	0.0	0.0	0.0	0.0
ASH099	NO	AT1	7887	578378	5228037	0.0	0.0	0.0	0.0
ASH100	NO	AT1	8012	578355	5228077	0.0	0.0	0.0	0.0
ASH101	NO	AT1	8091	578349	5228118	0.0	0.0	0.0	0.0

Ashtabula I Wind Energy Center Improvement Project
Shadow Flicker Assessment Results

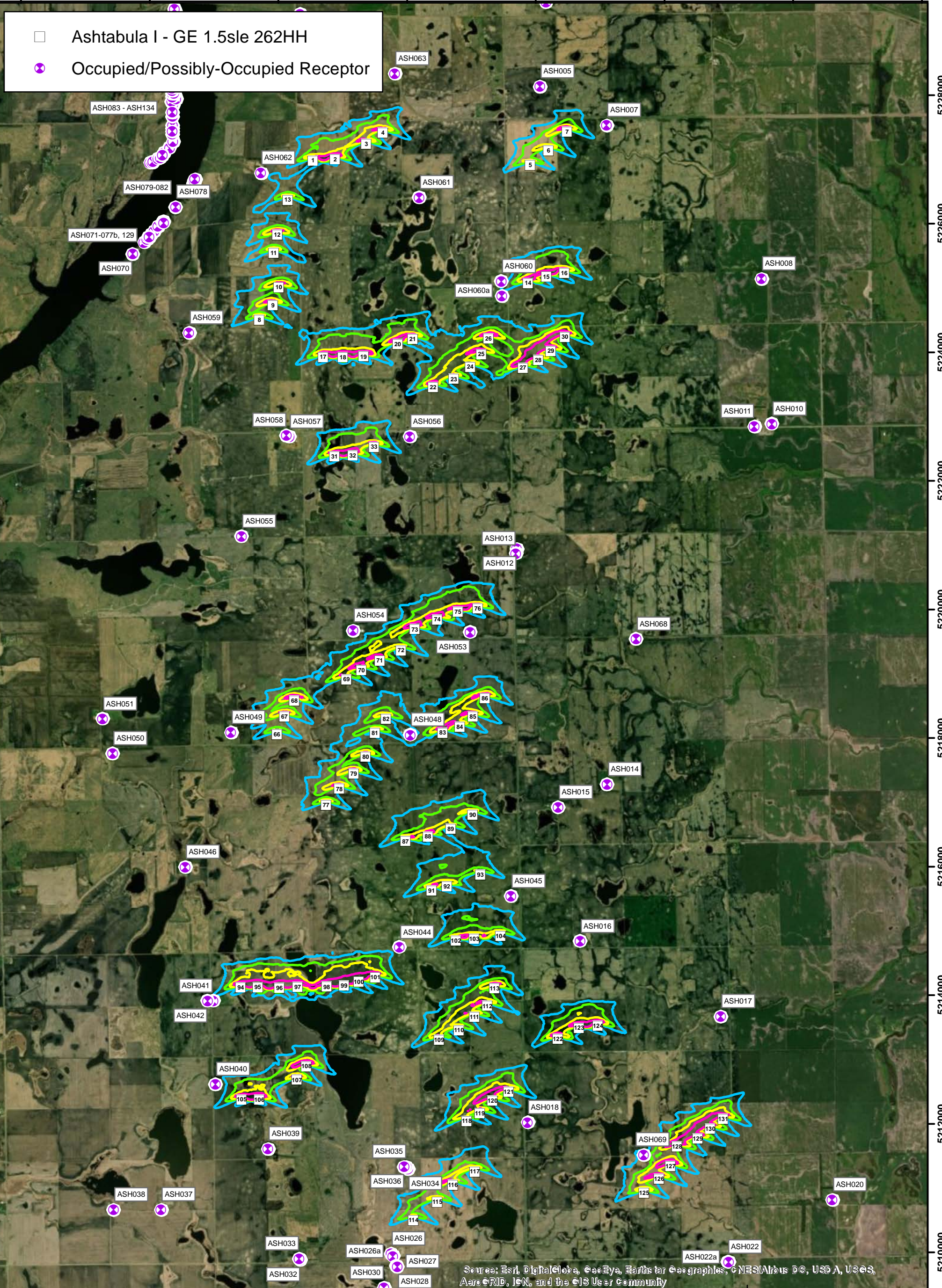
Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH102	NO	AT1	8194	578333	5228155	0.0	0.0	0.0	0.0
ASH103	NO	AT1	8283	578327	5228201	0.0	0.0	0.0	0.0
ASH104	NO	AT1	8398	578326	5228270	0.0	0.0	0.0	0.0
ASH105	NO	AT1	8775	578308	5228459	0.0	0.0	0.0	0.0
ASH106	NO	AT1	8908	578317	5228544	0.0	0.0	0.0	0.0
ASH107	NO	AT1	9019	578314	5228598	0.0	0.0	0.0	0.0
ASH112	NO	AT1	9348	578345	5228801	0.0	0.0	0.0	0.0
ASH113	NO	AT1	9398	578345	5228825	0.0	0.0	0.0	0.0
ASH114	NO	AT1	9464	578357	5228870	0.0	0.0	0.0	0.0
ASH115	NO	AT1	9573	578355	5228918	0.0	0.0	0.0	0.0
ASH116	NO	AT1	9634	578386	5228980	0.0	0.0	0.0	0.0
ASH117	NO	AT1	9663	578389	5228996	0.0	0.0	0.0	0.0
ASH118	NO	AT1	9689	578390	5229009	0.0	0.0	0.0	0.0
ASH119	NO	AT1	9731	578385	5229022	0.0	0.0	0.0	0.0
ASH120	NO	AT1	9759	578391	5229041	0.0	0.0	0.0	0.0
ASH121	NO	AT1	9862	578393	5229088	0.0	0.0	0.0	0.0
ASH123	NO	AT1	9943	578399	5229129	0.0	0.0	0.0	0.0
ASH124	NO	AT1	10201	578310	5229151	0.0	0.0	0.0	0.0
ASH125	NO	AT1	10142	578398	5229213	0.0	0.0	0.0	0.0
ASH126	NO	AT1	10218	578399	5229246	0.0	0.0	0.0	0.0
ASH127	NO	AT1	10244	578411	5229268	0.0	0.0	0.0	0.0
ASH128	NO	AT1	10374	578385	5229298	0.0	0.0	0.0	0.0
ASH129	NO	AT11	6409	577994	5225802	0.0	0.0	0.0	0.0
ASH130	NO	AT13	6801	578199	5227078	0.0	0.0	0.0	0.0

Ashtabula I Wind Energy Center Improvement Project
 Shadow Flicker Assessment Results

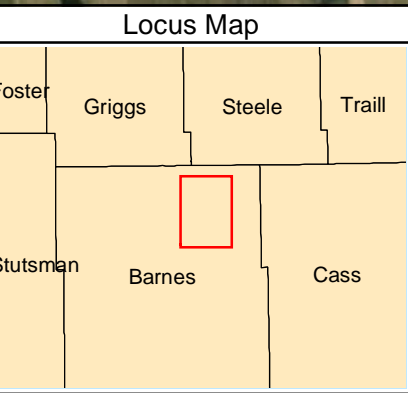
Receptor ID	Participating Landowner	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment With Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (hours/year)	Project (hours/year)	Existing (hours/year)	Project (hours/year)
ASH131	NO	AT13	6858	578353	5227444	0.0	0.0	0.0	0.0
ASH132	NO	AT13	7277	578358	5227683	0.0	0.0	0.0	0.0
ASH133	NO	AT13	7405	578355	5227744	0.0	0.0	0.0	0.0
ASH134	NO	AT1	10479	578389	5229345	0.0	0.0	0.0	0.0

Note – Where the Project contributes to the cumulative assessment levels, receptors ASH041, ASH048, and ASH069 are modeled to experience over 30 hours per year of shadow flicker. All owners have signed waivers.

576000 578000 580000 582000 584000 586000 588000 590000



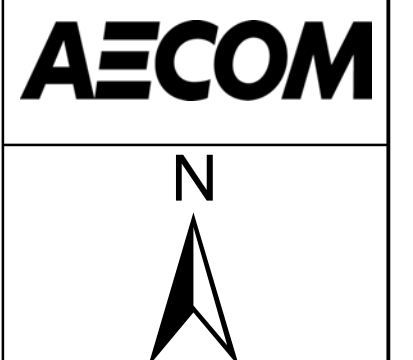
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Appendix A

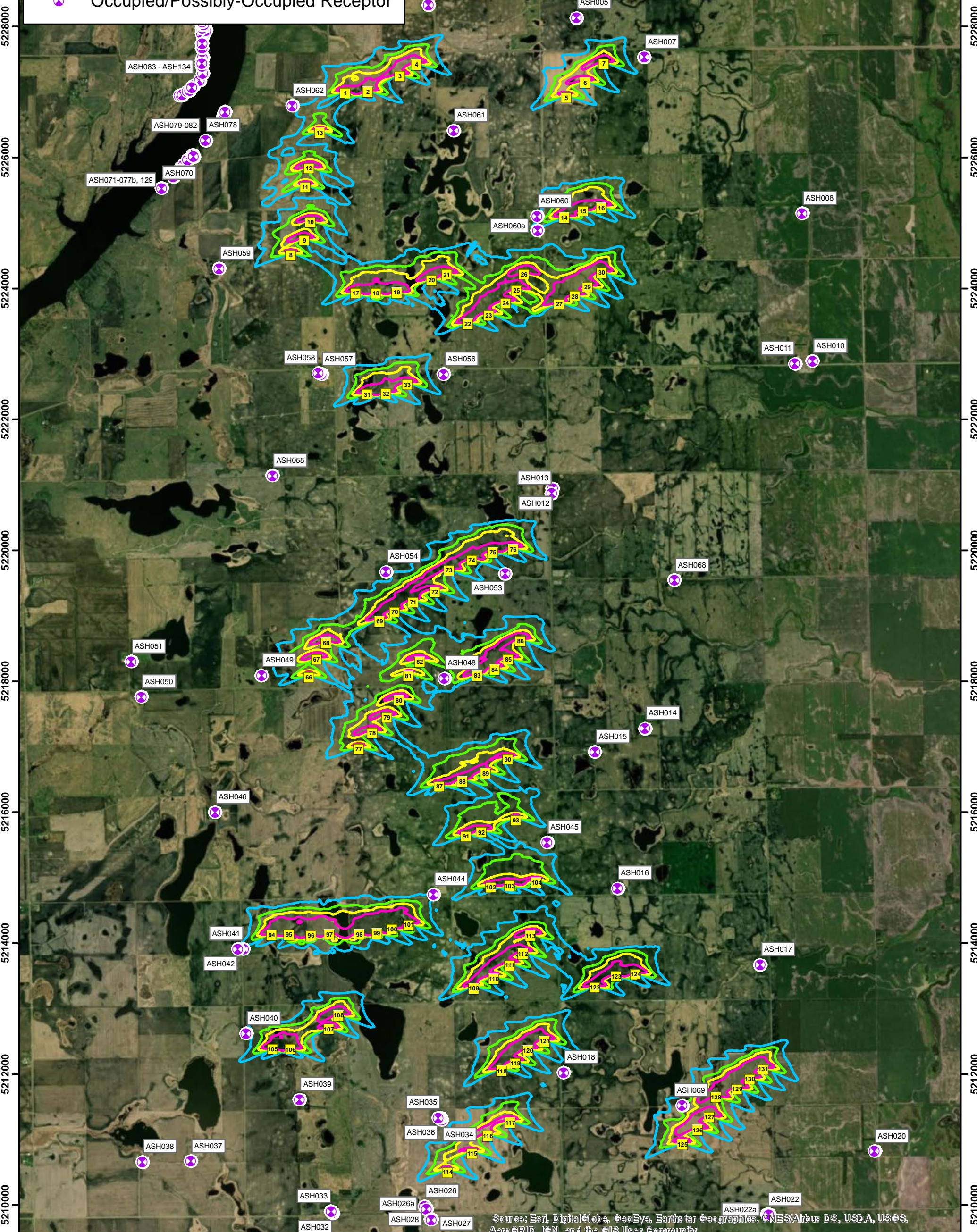
Ashtabula I Operations Only - Existing

Predicted Shadow Flicker from Existing Turbines
Ashtabula I Wind Energy Improvement Project
Barnes County, ND

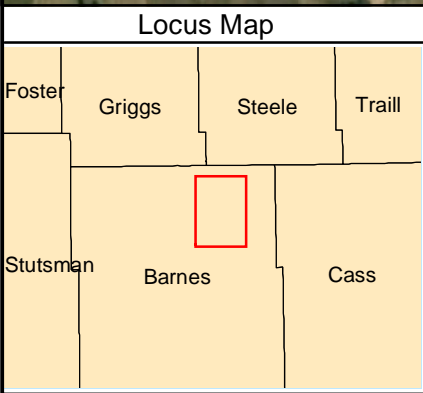


576000 578000 580000 582000 584000 586000 588000

■ Project - GE 1.6-91 262HH
● Occupied/Possibly-Occupied Receptor



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- 30 hours
- 60 hours
- 90 hours
- 120 hours

Appendix A

Ashtabula I Operations Only - Project

Predicted Shadow Flicker from Upgraded Turbines
Ashtabula I Wind Energy Improvement Project
Barnes County, ND

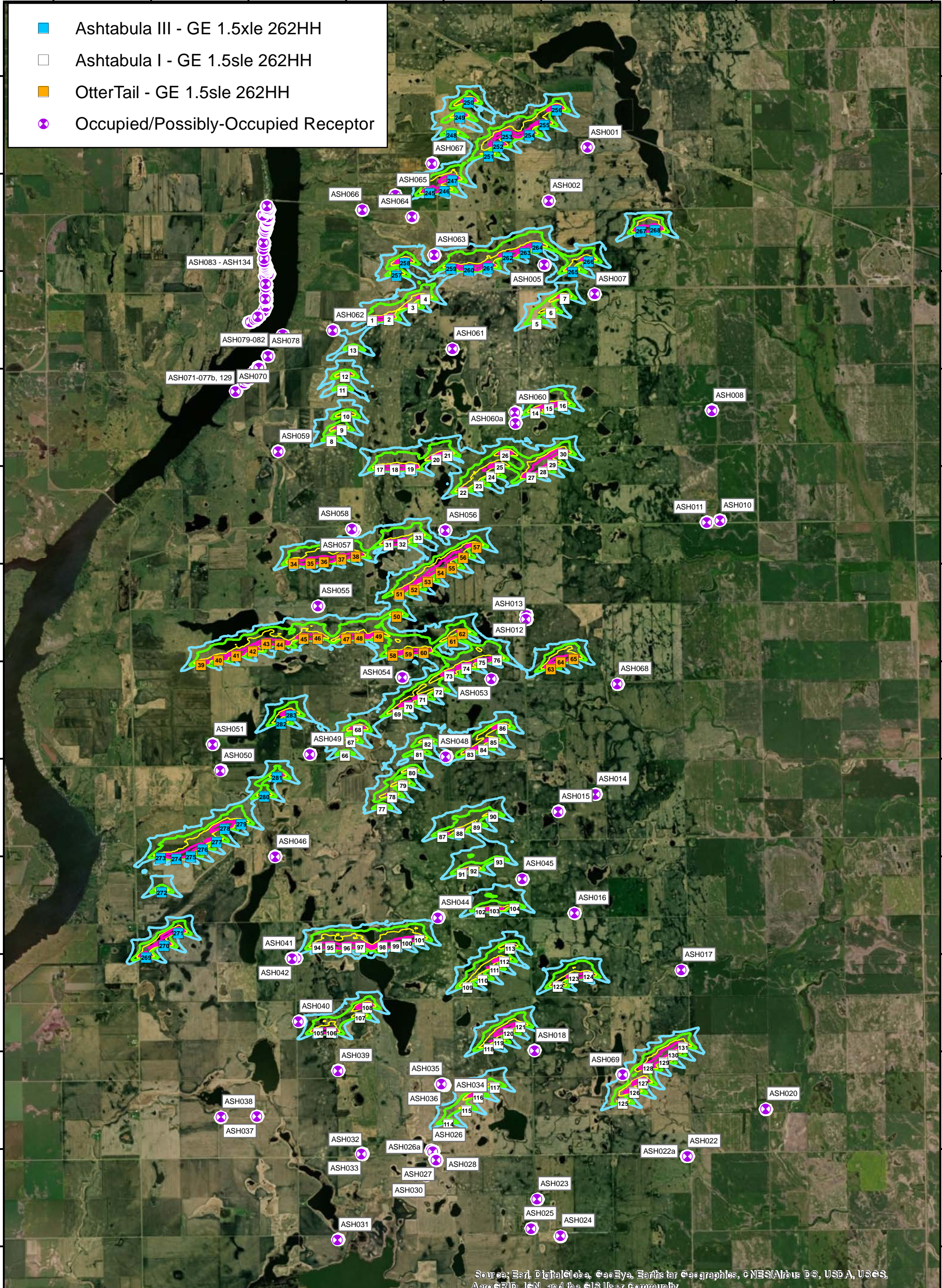
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574000 576000 578000 580000 582000 584000 586000 588000 590000 592000

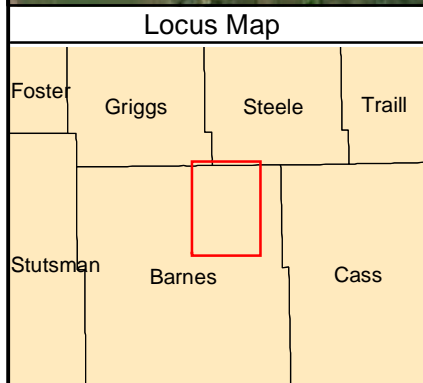
- Ashtabula III - GE 1.5xle 262HH
- Ashtabula I - GE 1.5sle 262HH
- OtterTail - GE 1.5sle 262HH
- Occupied/Possibly-Occupied Receptor

5232000
5230000
5228000
5226000
5224000
5222000
5220000
5218000
5216000
5214000
5212000
5210000
5208000

5232000
5230000
5228000
5226000
5224000
5222000
5220000
5218000
5216000
5214000
5212000
5210000
5208000



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- ### Legend
- 30 hours
 - 60 hours
 - 90 hours
 - 120 Hours

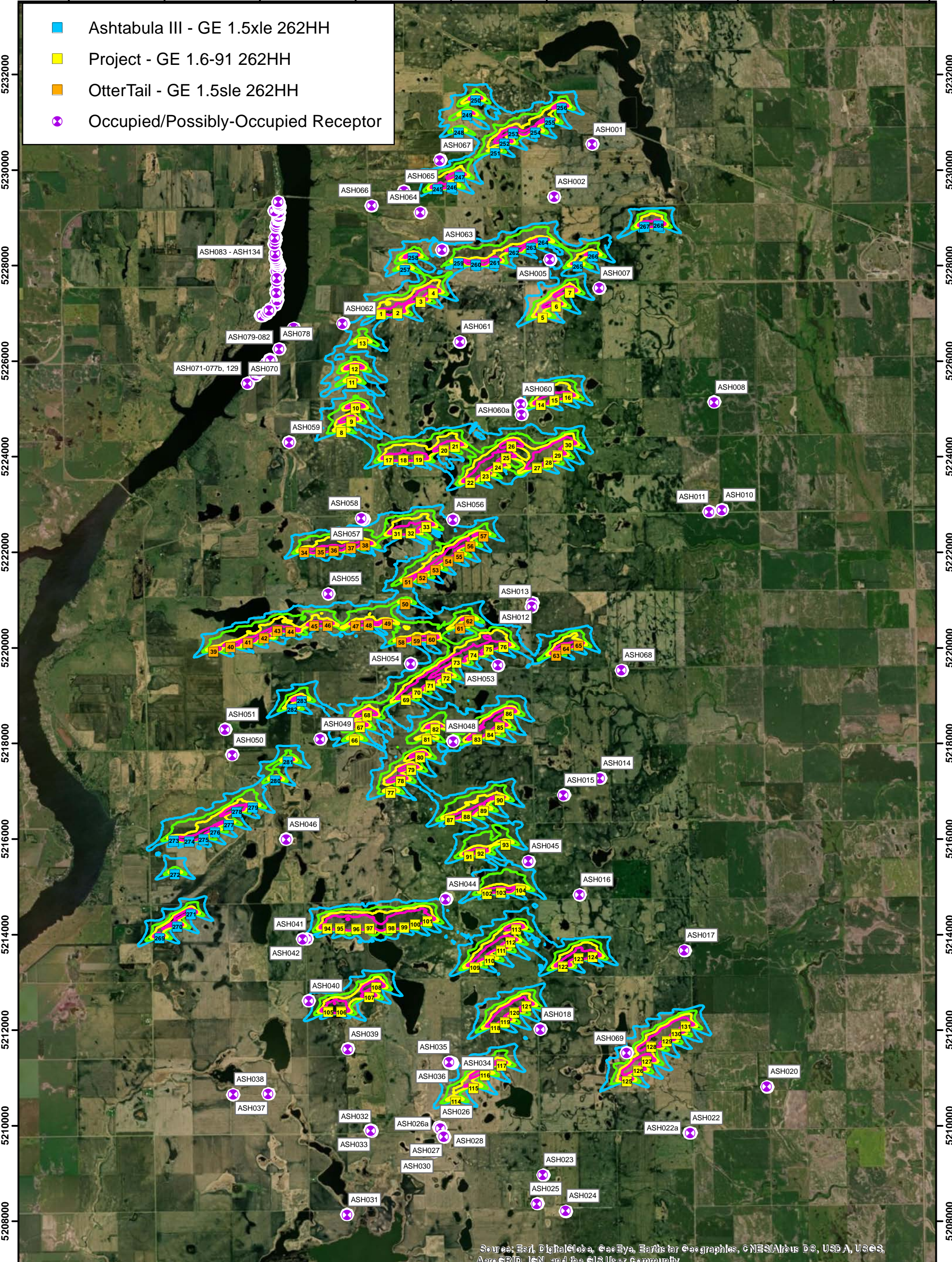
Appendix A

Cumulative Assessment - Existing

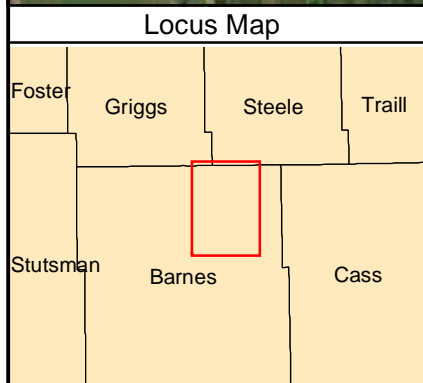
Predicted Shadow Flicker from Existing Turbines
Ashtabula I Wind Energy Improvement Project
Barnes County, ND

574000 576000 578000 580000 582000 584000 586000 588000 590000 592000

- Ashtabula III - GE 1.5xle 262HH
- Project - GE 1.6-91 262HH
- OtterTail - GE 1.5sle 262HH
- ⊗ Occupied/Possibly-Occupied Receptor



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- ### Legend
- 30 hours
 - 60 hours
 - 90 hours
 - 120 Hours

Appendix A

Cumulative Assessment - Project

Predicted Shadow Flicker from Upgraded Turbines
Ashtabula I Wind Energy Improvement Project
Barnes County, ND




Appendix B

Acoustic Assessment Results

Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH001	No	AT7	10333	584954	5230548	24.6	26.7	41.9	41.9
ASH002	No	AT7	6714	584162	5229454	31	33.2	43.6	43.7
ASH005	Yes	AT7	2700	584069	5228143	39.7	42.1	48.8	49.2
ASH007	Yes	AT7	2055	585104	5227541	41.2	43.6	46.1	47
ASH008	No	AT16	10057	587509	5225152	29.9	32	31.5	33
ASH010	No	AT30	11452	587673	5222895	27.8	29.8	28.8	30.5
ASH011	No	AT30	10682	587400	5222858	28.7	30.8	29.7	31.4
ASH012	Yes	AT76	3656	583706	5220951	39	41.3	42.5	43.7
ASH013	Yes	AT76	3433	583692	5220879	39.4	41.7	42.8	44
ASH014	No	AT90	7053	585114	5217288	36	38.1	36.7	38.6
ASH015	No	AT90	4396	584353	5216930	39.2	41.5	39.5	41.6
ASH016	No	AT104	4066	584692	5214846	40.5	42.8	40.5	42.8
ASH017	No	AT131	5264	586876	5213680	36.5	38.7	36.5	38.7
ASH018	Yes	AT121	1813	583871	5212031	45.7	48.1	45.7	48.1
ASH020	No	AT131	6911	588611	5210828	32.2	34.5	32.2	34.5
ASH022	No	AT126	5482	586982	5209860	35.8	38.1	35.8	38.1
ASH022a	No	AT126	5526	587004	5209861	35.5	37.8	35.5	37.8
ASH023	No	AT115	7581	583918	5208985	33.7	35.8	33.7	35.8
ASH024	No	AT125	9813	584400	5208229	30.6	32.7	30.6	32.7
ASH025	No	AT114	8938	583800	5208376	30.9	33	30.9	33
ASH026	Yes	AT114	2052	581752	5209985	40.8	43.2	40.8	43.2
ASH026a	Yes	AT114	2098	581780	5209951	40.8	43.2	40.8	43.2
ASH027	No	AT114	2493	581833	5209793	39.8	42.2	39.8	42.2
ASH028	No	AT114	2501	581851	5209784	39.8	42.1	39.8	42.1

Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH030	No	AT114	3750	581641	5209458	36.5	38.8	36.5	38.8
ASH031	No	AT114	10734	579830	5208150	26.8	28.9	26.8	28.9
ASH032	No	AT114	6110	580343	5209890	31.9	34.1	31.9	34.1
ASH033	No	AT114	6146	580324	5209912	32	34.2	32	34.2
ASH034	Yes	AT115	2283	582013	5211309	42.9	45.3	42.9	45.3
ASH035	Yes	AT115	2409	581991	5211341	43.6	46	43.6	46
ASH036	Yes	AT115	2473	581960	5211339	43.3	45.8	43.3	45.8
ASH037	No	AT105	6943	578179	5210676	30.8	32.8	31.5	33.3
ASH038	No	AT105	8610	577443	5210670	29.2	31.3	30.8	32.3
ASH039	Yes	AT106	2530	579842	5211620	41.5	43.9	41.6	43.9
ASH040	Yes	AT105	1556	579026	5212624	44.4	46.9	44.6	47
ASH041	Yes	AT94	1565	578986	5213919	44.8	47.2	45.1	47.4
ASH042	Yes	AT94	1821	578902	5213917	43.6	46	44.1	46.3
ASH044	Yes	AT101	1984	581886	5214753	45.4	47.8	45.5	47.9
ASH045	Yes	AT93	1892	583616	5215547	45.4	47.8	45.4	47.8
ASH046	No	AT94	6787	578554	5216003	35.9	38.1	42.7	43.3
ASH048	Yes	AT82	1458	582050	5218058	48.2	50.7	48.4	50.8
ASH049	Yes	AT66	2357	579265	5218097	42.1	44.5	45.7	46.9
ASH050	No	AT66	8435	577429	5217768	31.4	33.5	43	43.1
ASH051	No	AT66	8937	577270	5218306	30.5	32.6	41.3	41.5
ASH053	Yes	AT75	1204	582982	5219653	49	51.5	49.6	51.9
ASH054	Yes	AT71	2066	581162	5219682	45.6	48.1	48.8	50.2
ASH055	Yes	AT31	6233	579432	5221146	35.9	38.1	46.1	46.3
ASH056	Yes	AT33	1896	582043	5222696	44.4	46.8	47.2	48.6

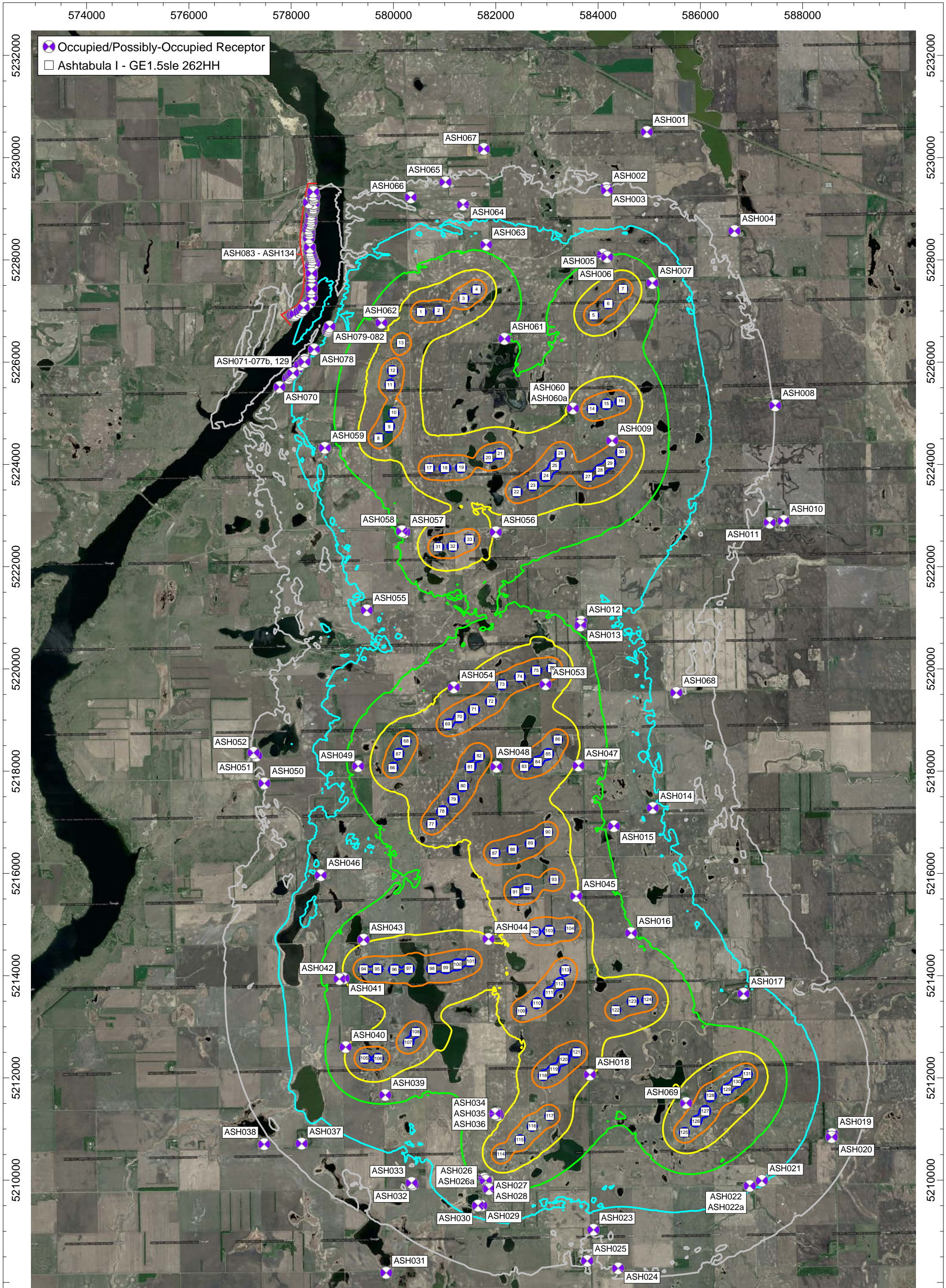
Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH057	Yes	AT31	2521	580172	5222694	41.7	44.1	46.3	47.2
ASH058	Yes	AT31	2685	580128	5222718	41.3	43.7	46.1	47
ASH059	Yes	AT8	3647	578613	5224312	38.2	40.6	39.5	41.3
ASH060	Yes	AT14	1371	583466	5225111	46.5	49	46.7	49.1
ASH060a	Yes	AT14	1478	583475	5224889	46.5	49	46.8	49.1
ASH061	Yes	AT4	3779	582191	5226417	40.2	42.5	42.3	43.9
ASH062	Yes	AT13	1956	579729	5226798	43.2	45.6	43.6	45.8
ASH063	Yes	AT4	3088	581811	5228343	37.6	39.9	47.9	48.2
ASH064	No	AT4	5663	581359	5229125	33.9	36.2	45.4	45.6
ASH065	No	AT4	7321	581016	5229566	31.3	33.5	43.5	43.7
ASH066	No	AT4	7391	580340	5229269	32.2	34.4	40	40.5
ASH067	No	AT4	9186	581766	5230216	28.9	31	47.9	48
ASH068	No	AT76	8221	585563	5219549	33.1	35.2	38.7	39.4
ASH069	Yes	AT126	1478	585679	5211529	48.1	50.6	48.1	50.6
ASH070	No	AT11	7196	577738	5225539	28.9	31	29.4	31.4
ASH071	No	AT11	6651	577911	5225718	31.9	34.1	32.4	34.4
ASH072	No	AT11	6517	577957	5225770	30.7	32.9	31.6	33.5
ASH073	No	AT11	6453	577979	5225790	29	31.1	29.6	31.5
ASH074	No	AT11	6306	578031	5225839	29.1	31.2	29.8	31.7
ASH075	No	AT11	6199	578073	5225892	32.1	34.4	32.7	34.7
ASH076	No	AT11	6058	578133	5225969	29.5	31.6	30.1	32
ASH077	No	AT11	5921	578192	5226031	29.7	31.8	30.3	32.2
ASH077a	No	AT12	5839	578219	5226046	15.2	17.1	16.5	18
ASH077b	No	AT11	5824	578220	5226022	26	28	26.7	28.4

Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH078	No	AT12	5372	578407	5226268	30.5	32.7	31.2	33.1
ASH079	No	AT13	4907	578675	5226630	31.1	33.2	31.9	33.8
ASH080	No	AT13	4882	578688	5226658	31.2	33.4	32	33.9
ASH081	No	AT13	4876	578693	5226674	31	33.2	31.9	33.8
ASH082	No	AT13	4855	578706	5226704	31	33.2	31.9	33.8
ASH083	No	AT13	7281	578007	5226955	33.3	35.4	34.2	36.1
ASH084	No	AT13	7185	578038	5226958	33.7	35.9	34.7	36.5
ASH085	No	AT13	7161	578050	5226973	33.8	35.9	34.7	36.5
ASH086	No	AT13	6946	578131	5227015	34.5	36.6	35.5	37.3
ASH087	No	AT13	6852	578168	5227036	34.7	36.8	35.7	37.5
ASH088	No	AT13	6747	578230	5227114	34.7	36.8	35.9	37.6
ASH089	No	AT13	6583	578315	5227189	35.2	37.3	36.5	38.2
ASH090	No	AT13	6581	578363	5227288	35.1	37.2	36.5	38.1
ASH091	No	AT13	6781	578355	5227401	35	37.1	36.5	38.1
ASH092	No	AT13	6945	578351	5227492	34.6	36.7	36.1	37.7
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ASH095	No	AT13	7763	578347	5227908	33	35.1	35.2	36.6
ASH096	No	AT1	7671	578410	5227951	33.8	35.9	36	37.3
ASH097	No	AT1	7875	578355	5227980	33	35.1	35.3	36.6
ASH098	No	AT1	7947	578357	5228036	32.8	34.9	35.2	36.5
ASH099	No	AT1	7887	578378	5228037	33.2	35.3	35.5	36.8
ASH100	No	AT1	8012	578355	5228077	32.7	34.7	35.1	36.4
ASH101	No	AT1	8091	578349	5228118	32.4	34.5	35.1	36.3

Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH102	No	AT1	8194	578333	5228155	32.2	34.3	34.9	36.2
ASH103	No	AT1	8283	578327	5228201	32	34.1	34.9	36.1
ASH104	No	AT1	8398	578326	5228270	32.5	34.5	35.2	36.4
ASH105	No	AT1	8775	578308	5228459	31.8	33.8	34.9	36
ASH106	No	AT1	8908	578317	5228544	31.7	33.8	34.9	36
ASH107	No	AT1	9019	578314	5228598	31.4	33.5	34.7	35.8
ASH112	No	AT1	9348	578345	5228801	31.4	33.4	35	36
ASH113	No	AT1	9398	578345	5228825	31.1	33.1	34.8	35.7
ASH114	No	AT1	9464	578357	5228870	31.2	33.2	34.8	35.8
ASH115	No	AT1	9573	578355	5228918	30.9	32.9	34.7	35.6
ASH116	No	AT1	9634	578386	5228980	31	33	34.9	35.8
ASH117	No	AT1	9663	578389	5228996	31	33	34.9	35.8
ASH118	No	AT1	9689	578390	5229009	31	33	34.9	35.8
ASH119	No	AT1	9731	578385	5229022	30.9	32.9	34.9	35.8
ASH120	No	AT1	9759	578391	5229041	30.9	32.9	34.9	35.8
ASH121	No	AT1	9862	578393	5229088	30.8	32.8	34.8	35.7
ASH123	No	AT1	9943	578399	5229129	30.7	32.7	34.8	35.7
ASH124	No	AT1	10201	578310	5229151	29.1	31.2	33.2	34.2
ASH125	No	AT1	10142	578398	5229213	30.2	32.2	34.5	35.4
ASH126	No	AT1	10218	578399	5229246	30	32	34.3	35.2
ASH127	No	AT1	10244	578411	5229268	30.1	32.1	34.5	35.3
ASH128	No	AT1	10374	578385	5229298	29.4	31.4	33.9	34.7
ASH129	No	AT11	6409	577994	5225802	19.5	21.3	21	22.3
ASH130	No	AT13	6801	578199	5227078	34.6	36.7	35.7	37.4

Receptor ID	Participating Landowner?	Nearest Turbine ID	Distance to Nearest Turbine (feet)	Receptor Coordinates (UTM Zone 14, NAD 83)		Ashtabula I Operations Only		Cumulative Assessment with Operation of Ashtabula III and Otter Tail Turbines	
				Easting (m)	Northing (m)	Existing (Leq, dBA)	Project (Leq, dBA)	Existing (Leq, dBA)	Project (Leq, dBA)
ASH131	No	AT13	6858	578353	5227444	34.8	36.9	36.4	37.9
ASH132	No	AT13	7277	578358	5227683	34.1	36.2	36	37.5
ASH133	No	AT13	7405	578355	5227744	33.9	35.9	35.8	37.3
ASH134	No	AT1	10479	578389	5229345	29.2	31.2	33.8	34.6

Note – Where the Project contributes to the cumulative assessment levels, receptors ASH048, ASH053, ASH054 and ASH069 are modeled at over 50 dBA. All owners have signed waivers.



N

Date Created:
05/30/2019

Created by:
CK

AECOM Imagine it.
Delivered.

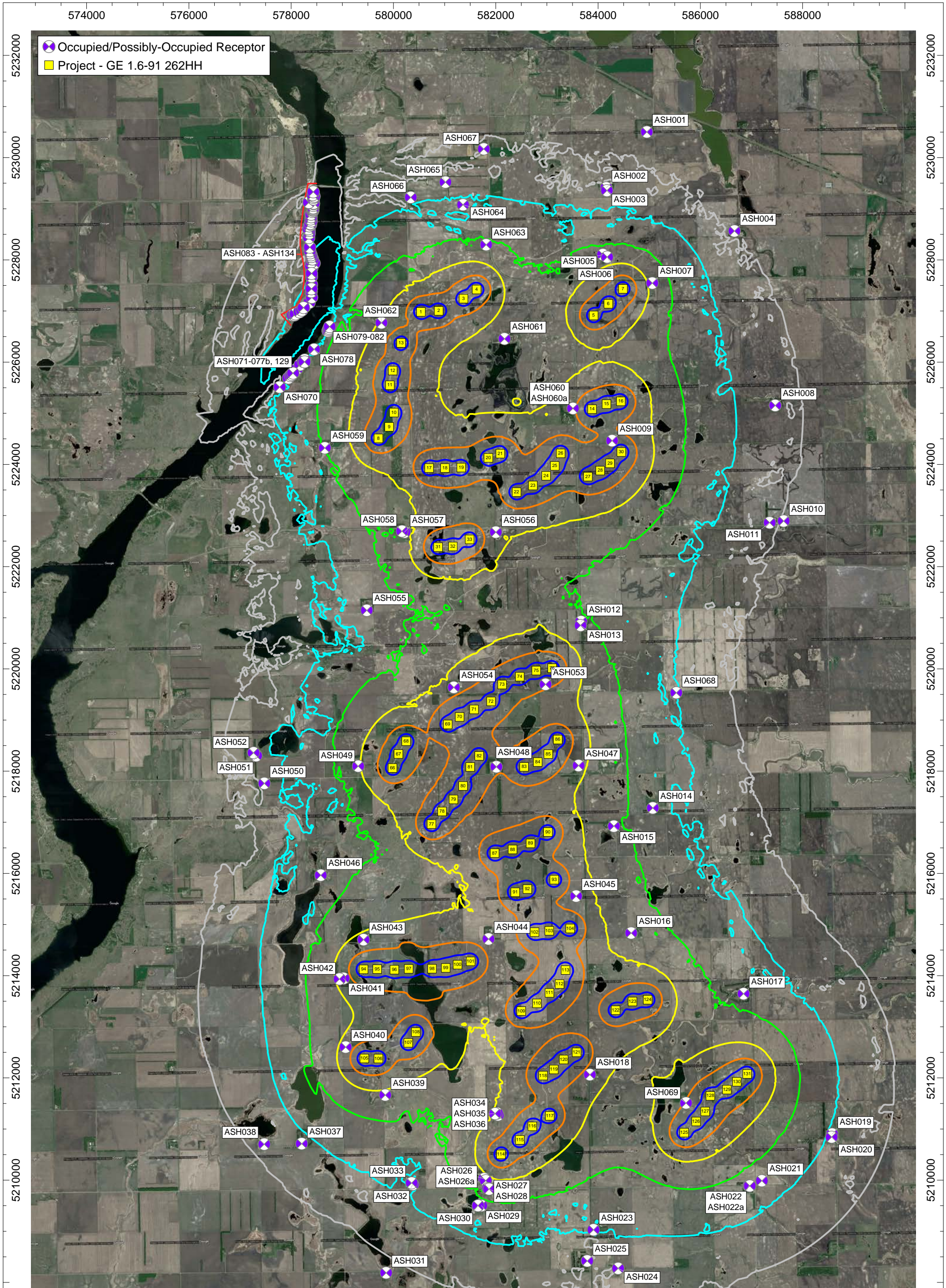
Acoustics & Noise Control Practice

Appendix B
Ashtabula I Operations Only - Existing
Wind Turbines at Maximum Rotational Wind Speed

Predicted Project Operation Noise Contours
Ashtabula I Wind Energy Center Improvement Project
Barnes County, ND

Sound Level Contour Ranges (dBA)

	30 dBA
	35 dBA
	40 dBA
	45 dBA
	50 dBA
	55 dBA



N

Date Created:
05/30/2019

Created by:
CK

AECOM Imagine it.
Delivered.

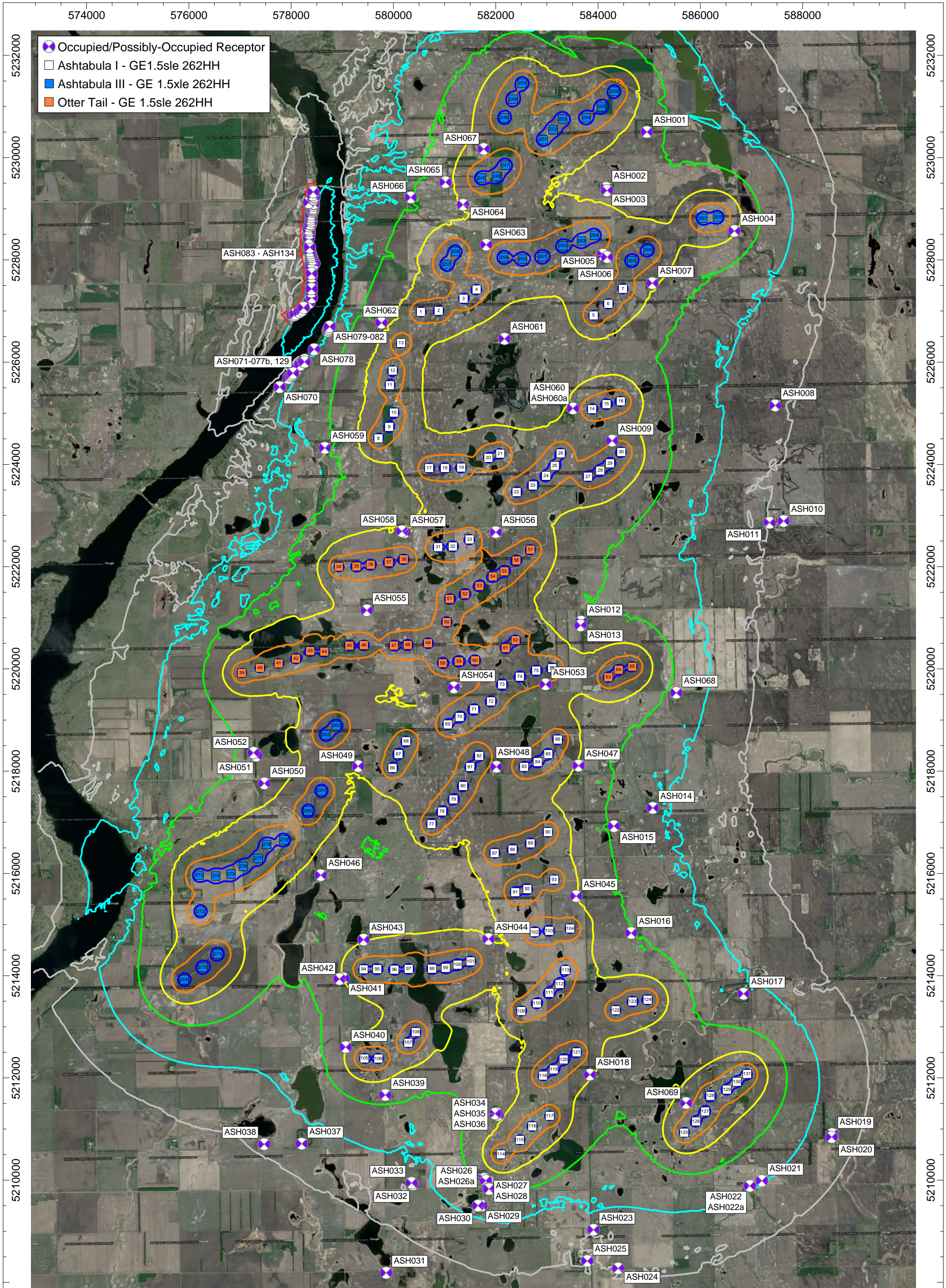
Acoustics & Noise Control Practice

Appendix B
Ashtabula I Operations Only - Project
Wind Turbines at Maximum Rotational Wind Speed

Predicted Project Operation Noise Contours
Ashtabula I Wind Energy Center Improvement Project
Barnes County, ND

Sound Level Contour Ranges (dBA)

	30 dBA
	35 dBA
	40 dBA
	45 dBA
	50 dBA
	55 dBA



North Arrow

Date Created: 05/30/2019

Created by: CK

AECOM Imagine it. Delivered.

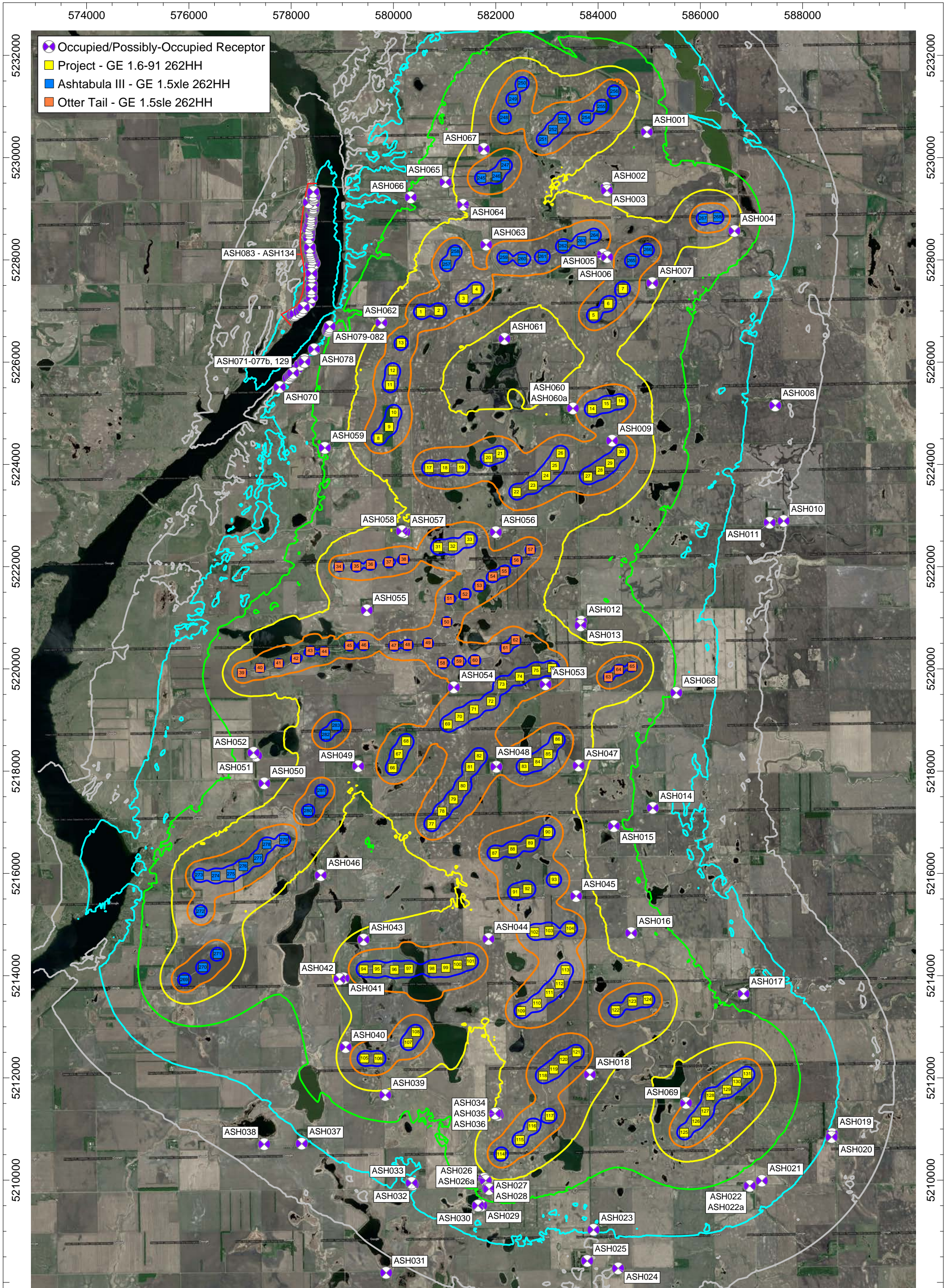
Acoustics & Noise Control Practice

Appendix B
Cumulative Assessment - Existing
Wind Turbines at Maximum Rotational Wind Speed

Predicted Project Operation Noise Contours
Ashtabula I Wind Energy Center Improvement Project
Barnes County, ND

Sound Level Contour Ranges (dBA)

30 dBA
35 dBA
40 dBA
45 dBA
50 dBA
55 dBA



N

Date Created:
05/30/2019

Created by:
CK

AECOM Imagine it.
Delivered.

Acoustics & Noise Control Practice

Appendix B
Cumulative Assessment - Project
Wind Turbines at Maximum Rotational Wind Speed

Predicted Project Operation Noise Contours
Ashtabula I Wind Energy Center Improvement Project
Barnes County, ND

Sound Level Contour Ranges (dBA)

30 dBA
35 dBA
40 dBA
45 dBA
50 dBA
55 dBA