nationalgrid

Lockport-Batavia Line 112
Rebuild Project

Exhibit 3

Alternatives

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EXHIBIT 3: ALTERNATIVES

3.1 INTRODUCTION

The Applicant[1] analyzed alternatives to rebuilding its existing Lockport – Batavia Line 112 ("Existing Line 112") to address the need described in Exhibit E-4 – Engineering Justification. Considering the specific purpose and need for the Project and the fact that Existing Line 112 has been located on an existing right-of-way ("ROW") for over one hundred years, alternatives that would typically be reasonable for a proposed new transmission facility on a proposed new ROW would not be reasonable for this Project.

As described in Exhibit 2, Existing Line 112 has been divided into six (6) Segments[2] (Segments 1-5 and Segment 7) in order to facilitate discussion of impacts, costs, and construction requirements associated with the Project. These same segments will be referenced in this exhibit to discuss alternatives.

The following sections discuss alternative transmission line technologies and structure types, an alternative transmission line route for Segment 4 in the Tonawanda Wildlife Management Area ("TWMA"), alternative ROW configurations in the northernmost portion of Segment 3 to ensure conformance with New York State electric and magnetic field requirements, an underground alternative, alternative methods for fulfilling the energy requirements of the Project, and the alternative of taking no action.

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[1] In this exhibit, the term "Applicant" and numerous other capitalized terms are defined in the Glossary included in this Application.

[2] Another segment of Existing Line 112, designated as Segment 6, extends approximately 1.9 miles on the site of the Western New York Science and Technology Advanced Manufacturing Park being developed by the Genesee County Economic Development Center, from new Structure 173 ½ to new Structure 184 ½. Segment 6 is not part of the Project. It was the subject of a report to the Commission under 16 NYCCR Part 102 (Case 22-T-0502). The Applicant intends to include as-built drawings of Segment 6 in the EM&CP.

3.2 NO ACTION ALTERNATIVE

The no action alternative does not serve the need to address the deteriorated asset condition of the 1907-vintage steel tri-leg towers on Existing Line 112. Therefore, National Grid does not consider the no action alternative an effective alternative to the Project.

3.3 ALTERNATIVE TECHNOLOGIES

National Grid considered one (1) possible alternative transmission technology: use of direct current (“DC”) electric transmission. To install a new DC transmission line between the Lockport and Batavia Substations, National Grid would need to build a new power conversion facility and interconnect it to each of the two (2) substations, presently designed to handle only alternating current (“AC”) circuits. Because of the relatively short ROW distance between the Lockport and Batavia Substations (34 miles), the installation of a DC circuit and associated conversion facilities would be cost prohibitive. This result is to be expected for a short distance DC transmission line incorporated into an AC system. DC circuits are typically utilized to transfer bulk power from point to point over long distances with interconnection into the AC system. Additionally, the existing substations served off of Existing Line 112 would require either a different source or significant modification and expansion to become DC-to-AC conversion facilities. Accordingly, the DC alternative was not considered further for the replacement of Existing Line 112.

3.4 ALTERNATIVE STRUCTURE AND CONDUCTOR TYPES

In 2018, National Grid did a quantitative comparative analysis of wood-pole vs. steel-pole structures based on considerations of safety, reliability/resilience, cost and environmental impact. This analysis determined that, overall, steel-pole structures were superior to wood-pole structures. This led to an update of National Grid's transmission line design standards for major rebuild/refurbishment capital projects, whereby the replacement of tangent structures will be with light-duty steel pole structures and the replacement of angle and dead-end structures will be with self-supporting steel pole structures typically set on caisson foundations.[3]

Structure types were optimized to ensure that modifications to adjacent circuits were minimized to the greatest extent practicable. The use of galvanized steel pole single-circuit braced post structures in Segments 1 and 2 was driven by the need to ensure circuit to circuit clearances in the Project ROW. These structures are more narrow than the standard galvanized steel pole delta davit arm structures proposed for Segments 3, 4, 5, and 7. The use of the galvanized steel pole single-circuit braced post insulator structures in Segments 1 and 2 allow for the one-for-one replacement of existing structures, whereas the use of galvanized steel pole delta davit arm structures would require additional structures with shorter span lengths to control conductor motion in the Project ROW, which in turn would add cost and additional ground line impacts to the Project.

National Grid's standard conductor type for 115kV transmission lines is 795 MCM Aluminum Consductor Steel Reinforced ("ACSR") "Drake" (26/7), which is proposed for this Project. National Grid considered using 477 MCM ACCR "Hawk" (26/7) conductor, which has the same current carrying capacity as the 795 MCM ACSR "Drake" (26/7) and the added benefit of lighter weight, smaller diameter, and less sag during high current flows (maximum operating temperature) which allows for longer span lengths and thus fewer required poles. However, there are characteristics of Existing Line 112's configuration in Segment 2 and future design requirements in Segment 4 which prevented the use of the more expensive 477 MCM ACCR "Hawk" (26/7) conductor.

As seen in Figure 3-1 below, the ROW in Segment 2 is occupied by the 115kV Existing Lines 107, 108, 111, 112, 113 and 114, in addition to Existing Line 112. The typical span length for these lines in the shared ROW is between 500 and 550 feet. To take full advantage of the 477

[3] National Grid Transmission Line Design Guide GL.06.01.121 Version 1.26 – 5/27/2020.

MCM ACCR “Hawk” (26/7) conductor and lengthen the spans of the Rebuilt Line 112, structure placement would be optimized based on maximum allowable span length, creating instances where a new structures would be introduced that do not align with the existing structure locations of the adjacent circuits. This in turn would introduce circuit-to-circuit clearance challenges with conductor blow-out, along with adverse visual impact in the rural landscape of Segment 2.

FIGURE 3-1 CONFIGURATION OF TRANSMISSION LINES IN SEGMENT 2

(Left-Right: Existing Lines 114 & 113, Existing Line 112, Existing Line 111, Existing Line 107 and Existing Line 108)

For Segments 3, 4, 5, and 7, where the Exising 112 Line runs alone in its own ROW for approximately nine (9) miles, it was determined in preliminary engineering that the required dead-end structures at the boundaries of Segments 4 and 7 result in the remaining sections being much shorter. These shorter sections did not allow for the total number of structures in each Segment to be reduced to a point where the increased material cost of the 477 MCM ACCR “Hawk” was fully offset by the removal of structures from the scope.

3.4.1 Environmental Impacts – Alternative Structure Types

3.4.1.1 Visual Impacts

Electric transmission facilities can impact both the character and scenery of a landscape. From a scenery perspective, it is difficult to completely avoid all visual impacts when siting overhead electric transmission facilities. These challenges include, but are not limited to, the structure height necessary to carry the proposed voltage and traverse variable terrain, length of project ROW, and the absence of natural vegetative cover in some areas. Additionally, siting transmission facilities only in the interest of reduced visual impact can often be incompatible with providing optimal service to electric customers. As discussed in Section 4.4 of Exhibit 4, because this Project is a rebuild of existing transmission lines, the viewscape already includes electric transmission infrastructure. As such, visual impact associated with this Project should be assessed in this context.

To analyze visual impacts for the Project, both viewshed analysis and visual simulations were conducted, as described herein.

3.4.1.2 Cultural Resources

A Phase IA archeological sensitivity assessment and literature review and Phase IB archeological testing were conducted for all segments of the Project, and the results were submitted to the OPRHP. On June 22, 2022, OPRHP issued an opinion letter stating, "it is the opinion of the OPRHP that no properties, including archeological and/or historic resources, listed in or eligible for the New York State and National Registers of Historic Places will be Adversely Impacted by this Project." See Appendix A – Agency Correspondence. Alternative structure types are not anticipated to have a different level of impact on cultural resources than the structures described in Section 3.4.

3.4.1.3 Terrestrial and Wildlife Resources

For alternative structure types, vegetative communities within the Project ROW would be temporarily disturbed to some degree by construction activities and equipment access. Within the Project ROW, trees and shrubs would be mowed or cleared to provide unimpeded and safe access to proposed structure work sites for all alternative structure types. Impacts to terrestrial and wildlife resources are not expected to vary depending on structure types.

3.4.1.4 Wetlands and Water Resources

The Existing Line 112 centerline traverses approximately 31,657 linear feet of delineated wetlands, with approximately fifty-eight (58) existing structures located in delineated wetlands. Current design of the Project includes fifty (50) replacement structures located in delineated wetlands, including five (5) structures and their associated work pads located within twenty-five (25) feet of delineated streams. Impacts to wetlands and water resources are not expected to vary depending on structure types.

3.4.1.5 Topography and Soils

There are no unique geologic or topographic features that would be permanently affected by the construction or operation of the Project. Temporary environmental effects during construction related to topography and soils would most likely occur in areas of steep slopes or areas where activities could result in significant ground disturbance. Impacts to topography and soils for each alternative are considered negligible for comparison purposes.

3.4.1.6 Noise

While operational noise impacts would be nominal for each of the structure type alternatives, temporary noise impacts from construction are anticipated. Utilizing the steel-pole and conductor design consistent with National Grid's current transmission line design standards would be consistent with current noise levels.

3.4.2 Structure Type Conclusion

It is the Applicant's opinion that the steel-pole design consistent with National Grid's current transmission line design standard presents the alternative of least impact on resources discussed in this exhibit. Moreover, the Applicant intends to minimize impacts by selective structure placement and the use of good construction practices, which will be detailed in the Environmental Management and Construction Plan ("EM&CP").

3.5 ALTERNATIVE ROUTE

The acquisition of new easements and other land rights that would be required to relocate Rebuilt Line 112 to a ROW significantly different from that of Existing Line 112 would result in greater costs compared to rebuilding Existing Line 112 along its existing ROW, and no environmental or operational benefits would be gained. Aerial photography shows there are no entirely new routes available that would avoid significant impact to existing residential developments, agricultural lands, or commercial/industrial areas. Furthermore, the need for this Project is only to rebuild the portion of Existing Line 112 from Structure 1-2, just outside of the Lockport Substation, to the last steel tri-leg structure (Structure 211), because from Structure 211 to Batavia Substation, all the structures in Existing Line 112 are single circuit wood poles which are in acceptable asset condition and not in need of replacement. Relocating Existing Line 112 would involve unneccesarily increasing the scope of work, cost and impacts of the Project.

In addition to the potentially significant land use and visual impacts associated with establishing a new route, the following factors also justify the use of the proposed route for the Project:

- National Grid generally has existing property rights that allow for the rebuild and reconductoring of the existing lines, as was contemplated when the initial property rights were acquired.
- The proposed route uses existing multi-line transmission corridors in Segments 1 and 2, and following existing transmission corridors is the Applicant's first choice for establishing any new alternative route.
- Without significant modifications to the substations presently served, any new line would have to approach and re-enter the existing substations from the same positions as the existing lines, thereby forcing any new route back to the proposed route in the vicinity of the substations.

These factors led the Applicant to propose rebuilding Existing Line 112 along its current centerline, with only two exceptions (see below).

First, the Applicant proposes a minor alignment adjustment between Structures 195 and 200 in Segment 7. This is to minimize the amount of additional ROW required through a residential parcel, as more fully described in Exhibit 2.

3.5.1 Segment 4 Relocation

The second exception arose because, as no viable new ROW was identified for relocating the entire length of the Project, the alternative routing analysis turned to comparing the reuse of the Segment 4 Existing ROW, an approximately 1.8 mile section of Existing Line 112 between existing Structure 141 and existing Structure 160, to options involving relocation of Segment 4 to a new ROW.

The Applicant consulted with New York State Department of Environmental Conservation ("NYSDEC") Region 8 representatives about reroute alternatives for Segment 4 which would avoid, as much as possible, large wetland areas containing sensitive plant and wildlife species and provide better access for National Grid routine maintenance and storm restoration activities while still being within the TWMA. Several Segment 4 reroute alternatives discussed with the NYSDEC Region 8 were ultimately rejected due to either the disturbance of sensitive plant and wildlife species, the location being within the New York Power Authority's ("NYPA") 345kV Niagara-Adirondack transmission line corridor that NYPA declined to share, potential land use conflicts with the nearby Tonawanda Reservation and Iroquios National Wildlife Refuge, or the need for multiple road crossings to avoid rural residences.

The NYSDEC Region 8 recommended a route that is approximately 0.2 miles to the northeast of the centerline of Segment 4 Existing. The route runs along the south side of Lewiston Road (NYS Route 77 in the Town of Alabama) and along the west side of Feeder Ditch Road, extending approximately 2.2 miles from Structure 142 to Structure 160.

National Grid has evaluated the alternative route recommended by the NYSDEC Region 8. It considers it to be the most environmentally compatible route for this part of the Project, and believes that the NYSDEC agrees. Thus, National Grid has included it in the Project as Segment 4 Relocation.

The Segment 4 Relocation portion of the Project (in Figure 3-2) consists of rebuilding Existing Line 112 with approximately twenty (20) new single circuit steel davit arm structures. It requires acquisition of additional 100 foot ROW in the TWMA and additional property rights / operational easement on mostly undeveloped land.

The analysis in the following sections compares use of the route recommended by the NYSDEC Region 8 (*i.e.*, Segment 4 Relocation) to reuse of the Segment 4 Existing ROW (*i.e.*, Segment 4 Existing Rebuild) and provides the detailed basis for National Grid's decision to propose the former for Segment 4 of the Project.

3.5.2 Reuse of Segment 4 Existing ROW

Reusing the Segment 4 Existing ROW would continue the placement of Line 112 in large NYSDEC regulated wetlands within the TWMA. Segment 4 Existing is supported on steel tri-leg towers that are ten foot offset from the centerline of the existing 40-foot-wide easement. If the Segment 4 Existing ROW were to be reused for the Project, single circuit steel davit arm structures would be utilized and Rebuilt Line 112 would be installed along the same centerline as Segment 4 Existing.

3.5.3 Environmental Impacts – Use of Segment 4 Existing ROW or Segment 4 Relocation ROW

The intent of this section is to describe the existing environmental conditions and identify and compare the potential environmental impacts associated with reuse of the Segment 4 Existing ROW versus use of the Segment 4 Relocation ROW. Resources are presented on a summary basis, and a comparison of the environmental conditions and impacts discussed in this section is provided in Table 3.5-1 below.

3.5.3.1 Land Use

Segment 4 Existing is best characterized as an existing utility ROW that is presently occupied by Existing Line 112. Land use is classified as agricultural per Genesee County Geographic Information System ("GIS') real property parcel data information. The Existing ROW traverses NYSDEC wetland areas within the TWMA, and the Existing ROW crosses Meadville Road. Overall adjacent land uses are mostly agricultural, residential, conservation lands, and public parks. The reuse of the Segment 4 Existing ROW by rebuilding Line 112 (including replacement of structures, conductor and shield wire) in the same location as Segment 4 Existing would result in the need to expand the Existing ROW to a 100 foot width and to acquire danger tree rights on abutting parcels. This ROW expansion would be driven by the need to ensure that the proposed facilities are located on land with Applicant-owned rights, to ensure conformance with the Public Service Commission's electric and magnetic field guidelines, and to ensure that the corridor conforms with the Applicant's Transmission Right-of-Way Maintenance Plan ("TROWMP"). Clearing of trees and shrubs would be kept to a minimum but still be consistent with the standards of National Grid's TROWMP.

The Segment 4 Relocation alternative would still be inside the TWMA, and its land use would remain classified as agricultural. Overall, adjacent land uses are mostly agricultural, residential, Conservation Lands, and public parks. The relocation would avoid NYSDEC wetlands within the TWMA as much as possible. The Segment 4 Relocation alternative would require the acquisition of 100 foot wide ROW in the TWMA, generally in the form of operational easements for its entire length (approximately 2.2 miles). The area covered by the new operational easements required for Segment 4 Relocation would total approximately twenty-nine (29) acres.

The acquisition of operational easements on the Segment 4 Relocation alternative for the most part affects undeveloped land. Segment 4 Relocation would be wholly within the TWMA.

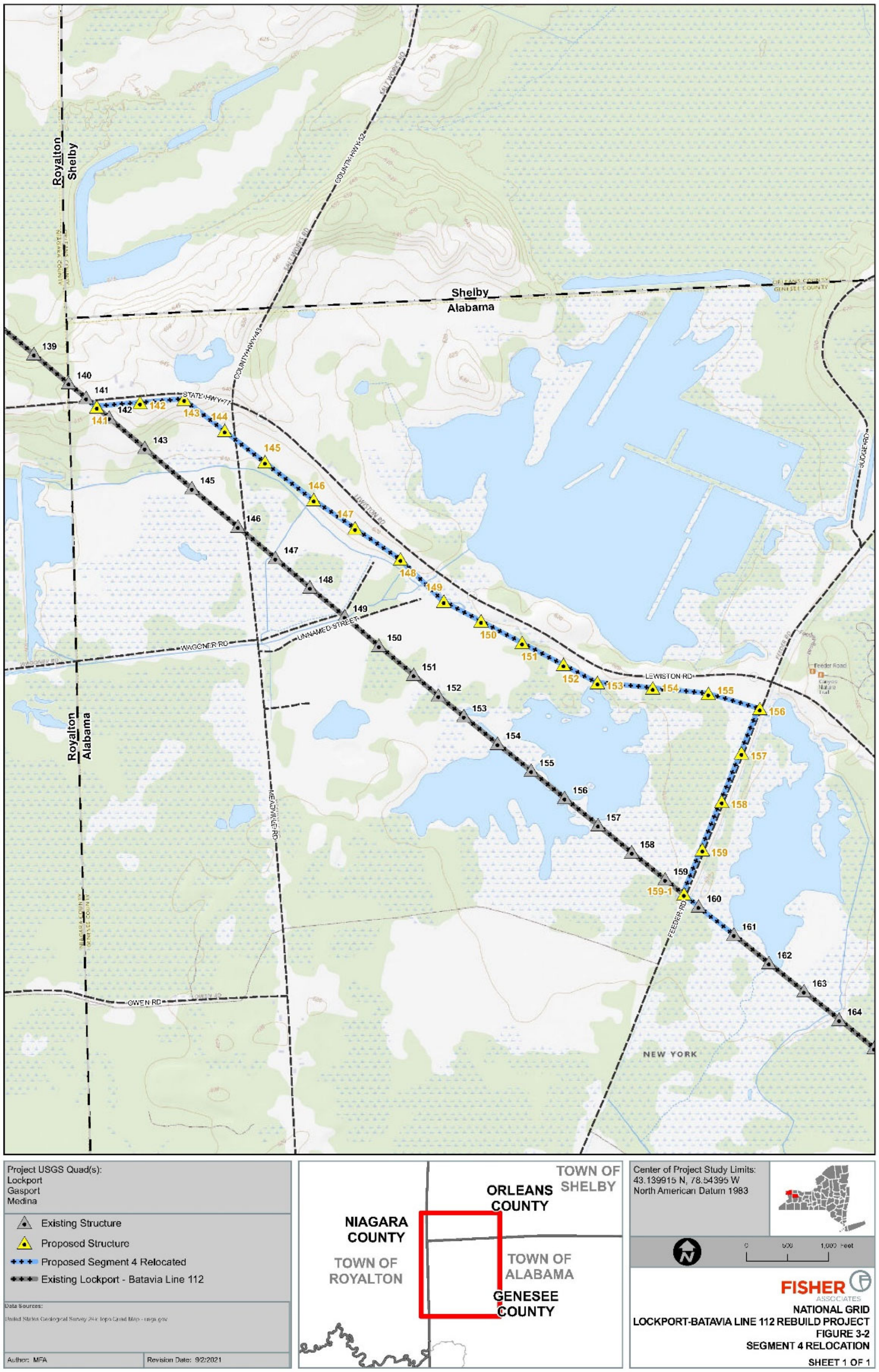
The Segment 4 Relocation alternative would allow for the removal of Existing Line 112 from the Segment 4 Existing ROW and would move the line outside of the large NYSDEC wetlands in this area.

3.5.3.2 Visual Resources

Use of the Segment 4 Relocation alternative as part of the Project would result in the removal of eighteen (18) transmission structures along Segment 4 Existing within the NYSDEC wetlands in the TWMA, eliminating their negative visual impacts, and the addition of approximately twenty (20) structures in a new utility ROW southwest of Lewiston Road that are mainly outside of NYSDEC wetlands, resulting in negative visual impacts for that ROW. The visual impacts of the Project would be little different if it included the Segment 4 Existing Rebuild: most of the structures on Segment 4 Existing would be removed, eliminating their negative visual impacts (except for select existing structures that NYSDEC has requested be retired in-place to allow for avian nesting), and the installation of approximately twenty (20) new structures in Segment 4 Existing would result in negative visual impacts for that ROW. The proposed structure heights would be approximately 15-20 feet higher than the existing structures, one residence is located within 100 feet of the edge of ROW.

Overall, the somewhat greater number of single circuit structures that would be required for the Segment 4 Relocation alternative would result in a slight incremental visual impact to the area as compared to the Segment 4 Existing Rebuild alternative. See Figure 3-3 for a viewshed analysis comparison of the Segment 4 Relocation alternative versus the Segment 4 Existing Rebuild alternative.

FIGURE 3-2 SEGMENT 4 RELOCATION



In Figure 4.4-2 of Exhibit 4, Viewpoints 3 and 4 (Lewiston Road, Alabama, New York, at the northwest and southeast ends, respectively, of the Segment 4 Relocation alternative), show Segment 4 Existing (existing conditions photos) and simulations of the Segment 4 Relocation alternative. Viewpoint 3 is from within the Lewiston Road ROW, and it is reflective of a small number of viewers of a specific local constituency that would generally have short duration views. Viewpoint 4 is from within the Lewiston Road ROW approximately 230 feet east of two residences and near the TWMA overlook, and it is reflective of regional and local viewers that would generally have short and long duration views.

3.5.3.3 Cultural Resources

A Phase IA archeological sensitivity assessment and literature review and Phase IB archeological testing were conducted for all segments of the Project, and the results were submitted to the OPRHP. On June 22, 2022, OPRHP issued an opinion letter stating, "it is the opinion of the OPRHP that no properties, including archeological and/or historic resources, listed in or eligible for the New York State and National Registers of Historic Places will be Adversely Impacted by this Project." See Appendix A – Agency Correspondence. Alternative structure types are not anticipated to have a different level of impact on cultural resources than the structures described in Section 3.4.

3.5.3.4 Terrestrial and Wildlife Resources

Construction of the Segment 4 Relocation alternative would result in temporary disturbance of vegetative communities by construction activities and equipment access. Trees and shrubs on the Existing ROW would be mowed or cleared to provide unimpeded and safe access to proposed structure work sites and for structure work pads. This activity would result in minor short-term impacts to the existing conditions, with no permanent impacts expected.

Removal of Line 112 from Segment 4 Existing will result in a significant increase in vegetation as Segment 4 Existing is in wetlands and requires cyclical mowing to maintain access. Relocation of this portion of Line 112 would result in an increase in terrestrial and wildlife habitat.

Following construction, the vegetation on all segments of the new Project would be maintained in accordance with National Grid's TROWMP and would return to the same shrub and herbaceous vegetative cover type that presently exists on the Project ROW.

3.5.3.5 Wetlands and Water Resources

Based on a preliminary design, the Segment 4 Relocation alternative would have the potential for fourteen (14) structures to be located within wetlands (Structures 145, 146, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, and 159-1), whereas the Segment 4 Existing rebuild alternative would have the potential for sixteen (16) structures (Structures 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, and 159) to be located within wetlands. Additionally, there are a larger number of wetland communities along the Segment 4 Existing ROW than in the Segment 4 Relocation alternative, so it is anticipated that overall there would be less potential for wetland impacts by selecting the Segment 4 Relocation alternative versus the Segment 4 Existing Rebuild alternative.

The Segment 4 Existing Rebuild alternative centerline would cross one (1) stream (field delineated Stream 009, Mud Creek and Tributaries, which is a tributary to Tonawanda Creek, a NYSDEC Class C stream), potentially resulting in additional impacts depending on location of work pad siting and access. The proposed Segment 4 Relocation alternative centerline would not cross any streams.

It is the Applicant's opinion that the Segment 4 Relocation alternative would have fewer impacts to wetlands and water resources.

3.5.3.6 Topography and Soils

There are no topography or soil related impacts anticipated as a result of selecting either the Segment 4 Existing Rebuild alternative or the Segment 4 Relocation alternative.

3.5.3.7 Noise

Construction for both the Segment 4 Existing Rebuild and Segment 4 Relocation alternatives would result in temporary noise impacts associated with removal and installation of structures. There are no permanent noise related impacts anticipated as a result of selecting either the Segment 4 Existing Rebuild alternative or the Segment 4 Relocation alternative.

3.5.3.8 Invasive Species

An initial survey for the presence and abundance of invasive species as listed on the NYSDEC Prohibited and Regulated Invasive Species List issued September 10, 2014 (under Title 6 NYCRR Part 575: Prohibited and Regulated Invasive Species) was performed between August

6 and October 2, 2019, June 16, 2020, and November 12 and 13, 2020 and can be found in Appendix E of the Application. The survey identified invasive species within both Segment 4 alternatives. The EM&CP will address the measures to be implemented to minimize the introduction and spread of invasive species during construction. Based on National Grid's experience on other projects, it is anticipated that good construction practices will prevent any spread of invasive species to surrounding areas regardless of which alternative route for Segment 4 is selected.

TABLE 3.5-1 SEGMENT 4 EXISTING REBUILD AND SEGMENT 4 RELOCATION ROUTES - IMPACTS COMPARISON

	Segment 4 Existing Rebuild	Segment 4 Relocation
Length (mi)	1.8	2.2
Proposed Structure Type	Light-duty single circuit steel davit arm and dead-end structures with steel poles on caisson foundations.	Light-duty single circuit steel davit arm and dead-end structures with steel poles on caisson foundations.
Property Rights Required (acres / parcels)	TWMA	TWMA
Existing easement expansion (feet)	0 – 60	100
Residences within 100 feet of ROW	1	0
Land Use	Agricultural and Fish, Game and Wildlife Preserves	Agricultural and Fish, Game and Wildlife Preserves
Visual	Widening of Existing Line 112 ROW (increase in visual impact); removal of all existing Segment 4 Existing structures (decrease in visual impact)	New utility ROW and greater number of structures (increase in visual impact); removal of most existing Segment 4 Existing structures (decrease in visual impact)
Cultural	No Effect	No Effect
Terrestrial and Wildlife	Negligible	Negligible
Wetlands and Water Resources	21.2 acres of wetlands within Project ROW, 16 str. in wetlands; 1 stream crossing[1] +/- 1.6 miles of wetlands will be crossed.	19.2 acres of wetlands within Project ROW, 14 str. in wetlands; 0 stream crossings, +/- 1.3 miles of wetlands will be crossed.
Topography and Soils	None	None
Noise	Temporary construction-related	Temporary construction-related
Invasive Species	Negligible	Negligible
Notes: [1] Stream 009 is located within the Tonawanda Wildlife Management Area.		

3.5.4 Segment 4 Alternative Route Conclusion

In consideration of the resources described herein and the potential impacts resulting from each of the alternative routes considered for Segment 4, it is the Applicant's opinion that the Segment 4 Relocation alternative has fewer impacts than the Segment 4 Existing Rebuild alternative.

3.6 SEGMENT 3 ALTERNATIVE CONFIGURATIONS

In the northernmost portion of Segment 3 of the Project, National Grid has proposed to increase the width of ROW on both sides; specifically, 5 feet on the southwestern edge of ROW nearest the 115kV T1500 Lockport – Batavia Line 108, and 40 feet on the northeastern edge of ROW nearest the Rebuilt Line 112. The Figure 5-1 cross-section drawing associated with this location is number 100786-C-X-20. The increased width of ROW on the southwestern edge of ROW is driven by a pre-existing non-conformance with the Commission's electric field guidelines limiting electric field levels to 1.6 kV/m at edge of ROW. Without the additional 5 feet of operational easement on the southwestern edge of ROW, post-project electric field levels at edge of ROW would have been 2.04 kV/m. National Grid reviewed a number of alternatives in this location as part of the development of the Project to address this condition.

The first option reviewed to mitigate electric field levels was to convert the Existing Line 108 to a delta configuration and rebuild Line 108 on the same centerline. This option would have reduced electric fields to 1.30 kV/m and required no additional land rights on the southwestern edge of ROW. However, the resulting ground line impacts would have increased as five (5) additional structures on Line 108 would have required replacement with Structures 115 and 119 requiring concrete caisson foundations to support their respective dead-end loads and the line angle. Converting these five (5) additional structures on Line 108 would also have increased the overall cost of the Project due to the additional manpower and equipment it would have required to replace the structures, as well as additional material and matting for work areas, as these structures would be located in agricultural fields. Lastly, this conversion would not reduce or eliminate the need to acquire 40 feet of additional operational easement on the Rebuild Line 112 side of the ROW.

The second option to mitigate electric field levels was to reconstruct Existing Line 108 and Rebuilt Line 112 on double circuit structures centered in the middle of a 100 foot wide ROW. This option would have reduced electric field values at edge of ROW to less than 0.1 kV/m, assuming the conductor type on Line 108 was the same as existing (250 MCM Copper). This option also would have resulted in more ground line impacts during the course of construction as the new double circuit structures would have larger diameter foundations than those proposed solely for Rebuilt Line 112. This option also would have increased visual impacts, given that the double circuit structures would be significantly taller than those supporting Existing Line 112 and Existing Line 108, and been more costly than the preferred option. Lastly, an additional 20 feet of operational easement would still have been needed as part of this double circuit option as the existing ROW is 80 feet wide.

Given that the two (2) alternatives to address the pre-existing non-conformance with the Commission's electric field guidelines of limiting electric field levels to 1.6 kV/m at edge of ROW would result in increased cost and ground line impacts without eliminated the need for acquiring additional operational easement, the Applicant determined the rebuilding Existing Line 108 on delta configured structures along the same centerline and creating double circuit structures for Rebuilt Line 112 and Line 108 were not the appropriate option to mitigate electric field levels.

3.7 UNDERGROUND TRANSMISSION ALTERNATIVE

As part of its review of Project alternatives, National Grid considered whether an underground version of the Lockport – Batavia Line 112 Rebuild Project would meet the identified need. The Applicant developed a conceptual design and route for the underground alternative (referred to as the "115kV UG Alternative") from a proposed transition station in the vicinity of Lockport Substation at Structure 5 to a proposed transition station at Structure 209. Structure 5 and Structure 209 vicinities were selected to accommodate riser facilities and the need for land acquisition. Under the 115kV UG Alternative, the remainder of Existing Line 112 between Structures 209 to 211, approximately 0.2 miles, would be reconstructed as overhead transmission lines consistent with the proposed design for Rebuilt Line 112. The Applicant determined that the 115kV UG Alternative could conceivably meet the Project needs. However, as detailed below, this alternative has a considerably higher cost, significant operational disadvantages, and fewer environmental benefits, and the Applicant concluded that it is inferior to the Project.

In order to provide an underground transmission system reasonably equivalent to the one proposed by the Project, a new cable section and two (2) new intermediate transition stations would be required. Because the 115kV UG Alternative would not need to supply existing substations from Lockport Substation to Structure 209, it need not follow the existing ROW, so a representative roadway route was identified which is approximately 21.5 circuit miles in length. Two (2) new 115kV transition stations would be required: one to transition the overhead line to underground at Structure 5 in the vicinity of Lockport Substation, and the other to transition back to overhead at Structure 209. From Structure 1-2 to Structure 5, approximately 0.3 miles, Existing Line 112 would be rebuilt as an overhead transmission line consistent with the proposed design for Rebuilt Line 112. The cable system for the 115kV UG Alternative would consist of one (1) set of 3,000 kcmil copper cross-linked polyethylene ("XLPE") insulated 115kV underground transmission cables. The cables would be installed in a concrete-encased ductline consisting of nine 6-inch polyvinyl chloride ("PVC") conduits. Three (3) conduits would contain 115kV power cables, three would be spares for future power cables, one would contain a ground continuity conductor, and the remaining conduits would contain relaying/communication cables. The ductline would be constructed on local roadways to avoid less-than-ideal construction conditions, wetlands, and the need for relocations along the existing right-of-way.

The underground transmission alternative would require the following system components:

- **Lockport Transition Station near Structure 5:** In the vicinity of the existing Lockport Substation near existing Structure 5, it would be necessary to establish a new Lockport transition station to allow for the underground Line 112 to tap to the Lockport Substation. This transition station would include three (3) 115kV cable riser structures, two (2) deadend structures for the overhead line, differential protection upgrades and associated control equipment, and a shunt reactor. An area approximately 100 feet by 100 feet would be required for this transition station. Land acquisition would likely be required for the transition station as the ROW in Segment 1 is congested with other 115kV transmission lines (see Figure 3-1).

- **Underground Cable from Lockport Substation to new Stucture 209 Transition Station:** This underground segment would consist of approximately 21.5 circuit miles of 115kV cable from the new Lockport Transition Station (described above) to a new Structure 209 Transition Station (described below). The bulk of the route would be constructed with a "open-trench" technique on new ROW on local roadways.
- **Structure 209 Transition Station:** In the vicinity of the existing Structure 209, it would be necessary to establish a transition station to allow for the underground Line 112 to transition overhead to continue past Structure 209. The transition station would include a deadend structure, three (3) riser structures, as well as differential protection equipment and associated control equipment. An area approximately 100 feet by 50 feet would be required for this transition station. Land acquisition would be required for the transition station.

Costs associated with the various component segments are tabulated in Table 3.7-1.

TABLE 3.7-1 COSTS ASSOCIATED WITH UNDERGROUND TRANSMISSION ALTERNATIVE

Element	Cost $ Million
Underground 115kV Cable from Lockport Transition Station to Structure 209 Transition Station	301
Lockport Transition Station	<1.5
Structure 209 Transition Station	<0.5
Overhead Removal Costs	3.25
Total (note additional costs shown below)	306.25

Table 3.7-1 <u>does not</u> include:

- Allowance for Funds Used During Construction ("AFUDC").
- Land acquisition costs for transition stations.

- ROW acquisition costs[4].
- Shunt reactive compensation associated with cable capacitance[5].

The total Project cost is discussed in Exhibit 9. The underground alternative represents a substantial cost increase over the Project.

3.7.1 Underground Transmission Operational Issues

In addition to the significantly higher costs, there are a number of system and operational issues associated with underground transmission lines. These include:

- **Lengthy Outage Repair Times:** When an overhead transmission line experiences an outage, it typically can be repaired within 24 to 48 hours. In the case of a failure of an underground transmission cable, repair times can be in the range of two weeks or more. The considerably greater outage times for underground cables expose the remainder of the transmission system to emergency loadings for longer periods of time. There is also increased exposure to loss of another transmission segment (N-1-1), with possible loss of load, during the extended underground outage.
- **Difficulty in "tapping" underground transmission lines:** It is relatively straightforward to tap an overhead transmission line for distribution substations along the line route. Tapping an underground transmission line is much more complex, and typically means interrupting the cables, establishing an above-ground transition station, redirecting the cables into the transition station, and "tapping" the cables at the transition station. In the case of Line 112, there are presently no taps along this portion of the route, but there may be future need to tap.
- **Effect on Reclosing and Circuit Restoration:** Many faults on overhead lines are temporary in nature. Often it is possible to "reclose" (re-energize) an overhead line after a temporary fault, and return the line to service with only a brief interruption. Faults on underground transmission cables are almost never temporary, and reclosing into a transmission cable fault can result in more extensive damage, thus extending already-long repair times. The cable must remain out of service until the problem is diagnosed and repairs are completed. In order to operate the overall underground alternative system efficiently, it would be necessary to install relaying equipment at the Lockport transition station and at the transition station at Structure 209 to distinguish between faults on the underground system and the overhead

[4] While ROW acquisition costs were not examined for the purposes of this estimate, it is possible that National Grid lacks underground transmission rights on portions of the Existing ROW that it does not own in fee. This is not a problem, however, as the representative roadway route considered for the 115kV UG Alternative is not on the existing ROW.

[5] There would be 50 MVAR of line charging associated with the underground alternative. Offsetting this line charging might trigger the need for additional substation equipment and additional yard expansion.

system. This would also minimize the amount of cable testing required after a circuit breaker operation.

- **Cable Capacitance:** Underground cables have significantly higher capacitance than overhead lines, meaning that it takes reactive power (measured as megavolt amperes of reactive power ("MVAR")) to "charge up" the cable before the cable can transmit real power (measured as megawatts ("MW")). Cable capacitance effects become greater as line length increases and as system voltages increase. Cable capacitance has several ramifications:
  - Part of the cable's capacity is used up by the charging current, so larger conductors are sometimes needed to transmit the equivalent amount of power.
  - Capacitance can create voltage control problems, meaning that the voltage can get too high when the transmission system is at light load. If Line 112 were to be placed underground, it would require approximately 50 MVAR of cable charging. Limited load-flow analysis indicates that the transmission system likely cannot absorb this much line charging in this area, and voltage performance would be unacceptable under several operating conditions and contingencies. In order to compensate for the cable capacitance and keep the system voltages acceptable, installation of a shunt reactor of up to 50 MVAR would be necessary. The addition of a shunt reactor would likely require an expanded substation yard at the reactor location. The control system to maintain acceptable system voltage under different operating scenarios would be fairly complex.
  - Cable capacitance causes higher switching transient voltages on the system (voltage "spikes" during switching). This can damage other system components, may trigger the need to replace surge arresters throughout the area, and complicates future system expansions.
- **Cable Reactance and Load Hogging:** The underground cable would have a significantly lower series reactance than the overhead lines that would operate in parallel with the cable. This means that there would be an unequal split of the power flow between the underground 115kV cables and other nearby parallel transmission lines, with the underground cable "hogging" the load. Under future loading conditions, the underground cable could be operating at its thermal limit while the overhead line would be operating well below its limit. This could limit operating flexibility on the transmission system and might trigger the need for additional system reinforcements.
- **Ratings:** It is often difficult to match overhead line ratings with underground cables. Should line ratings need to be upgraded in the future, it is much more difficult to upgrade ratings on underground lines than it is to upgrade ratings on overhead lines. The three spare conduits in the ductline system serve to account for a potential need for upgraded ratings.

3.7.2 Environmental Impacts

Underground transmission construction techniques have the potential to increase temporary construction related impacts to wetlands, streams, agriculture, and other environmental resources along the identified new ROW. With overhead construction, it is frequently possible to span wetlands and other sensitive resource areas from structure to structure. However, with underground construction, the temporary impacts can be greater because it is necessary to trench the entire route. Trenchless techniques such as horizontal direction drill and pipe jacking can be used to minimize trenching, but such techniques can create additional design, construction, and economic issues and can have their own associated environmental issues (frac-out, drilling set up, stringing conduit).

Because the 115kV UG Alternatives representative roadway route follows local roadways, there would be significant, but temporary, effects on traffic during construction.

The need for two new transition stations could result in permanent land use and visual impacts to local areas.

Although it is difficult to directly compare environmental effects from overhead and underground construction, the potential for the 115kV UG alternative to have both temporary and permanent impacts cannot be ignored. Continuous construction on new ROW would most likely result in more temporary construction related impacts, while the need for new transition stations could result in permanent land use and localized visual impacts. As with the overhead line construction proposed for the Project, many of the environmental effects of underground construction can be mitigated through Best Management Procedures and good construction practices.

3.7.3 Conclusion on Underground Alternative

The 115kV UG Alternative could potentially meet the need of allowing those deteriorated assets approaching the end of their service life on Existing Line 112 to be retired. However, the underground alternative is substantially more expensive than the Project. The Underground Alternative also would have significant operational issues, including increased complexity, longer restoration times, load hogging issues, and voltage control issues. In this case, the 115kV UG Alternative would be technically inferior to the Project. Although difficult to compare directly, it can be expected that underground construction will result in temporary construction-related impacts and the potential for permanent land use and visual impacts associated with the need for new transition stations. Overall, significantly lower costs and operational advantages make the Project clearly superior to the 115kV UG Alternative.

3.8 NON-TRANSMISSION ALTERNATIVES

National Grid reviewed the potential for a non-transmission alternative to the Project using the Non-Wires Alternatives ("NWAs") Suitability Criteria ("Suitability Criteria") set forth in the November 2018 Supplemental Distributed System Implementation Plan ("SDSIP").[6] The SDSIP recognizes that NWAs (*e.g.*, energy efficiency, demand response, and distributed generation) "represent opportunities to defer or avoid a subset of traditional 'wires' investments, potentially resulting in cost savings for customers and/or environmental benefits while maintaining reliability and resiliency" (SDSIP at 41).

3.8.1 NWA Suitability Criteria

The SDSIP recommends the use of three basic Suitability Criteria – project type, project timeline, and project cost – to identify those utility projects for which an NWA may have the greatest opportunity for success. Utility projects of different types (*e.g.*, load relief, reliability, new business, asset condition) are seen as more or less capable of replacement with an alternative resource on an equivalent basis. Utility projects with longer lead times allow more time for the competitive procurement and implementation of NWAs. Finally, NWAs may be more likely to be cost-competitive against utility projects with higher costs, as they are able to overcome the transaction and opportunity costs associated with smaller scale projects (SDSIP at 46).

The SDISP recognizes that each utility has unique electrical systems that present specific challenges, and therefore calls for each utility to complete an NWA Suitability Criteria matrix that incorporate these three criteria. The matrix that National Grid utilized is provided below.

[6] The SDSIP was filed by the Joint Utilities (Central Hudson Gas and Electric Corporation, Consolidated Edison Company of New York, Inc., New York State Electric and Gas Corporation, National Grid, Orange, and Rockland Utilities, Inc. and Rochester Gas and Electric Corporation) in Case 16-M-0411, "In the Matter of Distributed System Implementation Plans".

TABLE 3.8-1 NATIONAL GRID NWA SUITABILITY CRITERIA		
Criteria	**Potential Elements Addressed**	
Project Type Suitability	**Project types include Load Relief and Reliability. Other types have minimal suitability and will be reviewed as suitability changes due to State policy or technological changes.**	
Timeline Suitability	**Large Project**	36-60 months
	Small Project	18-24 months
Cost Suitability	**Large Project**	≥$1M
	Small Project	≥$500k
Source: 2018 DSIP, Table 2.13.1, p. 231		

3.8.2 Project Assessment

As discussed in Exhibit E-4 – Engineering Justification, the proposed rebuilding and reconductoring of Line 112 is driven by asset condition issues, including corrosion issues at steel-to-steel connection points and on cross-members, plus the need for structural steel replacements and reinforcements. Capacity considerations have informed the choice of 795 ACSR conductor for the Project; however, reconstruction of the line is required even in the absence of any capacity considerations. As such, it falls squarely into the definition of an Asset Condition project found in the SDSIP: "Planned repair, replacement or enhancement of existing infrastructure to maintain minimum safety and reliability performance" (SDSIP at 45).

The SDSIP notes that asset condition projects are typically not suitable for replacement with a NWA: "NWA are not likely to improve the condition of existing T&D assets that must remain in service as part of the NWA alternative. Therefore, NWA in this area must also include the repair or replacement of the assets that were driving the need for the project recommendation. However, some projects may have components which need to be reconstructed and other components which may be suitable for NWA" (*id.*). In this case, the need to rebuild Line 112 is driven by asset condition issues. Non-wires alternatives such as energy efficiency, demand response, and distributed generation clearly cannot address these issues. Therefore, such measures would not be an effective alternative to the Project.

3.8.3 Current NWA Activities

Due to the fail of the suitability criteria, this Project will not be considered for NWA solicitation.

3.8.3.1 Summary

A screening based on NWA Suitability Criteria concluded that there is no feasible NWA for the Lockport-Batavia Line 112 Rebuild Project due to project type and urgency of the need for this Project. The implementation of non-wires measures such as energy efficiency, demand response, and distributed generation could not be developed before the asset needs replacement, nor could these programs/alternatives reduce the cost or scope of the chosen Project. Therefore, such measures would not be an effective alternative to the Project.

REFERENCES

Genesee County Web Mapping, Real Property Data - Land Use. Available online at: https://cogeneseeny.maps.arcgis.com/apps/webappviewer/index.html?id=0600d51c145b44c1b13dfb773063af03. Last accessed September 2021.

EXHIBIT 4 – ALTERNATIVES

ADDITIONAL FIGURES

FIGURE 3-3 VIEWSHED ANALYSIS SEGMENT 4 - COMPARISON OF SEGMENT 4 RELOCATED ALTERNATIVE AND SEGMENT 4 EXISTING REBUILD ALTERNATIVE

(1 Sheet)

FISHER ASSOCIATES

NATIONAL GRID
LOCKPORT-BATAVIA LINE 112 REBUILD PROJECT
VIEWSHED ANALYSIS SEGMENT 4 COMPARISON OF PREFERRED RELOCATION OPTION AND EXISTING REBUILD ROUTE ALTERNATIVE
FIGURE 3-3

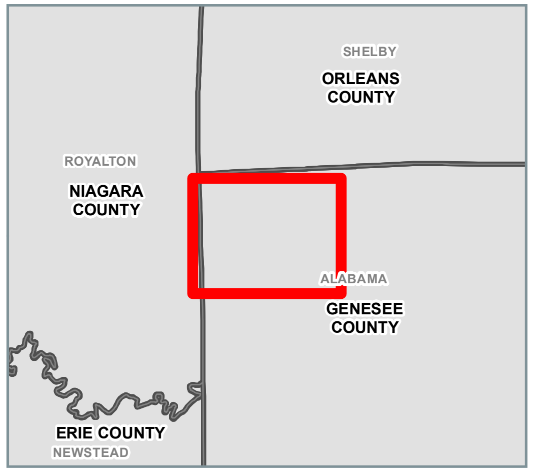
- Proposed Structure
- Existing Structure
- Existing Lockport - Batavia Line 112
- Proposed Segment 4 Relocated

Viewshed Analysis

- Not Visible
- Visible

Map Revision Date: 8/19/2021 | Aerial Date: 2020

0 375 750 Feet



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