Exhibit E

Route Evaluation Study

6011 Greenwich Windpark, LLC

PRELIMINARY DELIVERY ROUTE EVALUATION

Greenwich Wind Farm
Erie, Huron, Ashland & Medina County, Ohio

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This report summarizes findings and recommendations based on a desktop analysis and visual assessment of identified potential wind turbine part delivery routes for the proposed Greenwich Wind Farm in Huron County, Ohio.

MCA Project #: 1027-13-5786C

December 9, 2013

TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

The Greenwich Wind Farm development is a proposed wind energy project in Greenwich Township, Huron County, Ohio. The project site is located south and east of the Village of Greenwich. To facilitate construction of the wind turbines, it is anticipated that the turbine parts will be delivered via ground transportation to each of the individual turbine site. As such, a delivery route must be selected that will allow the delivery trucks to access the turbine sites with the minimal amount of obstructions, limitations, and improvements necessary to facilitate the deliveries.

Metro Consulting Associates, LLC (MCA) has been contracted by Windlab Systems, Pty Ltd (Client) to perform a preliminary evaluation study to determine a conceptual delivery routing that takes into account the potential limitations associated with the delivery truck clearance, geometry, and loading. In response to this request, MCA defined a scope of potential delivery routes, made some assumptions for the proposed blade delivery vehicle which would prove to be the most restrictive for the project, reviewed Client provided data, analyzed available Geographic Information Systems data, visited the site to perform a general visual assessment of these identified potential delivery routes, and prepared this report to summarize the findings and recommendations.

Based on the results of this preliminary evaluation, MCA offers the following summary of our findings and recommendations:

1. The delivery route is recommended to originate from Interstate 71 and take US Route 224 into the project site area. This recommendation is primarily due to the road geometry for US 250 internal to the City of Norwalk that would limit access of a turbine blade truck without expansive improvements to private properties and/or interruption of traffic patterns. In addition, a delivery route down US Route 250 would be exposed to 12 overhead obstructions that appear to encroach on the assumed delivery truck clearance profile.
2. Based on the visual assessment, there appears to be seven (7) areas along the tertiary delivery routes internal to the site that may exceed the assumed maximum allowed 6% longitudinal grade. It is recommended these areas be field surveyed to confirm prior to deliveries.
3. Based on the visual assessment, there appears to be one (1) area along the tertiary delivery routes that may exceed the assumed maximum change of six inches in 50 feet required to prevent the loaded blade truck from "bottoming out". It is recommended these areas be field surveyed to confirm prior to deliveries.
4. MCA expects a minimum of six (6) public road intersections internal to the project site that would require temporary improvements to facilitate the blade delivery truck in accessing the individual proposed turbine sites. A Preliminary Internal Delivery Routing Map is included in Appendix D2 and the conceptual temporary intersection improvement diagrams are included in Appendix D4.
5. According to Ohio Revised Code, Sections 5577.04, 5577.05, no vehicle shall be operated upon the public highways, streets, bridges and culverts within the state whose dimensions exceed 13'-6" in height, 75'-0" in length, and a gross vehicle weight of 80,000 pounds. Since it is anticipated that the wind blade delivery truck will exceed all of these specifications for standard traffic limits, a special permit and/or agreement will likely be required through District 3 of the Ohio Department of Transportation and Huron County.

The following report documents the scope of the assessment area, the design delivery vehicle specification assumptions, the limitation assessment procedure, the conceptual intersection improvements, delivery route recommendations, and conceptual mitigation efforts that would be required in detail.

2.0 DESIGNATED DELIVERY ROUTE SCOPE OF ASSESSMENT

Based on the information provided by the Client, it was assumed prior to this route evaluation that the wind farm deliveries will originated from either Interstate 71 or Interstate 80/90 (Ohio Turnpike). These federal interstate roads were not included in the scope of this assessment. It is assumed that any required permits to use these federal Interstates for deliveries would be the responsibility of the turbine manufacturer. This is based on previous experience with similar projects of this nature. Prior to this evaluation, three (3) public roadways totaling approximately 57 miles were identified as potential secondary delivery routes directly linking the major Interstates to the proposed project area. These roadways were included in the scope of the assessment and are defined as follows:

<u>Secondary Delivery Routes</u>

US Route 224:	±32 miles of road from Interstate 71 to the project area
US Route 250:	±18 miles of road from the Ohio Turnpike to SR 13 at Fitchville.
SR 13:	±7 miles of road from US Route 250 to the south boundary of the project area

Prior to this route evaluation, five (5) public roadways totaling approximately 11 miles were identified as potential tertiary delivery routes linking the secondary roadways to each of the individual turbines site locations as provided by the Client. These roadways were included in the scope of the assessment and are defined as follows:

<u>Tertiary Delivery Routes</u>

Baseline Road:	±2 miles of road from SR 13 to Rome Greenwich Road
Rome Greenwich:	±2 miles of road from Baseline Road to US 224
Plymouth East Road:	±3 miles of road from Roam Greenwich Road to Nineveh Road
Nineveh Road:	±2 miles of road from Alpha Road to Plymouth East
Alpha Road:	±2 mile of road from SR 13 to Town Line Road

Refer to Appendix A for a visual representation of the roads associated in the scope of the assessment for this report.

3.0 DELIVERY DESIGN VEHICLE SPECIFICATION ASSUMPTIONS

To define the potential route limitations and areas of concern along the delivery routes, assumptions had to be made for the projected delivery vehicle specifications. These assumptions include delivery truck clearance dimensions, turning radii specifications, and required loading scenarios. The Client specified that the turbine manufacturer for the Greenwich Wind Farm project will likely be Nordex. For purposes of this assessment, it is assumed that the wind turbine model being constructed is the Nordex model N117/2400 turbine, which is the largest third generation Nordex turbine that has been use in similar locations for lower wind speed sites. The delivery truck specifications for use in this evaluation is predominantly based on the delivery vehicles specifications and requirements listed in the Nordex "Transport, Access Roads and Crane Requirements" document included in Appendix B.

Overhead obstruction clearance limits for the delivery vehicles are assumed to be 14'-5". This assumption is based on Section 3.4 "Clearance Profile On A Straight Route" from the Nordex "Transport, Access Roads and Crane Requirements" document included in Appendix B. Any overhead obstructions along the potential delivery routes that were determined to be less than 15 feet have been noted as a potential concern for deliveries. The maximum longitudinal grade allowed for the designated delivery routes was assumed to be 6% and the maximum dips or humps along the roadway were assumed to be 6 inches of elevation change in 50 feet. This assumption is based on Section

3.3 “Slopes” from the Nordex “Transport, Access Roads and Crane Requirements” document included in Appendix B. Any potential longitudinal grade over 6% and dips or humps along the roadway that exceed 6 inches in 50 feet have been noted as a potential concern for deliveries. The turning radii specifications for the delivery vehicles were assumed based on a turning template created for a 57 meter manual steer wind turbine blade trailer truck used by Nordex to transport the N117/2400 wind turbine blades on a similar project and Section 3.5 “Curves” from the Nordex “Transport, Access Roads and Crane Requirements” document included in Appendix B, which specifies a minimum required turning radius of 164 feet. The loaded delivery vehicle length is assumed to be a total of 206 feet based on a typical 57 meter blade truck previously used by Nordex on a similar project. Vehicle weights have been assumed to have a maximum design loading of approximately 26,400 pounds per axle and a maximum gross design loading of 363,600 pounds based on Section 3.1 “Loads” from the Nordex “Transport, Access Roads and Crane Requirements” document included in Appendix B.

4.0 DESIGNATED DELIVERY ROUTE LIMITATION ASSESSMENT

Prior to the visual field assessment phase of the route evaluation, MCA staff identified and documented numerous points of interest along the delivery routes within the scope of this assessment using available Geographic Information Systems data and Google Maps API Street View. These areas of interest were geo-referenced on a map of the potential delivery routes and used by field staff to locate these identified points of interest in the field and target their visual inspections.

MCA field staff visited the site during the week of December 2, 2013. Weather conditions during the field visits were generally clear with minor occurrences of partly cloudy and light rain conditions. MCA drove each section of roadway within the scope of the assessment, visually located and assessed pre-determined points of interest, observed the roadways for additional points of interest, documented any noteworthy or unique items, assigned general conditions to the roadways and underlying culverts, and took site photos during these field visits.

4.1 ROADWAY CONDITION ASSESSMENT

During the site investigation, MCA staff drove each section of roadway and documented the surface material along with any visual evidence of distress, deterioration, surface failure or drainage issues that could provide evidence of the general condition of the roadway. For paved sections of roadway, the types of cracking noted include transverse and longitudinal cracking, block cracking, edge cracking, and fatigue or “alligator” cracking. The presence of rutting, pumping, pothole formation, and patchwork, and ponding of water on the roadway surface was also noted. For unpaved sections of roadway, gravel corrugation or “washboarding”, rutting, and ponding water on the roadway surface was noted. Refer to the Glossary in Appendix F for a brief definition of each type of distress mentioned in this report.

Based on the visual evidence collected, the roadways within the scope of the assessment were assigned a general condition classification of either V. GOOD, GOOD, FAIR, POOR, or V. POOR. These general classifications can be defined as follows:

<u>Paved Roadways</u>

V.GOOD:	Pavement appears new and does not show any signs of distress or failure.
GOOD:	Pavement exhibits few visible signs of surface deterioration. Pavement shows low severity of cracking.
FAIR:	Typical distresses can include the following in a low to moderate severity: rutting, transverse and longitudinal cracking, block cracking, fatigue cracking, patchwork, and potholes.

POOR: Typical distresses can include the following in a moderate to high severity: rutting, transverse and longitudinal cracking, block cracking, fatigue cracking, patchwork, and potholes. Maintenance should be expected during construction.

V.POOR: Typical distresses across the majority of the pavement can include the following in high severity: rutting, transverse and longitudinal cracking, block cracking, fatigue cracking, patching, and potholes. Pre-construction improvements should be considered.

Unpaved Roadways

V.GOOD: Surface does not show any signs of deterioration or drainage issues.

GOOD: Surface shows low severity of corrugation or rutting and no signs of drainage issues.

FAIR: Typical distresses can include the following in a low to moderate severity: corrugation, rutting, and ponding of water. Maintenance should be expected.

POOR: Typical distresses can include the following in a moderate to high severity: corrugation, rutting, and ponding of water. Maintenance should be expected.

V.POOR: Typical distresses across the majority of the roadway can include the following in high severity: corrugation, rutting, and ponding of water. Pre-construction improvements should be expected.

On average, the general condition of the secondary roads can be classified as in GOOD condition, with some localized areas of cracking and recent patchwork. It appears as in the stretch of US Route 224 running through Ashland County had been recently resurfaced within the last year, as older aerial imagery from 2012 depict this area along this section of US Route 224 as having heavy transverse and longitudinal cracking, block cracking, fatigue cracking, and excessive patchwork repairs and the recent field assessment identified a new surface pavement overlay in this area. None of the paved roadways appeared to be in V.POOR conditions and it is initially not expected that any of the roadways would require conditional improvements prior to deliveries. There were no unpaved roadways associated with the planned delivery routes.

Based on the general visual assessment of the roadways, there appears to be seven (7) areas along the tertiary delivery routes internal to the project area that have the potential to exceed the assumed maximum 6% longitudinal grade. These general locations are labeled on the Overall Roadway and Inventory Assessment Map included in Appendix C1. Based on the general visual assessment of the roadways, there appears to be one (1) location along the tertiary delivery routes that show the potential of there being humps in the road where the change in elevation exceeds the assumed maximum of six inches in 50 feet that is required to prevent the load from "bottoming out". This location is the railroad crossing at point of interest ID 320. Refer to Appendix C1 for the visual location of this railroad crossing and Appendix C5 for photographs of this railroad crossing.

Other noteworthy or unique roadway items were documented during the site visit, including speed limit signage and special load limit signage. The speed limits are represented on the Overall Roadway and Inventory Assessment Map included in Appendix C1. No special load limit signage was discovered during the site visit.

Table 1 included in Appendix C2 lists an inventory of each roadway assessed, the section of roadway documented, the approximate lane widths, surface type, the assigned general condition of the roadway, and any additional notes of importance that were documented during the field visit for each section of roadway. The section of roadway IDs listed in Table 1 corresponds to the intersection ID labels shown on the Preliminary Internal Delivery Routing Map found in Appendix D2. Site photos that depict selected areas of interest have been provided in Appendix C5.

4.2 OVERHEAD OBSTRUCTION INVENTORY AND CLEARANCE ASSESSMENT

Prior to the site visit investigations, MCA staff identified and documented numerous points of interest along the potential delivery routes using available Geographic Information Systems data and Google Maps API Street View to determine overhead obstructions that could encroach on the required delivery truck clearance. These areas of interest were geo-referenced on a map of the potential delivery routes and used by field staff to locate the overhead obstructions in the field and target their visual inspections. Approximate clearance heights for each of the identified overhead obstructions were also approximated using Google Maps API Street View imagery.

During the site investigation, MCA staff located the existing overhead obstructions as referenced during the desktop review that were initially determined to encroach on the required 15 feet of clearance required to facilitate deliveries. Hot sticks were used to measure the approximate clearance heights on the existing overhead wire obstructions, traffic signal lights, railroad mast arms, tree branch overhangs, and overpass structures. A total of 501 overhead wire crossings, 8 bridge overpasses, 6 navigational information mast signs, 1 transmission line, 24 traffic signal crossings, and 10 tree overhangs were documented.

Table 2 included in Appendix A3 lists an inventory of each of the overhead obstructions along the potential delivery routes, including ID number, approximate clearance height, and any additional notes of importance that were documented during the field visit. Overhead obstructions that were determined to encroach on the required 15 foot delivery vehicle clearance are highlighted in the color red in Table 2. The ID numbers listed in Table 2 correspond to the ID numbers shown on the Overall Roadway and Inventory Assessment Map included in Appendix A1.

4.3 CROSSING INVENTORY AND CONDITION ASSESSMENT

Prior to the site visit investigations, MCA staff identified and documented numerous locations of interest along the potential delivery routes using available Geographic Information Systems data and Google Maps API Street View to determine any potential locations or drainage patterns that demonstrate a potential of drainage flowing under the roadway where a culvert or bridge crossing could exist. These areas of interest were geo-referenced on a map of the potential delivery routes and used by field staff to locate the roadway crossings in the field and target their visual inspections.

During the site investigation, MCA staff located the existing culverts and bridges as referenced during the desktop review. MCA also examined other areas in the field that showed visual evidence of a possible drainage course crossing under the road, including low spots in the vertical road alignment and transverse patchwork that suggests a culvert may have been installed by means of open-cutting the roadway. Once a culvert was located in the field, it was assigned a unique ID number and the estimated cover beneath the roadways, general condition, and any additional field notes of interest were documented. A total of 133 culverts and 23 bridge structures were located along the potential delivery routes.

Based on the visual evidence collected, each culvert or bridge located was assigned a general condition classification of either V. GOOD, GOOD, FAIR, POOR, or V. POOR. These classifications can be defined as follows:

V.GOOD: Culvert appears to be a newer installation. Culvert does not show any signs of distress, damage, or environmental degradation.

GOOD: Culvert appears to be a newer installation. Culvert exhibits few visible signs of distress, damage, or environmental degradation.

FAIR:	Culvert appears to be older. Typical distresses can include the following in a low to moderate severity: pipe deformation, structure cracking, joint dislocation, blockage by sedimentation, and environmental degradation.
POOR:	Culvert appears to be older. Culvert can include the following in a moderate to high severity: pipe deformation, structure cracking, joint dislocation, blockage by sedimentation, and environmental degradation. Existing ground cover is usually minimal.
V.POOR:	Culvert appears to be older. Culvert can include the following in high severity: pipe deformation, structure cracking, joint dislocation, blockage by sedimentation, and environmental degradation. Existing ground cover is usually minimal. Pre-construction improvements should be considered.

MCA has determined that on average, the subject culverts vary greatly in age, type and general condition. Most of the culvert and bridge structures can be classified as in GOOD to FAIR condition. None of the culverts roadways appeared to be in V.POOR condition and it is initially not expected that any of the roadway would require improvements prior to deliveries, unless directed by the agency having jurisdiction over the delivery roads. A few of the culverts appeared to both be in POOR condition and have less than 2 feet of cover under the road. Although not a certainty, as a general issue of concern, these culverts with minimal cover and already showing evidence of degradation have a higher risk of becoming fatigued and failing under the repeated heavy loading of the turbine delivery trucks.

MCA also reviewed available information to determine areas of where private railroads and underground pipelines appeared to cross the delivery route roadways. Five (5) CSX Railroad crossings and two (2) Sunoco petroleum pipeline crossings were discovered along the potential delivery routes. These locations and any evidence of ownership information, contact phone numbers, and owner reference identification numbers were documented in the field and are included in the “Notes” column shown in Table 3 included in Appendix C4.

Other noteworthy or unique roadway items were documented during the site visit, including identification signage, size of the culvert opening, and material type. No special load limit signs were discovered during the site visits.

Table 3 included in Appendix C4 lists an inventory of each of the objects crossing under the potential delivery routes, including ID number, approximate cover underneath the roadway, the assigned general condition of the object, and any additional notes of importance that were documented during the field visit. Culverts that were determined to be in POOR condition and have less than 2 feet of cover were highlighted in the color red on Table 3. The crossing ID numbers listed in Table 3 correspond to the ID numbers shown on the Overall Inventory and Roadway Conditions Assessment Map included in Appendix C1. Site photos that depict selected areas of interest have been provided in Appendix C5.

5.0 CONCEPTUAL ROADWAY INTERSECTION IMPROVEMENTS

The turning radii specifications for the prospective delivery vehicles were based on a manual steer trailer truck used by Nordex to transport the 57 meter N117/2400 wind turbine blades on a similar project. The minimum turning radius is 164 feet as specified in 3.5 “Curves” from the Nordex “Transport, Access Roads and Crane Requirements” document included in Appendix B. The aforementioned blade truck was also modeled using AutoTURN version 8.0 to develop a truck template used in simulating the required truck tire path and load swing clearance areas. Using this truck template, other typical intersection improvement schemes were created based on these simulations. The typical truck turning template schemes are included in Appendix D1.

Based on the Client provided proposed turbine locations and considering any existing obstructions observed at each of the public road intersections internal to the project area, and the typical truck turning template schemes, MCA developed a preliminary delivery routing to each of the turbine sites using the typical truck turning template schemes. For conceptual purposes, MCA identified six (6) public road intersections that would require temporary improvements to facilitate deliveries to each of the specified turbine locations. These improvements involve some temporary crop damage to adjacent properties within the general project area. The Preliminary Internal Delivery Routing Map has been included in Appendix D2 and the Conceptual Road Intersection Improvement Diagrams depicting the required conceptual public road intersection improvements are included in Appendix D3. Site photos depicting the existing intersections at the time of the field assessment have been included in Appendix C5.

6.0 PRELIMINARY DELIVERY ROUTE RECOMMENDATIONS

Based on the aforementioned delivery route assessment, MCA initially recommends the proposed deliveries are routed off of Interstate 71 onto the secondary road US Route 224, taking US Route 224 into the project site. This recommendation is primarily due to the loaded wide turbine blade trucks not being able to make two (2) of the required turns along US Route 250 within the City of Norwalk. In particular, the turn required at the US 250 and League Street intersection and the turn required at the Whittlesey Avenue and League Street intersection. Although these intersection radii are larger than typical roads and appear to be able to support larger WB-50 semi-trailer traffic, these intersections cannot facilitate the large wind blade trailer without extensive improvements to private properties and interruption of traffic patterns. Aerial imagery and site photographs of these intersections are included in Appendix D4. In addition, a delivery route down US Route 250 would be exposed to 12 overhead obstructions that appear to encroach on the assumed required delivery truck clearance profile of 15 feet.

Refer to Appendix D2 for the recommended delivery routing along the tertiary roads. This preliminary delivery routing is based on minimizing the extent of the intersection improvements required to facilitate the internal deliveries as discussed in Section 5.0 of this report. Huron County should be contacted during the balance of plant permitting phase of the project to coordinate the specifics of the road use and determine any potential limited use roads.

7.0 POTENTIAL SPECIAL PERMITS, IMPACTS AND MITIGATIONS

According to Ohio Revised Code, Sections 5577.04, 5577.05, no vehicle shall be operated upon the public highways, streets, bridges and culverts within the state whose dimensions exceed 13'-6" in height, 75'-0" in length, and a gross vehicle weight of 80,000 pounds. Since it is anticipated that the N117/2400 wind blade delivery truck will exceed all of these specifications for standard traffic limits, a special permit will likely be required through District 3 of the Ohio Department of Transportation and Huron County or additional modifications will be required to the delivery vehicles to accommodate these State requirements. Refer to the Delivery Design Vehicle Specification Assumptions in Section 3.0 of this report. It is important to coordinate with the agency having jurisdiction over the traveled roadway as soon as site-specific delivery vehicle specifications are determined for the project to identify any special permits that would be required for the projected uses of the roads.

As with any oversized and heavy loaded vehicles, damage may occur to the road surface and associated structures, especially during repeated loadings as required for the construction of a wind farm. For a typical project of this nature, a road agreement documenting the specifics of the planned road use would likely be required to be certified by both the agency having jurisdiction over the road and the developer prior to construction. The agency having jurisdiction over the roadways will also typically require a pre-construction and a post-construction roadway assessment to document any preexisting deterioration or failure from deterioration or failure that may have been caused by the wind development. A pre-construction and a post-construction roadway assessment and a pre-construction video survey is recommended to document roadway conditions immediately prior to construction. This is especially true since the secondary delivery roads were witnessed to have a significantly higher truck volume in comparison to other roads in the area, and thus a potentially higher risk of pavement and culvert degradation that would not result from the proposed wind farm construction traffic. It is important to coordinate with the agency having jurisdiction over the traveled roadway as soon as site-specific delivery vehicle specifications are determined for the project to identify any special requirements these agencies may impose on the project for use of the roads.

Five (5) CSX Railroad crossings and two (2) Sunoco petroleum pipeline crossings were discovered along the potential delivery routes. These companies may require temporary crossing permits for carrying the overloaded truck weights across their easements. It is recommended that these companies be contacted as soon as site-specific delivery vehicle specifications are determined for the project. The owner information, contact phone numbers and owner crossing reference numbers discovered during the field assessment are included in the "Notes" colomn of Table 3 included in Appendix C4.

Based on the general visual assessment of the roadways, there appears to be seven (7) areas along the tertiary delivery routes internal to the project area that have the potential to exceed the assumed maximum 6% longitudinal grade. It is recommended these areas be field surveyed to confirm prior to deliveries. In accordance with previous experience, excessive longitudinal slopes can be overcome by modifications to the delivery vehicles and/or the use of auxiliary vehicles providing external hull assistance.

Based on the general visual assessment of the roadways, there appears to be one (1) location along the tertiary delivery routes that show the potential of there being humps in the road where the change in elevation exceeds the assumed maximum of six inches in 50 feet that is required to prevent the load from "bottoming out". This area is the railroad crossing at point of interest ID 320. Refer to Appendix C5 for photographs of this railroad crossing. It is recommended these areas be field surveyed to confirm prior to deliveries. This hump can be corrected by designing a slight milling down of the existing pavement and applying an overlay and rail wedge over the existing road.

8.0 REPORT CONSIDERATIONS AND LIMITATIONS

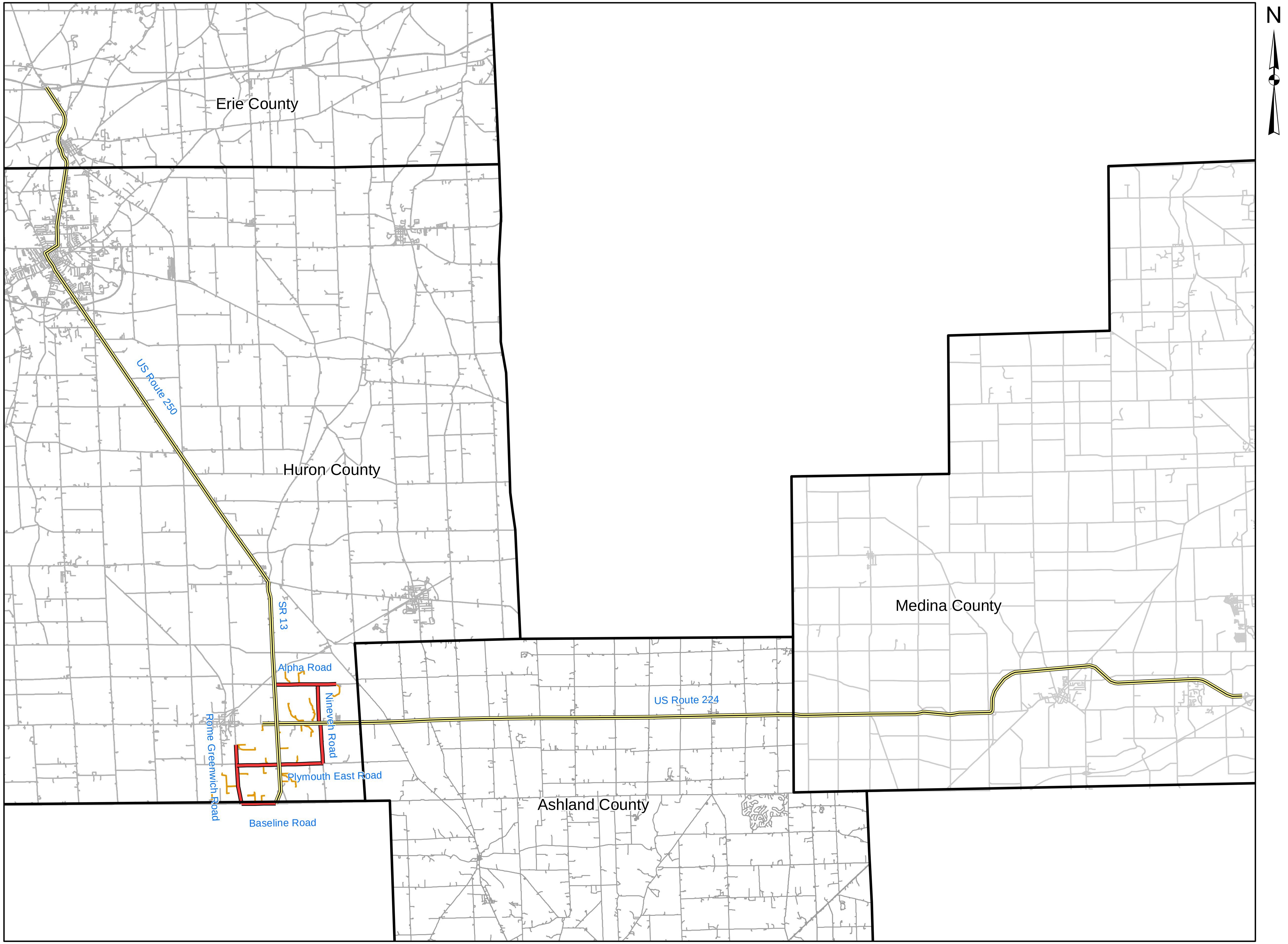
Per Client direction, the scope of this report is to provide an inventory and visual inspection assessment on the general condition of the subject roadways and underlying culverts. MCA has not performed a structural analysis on any of the existing subject roadways, culverts, or bridge structures. Although professional responsibility was taken to research all available data and locate every potential area of concern within the scope of this evaluation, MCA cannot claim that the inventory of overhead obstructions, bridges, culverts, other points of interest, or the potential areas of concern presented in this report to be all-inclusive. Potential areas of concern are based on assumptions made for the anticipated delivery vehicles. Actual delivery truck parameters and site specific conditions may dictate alternate concerns and recommendations.

This document and its attachments shall be interpreted as a professional engineering opinion based upon the procedures and review as discussed in the enclosed documents. It should be understood that this report summarizes a preliminary evaluation and is per the request and for the use and benefit of the Client only. MCA reserves the right to revise any conclusions presented in this report as additional information is made available.

Should you have any questions or require any additional information regarding this document, please do not hesitate to contact us at (734) 483-1427.

APPENDIX A

Designated Delivery Route Scope Assessment Map



WINDLAB SYSTEMS

GREENWICH WIND FARM

PRELIMINARY DELIVERY
ROUTE EVALUATION

1 in = 3 miles

0 1.5 3 6
Miles

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DRAWN BY	MCA JOB #	DATE	REV	ISSUED FOR:
RP	1037-13-5786	11-18-13		CLIENT

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APPENDIX B

Nordex Transport, Access Roads and Crane Requirements, Ver. Gamma
Section 3, Requirements For The Access Roads

Transport, Access Roads and Crane Requirements

Nordex N80/N2500, N90/2500, N100/2500, N117/2400
Version gamma

Table of Contents

1 Basics

All details regarding the transport project must be agreed to with all persons involved beforehand.

Local conditions always define the transport project (i.e., the process is always project-specific).

All drawing dimensions in chapter 2 are given in millimeters (mm).

3 Requirements for the access roads

To avoid problems during the erection of the wind turbine, the following minimum requirements for the access roads must be met under normal soil conditions:

3.1 Loads

The access roads for each wind turbine must be capable of supporting the following loads:

Vehicles:

- Approx. 50 concrete and construction vehicles, up to 70 vehicles for hybrid towers
- 12 to 20 heavy trucks for crane erection, depending on hub height
- Approx. 10 to 13 heavy trucks with turbine components (3 to 5 tower sections, 3 rotor blades, 3 for nacelle, rotor hub and drive train, 2 for switch cabinet (Bottombox), small parts and erection container)
- Max. length: 57 m
- Required clearance height: 4.40 to 5.90 m depending on the method of transportation
- Different types of construction vehicles

Vehicle weights:

- Max. load per axle: approx. 12 metric tons
- Max. overall weight: approx. 165 metric tons

3.2 Specifications

Roads must be constructed of sufficient design to accommodate the numerous component loads without failure under normal weather conditions at the project site. The maximum allowable rutting during delivery is 3″. When rutting exceeds 3″, the BoP Contractor/ Owner must redress the roads to allow for the safe delivery of components to the foundation pad to continue.

Site access roads must be constructed up to the crane pad and foundation laydown area. Additional road or cleared area capable of supporting empty delivery trucks must be constructed around the turbine to allow for the truck to leave the site without backing out after unloading. If such loop is not possible due to site constraints then another form of truck turnaround must be constructed. Neither loaded nor empty trucks can back long distances or around curves of any type.

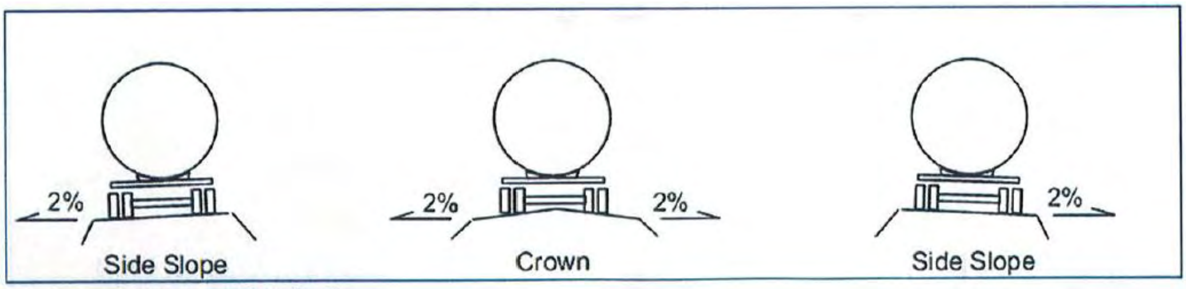
Site access roads must be compacted to 95% and have a solid surface such as crushed rock or recycled asphalt and concrete. At locations where the road bearing pressure cannot be achieved through compaction or use of more aggregate, cement or lime stabilization may be needed.

BoP Contractor or Owner shall be responsible for the final road design and adherence to the requirements of this specification.

3.3 Slopes

Site access roads must be constructed such that slopes do not exceed 6 %. Where project site conditions require inclinations greater than 6% Nordex must be given prior notice and provide authorization that components and cranes can be transported along such inclinations. Where slopes and curves are combines, access roads must be constructed such that the maximum slope throughout a curve does not exceed 4%.

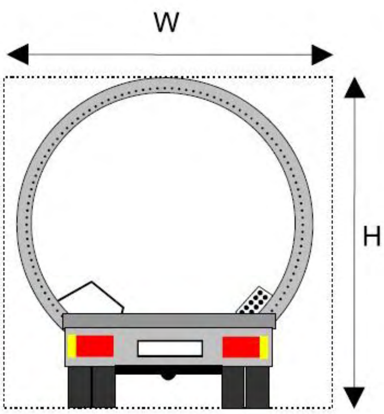
Site access roads must be constructed such that the road crown or side slope does not exceed 2%.



Site access roads must be constructed such that the dips or humps long the roadway do not exceed 6 inches in 50 feet. Generally it is not acceptable to double this requirement (12 inches in 100 feet) as some loads have up to and exceeding 100 feet between front and rear trailer axels with loads less than 12 inches from the road surface.

3.4 Clearance profile on a straight route

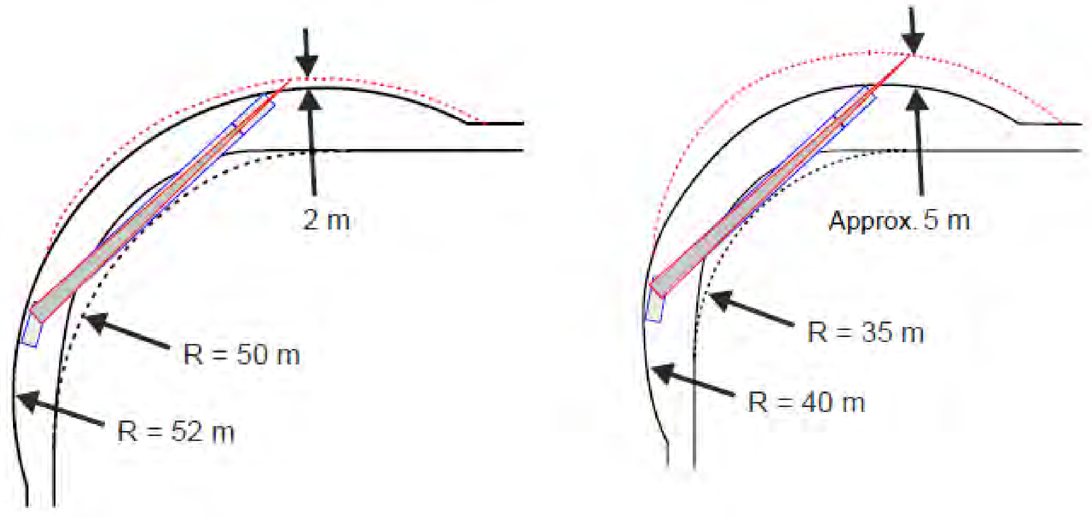
	For all hub heights	
H	Clearance height	4.40 to 5.90 m, depending on method of transportation
W	Clearance width	4.50 m



3.5 Curves

The following sketch shows the required space for the rotor blade of an N117/2400 or N100/2500 in a curve with an inner radius of 50 m or for the rotor blade of an N90 /2500 in a curve with an inner radius of 35 m (examples). The continuous lines depict the travel of the truck. The dashed lines mark the areas covered by the vehicle and the rotor blade. The outer area covered is determined by the length of the rotor blade protruding at the rear.

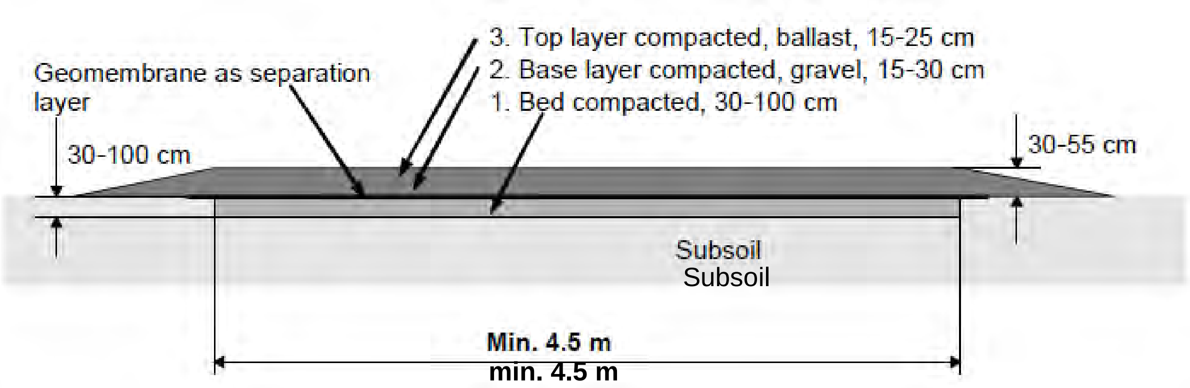
The area covered (dashed) must be free of all obstacles, i.e., trees, streetlights, buildings, masts, etc.



Where site roads are constructed having adjacent opposite curves, a minimum 140 feet of straight road must be constructed between the curves.

3.6 Road foundation

Example of a cross-section of an access road



APPENDIX C

Designated Delivery Route Limitation Assessment

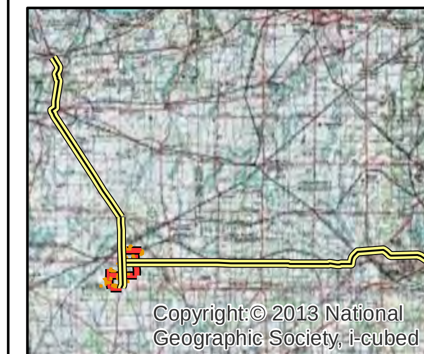
N

windlab

WINDLAB SYSTEMS

GREENWICH WIND FARM

PRELIMINARY DELIVERY ROUTE EVALUATION



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- Turbine Access Roads

1 in = 600 ft

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Feet

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FAX: 734.483.3431
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GREENWICH WIND FARM

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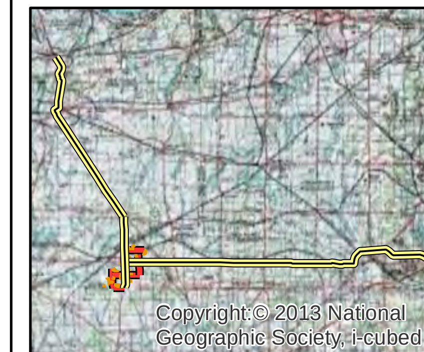

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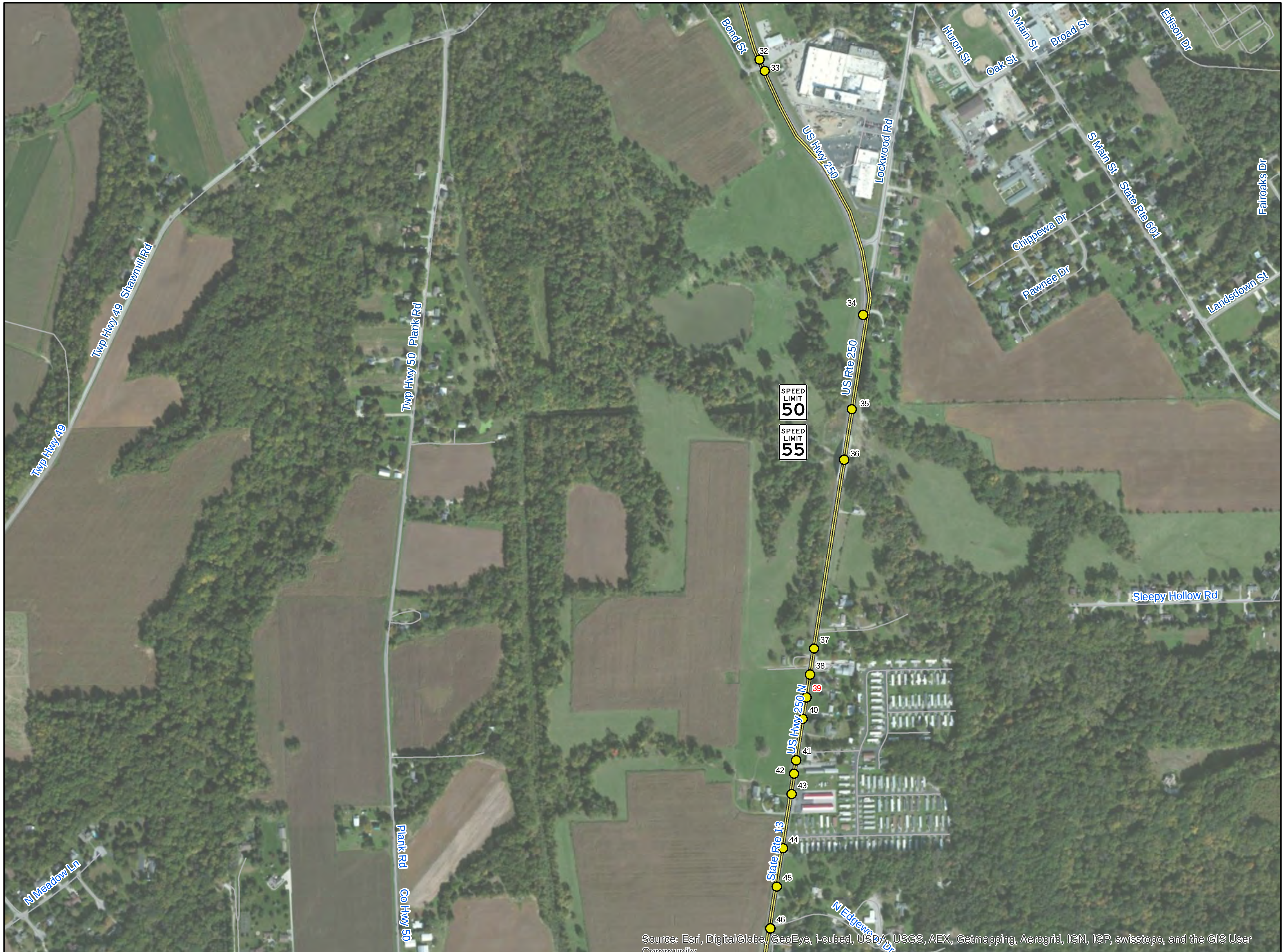

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GREENWICH WIND FARM

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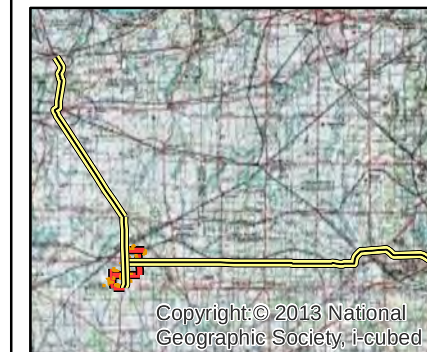

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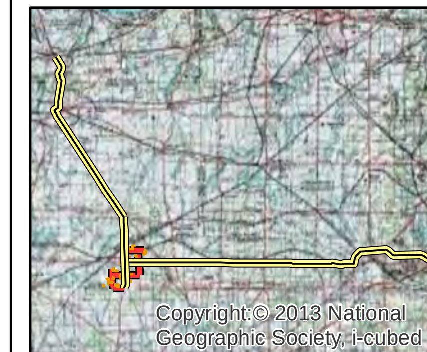

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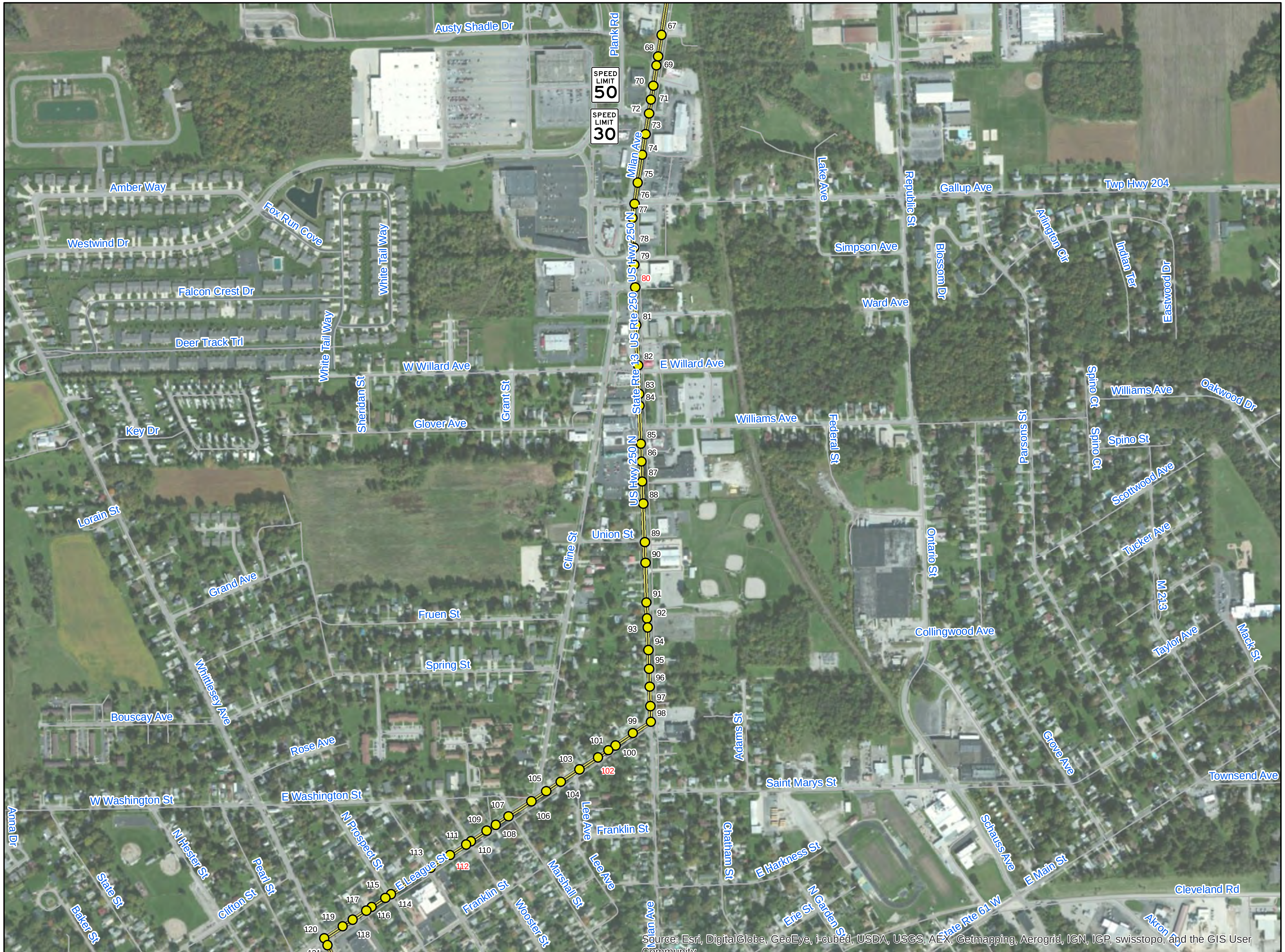

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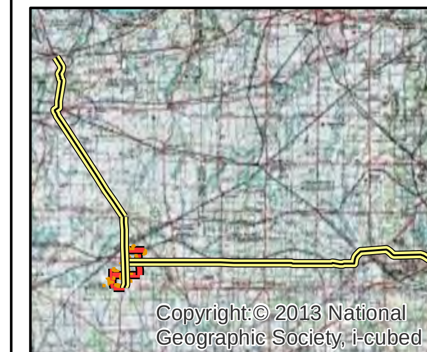

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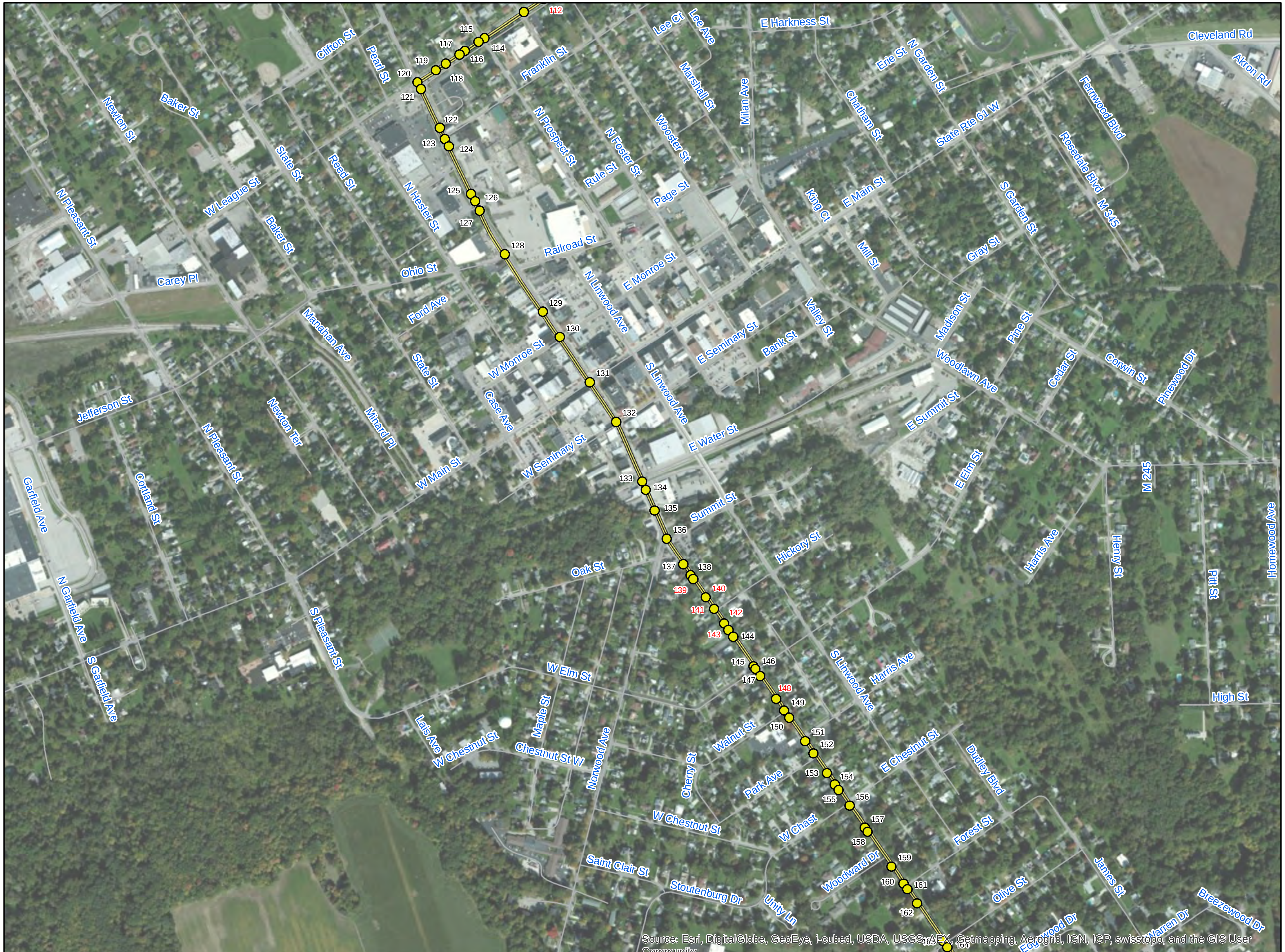

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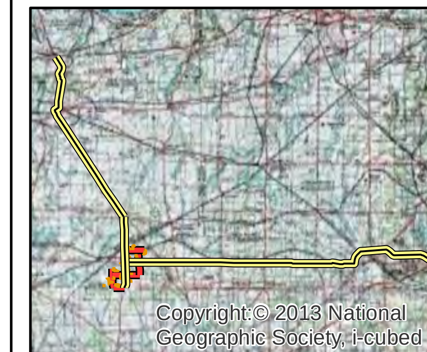

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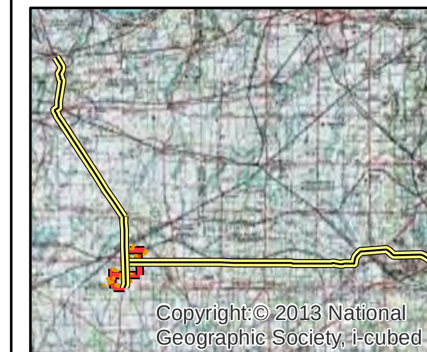

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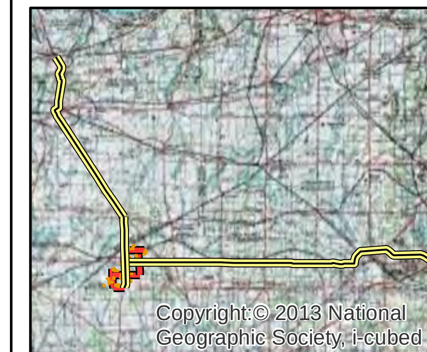

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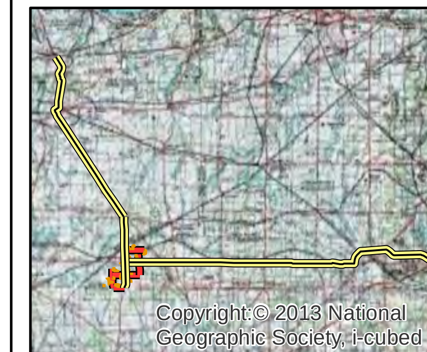

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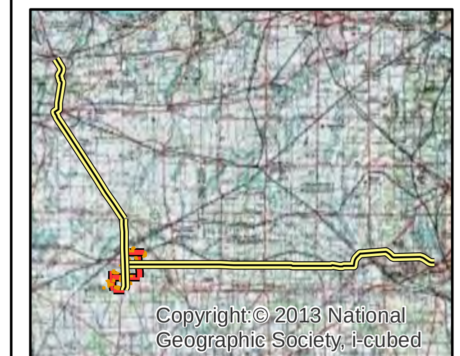

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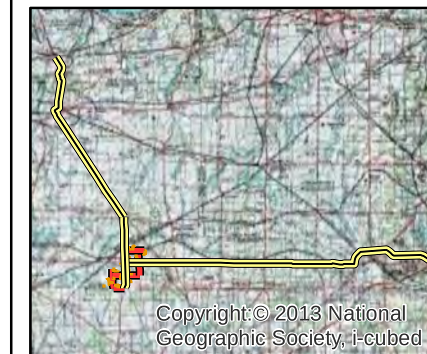

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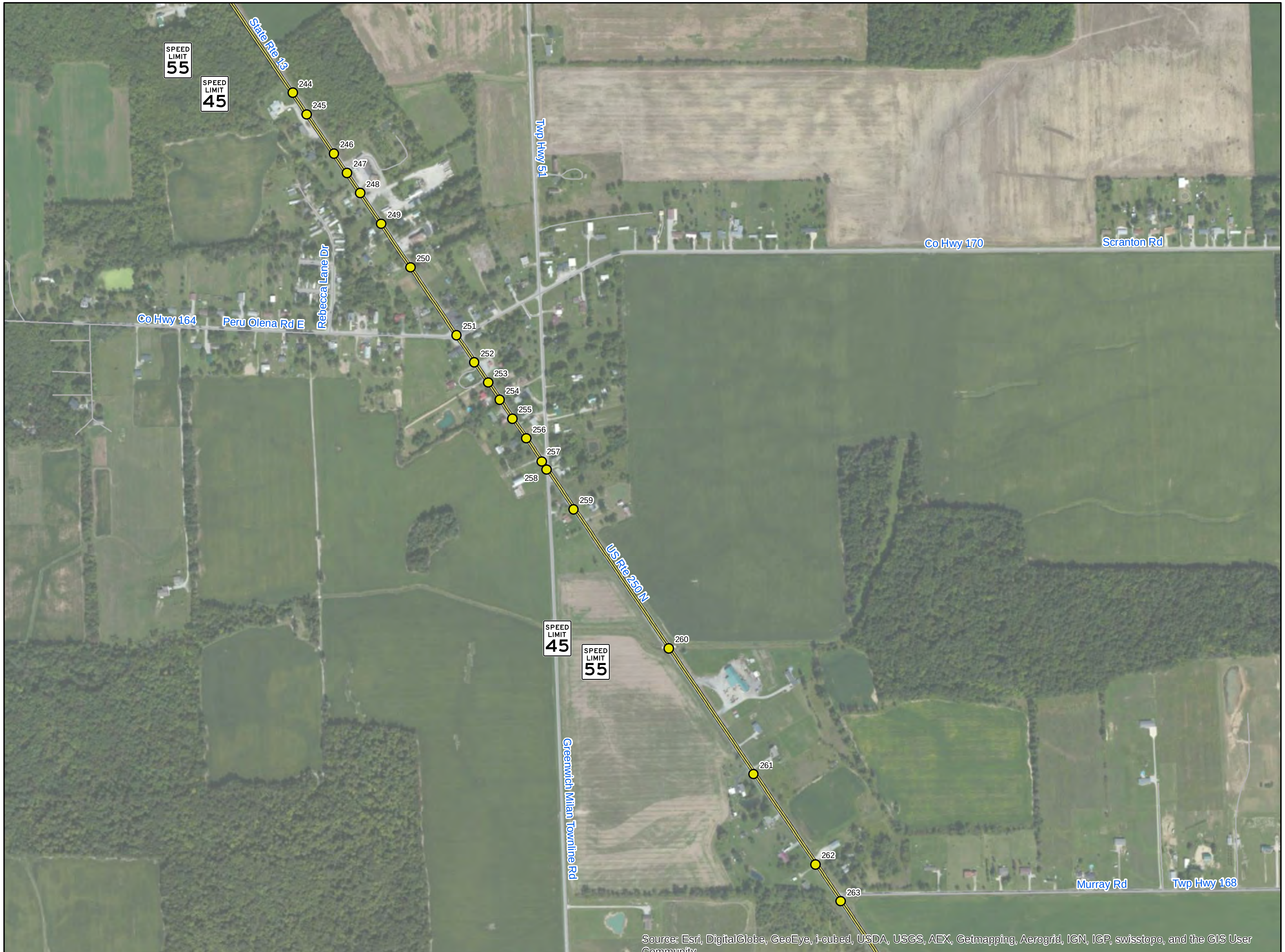

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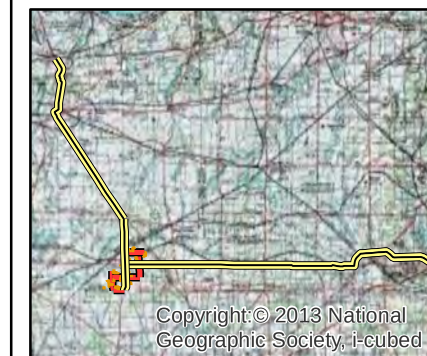

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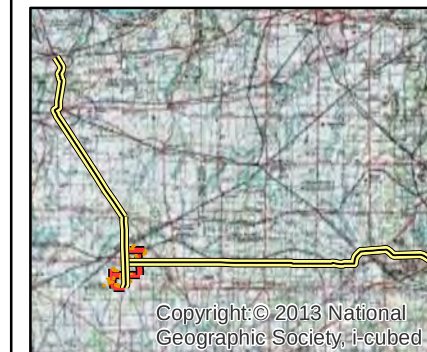

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