nationalgrid

Black River – Clay
115 kV Transmission Rebuild Project

Exhibit E-1

Description of Proposed Transmission Facilities

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EXHIBIT E-1: DESCRIPTION OF PROPOSED TRANSMISSION FACILITIES

E-1.1 INTRODUCTION

The Applicant[1] proposes to rebuild approximately 60.9 miles of 115 kV transmission line running between the Black River Substation in the Town of LeRay, Jefferson County to the Clay Substation in the Town of Clay, Onondaga County. This proposed Project begins at existing Structure 6.5 approximately 0.7 miles south of the Black River Substation[2] and traverses Towns of LeRay, Rutland, Rodman, Worth, and Lorraine in Jefferson County; the Towns of Boylston, Orwell, Albion, Parish, and Hastings and the Village of Central Square in Oswego County; and the Towns of Cicero and Clay in Onondaga County. The Project is essentially viewed as two sections: the double circuit Black River –LHH section (35.9 miles) and the bussed LHH – Clay section (25 miles). Both sections will be rebuilt as two single circuit facilities. Due to the voltage (115 kV) and the length (>10 miles), the proposed Black River – Clay Project will trigger the licensing and permitting requirements under Article VII of the New York State Public Service Law.

As outlined in Exhibit 2, the Project consists of the rebuild of the existing 115 kV Black River – Middle Road #8 Line, Coffeen – Black River – Lighthouse Hill #5 Line, Middle Road – Lighthouse Hill #6 Line, Lighthouse Hill – Clay #7 Line, and Lighthouse Hill – Clay #7 (bussed) Line from double circuit structures to two single circuit facilities. The Proposed route of the project has been divided into eight segments (Segments 1–8), which are all proposed to be rebuilt in their entirety. Black River – LHH Lines #5, #6, and #8 will be split into Black River – Staplin Creek #8, Black River – Staplin Creek #10, Staplin Creek – Tar Hill #5, and Staplin Creek – Tar Hill #6. The LHH – Clay Line #7 and LHH – Clay #7 (bussed) Line will be split into Tar Hill – Mallory #17, Tar Hill – Clay #27, and Mallory – Clay #7. Table E-1-1 outlines these existing and proposed line names.

Table E-1-1 Existing and Proposed Line Names

Segment No.	Existing Line Name	Proposed Line Name
1	Black River – Middle Road #8 Line, Coffeen – Black River – Lighthouse Hill #5 Line, & Middle Road – Lighthouse Hill #6 Line	Black River – Staplin Creek #10 & Staplin Creek – Tar Hill #5 Black River – Staplin Creek #8 & Staplin Creek – Tar Hill #6

[1] For clarity and consistency, the Applicant has developed a Master Glossary of Terms used throughout the Application to refer to the relevant components of the Project.
[2] Work extending northward from existing Structure 6.5 will fall under the scope of a separate Article VII application.

Segment No.	Existing Line Name	Proposed Line Name
2	Coffeen – Black River – Lighthouse Hill #5 & Middle Road – Lighthouse Hill #6	Staplin Creek – Tar Hill #5 & Staplin Creek – Tar Hill #6
3	Coffeen – Black River – Lighthouse Hill #5 & Middle Road – Lighthouse Hill #6	Staplin Creek – Tar Hill #5 & Staplin Creek – Tar Hill #6
4	Coffeen – Black River – Lighthouse Hill #5, Middle Road – Lighthouse Hill #6 Lighthouse Hill – Clay #7, & Lighthouse Hill – Clay #7 (bussed)	Staplin Creek – Tar Hill #5 & Staplin Creek – Tar Hill #6
5	Lighthouse Hill – Clay #7 & Lighthouse – Clay #7 (bussed)	Tar Hill – Mallory #17 & Tar Hill – Clay #27
6	Lighthouse Hill – Clay #7 Lighthouse – Clay #7 (bussed)	Mallory – Clay #7, Tar Hill – Mallory #17, Tar Hill – Clay #27
7	Lighthouse Hill – Clay #7 Lighthouse – Clay #7 (bussed)	Mallory – Clay #7 & Tar Hill – Clay #27,
8	Lighthouse Hill – Clay #7 Lighthouse – Clay #7 (bussed)	Mallory – Clay #7 & Tar Hill – Clay #27

The existing structures, which this Project proposes to replace, are primarily composed of double circuit wood structures, double circuit steel structures, and steel lattice towers. The primary structure design for the Project will include two (2) monopole steel single circuit davit arm structures, side by side along the transmission corridor. A secondary configuration consists of combinations of two (2) vertical deadend structures or one single circuit and one double circuit structure. Single circuit structures will be directly embedded into crushed stone or low strength concrete. Angle and deadend structures will be supported by reinforced concrete caisson foundations. Double circuit structures will utilize either direct embedded foundations or reinforced concrete caisson foundations, as dictated by site specific loading and geotechnical data.

E-1.2 TRANSMISSION LINE DESIGN

The structure designs for the Project have been developed in accordance with the latest edition of the NESC, National Grid Transmission Line Design and Structure Loading criteria, and ROW considerations such as ROW width, the location of existing facilities, ROW terrain and environmental conditions.

E-1.2.1 Design Voltage, Conductor, Grounding, and Insulators

The rebuilt lines are designed to operate at a nominal system voltage of 115 kV alternating current. Their voltage of initial operation will also be 115 kV.

The proposed conductor type for the Lines will be 636 kcmil 26/7 ACSS "Grosbeak" 285 Ultra High Strength conductor with two subconductors per phase for three phases over the full length of the project. [redacted] All conductors proposed to be installed as part of the Project would have a non-specular finish.

The aerial ground wire type proposed to be utilized on the rebuilt lines will be a ½" 48 count DNO-13120 all corning glass OPGW for the full length of the Project. In select locations, an additional 19#5 aerial ground wire may be utilized where additional protection is required. In locations where the rebuilt lines cross under existing overhead electric transmission lines, the aerial ground wire may be terminated at the structures on either side of the crossing to ensure that proper clearances to the crossing circuits are maintained. In these instances, the Applicant may elect to install either an underslung span of OPGW or ADSS cable or buried ADSS cable in conduit to ensure the continuity of the fiber optic cable. This will be detailed in the EM&CP.

Grounding on the proposed lines will be provided in one of two ways. In instances where structures are set on reinforced concrete foundations, the grounding will be accomplished using driven ground rods set a minimum of three (3) feet from the exterior concrete of the foundation and bonded to a grounding plate located near the base of the structure. Steel pole direct embed structures will be placed in corrugated metal pipe that is bonded to the structure grounding plate located near the ground line of the structure. Each structure will be tested for conformance with National Grid Standards and where the ground resistance of the grounding system exceeds allowable limits, supplemental grounding measures will be employed (e.g., by installing additional ground rods or buried counterpoise). In instances where aerial ground wire and OPGW cannot be continuous (primarily where the line must cross under another line) the use of buried wire grounding systems and an underhung ADSS cable will be considered.

Insulator design for the proposed 115 kV lines will be toughened glass ball and socket disc insulators. In all suspension applications, regardless of structure type, insulator strings will consist of ten discs. Structures located at critical crossings such as highways, railroads, and navigable water crossings will utilize double insulator strings. Deadend and angle structures may require the use of two parallel strings of ten ball and socket insulators if it is determined that a single insulator string is not able to withstand the conductor loadings at that location. Post insulators (insulators installed to carry the deadend loops) will be installed where the line angles are greater than 50 degrees. Where required, restrained porcelain strut insulator assemblies will be utilized to mitigate the effects of conductor blow-out and to maintain the appropriate clearance between the conductor and the grounded surfaces of the structure. Porcelain post type insulators will be utilized on switching devices associated with the Project. The color of the porcelain insulators proposed for the Project is gray for all applications.

E-1.2.2 Structure Type, Size, and Material

Several different structure types will be used for the Project (see Figures 5-4 through 5-5, Exhibit 5).

The primary structure type for the proposed Lines will be LD Steel Pole Davit Arm Suspension Single Circuit and Engineered Steel Davit Arm Deadend Single Circuit. The galvanized steel will have a grayish finish. In instances where an existing tap needs to be re-established from the proposed lines, single circuit phase over phase galvanized steel single pole structures will be utilized. New structures which will be installed to support switches will be galvanized steel, single circuit single poles with the phases configured in a vertical arrangement. Typically, it is assumed that replacement structures will generally be located between 10 to 15 feet ahead or back of the existing structure locations (1:1 replacement, offset, and one new circuit typically offset 50 feet from the existing centerline), resulting in the average span length of approximately 525 feet. Table E-1-2 shows the approximate quantities of transmission structures to be installed as part of the Project.

Table E-1-2 Quantities of 115 kV Structures to be Installed as Part of the Project

Structure Type	Quantity (of 1,202 Structures)	Proposed Height Range (feet)
Engineered Steel Davit Arm Deadend	234	70–110
Engineered Steel Davit Arm Suspension	16	110–120
Engineered Steel Davit Arm Suspension Restrained	4	115–120
Engineered Steel Double Circuit Davit Arm Deadend	24	80–125
Engineered Steel 3-Pole Deadend	2	45–50
Engineered Steel Double Circuit Davit Arm Suspension	24	95–110
Engineered Steel Vertical Deadend	25	80–105
Engineered Steel Vertical Davit Arm Deadend	1	80
Engineered Steel Vertical Davit Arm Suspension	4	100–105
Engineered Steel H-Frame Deadend	6	50–70
Light Duty Steel Davit Arm Suspension	856	85–130
Light Duty Steel Davit Arm Suspension w/ Restrained Insulator	6	85–130

Figures accompanying Exhibit 5 provide typical cross-sections of these proposed structures within the Project ROW segments as well as each structure type proposed.

E-1.2.3 Structural Loading and Foundations

Structure design will be done in accordance with applicable national and state codes, including the NESC, as well as more stringent criteria imposed by National Grid. The NESC specifies both the minimum structural load criteria to determine the required structural capacity and clearances for energized hardware and wires. Typical clearance requirements defined by the

NESC include clearances to ground, adjacent transmission lines, railroads, buildings, and other facilities. The minimum structure load required by NESC or National Grid is as follows:

- NESC Heavy Loading (250B): ½-inch radial ice at 0° F with a 40-mph wind
- NESC Extreme Wind Loading (250C): 95 mph wind at 60° F.
- NESC Extreme Ice with Concurrent Wind Loading (250D): 1-inch radial ice at 15°F with a 40-mph wind; and
- National Grid Heavy Ice: 1½ inch radial ice at 30°F with a 28-mph wind

In addition to the NESC, there are several published standards that will be followed, depending on the type of structure and material used. Some of the common standards include:

- Steel Lattice Structures – American Society of Civil Engineers Manual 10-97 "Design of Latticed Steel Transmission Structures"
- Tubular Steel Poles – American Society of Civil Engineers Manual 72 "Design of Steel Transmission Pole Structures"
- Rural Utilities Service Bulletin 1724E-200 "Design Manual for High Voltage Transmission Lines"
- American Concrete Institute ACI 336.3R-14 – Report on Design and Construction of Drilled Piers
- American Concrete Institute ACI 318-19 – Building Code Requirements for Structural Concrete

E-1.2.4 Structure Foundation Design

The Project proposes to employ two (2) types of foundations for the transmission line structures. Typical tangent, single circuit steel pole suspension structures are proposed to have direct embed foundations. The direct embedded foundation consists of placing a steel pole directly into a 12-gauge CMP (commonly referred to as a culvert), to a specified depth determined in final design, which would be 10% of the structure height plus typically six additional feet. Upon setting the pole within the culvert, crushed stone backfill will be placed in the space remaining between the pole and the inside area of the culvert and tamped at no greater than twelve-inch intervals. The purpose of the culvert is to provide a grounding system for the structure as well as to provide a foundation of suitable character to support the structure loadings. Diameters of these culverts will range from three (3) to four (4) feet depending upon the diameter of the steel pole. Steel pole structures designed for line angles, relatively long spans, wire pulling locations, and deadend locations will be self-supporting and will typically be set on reinforced concrete caisson foundations. These concrete foundations will typically range from six (6) to ten (10) feet in diameter and typically set to a depth of fifteen (15) to forty (40) feet depending upon structure loading and soil conditions. However, should existing soil conditions, structure loading, and costs dictate the need, alternate foundation types, such as, vibratory caissons, micropyles, helical piles, rock anchors, will be used. This will be detailed in the EM&CP.