BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT, OWN AND OPERATE THE RIO PUERCO TO PAJARITO TO PROSPERITY 345 KV TRANSMISSION PROJECT	)	**Docket No. 26-00000__**
PUBLIC SERVICE COMPANY OF NEW MEXICO,	)	
Applicant.	)	

DIRECT TESTIMONY

OF

JULIA L. MUNOZ

February 25, 2026

NMPRC DOCKET NO. 26-00000__
INDEX TO THE DIRECT TESTIMONY OF
JULIA L. MUNOZ

WITNESS FOR
PUBLIC SERVICE COMPANY OF NEW MEXICO

I. INTRODUCTION AND PURPOSE

Q. Please state your name, position, and business address.

A. My name is Julia L. Munoz. I am an Engineer IV for Public Service Company of New Mexico ("PNM" or "Company"). My business address is 2401 Aztec Road NE, Albuquerque, New Mexico 87107. I am testifying on behalf of PNM.

Q. Please summarize your educational background and professional qualifications.

A. My educational background and professional experience are summarized in PNM Exhibit JLM-1.

Q. Please describe your responsibilities as an Engineer IV.

A. As an Engineer IV, I help plan, schedule, and coordinate large and significant engineering projects and small complex projects. I provide advanced technical direction to contractors and company personnel, and function as a lead for staff engineers and professionals as appropriate.

Q. Please state the purpose of your Direct Testimony.

A. The purpose of my testimony is to support approval of the Rio Puerco to Pajarito to Prosperity 345 kV transmission project (the "Project") from a right-of-way ("ROW") requirements perspective. I discuss and provide support for the ROW width requirement calculations for the Project.

Q. Are you a licensed Professional Engineer ("PE") in the State of New Mexico?

A. Yes. I obtained my PE license in December 2024.

Q. What is a PE stamp?

A. A PE stamp is an official licensed stamp on an engineering drawing or plan. This indicates that a licensed PE has worked on and/or reviewed the technical drawings.

Q. Are the calculations you are sponsoring PE-stamped?

A. Yes.

II. DETERMINATION OF ROW WIDTH IN EXCESS OF 100 FEET

Q. What are the requirements regarding ROW widths in relation to the proposed 345 kV transmission line?

A. The National Electrical Safety Code ("NESC")[1] (2023) requires utilities to maintain minimum clearance distances for power lines from objects and the ground. PNM must maintain all clearance requirements under various wire conditions, including during wind events and higher sag conditions. The Federal Energy Regulatory Commission ("FERC") also enforces federally mandatory reliability standards (developed by the North American Electric Reliability Corporation, or "NERC") that require vegetation management in and

[1] *See* https://standards.ieee.org/products-programs/nesc/.

around transmission line ROW to prevent outages. PNM must be able to clear sufficient widths to comply with these requirements and help ensure reliability. Below is the list of requirements PNM is subject to:

1) NESC Rules 234C1a and 234C1b for horizontal clearance for transmission line conductors.
2) NESC Rule 250C Extreme Wind to the edge of the ROW.
3) NERC FAC-003 Minimum Vegetation Clearance Distances.

In addition, PNM has transmission line design standards which are followed when determining the necessary ROW width. These standards are provided in PNM Exhibit JLM-4. These standards were developed by PNM subject matter experts and reflect PNM's internal standards incorporating all the NESC and NERC requirements, and general industry standards.

Q. Has PNM determined the width of ROW needed for the Project?

A. Yes. PNM has determined a maximum ROW width requirement of 150 feet for the Project. PNM Exhibit JLM-2, JLM-3, and JLM-4 provide insight into the need for this 150-foot ROW width. I performed and PE stamped the calculations and drawings in PNM Exhibits JLM-2 and JLM-3.

Q. Please explain why a 150-foot ROW width is required for the Project?

A. A 150-foot ROW width is required for the following reasons:

1) To maintain required NESC and NERC clearances. PNM utilizes NESC Rules 234C1a, 234C1b, and 250C as well as NERC requirements to determine the

appropriate ROW requirements. These rules establish minimum horizontal and vertical clearance requirements for electrical conductors to buildings and vegetation, respectively. The calculated required clearances depends on factors such as the voltage of the line, elevation, weather conditions including wire temperature, ice thickness and wind speed, and transmission structure configurations. The supporting calculations are provided in PNM Exhibit JLM-2 and PNM Exhibit JLM-3.

2) To maintain PNM's line design requirement, PNM's transmission line design standards recommend a 150-foot ROW width for 345 kV transmission lines. These standards are provided as PNM Exhibit JLM-4.

3) To ensure all NESC requirements are maintained at the time of initial energization and in the future as developments, businesses, and residential areas are constructed near the transmission line corridor. The proposed transmission line is on the outskirts of the Albuquerque area, making it a likely location for future development of the permanent structures mentioned above.

4) For vegetation maintenance purposes. The 150-foot width allows for sufficient vegetation clearing to prevent potential vegetation-related events which would result in adverse impacts such as outages and reliability concerns. An example of a vegetation related event is when a tree branch comes into contact with the power line, potentially causing an outage.

5) To allow for safe inspection, maintenance and operation activities. After the line is built, PNM will inspect the lines and may end up needing to perform maintenance activities, requiring large equipment. The equipment and all maintenance activities

should be contained in the ROW so as not to impact developments, businesses, or residents that may be in the area at that time. A 150-foot-wide ROW allows for the safe operation of equipment during maintenance activities.

Q. Please explain the contents of PNM Exhibit JLM-2.

A. Page 1 of PNM Exhibit JLM-2 shows the detailed calculations for NESC required horizontal clearances from the transmission line conductor to building structures for Rules 234C1a and 234C1b. The calculations provided also include requirements to meet horizontal clearances from the transmission line conductor under NESC 250C Extreme Wind to the edge of the ROW. This additional clearance considers NERC FAC-003 Minimum Vegetation Clearance Distances.

The NESC clearance values include adjustment adders for voltages above 22 kV phase-to-ground and altitudes above 3,300 feet. PNM uses a standard altitude of 7,300 feet across its system.

Pages 2-4 of PNM Exhibit JLM-2 are supporting exhibits for the calculations of the blowout analysis for the typical H-frame tangent structure expected to be used across the project. While there may be additional structure types in the project, the primary new construction will be H-frames with bundled (2) 795kcmil ACSR “Drake” conductor. A 1200-foot maximum span length is used for the analysis to accommodate final structure spotting and coordination as detailed design progresses. Actual design spans will vary depending on obstructions, topography changes, future design considerations, such as the

Paseo del Volcan New Mexico Department of Transportation corridor, and height considerations across various sections of the line. A 1200-foot span would be the maximum design span used for this project. The structure heights will provide required vertical clearance from the conductor under maximum operating temperature (212°F) at midspan to the existing terrain as it is surveyed.

The proposed H-frame tangent was analyzed under the following load cases:

- NESC Rule 234C1a – Conductor at rest, 0psf wind, 60°F
- NESC Rule 234C1b – Conductor under 6psf wind, 60°F
- NESC Rule 250C – Conductor under 21.2psf wind, 60°F

To determine the conductor blowout under each load case, the structure and wires were modeled in the transmission line design software Power Line Systems - Computer Aided Design and Drafting ("PLS-CADD"). The results of the maximum required ROW width considering conductor blowout alone are illustrated on Sheets 2-4. The controlling load case for the proposed H-frame structures was NESC Rule 250C, requiring a ROW width of 141.8 feet.

Page 5 of PNM Exhibit JLM-2 is a visual of the maintenance and construction equipment PNM considers when setting ROW width requirements. The dimensions for the various construction equipment expected to be used during construction and maintenance activities vary substantially based on factors such as the type of work being performed, crew availability, line outage constraints, and equipment availability. The visual is meant to provide a general setup for work at the structure or along the midspan of the line. Based on assumptions of line truck dimensions and offsets from the structure and conductor, PNM has determined it needs 148 feet to be able to safely maintain or construct the line. This is just under the 150 feet ROW width requested.

Q. Please explain the contents of PNM Exhibit JLM-3.

A. PNM Exhibit JLM-3 provides Audible Noise Calculations, performed using Electric Power Research Institute ("EPRI") Redbook Application Tools. The inputs and outputs are provided for transparency (the tool uses metric units). Based on the provided inputs, the EPRI tool calculates an audible noise level L_{50} during rain of 50.9dbA at the edge of the proposed 150-foot ROW width at 1 meter above ground (3.28 feet) and a maximum value of 52.9dbA at any point in the ROW at 1 meter above ground. The EPRI tool also calculates a maximum audible noise level of 42.9dbA during fair weather at the edge of the proposed 150-foot ROW at 1 meter above ground. This calculated value is under the EPA's recommended 55dbA limit (U.S. EPA 1974).

Q. Please explain the contents of PNM Exhibit JLM-4.

A. PNM Exhibit JLM-4 is PNM's Transmission Line Design Standard document. It includes design loading and clearance requirements for transmission lines. The standards use NESC clearances and add PNM buffers to account for future development, changes in terrain, and changes in structure configurations without resulting in violations or safety concerns. The proposed 345 kV transmission line will be designed to these standards, and preliminary design captures these requirements and design standards.

Q. Are there other general construction considerations that require additional land use widths?

A. No. PNM will require temporary use areas of greater than 100 feet in width to set up wiring pulling sites at the start and end of each dead transmission line structure. However this is for construction purposes, no permanent structures will require a ROW width in excess of 150 feet once the project is constructed.

III. CONCLUSION

Q. Please summarize the key points of your testimony.

A. I performed the ROW calculations that support PNM's request for a ROW width of 150 feet. This width is required for PNM to maintain NESC and NERC clearances and ensures safe operation and maintenance of the line. These calculations are PE Stamped.

Q. Does this conclude your testimony?

A. Yes.

GCG#534825

Julia L. Munoz Resume

PNM Exhibit JLM-1

Is contained in the following 1 page.

Julia L. Munoz

EDUCATIONAL AND PROFESSIONAL SUMMARY

Name: Julia L. Munoz

Address: Public Service Company of New Mexico
2401 Aztec Road NE
Albuquerque, NM 87107

Position: Engineer IV

Education: Bachelor of Science – Civil Engineering, University of New Mexico, 2017
Professional Engineer (PE), 2024

Employment: Employed by Public Service Company of New Mexico (PNM) since 2019

Positions held within the Company include:
Transmission Line Engineer (Engineer II-IV) (2020-Present)
Rotational Engineer (2019-2020)

Right of Way Calculations

PNM Exhibit JLM-2

Is contained in the following 5 pages.

PNM Engineering
Engineer: Julia Munoz
Project: Pajarito-Rio Puerco 345kV Transmission Line
Required NESC Horizontal Clearances – Rule 234C1a & 234C1b

$V_N = Nominal\ Operating\ Voltage\ Phase - Phase\ (kV)$

$V_M = Maximum\ Transient\ Overvoltage\ Phase - Phase\ (kV)$

$V_{M\_G} = Maximum\ Transient\ Overvoltage\ Phase - Ground\ (kV)$

$E = Design\ Elevation\ (ft)$

$A_V = NESC\ Rule\ 234G1, adder\ for > 22\ kV\ Phase - Ground\ (ft)$

$A_E = NESC\ Rule\ 234G2, adder\ for > 3{,}300\ ft\ MSL\ Elevation\ for > 50\ kV\ Phase - Ground\ (ft)$

$X_R = NESC\ Rule\ 234C1a\ Required\ Horizontal\ Clearance\ At\ Rest\ (ft)$

$X_{@6psf} = NESC\ Rule\ 234C1b\ Required\ Horizontal\ Clearance\ at\ 6psf\ (ft)$

$X_{@21.2psf} = PNM\ Required\ Horizontal\ Clearance\ at\ NESC\ 250C\ (21.2psf)\ (ft)$

$V_N = 345\ kV$

$V_M = 1.05 \times V_N = 362.25\ kV$

$V_{M\_G} = V_M \div \sqrt{3} = 209.14\ kV$

$E = 7{,}300\ ft$

$$A_V = (V_{M\_G} - 22\ kV) \times \left(\frac{0.4\ \frac{in}{kV}}{12\ \frac{in}{ft}} \right) = 6.97\ ft$$

$$A_E = (V_{M\_G} - 50\ kV) \times \left(\frac{0.4\ \frac{in}{kV}}{12\ \frac{in}{ft}} \right) \times 0.03 \times \left(\frac{E - 3{,}300\ ft}{1{,}000\ ft} \right) = 0.64\ ft$$

$X_R = 7.5\ ft + A_V + A_E = 15.11\ ft \rightarrow \mathbf{X_R = 15.2\ ft}$

$X_{@6psf} = 4.5 + A_V + A_E = 12.11\ ft \rightarrow \mathbf{X_{@6psf} = 12.2\ ft}$

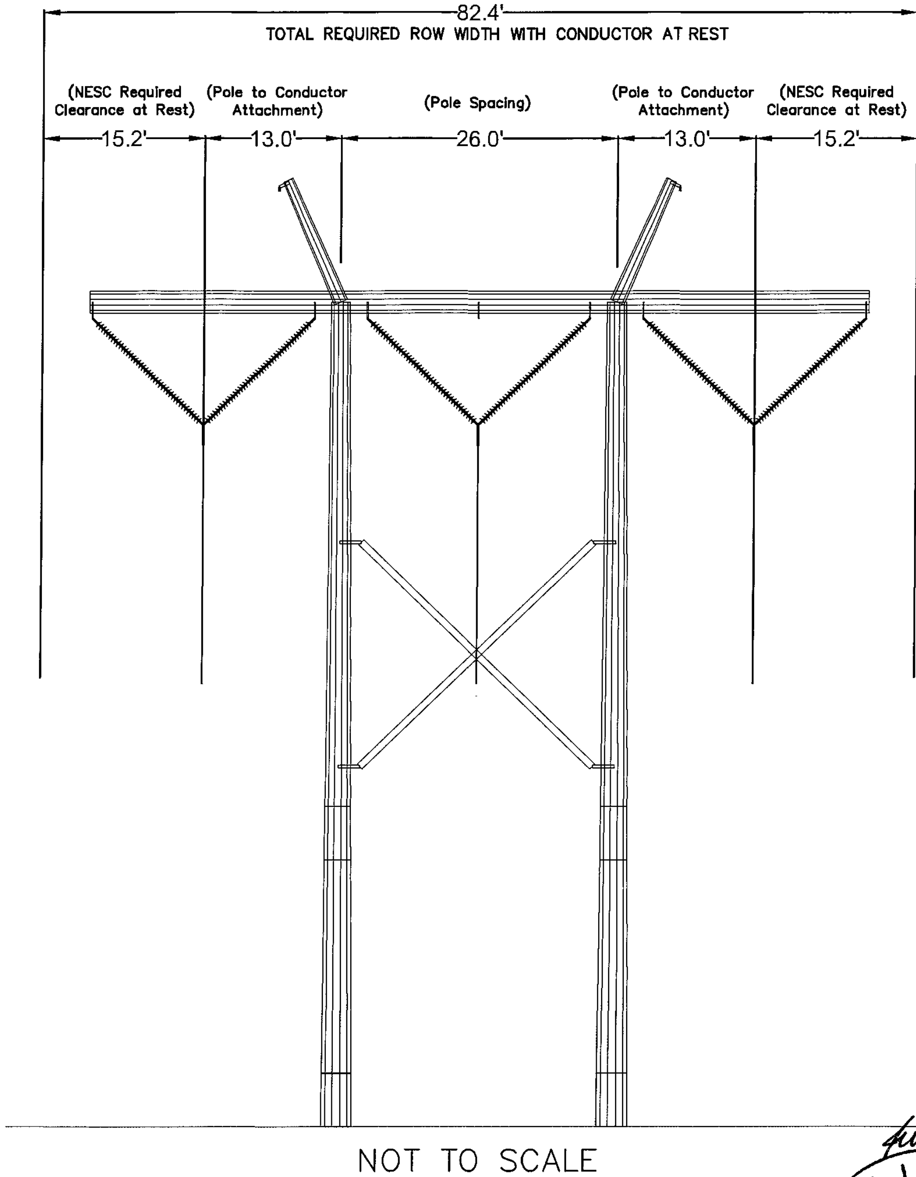
$\mathbf{X_{@21.2psf} = 5.0\ ft}$

JULIA LEE MUNOZ
NEW MEXICO
30349
2-17-26
PROFESSIONAL ENGINEER

PNM PUBLIC SERVICE COMPANY OF NEW MEXICO

PAJARITO–RIO PUERCO 345kV T-LINE
HORIZONTAL BLOWOUT CALCULATIONS

DR: JLM	DATE: 02/17/26	PAJA-RIPU-ROW S1
ACAD: PAJA-RIPU-ROW	APP: JR	

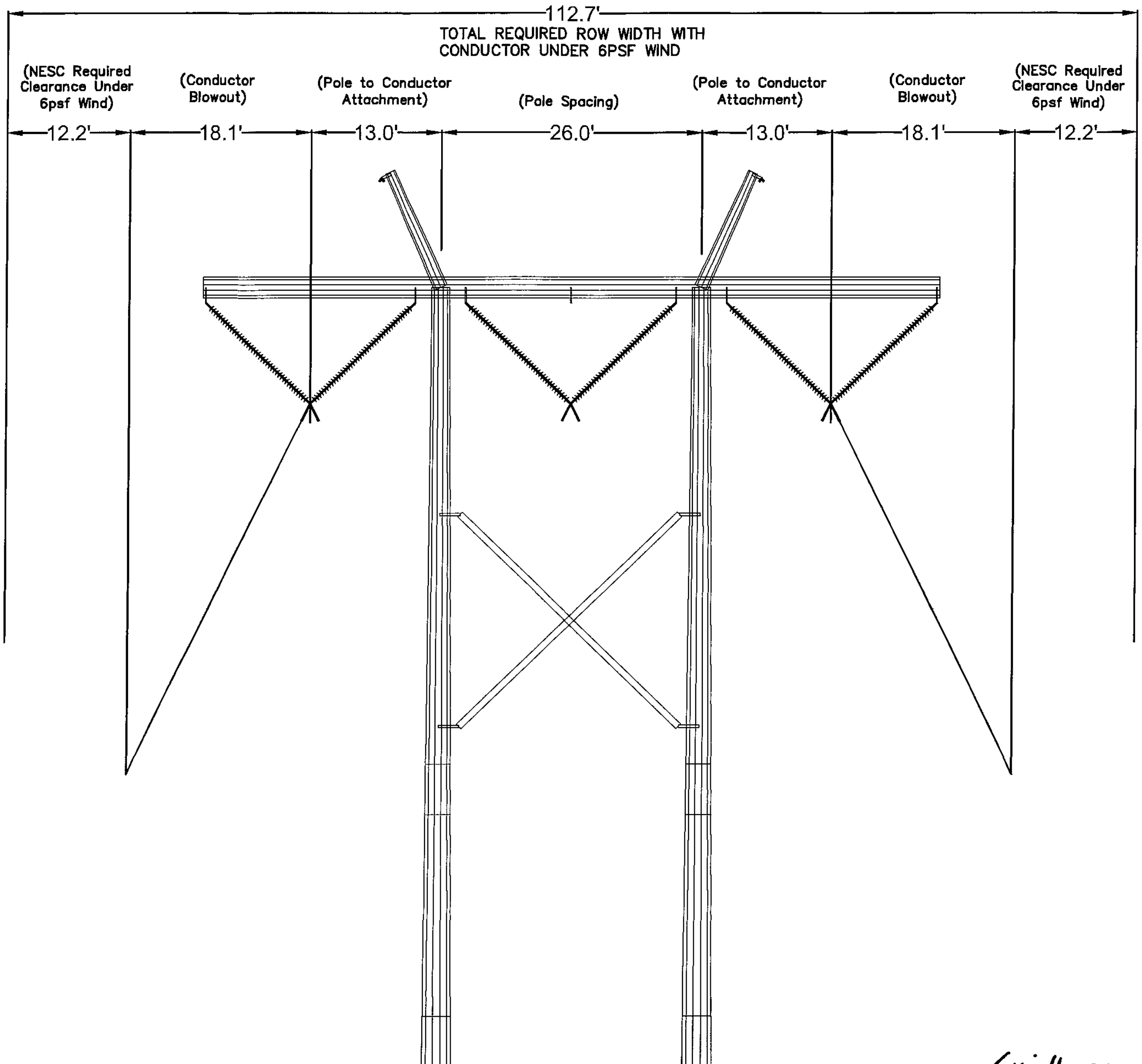


JULIA LEE MUNOZ
NEW MEXICO
30349
2-17-26
PROFESSIONAL ENGINEER

STRUCTURE AND CONDUCTOR INFORMATION

Nominal Operating Voltage: 345kV
Structure Type: Single-Circuit Steel H-Frame Tangent
Insulator Type: V-String Suspension Insulator Assembly
Maximum Design Ruling Span: 1200ft
Conductor Type: Bundled (2) 795kcmil ACSR "Drake"
Weather Condition Displayed: 0psf wind at 60°F
NESC Rule Analyzed: 234C1a

PNM	PUBLIC SERVICE COMPANY OF NEW MEXICO		
PAJARITO–RIO PUERCO 345kV T–LINE SINGLE–CIRCUIT H–FRAME TANGENT, AT REST			
DR: JLM	DATE: 02/17/26	PAJA–RIPU–ROW S2	
ACAD: PAJA–RIPU–ROW	APP: JR		



NOT TO SCALE

JULIA LEE MUNOZ
NEW MEXICO
30349
2-17-26
PROFESSIONAL ENGINEER

STRUCTURE AND CONDUCTOR INFORMATION

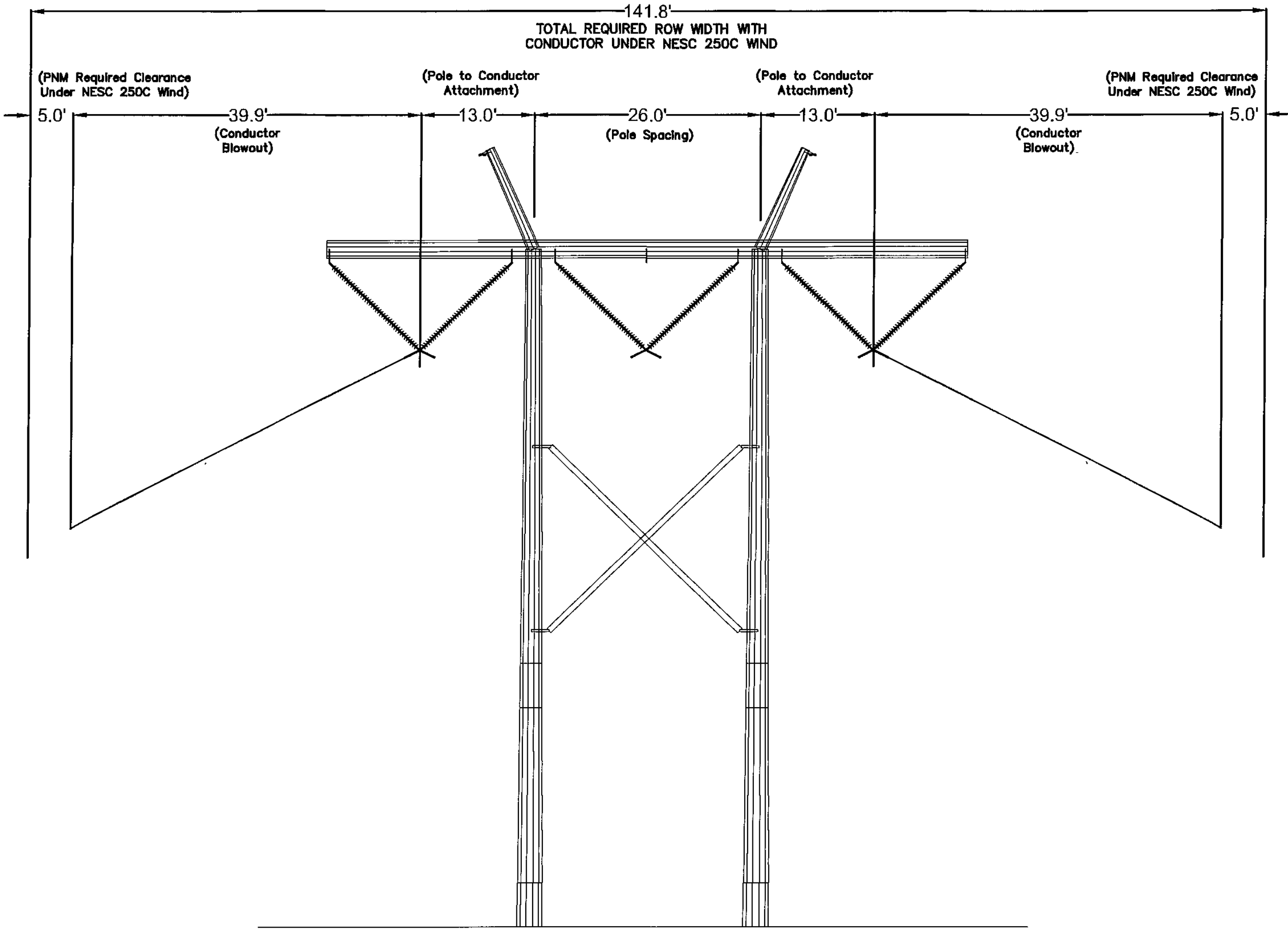
Nominal Operating Voltage: 345kV
Structure Type: Single-Circuit Steel H-Frame Tangent
Insulator Type: V-String Suspension Insulator Assembly
Maximum Design Ruling Span: 1200ft
Conductor Type: Bundled (2) 795kcmil ACSR "Drake"
Weather Condition Displayed: 6psf wind at 60°F
NESC Rule Analyzed: 234C1b

PNM PUBLIC SERVICE COMPANY OF NEW MEXICO

PAJARITO–RIO PUERCO 345kV T–LINE
SINGLE–CIRCUIT H–FRAME TANGENT, 6PSF WIND

DR:	JLM	DATE:	02/17/26	PAJA–RIPU–ROW S3
ACAD:	PAJA–RIPU–ROW	APP:	JR	

LastSavedBy: JSEYMOU PLOT DATE: 2/17/2026 8:48:56 AM



NOT TO SCALE

STRUCTURE AND CONDUCTOR INFORMATION

Nominal Operating Voltage: 345kV
Structure Type: Single-Circuit Steel H-Frame Tangent
Insulator Type: V-String Suspension Insulator Assembly
Maximum Design Ruling Span: 1200ft
Conductor Type: Bundled (2) 795kcmil ACSR "Drake"
Weather Condition Displayed: 21.2psf wind at 60°F
NESC Rule Analyzed: 234C

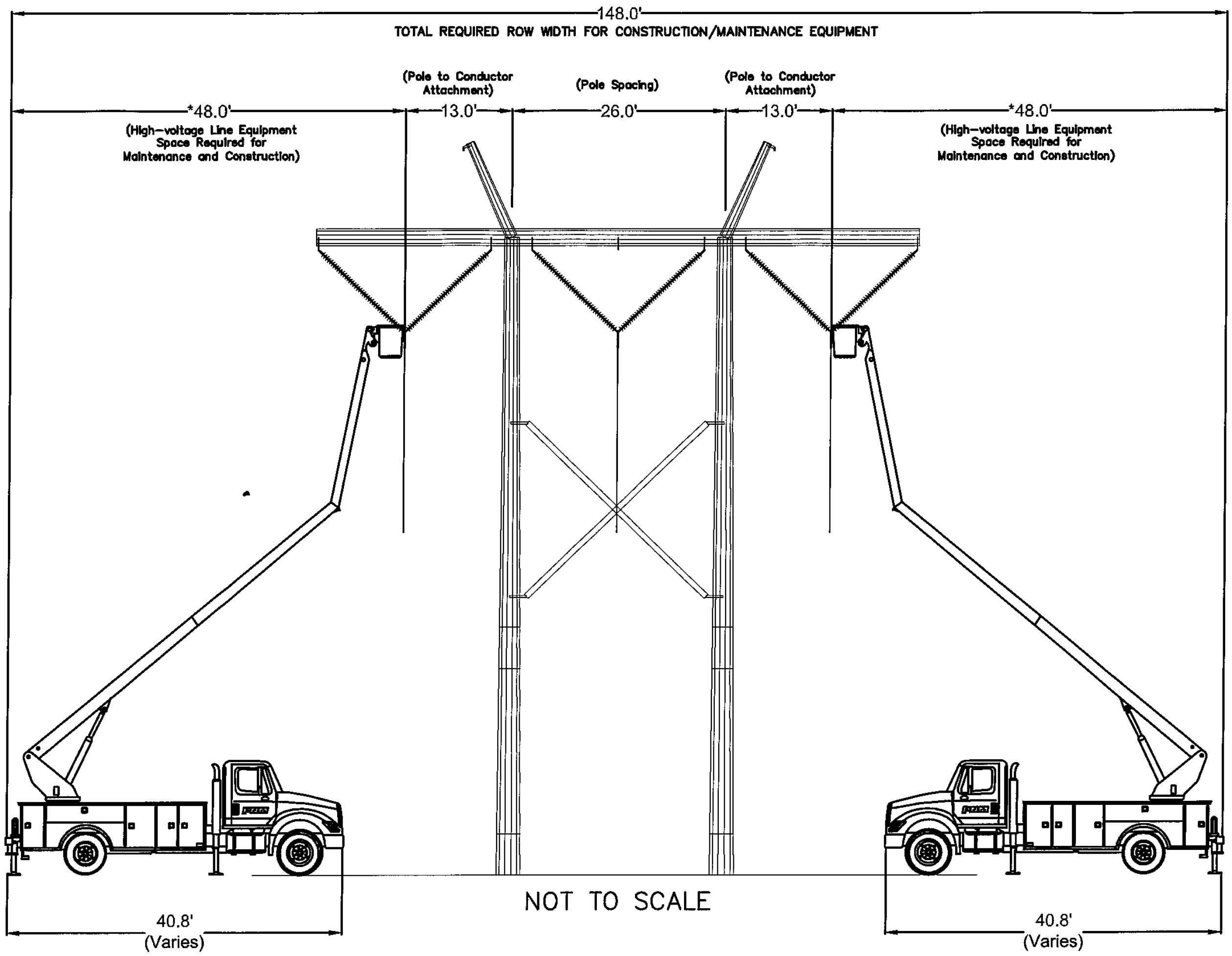
Julia Munoz
JULIA LEE MUNOZ
NEW MEXICO
30349
2-17-26
PROFESSIONAL ENGINEER

PNM PUBLIC SERVICE COMPANY OF NEW MEXICO

PAJARITO–RIO PUERCO 345kV T-LINE
SINGLE–CIRCUIT H–FRAME TANGENT, 21PSF WIND

DR:	JLM	DATE:	02/17/26	PAJA–RIPU–ROW S4
ACAD:	PAJA–RIPU–ROW	APP:	JR	

LastSavedBy: JSEYMOU PLOT DATE: 2/17/2026 8:49:38 AM



Dimensions for truck location and size are approximate and will vary. ROW and access requirements can be reasonably assumed for safe operation of equipment, safety of workers, and safety of the public.

*This distance varies depending on the type of work being performed, orientation of the truck, and availability of equipment.

PNM	PUBLIC SERVICE COMPANY			
PAJARITO–RIO PUERCO 345kV T–LINE SINGLE–CIRCUIT H–FRAME TANGENT, EQUIPMENT				
DR: JLM		DATE: 02/17/26		PAJA–RIPU–ROW S5
ACAD: PAJA–RIPU–ROW		APP: JR		

Audible Noise Calculations

PNM Exhibit JLM-3

Is contained in the following 1 page.

----INPUT DATA-----

Bundle ID (#)	Number of Subconductors	Subconductor Diameter (cm)	Subconductor Spacing (cm)	Voltage-to-Ground (kV)	Phase Angle (degree)	Horizontal Coordinate (m)	Vertical Coordinate (m)
1A	2	2.81	45.7	199.2	0.0	-7.93	19.42
1B	2	2.81	45.7	199.2	-120.0	0.00	19.42
1C	2	2.81	45.7	199.2	120.0	7.93	19.42
1	1	1.60	0.0	0.0	0.0	5.79	26.72
2	1	1.60	0.0	0.0	0.0	-5.79	26.71

Altitude. 2225 (m)
Height Above Ground: 1 (m)

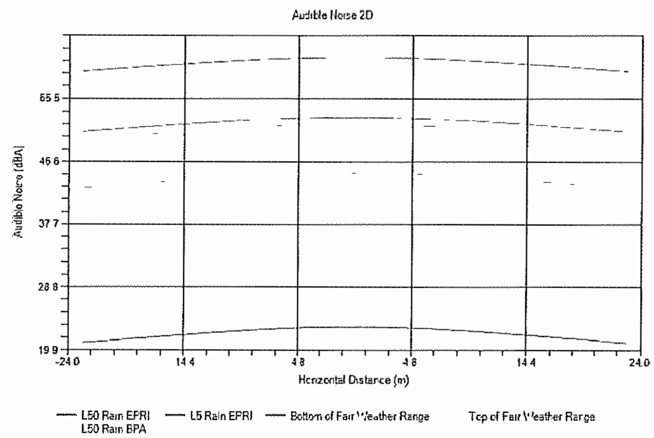
----------- SURFACE GRADIENT AND GENERATED ACOUSTIC POWER (db above 1µW/m) ---------------

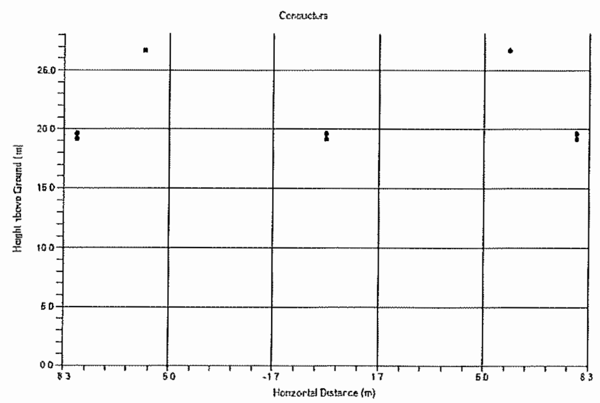
Bundle ID (#)	Number of Subconductors	Subconductor Diameter (cm)	Surface Gradient (kV/cm)	L50 Rain EPRI	L50 Rain BPA	L5 Rain EPRI	Fair Weather Range	
0A	2	2.81	15.56	-55.2	-54.5	-46.0	-90.3	-64.5
0B	2	2.81	16.90	-50.4	-50.2	-42.6	-78.6	-57.7
0C	2	2.81	15.56	-55.2	-54.5	-46.0	-90.3	-64.5
1	1	1.60	3.98	-252.1	-139.1	-182.5	-1174.2	-440.0
1	1	1.60	3.98	-251.8	-139.1	-182.3	-1171.5	-439.2

------------ AUDIBLE NOISE PROFILE ---------------

X (m)	L50 Rain EPRI (dbA)	L50 Rain BPA(*) (dbA)	L5 Rain EPRI (dbA)	Fair Weather Range (dbA)	Fair Weather Range (dbA)
-22.86	50.9	49.8	59.3	21.0	42.9
-21.95	51.0	49.9	59.4	21.1	43.0
-21.03	51.1	50.1	59.5	21.2	43.1
-20.12	51.2	50.2	59.6	21.4	43.2
-19.20	51.3	50.3	59.8	21.5	43.4
-18.29	51.5	50.4	59.9	21.6	43.5
-17.37	51.6	50.5	60.0	21.7	43.6
-16.46	51.7	50.6	60.1	21.8	43.7
-15.54	51.8	50.8	60.2	21.9	43.8
-14.63	51.9	50.9	60.3	22.1	43.9
-13.72	52.0	51.0	60.4	22.2	44.0
-12.80	52.1	51.1	60.5	22.3	44.2
-11.89	52.2	51.2	60.6	22.4	44.3
-10.97	52.3	51.3	60.7	22.5	44.3
-10.06	52.4	51.4	60.8	22.6	44.4
-9.14	52.5	51.5	60.9	22.7	44.5
-8.23	52.6	51.5	60.9	22.8	44.6
-7.32	52.6	51.6	61.0	22.9	44.7
-6.40	52.7	51.7	61.1	22.9	44.7
-5.49	52.7	51.7	61.1	23.0	44.8
-4.57	52.8	51.8	61.2	23.0	44.9
-3.66	52.8	51.8	61.2	23.1	44.9
-2.74	52.9	51.8	61.2	23.1	44.9
-1.83	52.9	51.9	61.3	23.2	45.0
-0.91	52.9	51.9	61.3	23.2	45.0
0.00	52.9	51.9	61.3	23.2	45.0
0.91	52.9	51.9	61.3	23.2	45.0
1.83	52.9	51.9	61.3	23.2	45.0
2.74	52.9	51.8	61.2	23.1	44.9
3.66	52.8	51.8	61.2	23.1	44.9
4.57	52.8	51.8	61.2	23.0	44.9
5.49	52.7	51.7	61.1	23.0	44.8
6.40	52.7	51.7	61.1	22.9	44.7
7.32	52.6	51.6	61.0	22.9	44.7
8.23	52.6	51.5	60.9	22.8	44.6
9.14	52.5	51.5	60.9	22.7	44.5
10.06	52.4	51.4	60.8	22.6	44.4
10.97	52.3	51.3	60.7	22.5	44.3
11.89	52.2	51.2	60.6	22.4	44.3
12.80	52.1	51.1	60.5	22.3	44.2
13.72	52.0	51.0	60.4	22.2	44.0
14.63	51.9	50.9	60.3	22.1	43.9
15.54	51.8	50.8	60.2	21.9	43.8
16.46	51.7	50.6	60.1	21.8	43.7
17.37	51.6	50.5	60.0	21.7	43.6
18.29	51.5	50.4	59.9	21.6	43.5
19.20	51.3	50.3	59.8	21.5	43.4
20.12	51.2	50.2	59.6	21.4	43.2
21.03	51.1	50.1	59.5	21.2	43.1
21.95	51.0	49.9	59.4	21.1	43.0
22.86	50.9	49.8	59.3	21.0	42.9

(*) According to the BPA method the L5 rain is obtained by adding 3.5 dB to the L50 rain and the L50 fair weather value is obtained by subtracting 25 dB from the L50 rain value





JULIA LEE MUNOZ
NEW MEXICO
30349
1-28-26
PROFESSIONAL ENGINEER

PNM PUBLIC SERVICE COMPANY OF NEW MEXICO

PAJARITO–RIO PUERCO 345kV T-LINE
AUDIBLE NOISE CALCULATIONS

DR: JLM	DATE: 01/14/26	PAJA-RIPU-ROW S6
ACAD: PAJA-RIPU-ROW	APP: JR	

Transmission Line Design Standards

PNM Exhibit JLM-4

Is contained in the following 48 pages.

TSD-000-001
Transmission Line
Design Standards Document

Public Service Company of New Mexico

Revision 3.4
2/5/2026

PURPOSE

This Design Standards Document (DSD) is intended to summarize design criteria for the design of 115kV & 345kV Projects for Public Service Company of New Mexico (PNM). The DSD was developed by PNM and is based on the National Electrical Safety Code 2017 (NESC), project scope documents, industry standards and codes, and existing PNM standards. This document is meant as a guide only and will be revised periodically by PNM and other relevant parties.

RECORD OF REVISIONS

Revision No.	Date	By	Description	Reviewed By
0	10/18/21	W. Alford	Issued for Approval	J. Flores-Olivas
1	11/1/21	W. Alford	Addressing Internal Comments	J. Flores-Olivas
2	11/19/21	E. Whitehouse	Addressing Internal Comments	J. Flores-Olivas
3	5/25/22	E. Whitehouse	Addressing Internal Comments	J. Flores-Olivas
3.1	8/1/22	E. Whitehouse	Addressing Internal Comments	J. Flores-Olivas
3.2	2/8/23	E. Whitehouse	Addressing Internal Comments	J. Flores-Olivas
3.3	4/7/25	J. Munoz	Addressing Internal Comments	J. Romero
3.4	2/5/26	J. Munoz	Addressing Internal Comments	J. Romero

SUMMARY OF REVISIONS

- Revision 0 – Initial submission of the document for client review and approval
- Revision 1 – Addressing initial internal comments, 345kV and 500kV phase to phase same circuit clearances and avian protection guidelines
- Revision 2 –
  - Section 3: Addition of NESC 5mA check
  - Section 5: Addition of Phase to overhead shield wire sag ratio criteria
  - Section 6: Adjustment of phase to supporting structure weather criteria
  - Section 7: Update to typical cable tension limit and clarification to bi-metallic conductor settings
  - Section 9: Addition of uplift load case and load application table
  - Section 10: Addition of anti-cascading criteria, structure placement and orientation, and fiber splice point locations
  - Section 11: Adjustment of foundation design parameters for direct embed and drilled pier foundations
  - Appendix A: Adjustment of supporting structures horizontal clearances and bridge vertical clearances. Addition of horizontal clearances for railroad tracks
- Revision 3 –
  - Section 2: Addition of coordinate system footnote
  - Section 3: Updated lightning flashover rate
  - Section 5: Addition of working clearance for wire-to-wire clearances on different supporting structures, distribution crossing clearance, and distribution underbuild clearance
  - Section 7: Addition of two OPGW wires to the cable properties
  - Section 8: Addition of minimum insulation requirements
  - Section 9: Updated table 21, updated section 9.3 notes 5 and 7, addition of structure modifications, addition of cambering and raking structures, and addition of light duty poles
  - Section 10: Updated anti-cascading criteria
  - Appendix A: Addition of local authority clearances footnote to all tables
- Revision 3.1 –

- Section 5: Updated galloping clearance
- Revision 3.2 –
  - Section 1: Updated to include the minimum number of borings per structure type.
  - Section 5: Addition of horizontal clearance criteria
  - Section 7: Addition of two OPGW wires and two ACSR wires to the cable properties. Removal of two OPGW wires from the cable properties.
  - Section 10: Addition of 100-year flood spotting criteria
  - Appendix B: Addition of 12.5kV clearance criteria
- Revision 3.3 –
  - Section 1.1.9: Addition of HFA requirements.
  - Section 3.5: Addition of structure shielding angle
  - Section 4: Addition of 15deg weather case & updated maximum operating weather case's ambient temperature from 90 to 104 deg F.
  - Section 4.1: Addition of NESC special wind regions
  - Section 6: Updated Table 14 to include additional elevation clearance.
  - Section 7.1: Updated cable properties
  - Section 7.2: Updated cable tension limits
  - Section 9.7.2: Addition of switch structure loading
  - Section 10.7: Addition of colocate structures
  - Section 11.4: Addition of minimum foundation reveal for drilled shaft foundations.
- Revision 3.4 –
  - Section 6.1: Updated Table 14 to correct weather case numbers for Moderate Wind (Swing 2).
  - Section 6.1: Removed highlighting from Table 14.
  - Section 7.2: Updated Table 16 to correct weather case numbers for NESC Extreme Wind and NESC Ice/Wind.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page No.

1.0 GENERAL

The Public Service Company of New Mexico (PNM) is the state's largest energy provider, powering residential and business customers across New Mexico every day.

PNM serves residential and business customers in greater Albuquerque, Rio Rancho, Los Lunas, Belen, Santa Fe, Las Vegas, Alamogordo, Ruidoso, Silver City, Deming, Bayard, Lordsburg, and Clayton. PNM also serves communities of the Tesuque, Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, Isleta, and Laguna Pueblos.

The terrain in New Mexico varies from 2,842 feet above mean sea level (ft-MSL) at Red Bluff Reservoir to the highest point in Wheeler Park at 13,167 ft-MSL.

Figure 1 Map of New Mexico and PNM Service Areas

1.1 Design Considerations

1.1.1 Survey Information

LiDAR and survey data for Projects will be provided by PNM. Additional LiDAR or ground survey may be required and shall be ordered only with the approval of PNM.

1.1.2 Elevation

Due to the variation in elevation within the PNM service territory, some areas and Projects may require additional design considerations including but not limited to clearances, weather criteria and load factors. Any project extending higher than 7300 ft-MSL in elevation shall require custom clearances.

1.1.3 Right-of-Way

Existing Right-of-Way (ROW) exhibits will be provided by PNM. New ROW easements will be procured by PNM. The Project Engineer shall support PNM with project specific requirements and needs when acquiring new ROW easements. Preferred ROW widths are 75 ft for 115kV lines and 150 ft for 345kV.

1.1.4 Structures

Standard 115kV and 345kV lines will be constructed using monopole or H-frame weathered or galvanized steel structures, unless otherwise specified by PNM. Structures shall be designed to PNM standards. The use of custom structures on Projects shall require PNM approval.

1.1.5 Geotechnical Investigation

PNM will provide a list of pre-qualified geotechnical engineering consultants in preparation for requesting bids for the geotechnical field investigation. Contractors shall produce geotechnical specifications to assist in the bid process as well as provide the necessary geotechnical guideline parameters for subsurface exploration. The Project Engineer shall provide a plan drawing showing the location and coordinates of the proposed borings to the geotechnical contractor.

Tangent structures shall be required to meet a minimum of one (1) boring per mile. Angle and deadend structures shall have one (1) boring done at each location. Structures with non-standard conductors or located in poor soil conditions shall require additional borings and approval from PNM.

1.1.6 Aerial Markers for FAA

Aerial markers may be required on a per project basis as directed by PNM.

1.1.7 Removal of Existing Transmission Line Facilities

Removal, replacement, or relocation of any of existing facilities are to be detailed in the design package. This shall include location and inventory of equipment being removed.

1.1.8 Avian Protection

Transmission lines will be designed in accordance with the commitments in the PNM Avian Protection Plan to avoid electrocutions and collisions in compliance with the Migratory Bird Treaty Act.

1.1.9 High Fire Areas

All structures in high fire areas (HFAs) shall be steel installation only. New lines built in HFAs shall be vertical configuration to reduce the conductor corridor. Rebuilds or structure replacements on an existing line should use vertical configuration, where practicable, though the existing configuration may be used with PNM approval.

2.0 PROJECT DATA

2.1 Coordinate System

All geospatial information will be based on the State Plane NAD 83, New Mexico West, Central and East horizontal datum, and the State Plane NAVD 88 vertical datum with a unit of US survey foot, Grid, unless stated otherwise.

Figure 2 New Mexico County Map

Table 1 New Mexico State Plane NAD 83 Zones

Eastern	
County	**Code**
Chaves	3001
Colfax	3001
Curry	3001
DeBaca	3001
Eddy	3001
Guadalupe	3001
Harding	3001
Lea	3001
Mora	3001
Quay	3001
Roosevelt	3001
San Miguel	3001
Union	3001

Central	
County	**Code**
Bernalillo	3002
Dona Ana	3002
Lincoln	3002
Los Alamos	3002
Otero	3002
Rio Arriba	3002
Sandoval	3002
Santa Fe	3002
Socorro	3002
Taos	3002
Torrance	3002
Valencia	3002

Western	
County	**Code**
Catron	3003
Cibola	3003
Grant	3003
Hidalgo	3003
Luna	3003
McKinley	3003
San Juan	3003
Sierra	3003

Note: If a project is across two NAD 83 zones, the zone with most of the project in it shall be selected.

3.0 ELECTRICAL PERFORMANCE

PNM's transmission standards shall be utilized for the design of each project, wherever practicable. Deviation from these standards in the design stage shall be communicated to PNM prior to final issuance of design drawings.

3.1 Lightning Performance

The structure geometry, insulation, and ground resistance shall be coordinated to achieve a lightning flashover rate of 4.0 flashovers per 100 miles per year for 115kV and 1.0 flashovers per 100 miles per year for 345kV transmission lines, unless specified otherwise by PNM.

3.2 Phase Transpositions

The need for line transpositions will be determined after the final conductor and configuration is decided through an electrical system study performed by the Project Engineer. The Project Engineer shall provide an electrical study for circuits longer than 40 miles to determine if a transposition is required.

3.3 Grounding Requirements

All structures shall be grounded to eliminate potentially hazardous stray currents and voltages prior to any conductor or shield wire installation. Grounding shall be detailed on design plans.

3.3.1 Structure Grounding

Grounding involves driving ground rods and electrically bonding them to the structure foundations. The desired maximum structure ground resistance is 25 ohms for 115kV and 15 ohms for 345kV. In areas where site studies indicate that it may be difficult to achieve structure grounding requirements with standard grounding designs, the Project Engineer/Contractor will present potential mitigation solutions for review and approval by PNM.

3.3.2 Grounding Structure Near Substation

Structures located inside the substation perimeter shall be treated as a metallic substation structure and a grounding analysis shall be performed by PNM substation engineering. Structures located less than 20 ft from the substation fence shall be analyzed as if it is located inside the substation, whereas structures located 20 ft or more outside substation fence shall be independently grounded.

3.3.3 Fence Grounding

At each point where the transmission line crosses a metal fence, ground rods shall be installed on the fences at the edge of the easement. If the angle of the crossing is such that the distance between grounds exceeds 300 ft, additional grounds shall be installed such that the distance between grounds within the easement does not exceed 300 ft. Whenever a fence gate crosses a transmission centerline, a ground shall be installed on each side of the gate opening. Any metal fence that parallels the transmission line within 200 ft of the centerline shall be grounded as indicated in Table 2.

Table 2 Parallel Fence Grounding Requirements

Distance from Centerline (ft)	Grounding Interval Along Fence Line (ft)
0 - 100	300
100 - 200	450

*Ground at every deadend fence post.

3.4 NESC 5 mA Check

NESC Rule 232-D3.C states that "For voltages exceeding 98kV ac to ground, either the clearances shall be increased or the electrical field, or the effects thereof, shall be reduced by other means as required to limit the steady state current due to electrostatic effects to 5 mA, rms, if the largest anticipated truck, vehicle, or equipment under the line were short-circuited to ground. The size of the anticipated truck, vehicle, or equipment used to determine these clearances may be less than but need not be greater than that limited by federal, state, or local regulations governing the area under the line. For this determination, the conductors shall be at a final sag at 50°C (120°F)."
In accordance with the rule stated above, a NESC 5 mA study shall be performed for lines that exceed voltages of 98kV phase to ground or 170 kV phase to phase. Cumulative electric field effects from parallel or adjacent lines shall be included where engineering judgment deems it necessary. The following maximum electric field values shall be maintained within the transmission right-of-way:

- 5.0 kV/m over highway crossing
- 10.0 kV/m over all other surfaces

3.5 Structure Shielding Angle

All structures shall have a maximum shielding angle of 30 degrees. Shielding angles over 30 degrees shall be discussed with PNM.

4.0 WEATHER DATA

Table 3 shows PNM weather cases to be used on all projects that fall within NESC Medium Zones. The values in Table 3 were developed in conjunction with NESC, RUS and may change due to site specific conditions.

Table 3 Weather Data

Weather Case No.	Description	Wind Velocity (mph)	Wind Pressure (psf)	Wire Ice Thickness (in)	Wire Temp. (deg F)	Ambient Temp. (deg F)
1	NESC Medium (250B)[15]	39.5	4.0	0.25	15.0	15.0
2	NESC Extreme Wind (250C)	90.0	20.7	0.0	60.0	60.0
3	NESC Concurrent Ice and Wind (250D)	30.0	2.3	0.0	15.0	15.0
4	Extreme Ice[5]	0.0	0.0	0.5	30.0	30.0
5	Cold Uplift	0.0	0.0	0.0	-5.0	-5.0
6	Maximum Operating[2]	0.0	0.0	0.0	*2	104.0
7	NESC Tension Limit (261H1c)	0.0	0.0	0.0	15.0	15.0
8	NESC Blowout 6PSF	48.4	6.0	0.0	60.0	60.0
9	No Wind (Swing 1)	0.0	0.0	0.0	60.0	60.0
10	Moderate Wind (Swing 2)	48.4	6.0	0.0	32.0	32.0
11	Moderate Wind (Swing 3)	48.4	6.0	0.0	60.0	60.0
12	High Wind (Swing 4)	90.0	20.7	0.0	60.0	60.0
13	Galloping (Swing) [5]	28.0	2.0	0.25	32.0	32.0
14	Galloping (Sag) [5]	0.0	0.0	0.25	32.0	32.0
15	-20 Deg F	0.0	0.0	0.0	-20.0	-20.0
16	0 Deg F	0.0	0.0	0.0	0.0	0.0
17	15 Deg F	0.0	0.0	0.0	15.0	15.0
18	30 Deg F	0.0	0.0	0.0	30.0	30.0
19	32 Deg F	0.0	0.0	0.0	32.0	32.0
20	32 Deg F ¼ Inch Ice[5]	0.0	0.0	0.25	32.0	32.0
21	60 Deg F	0.0	0.0	0.0	60.0	60.0
22	90 Deg F	0.0	0.0	0.0	90.0	90.0
23	120 Deg F	0.0	0.0	0.0	120.0	90.0
24	212 Deg F	0.0	0.0	0.0	212.0	90.0
25	PNM Extreme Wind (Wind on Wires)	94.8	23.0	0.0	60.0	60.0
26	PNM Extreme Wind (Wind on Structures)	123.4	39.0	0.0	60.0	60.0
27	Stringing (No Snub)	28.0	2.0	0.0	60.0	60.0
28	Construction (With Snub)	34.2	3.0	0.0	30.0	30.0
29	Everyday[3]	0.0	0.0	0.0	*3	*3
30	AAMT[4]	0.0	0.0	0.0	*4	*4
31	Deflection	28.0	2.0	0.0	40.0	40.0
32	PNM 3PSF Wind	34.2	3.0	0.0	60.0	60.0

1. NESC Medium should be utilized for the whole state unless specified otherwise by PNM. K Factor of 0.2 to be included per NESC.
2. Maximum Operating weather case is the maximum operating temperature (MOT) of the conductor. For ACSR, the MOT will be 212°F.
3. Everyday weather case is annual average temperature (AAT) for the project site.
4. AAMT annual average minimum temperature (AAMT) for the project site.
5. Density of ice is 57 lbs/ft^3.

4.1 NESC Special Wind Regions

Project sites with one or more structures identified in a NESC Special Wind Region, per National Electrical Safety Code 2017 (NESC) Section 25, are subject to a wind study investigation to determine the basic wind speed that should be utilized for NESC Extreme Wind (250C).

5.0 ELECTRICAL CLEARANCES

Structure configuration and spotting will be completed to maintain appropriate electrical clearances throughout the line. Clearance requirements shall adhere to those outlined in the following sections. All required clearance values are calculated using NESC, RUS, or other specified design documents. Required clearances are based on maximum phase-to-phase operating voltages (nominal phase-to-phase voltage with a 1.05 over-voltage factor for nominal voltages up to 500kV and 1.10 over-voltage factor for 500kV), unless otherwise noted. Elevations may exceed 3300 ft-MSL and therefore shall require elevation factors. Clearance values listed in this document include elevations factors for elevations above 3,300 ft-MSL and are adequate to an elevation of 7,300 ft-MSL. Project-specific clearances shall be increased if the elevation exceeds 7,300 ft-MSL. The Project Engineer shall coordinate with PNM to determine and agree if structures need to be designed for live line maintenance. The Project Engineer shall verify each project's elevation at the preliminary design stage.

For clearances to ground and obstacles not associated with the circuit to be installed, clearance buffers will be applied in addition to code requirements to account for construction and survey tolerances. For vertical and horizontal clearances, PNM requires minimum design buffers of 2.5 ft vertical and 2.5 ft horizontal for all ground and obstacle clearances in addition to those required by the NESC and avian protection guidelines.

5.1 Clearances to Ground and Obstacles

Permits such as Roadway, Railway, Pipeline, Canals, Rivers, Highways and FAA shall be considered on a per-project basis which may have clearance requirements that exceed PNM design standards.

5.1.1 Vertical Clearance to Ground and Obstacles

Vertical clearances to ground and obstacles under NESC Rules 232 and 234 shall meet or exceed the values summarized in Table 27, Table 28, and Table 29 in Appendix A.

5.1.2 Horizontal Clearances to Obstacles

Horizontal clearances to obstacles under NESC Rule 234 shall meet or exceed the values summarized in Table 28 and Table 29 in Appendix A.

5.1.3 Horizontal Clearance to Edge of Right-of-Way

Horizonal clearances to edge of right-of-way (ROW) shall consider a building constructed on the edge of the ROW. Horizontal clearances to buildings are stated in Appendix A, and corresponding weather conditions are listed in Table 6. When determining ROW clearances, structure deflection shall be considered, as noted in Section 9.4. Energized conductors and non-energized wires shall maintain 15' of clearance to the edge of the ROW at rest. Wires shall also maintain the horizontal clearances listed in Table 4 for NESC Extreme Wind (250C) to the edge of ROW.

Table 4 FAC-003 Minimum Vegetation Clearance Distances (MVCD)

Voltage (kV)	MVCD Distance (ft)
69	1.3
115	2.2
230	4.7
345	5.0
500	8.1

*MVCD are for alternating current voltages for elevations up to 8,000ft.

Transmission lines located in high fire areas shall coordinate with the Vegetation Management Team to obtain Project-specific vegetation clearances.

Spans that cannot meet the clearance to the edge of ROW criteria will be reported to PNM and documented in the project-specific design criteria document.

5.1.4 Applicable Weather Cases for Vertical Clearances

Vertical clearance requirements will be applied under the weather conditions summarized in Table 5.

Table 5 Vertical Clearance Weather Cases

Weather Case No.	Description	Sag (F/I)	Reference
20	32 Deg F ¼ Inch Ice	F	NESC 232-A3 & 234-A1c
5	Cold Uplift	I	NESC 234-A1d
21	60 Deg F	I	NESC 232-A3
23	120 Deg F	F	NESC 232-A1 & 234-A1a
24	212 Deg F	F	NESC 232-A2 & 234-A1b
6	*Maximum Operating	F	NESC 232-A2 & 234-A1b

*Maximum Operating weather case is the maximum operating temperature (MOT) of the conductor. For ACSR, the MOT will be 212°F.

5.1.5 Applicable Weather Cases for Horizontal Clearances

Horizontal clearance requirements will be applied under the weather conditions in Table 6.

Table 6 Horizontal Clearance Weather Cases

Weather Case No.	Description	Sag (F/I)	Reference
20	32 Deg F ¼ Inch Ice	F	NESC 234-A1c
8	NESC Blowout 6PSF	F	NESC 234-2
32	PNM 3PSF Wind	F	PNM Standard
5	Cold Uplift	I	NESC 234-A1d
23	120 Deg F	F	NESC 234-1a
24	212 Deg F	F	NESC 234-A1b
6	*Maximum Operating	F	NESC 234-A1b

*Maximum Operating weather case is the maximum operating temperature (MOT) of the conductor. For ACSR, the MOT will be 212°F.

5.2 Wire to Wire Clearances on Different Supporting Structures

Wire to wire vertical and horizontal clearances on different supporting structures under NESC Rule 233 shall meet or exceed the values summarized in Table 30 and Table 31 in Appendix B, respectively. PNM clearances include a 2.5 ft buffer to allow for modeling inaccuracies, survey inaccuracies, and construction tolerances.

5.2.1 Applicable Weather Cases for Wire to Wire Clearances on Different Supporting Structures

Wire to wire clearance on different supporting structures shall be applied under the weather conditions summarized in Table 7. Both circuits are assumed to have wind applied in the same direction simultaneously.

Table 7 Wire to Wire Clearances on Different Supporting Structures Weather Cases

Subject Conductor / Upper Crossing			Adjacent Conductor / Lower Crossing			Reference
Weather Case No.	Description	Sag (F/I)	Weather Case No.	Description	Sag (F/I)	
8	NESC Blowout 6PSF	F	32	PNM 3PSF Wind	F	PNM Standard
20	32 Deg F ¼ Inch Ice	F	19	32 Deg F	I	NESC 233-A
24	212 Deg F	F	21	60 Deg F	I	NESC 233-A
6	Maximum Operating	F	21	60 Deg F	I	NESC 233-A

5.2.2 Working Clearance for Wire to Wire Clearances on Different Supporting Structures

Wire to wire clearance on different supporting structures shall meet the minimum 15’ horizontal working clearance for 115kV circuits and the 20’ horizontal working clearance for 345kV circuits as per OSHA 1926.1408.

5.3 Wire to Wire Clearances on the Same Supporting Structure (Different Circuit)

Vertical wire to wire clearances on the same supporting structure at the support and midspan for the same utility shall meet or exceed the values summarized in Table 32 and Table 33 in Appendix C, respectively.

Vertical wire to wire clearances on the same supporting structure at the support and midspan for different utilities shall meet or exceed the values summarized in Table 34 and Table 35 in Appendix D, respectively.

Horizontal wire to wire clearances on the same supporting structure at the support and midspan for different or the same utilities shall meet or exceed the values summarized in Table 36 in Appendix E.

Referenced vertical and horizontal clearances are based on NESC Rule 235. PNM clearances include a 2.5 ft buffer to allow for modeling inaccuracies, survey inaccuracies, and construction tolerances.

5.3.1 Applicable Weather Cases for Wire to Wire Clearances on the Same Supporting Structure (Different Circuit)

Wire to wire clearance requirements will be applied under the weather conditions summarized in Table 8.

Table 8 Wire to Wires Clearances on the Same Supporting Structure (Different Circuit) Weather Cases

Clearance Type	Upper Conductor			Lower Conductor			Reference
	Weather Case No.	Description	Sag (F/I)	Weather Case No.	Description	Sag (F/I)	
Vertical	20	32 Deg F ¼ Inch Ice	F	19	32 Deg F	I	NESC 235-C
Vertical	24	212 Deg F	F	19	32 Deg F	I	NESC 235-C
Vertical	6	Maximum Operating	F	19	32 Deg F	I	NESC 235-C
Horizontal	21	60 Deg F	F	21	60 Deg F	I	NESC 235-B
Horizontal	8	NESC Blowout 6PSF	F	32	PNM 3PSF Wind	I	NESC 235-B

5.4 Phase to Phase Clearances of the Same Circuit

Phase to phase clearances of the same circuit at the supports and at midspan shall meet or exceed the values summarized in Table 9. Referenced clearances are based on NESC Rule 235. PNM clearances include a 1.0 ft buffer for voltages below 100kV and a 2.0 ft buffer for voltages above 100kV. These buffers allow for modeling inaccuracies, survey inaccuracies, and construction tolerances.

Table 9 Phase to Phase Clearances of the Same Circuit Requirements

RADIAL CLEARANCES BETWEEN PHASES OF THE SAME CIRCUIT								
Rule 235-E NESC 2017 Pg. 158 and Base Clearance from Table 235-6 NESC 2017 Pg. 180 Assumed elevation of 7,300 ft-MSL.								
		Open Supply Conductors						
	Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.05	1.05	1.00
	Line to Line Voltage	500	345	230	115	69	46	34.5
	CODE	kV	kV	kV	kV	kV	kV	kV
Radial Clearance between Phases of the Same Circuit at the Supports	PNM	**24.0[3]**	**17.0[3]**	**11.6**	**7.6**	**5.0**	**4.2**	**4.2**
	RUS Table 6-1	No Value[2]	No Value[2]	9.6	5.6	4.0	3.2	3.2
Radial Clearance between Phases of the Same Circuit at Mid Span	PNM	**24.0[3]**	**17.0[3]**	**11.0**	**6.9**	**4.3**	**3.5**	**3.5**
	RUS Table 6-1	No Value[2]	No Value[2]	9.0	4.9	3.3	2.5	2.5

1. NESC does not provide a required clearance
2. RUS does not prove a required clearance
3. Based on values adopted by various utilities per industry standards (plus PNM buffer). These values should be used as a guideline, the actual required clearances are a function of several variables including type of structure adopted, span lengths, voltages, terrain and possibility of Aeolian vibration and galloping.

5.4.1 Applicable Weather Cases for Phase to Phase Clearances of the Same Circuit

Wire to wire clearance requirements will be applied under the weather conditions summarized in Table 10.

Table 10 Phase to Phase Clearances of the Same Circuit Requirements Weather Cases

Upper Conductor			Lower Conductor			Reference
Weather Case No.	Description	Sag (F/I)	Weather Case No.	Description	Sag (F/I)	
20	32 Deg F ¼ Inch Ice	F	19	32 Deg F	I	NESC 235-C
21	60 Deg F	F	21	60 Deg F	I	NESC 235-B

5.5 Phase to Overhead Shield Wire Clearances

The radial clearance between phases and shield wires on the same supporting structure at the support and midspan shall meet or exceed the values summarized in Table 11. The values in Table 11 are based on the RUS Bulletin 1724E-200 (2015) Section 6 and include a 2.0 ft buffer to account for ice jumping.

In addition to the clearance values stated in Table 11, an overhead shield wire to phase sag ratio of 80% shall be maintained at a 60°F final cable condition for all wires.

Table 11 Phase to Overhead Shield Wire Clearance Requirements

RADIAL CLEARANCES BETWEEN PHASES TO OVERHEAD SHIELD WIRE OF THE SAME CIRCUIT			
	Phase Voltage	345	115
	CODE	kV	kV
Radial Clearance between Phase and Overhead Shield Wire attached to the Same Structure at the Supports	PNM	10.5[3]	5.9
	RUS Table 6-1	No Value[2]	3.9
Radial Clearance between Phase and Overhead Shield Wire attached to the Same Structure at Mid Span	PNM	9.5[3]	5.2
	RUS Table 6-1	No Value[2]	3.2

1. The two (2) foot buffer for ice jumping can be removed when shield wires have a horizontal offset greater than 12 inches from energized wires below.
2. RUS does not prove a required clearance
3. Based on values adopted by various utilities per industry standards (plus PNM buffer).

5.5.1 Applicable Weather Cases for Phase to Overhead Shield Wire Clearances

Phase to overhead shield wire clearance requirements will be applied under the weather conditions summarized in Table 12.

Table 12 Phase to Overhead Shield Wire Clearance Requirements Weather Cases

Clearance Type	Upper Wire			Lower Conductor		
	Weather Case No.	Description	Sag (F/I)	Weather Case No.	Description	Sag (F/I)
Vertical	20	32 Deg F ¼ Inch Ice	F	19	32 Deg F	I
Vertical	23	120 Deg F	F	23	120 Deg F	I

5.6 Galloping

Conductor and shield wire galloping ellipses will be modeled using the A.E. Davison method for single loop galloping and the L.W. Toye method for double loop galloping under the conditions specified in Table 13. Modeled ellipse dimensions will reflect the full calculated size. Galloping will be calculated as single loop for span lengths up to 600 ft and double loop for span lengths greater than 600 ft. Zero inches of clearance will be maintained between ellipses, unless noted otherwise.

Table 13 Galloping Weather Cases

Weather Case No.	Description	Ice (in)	Wind (psf)	Sag (F/I)
13	Galloping (Swing)	0.25	2.0	F
14	Galloping (Sag)	0.25	0.0	F

5.7 Distribution and Third Party Attachments

All crossings should be verified with the respective parties.

5.7.1 Distribution Crossing Clearance

Wire to structure clearance shall meet or exceed the values summarized in Table 28 in Appendix A with an additional 38.5' above ground clearance for all distribution crossings. All crossings to be verified with PNM distribution at each phase of the project.

5.7.2 Distribution Underbuild Clearance

No distribution underbuild shall be on 345kV lines. PNM prefers to have no distribution underbuild on 115kV lines. If distribution underbuild is required, wire to wire clearance on the same supporting structure with distribution underbuild shall be greater of the values summarized in Table 32 in Appendix C or the minimum 15' clearance from the lowest transmission conductor attachment to the highest distribution attachment. In addition to the wire to wire clearance, an additional 38.5' above ground clearance for all distribution crossings to account for a future 45' distribution pole rebuild. All areas with underbuild to be verified with PNM distribution at each phase of the project.

6.0 CLEARANCE TO SUPPORTING STRUCTURE

6.1 Phase to Supporting Structure Clearance

The minimum radial clearance requirements from a conductor to its supporting structure shall meet or exceed the PNM values summarized in Table 14. The PNM values in Table 14 are based on NESC Rule 235 or RUS 1724E-200 with a 6-inch buffer and assumed elevation of 7,300 ft-MSL.

Table 14 Phase to Supporting Structure Clearance Requirements

Description	Cable Condition	Clearance	Weather Case No.	Description	Reference	Clearance (ft)	
						115kV	345kV
No Wind Clearance[1] (Condition 1)	Final	Minimum Clearance to Structure or Guy	9	No Wind (Swing 1)	PNM	**4.2**	**9.5**
					RUS Section 7	**3.7**	**9.0**[2]
		Minimum Clearance to Structure or Guy	16	0 Deg F	PNM	**4.2**	**9.5**
					RUS Section 7	**3.7**	**9.0**[2]
Moderate Wind Clearance (Condition 2)	Final	Minimum Clearance to Structure	10	Moderate Wind (Swing 2)	PNM	**2.8**	**7.1**
					NESC 235-6	**2.3**	**6.6**
		Minimum Clearance to Jointly Used Structures	10	Moderate Wind (Swing 2)	PNM	**3.0**	**7.3**
					NESC 235-6	**2.5**	**6.8**
		Minimum Clearance to Anchor Guys	10	Moderate Wind (Swing 2)	PNM	**3.5**	**8.9**
					NESC 235-6	**3.0**	**8.4**
Moderate Wind Clearance (Condition 3)	Final	Minimum Clearance to Structure	11	Moderate Wind (Swing 3)	PNM	**2.8**	**7.1**
					NESC 235-6	**2.3**	**6.6**
		Minimum Clearance to Jointly Used Structures	11	Moderate Wind (Swing 3)	PNM	**3.0**	**7.3**
					NESC 235-6	**2.5**	**6.8**
		Minimum Clearance to Anchor Guys	11	Moderate Wind (Swing 3)	PNM	**3.5**	**8.9**
					NESC 235-6	**3.0**	**8.4**
High Wind Clearance (Condition 4)	Final	Minimum Clearance to Structure or Guy	12	High Wind (Swing 4)	PNM	**1.6**	**3.0**
					RUS Section 7	**1.1**	**2.5**[2]

1. Clearance to structure at no wind case shall not be less than the dry arc distance of the insulator.
2. Based on values adopted by various utilities per industry standards.

7.0 CONDUCTOR AND SHIELD WIRE

7.1 Cable Properties

Unless otherwise approved by PNM, all new 115kV transmission structures shall be designed to support (2) DNO-6318 OPGW cables. Table 15 summarizes the properties for typical PNM wire types.

Table 15 Cable Properties

Voltage	Cable Type	Cable Name	Cable Description	Diameter (in)	Unit Weight (lbs/ft)	RBS (lbs)
N/A	OHGW	Shield Wire	3/8" EHS Steel	0.360	0.273	15,400
N/A	OPGW	AFL DNO-11282	72 Count Fiber	0.512	0.304	15,190
N/A	OPGW	AFL DNO-6318	144 Singlemode Fiber	0.630	0.417	19,791
N/A	OPGW	AFL DNO-12663	24 Corning LEAF & 120 Singlemode Fiber	0.630	0.417	19,791
115kV	ACSR	Drake	795 kcmil 26/7 ACSR	1.108	1.093	31,500
115kV	ACSR	Cardinal	954 kcmil 54/7 ACSR	1.196	1.227	33,800
115kV	ACSR	Chukar	1780 kcmil 84/19 ACSR	1.602	2.072	51,000
345kV	ACSR	Drake	2-795 kcmil 26/7 ACSR	1.108	1.093	31,500
345kV	ACSR	Pheasant	2-1272 kcmil 54/19 ACSR	1.382	1.634	43,600

* Non-standard conductors shall require PNM approval at project kick-off.

7.2 Cable Tensions

Typical cable tensions will be limited to the values outlined in Table 16 based on NESC Rule 261 or specified by the client. Additional OPGW cable tensions to be applied per manufacturer recommendations.

Table 16 Typical Cable Tension Limits

Cable Name	Weather Case	Description	Sag (F/I)	Tension Limit	Reference
All	1	NESC Medium	I	60% RBS	NESC Rule 261
All	2	NESC Extreme Wind	I	80% RBS	NESC Rule 261
All	3	NESC Ice/Wind	I	80% RBS	NESC Rule 261
All	7	NESC Initial Unloaded	I	35% RBS	NESC Rule 261
All	17	15 Deg	F	25% RBS	NESC Rule 261
All	21	60 Deg	F	17% RBS	PNM Standard
All	5	Cold Uplift	F	25% RBS	PNM Standard
Drake	1	NESC Medium	I	TBD per Project	PNM Standard
Cardinal	1	NESC Medium	I	TBD per Project	PNM Standard
Chukar	1	NESC Medium	I	TBD per Project	PNM Standard
Pheasant	1	NESC Medium	I	TBD per Project	PNM Standard

7.3 Aeolian Vibration

Aeolian vibration mitigation shall be based on a qualified engineering study, manufacturer's recommendations, or experience from comparable installations. Consideration shall include, but is not limited to conductor material, stranding, type, size, tension, conductor attachment hardware, span length, wind exposure, and expected atmospheric loadings. If vibration control devices are required, dampers will be installed on phase conductors and shield wire in accordance with manufacturer's placement recommendations. Dampers shall be installed on the ahead and back side every other structure and shall be included in design submittals. Table 17 summarizes the variables that will be used for Aeolian vibration analyses per Project.

Table 17 Aeolian Vibration Analysis Criteria

Parameter	Value
Maximum Steady Wind Speed (mph)	15
Average Annual Temperature (°F)	*
Average Annual Minimum Temperature (°F)	*

* Temperatures are dependent on Project location.

7.4 Bi-metallic Conductor Modeling

Aluminum has a thermal expansion coefficient larger than steel. Consequently, at some high temperature transition point, the aluminum strands used as the outer material of a bi-metallic conductor are no longer under tension. At temperatures higher than this transition point, it is assumed that the aluminum goes into compression. For calculation of maximum sag at high temperatures, the maximum virtual compressive strength of aluminum is assumed to be 1.5 ksi for ACSR only.

7.5 Creep & Load

Creep is permanent stretching of wire in response to application of tension over time. This permanent stretch results in lower tensions for wires in the "after creep" condition compared to the initial condition. For calculation of permanent stretch due to creep, a 60 Deg F weather case will be used.

Wires can also be permanently stretched due to short exposures to extreme load. Calculations done in the "after load" condition will include an adjustment for the permanent stretch caused by a short-term exposure to the following weather cases: NESC Medium (250B), NESC Extreme Wind (250C), NESC Ice & Wind (250D), and Extreme Ice.

7.6 Set and Phase Coordination for PLS-CADD Insulator Links

The PLSCADD insulator links noted in Table 18 shall be used for PNM Projects.

Table 18 PLS-CADD Insulator Links

VOLTAGE	CKT	SET		
		TANGENT	DEADEND	
			AHEAD	BACK
OHSW	Left	1	1	31
	Right	2	2	32
	Tap	3	3	33
345	Left/Top	4	4	34
	Right/Bottom	5	5	35
	Tap	6	6	36
230	Left/Top	7	7	37
	Right/Bottom	8	8	38
	Tap	9	9	39
115	Left/Top	10	10	40
	Right/Bottom	11	11	41
	Tap	12	12	42
69	Left/Top	13	13	43
	Right/Bottom	14	14	44
	Tap	15	15	45
46	Left/Top	16	16	46
	Right/Bottom	17	17	47
	Tap	18	18	48
12.47	Left/Top	19	19	49
	Right/Bottom	20	20	50
	Tap	21	21	51
NEUTRAL	Top	22	22	52
	Mid	23	23	53
	Bottom	24	24	54
MISC	Top	25	25	55
	Mid	26	26	56
	Bottom	27	27	57

8.0 INSULATORS & HARDWARE

8.1 Insulator Assemblies

Insulator assemblies will be selected from PNM's library of assemblies, wherever practicable. Deadend and strain structures will use strain assemblies. PNM preference is to use polymer insulators.

8.2 Insulator Strength

Insulator strengths will be determined during detailed design using the strength reduction factors outlined in Table 19 based on NESC Rule 277. All insulator strength factors shall be applied without load factors.

Table 19 Insulator Strength Reduction Factors

Load Case No.	Weather Case No.	Load Case	Ceramic			Non-ceramic		
			Suspension	Post		Suspension	Post	
				Cantilever	Tension / Compression		Cantilever	Tension / Compression
1	1	NESC 250B Medium	0.5	0.4	0.5	0.5	0.5	0.5
2	2	NESC 250C Extreme Wind	0.5	0.4	0.5	0.65	0.5	0.5
3	3	NESC 250D Extreme Ice/Wind	0.5	0.4	0.5	0.65	0.5	0.5
4	4	Extreme Ice	0.5	0.4	0.5	0.65	0.5	0.5
5	20	Differential Ice	0.5	0.4	0.5	0.65	0.5	0.5
6	25	PNM Extreme Wind (Wind on Wires)	0.5	0.4	0.5	0.65	0.5	0.5
	26	PNM Extreme Wind (Wind on Structures)						
7	27	Stringing (No Snub)	0.5	0.4	0.5	0.65	0.5	0.5
8	28	Construction (With Snub)	0.5	0.4	0.5	0.65	0.5	0.5
9	31	Deflection	0.5	0.4	0.5	0.65	0.5	0.5
10	5	Uplift	0.5	0.4	0.5	0.65	0.5	0.5

* Project Engineer shall verify that the custom insulator strength values from the vendors are unfactored, so strength reductions are not taken twice.

8.3 Hardware Strength

Per NESC Rule 261, attachment hardware shall be capable of supporting NESC 250B (Load Case No. 1) design loads inclusive of all load factors without exceeding 100% of its ultimate strength. For NESC 250C (Load Case No. 2) and 250D (Load Case No. 3), wire tension loads shall not exceed 80% of the hardware ultimate strength with no load factors.

8.4 Minimum Insulation Requirements

For elevations under 7,300ft, refer to current insulation standards for 115kV and 345kV. For elevations over 7,300ft, insulation requirements shall be discussed with PNM.

9.0 LOADINGS AND LOAD FACTORS

9.1 Assumptions

The following assumptions are used for structure load calculation on the Project:

- The 2017 NESC wind model will be used for NESC 250C Extreme Wind loading only
- Density of ice = 57 lbs/ft^3
- Structure icing is negligible
- Misc. conductor load (dampers, spacers, etc.) = 150 lbs
- Misc. OHGW load = 75 lbs

9.2 Loadings

Structures will be designed for the load cases summarized in Table 20.

Table 20 Structure Loadings

Load Case No.	Weather Case No.	Description	Sag (F/I)	Load Factor				
				Wire			Structure	
				Vert.	Wind	Tension	Weight	Wind
1	1	NESC 250B Medium[1]	I	1.5	2.5	1.65	1.5	1.0
2	2	NESC 250C Extreme Wind[2, 3]	I	1.0	1.0	1.0	1.0	1.0
3	3	NESC 250D Extreme Ice/Wind	I	1.0	1.0	1.0	1.0	1.0
4	4	Extreme Ice	I	1.0	1.0	1.0	1.0	1.0
5	20	Differential Ice	I	1.1	1.1	1.1	1.1	1.0
6	25	PNM Extreme Wind (Wind on Wires)	I	1.0	1.0	1.0	1.0	1.0
	26	PNM Extreme Wind (Wind on Structures)						
7	27	Stringing (No Snub)	I	2.0	2.0	2.0	2.0	1.0
8	28	Construction (With Snub)	I	1.5	1.5	1.5	1.5	1.0
9	31	Deflection	F	1.0	1.0	1.0	1.0	1.0
10	5	Uplift	I	1.0	1.0	1.0	1.0	1.0

1. A k value of 0.2 will be used with the NESC Medium load case.
2. Wind speed/pressure is the base wind speed/pressure. Wind speed/pressure will be adjusted per NESC Rule 250C.
3. A NESC 250C Extreme Wind loading case without any wires shall also be checked.

9.3 Application of Loads

Table 21 indicates what loadings specified in Table 20 shall be applied to each structure group.

Table 21 Load Application

Load Case No.	Weather Case No.	Description	Deadend		Strain			Suspension	
			Intact	One Side Only	Intact	One Side Only	Broken Wire	Intact	Broken Wire
1	1	NESC 250B Medium	X	X	X		X	X	
2	2	NESC 250C Extreme Wind	X	X	X			X	
3	3	NESC 250D Extreme Ice/Wind	X	X	X			X	
4	4	Extreme Ice	X	X	X			X	
5	20	Differential Ice			X			X	
6	25	PNM Extreme Wind (Wind on Wires)	X	X	X			X	
	26	PNM Extreme Wind (Wind on Structures)							
7	27	Stringing (No Snub)	X		X			X	
8	28	Construction (With Snub)	X		X			X	
9	31	Deflection	X	X	X	X		X	
10	5	Uplift	X	X	X				

1. Load cases 5 and 8 shall be excluded for structures utilizing braced post insulators.

The following load application details shall be used in conjunction with the information above:

1. Multi-circuit structures will be designed to allow for the installation of any one single circuit at a time in addition to the installation of all circuits.
2. Where multiple OHGW types are required, structures will be designed to carry the OHGW that produces the largest loads at all OHGW locations.
3. Deadend structures will be designed to support ahead wires only installed, back wires only installed, and both ahead and back wires installed for all applicable load cases.
4. Strain structures will be designed to support differential tension resulting from different ahead and back ruling spans.
5. A broken wire load case at the NESC 250B Medium case shall include a single broken shield wire or conductor. For construction using bundled conductor, one subconductor of any one phase bundle is assumed broken with the other subconductor(s) intact. Tensions will not be reduced by assumed insulator swing. NESC Medium load factors are applied to the intact wires. A load factor reduction of 1.1 will be applied to all load factors resulting from the broken wire.
6. Differential Ice load case is applied with conductor and shield wires on one side of the structure subjected to the iced condition with conductor and shield wires on the other side bare. The longitudinal loading at the attachment points considers the resulting loads from the iced wire tension on one side of the structure and the non-iced wire on the opposite side. A reduction in tension may be assumed for suspension insulator swing. The Differential Ice load case is not applied to deadend structures.
7. Stringing load case assumes any one phase or shield wire binds in the block during installation. The block is assumed to swing 45 deg resulting in a longitudinal load equal to sum of the vertical load and longitudinal load of the phase or shield wire for suspension structures. For deadend and strain structures, the Stringing load case will only be designed to support ahead wires only installed and back wires only installed.
8. Construction load case will be applied for wire snubbing to the ground or construction equipment at a pulling line slope of 3/1 (horizontal/vertical). For deadend and strain structures, the Construction load case will only be designed to support ahead wires only installed and back wires only installed.
9. Weight of lineman and tools shall be 300 lbs and added to load cases 7, 8, and 9.
10. Uplift load case will be applied to deadend and strain structures only.

9.4 Structure Modifications

Modified structures are structures that are select location replacements that are needed to be replaced due to a maintenance issue. Modified structures shall be evaluated using section 9.2 and 9.3 normally. If the structure design doesn't meet the loads in section 9.2 and 9.3, PNM should be notified.

9.5 Deflection

Structure deflection shall be calculated independently from an assumed rotation at the base of the structure or groundline due to foundation movement. Table 22 summarizes structure deflection limits.

Table 22 Structure Deflection Limits

Load Case	Weather Case No.	Description	Deflection Limits (% of Above Ground Height)			
			Tangent	Strain	Deadend	
					Intact	One Side Only
Deflection	30	Deflection	2	2	1	1
NESC Extreme Wind	2	NESC 250C Extreme Wind	7	7	7	7
NESC Ice/Wind	3	NESC 250D Extreme Ice/Wind	7	7	7	7

9.5.1 Cambering and Raking

Cambered and raked poles shall not be used.

9.6 Secondary Moments

Structures will be designed to withstand the secondary moments induced by structure deflection. These secondary moments will be based on the deflection of the structure itself and an assumed foundation rotation as specified in Table 25 or Table 26 for direct embed foundations and drilled shaft foundations, respectively.

9.7 Strength Reduction Factors

The following strength factors in Table 23 are applied to the loadings in Table 20. Strength factors for NESC load cases are based on NESC Rule 261. Guy strength reduction factors are based on the recommendations of Section 6.3.2 of the ASCE Manual of Practice 91.

Table 23 Strength Factors

Load Case No.	Weather Case No.	Description	Steel Poles, Arms, & Braces	Wood Poles, Cross Arms, & Braces	Guys	Guy Anchors
1	1	NESC 250B Medium	1.0	0.65	0.9	1.0
2	2	NESC 250C Extreme Wind	1.0	0.75	0.9	1.0
3	3	NESC 250D Extreme Ice/Wind	1.0	0.75	0.9	1.0
4	4	Extreme Ice	1.0	1.0	0.9	1.0
5	20	Differential Ice	1.0	1.0	0.9	1.0
6	25	PNM Extreme Wind (Wind on Wires)	1.0	1.0	0.9	1.0
	26	PNM Extreme Wind (Wind on Structures)				
7	27	Stringing (No Snub)	1.0	1.0	0.9	1.0
8	28	Construction (With Snub)	1.0	1.0	0.9	1.0
9	31	Deflection	1.0	1.0	0.9	1.0
10	5	Uplift	1.0	1.0	0.9	1.0

9.7.1 Light Duty Poles

Light duty poles shall be limited to 90% structure utilization.

9.7.2 Switch Structures

Switch structures shall be designed for full tension, deadend loading. The switch structure shall have balanced loading on both sides of the switch. Switch attachment details shall be coordinated with switch manufacturer and steel pole manufacturer. All switch structure loading shall be coordinated with PNM.

10.0 STRUCTURES

Unless otherwise noted or pre-approved by PNM, tubular galvanized or weathering steel structures shall be used on all designs.

10.1 Types

For purposes of applying the design criteria, the following defines the structure types on the project:

- Suspension Structure: A structure where the phase conductors and OHSWs are attached using suspension insulators and hardware or, in the case of the overhead ground wire, with a clamp not capable of resisting the full design tension of the wire.
- Strain Structure: A structure where the phase conductors and OHSWs are attached using deadend insulators and hardware but where the ability of the structure to resist a condition where all wires are broken on one side under full loading is not required or desired.
- Deadend Structures: A structure where the phase conductors and OHGWs are attached using deadend insulators and hardware and where the ability of the structure to resist a condition where all wires are broken on one side under full loading is required or desired.

10.2 Groups

Groups are based on actual structure line angles determined during the structure spotting process, groups may be further divided to improve structure utilization. Structure groups are to be determined by the Project Engineer and are anticipated to be broken up into, but not limited to, the following groups:

- 0 – 2 Degree Suspension Tangent
- 2 – 10 Degree Suspension Angle
- 0 – 60 Degree Strain
- 0 – 90 Degree Deadend

10.3 Uplift

Table 24 summarizes the uplift load criteria for conductor and shield wire suspension attachment points. Uplift will be allowed on strain and deadend structures.

Table 24 Uplift Design Parameters

Weather Case	Description	Sag (F/I)	Conductor Minimum Load (lbs)	OHSW Minimum Load (lbs)
5	Cold Uplift	I	0	0

10.4 Anti-Cascading Criteria

For failure containment, a deadend structure shall be spotted every 5 miles at a minimum. A strain structure shall be spotted every 2.5 miles. Deadend and strain structure locations shall be coordinated with PNM.

10.5 Structure Placement and Orientation

No structures shall be placed in 100-year flood zones. If a 100-year flood zone is unavoidable, PNM should be notified.

10.5.1 Switch Structures

Where line sectionalizing switches are mounted on transmission structures, the following criteria shall be met wherever feasible:

- The switch structure shall be spotted in an accessible location (preferably near a public road) for future maintenance and use.
- Switches shall be oriented to face away from roads, where applicable.

All switch structure locations shall be coordinated with PNM.

10.5.2 Deadend and Strain Structures

The first structure outside of a substation shall be a deadend. Deadend or strain structures shall also be spotted on both sides of a highway crossing.

10.6 Fiber Splice Point Locations

The project engineer shall reach out to PNM for splice location preferences. Consideration shall be given to the following:

- Minimize cumulative line angles over a continuous run of OPGW to reduce bends in the fiber tubes.
- Splice points shall be placed near public roads wherever practicable for increased accessibility and future maintenance.

The following are preferences that should be considered, wherever feasible:

- Splice points should be placed near transmission crossings.
- Splice points should be placed near a parallel line or parallel line splice location.

All splice locations shall be coordinated with PNM.

10.7 Colocate and Distribution Underbuild Structures

All colocate structure locations shall be coordinated with PNM. Colocate structures shall meet the following requirements:

- All cell antenna or joint use installations shall be reviewed and approved on a case-by-case basis.
- No cell antennas shall be installed on double circuit poles above conductors.
- Cell antenna installations shall not be allowed where installation or maintenance would require a substation or transmission line outage. Only locations that could be installed or maintained through hot-line-holds will be allowed.
- Underbuilt ADSS or any other communication wire shall not be allowed on any transmission line without distribution underbuild.

- Colocate structures and any component shall not exceed 95% usage.
- Distribution risers (PNM or customer owned) and transformers shall not be allowed on transmission structures.
- Three-phase and single-phase distribution takeoffs shall be limited as much as possible.
- A transmission pole shall never be used as part of another, unrelated structure.

11.0 FOUNDATIONS

11.1 Foundation Selection

All tangent structures will be supported by direct embed foundations and all other structures will be supported by drilled shaft foundations, wherever practicable. Areas inaccessible for concrete trucks shall use guyed structures.

11.2 Loadings

Foundations will be designed to withstand groundline reactions based on the results of the structure manufacturer's calculations. The maximum shear, moment, and axial loads from the structure manufacturer's calculations will be enveloped for the purposes of foundation design.

11.3 Direct Embed Foundation Design

Direct embed foundation design shall assume all embedded structures are subject to a geotechnical investigation to determine the embedment length. All direct embedded structures are based on the parameters outlined in Table 25.

Table 25 Direct Embed Foundation Design Parameters

Attribute	Design Value
Analysis Tool	MFAD
Total Deflection (in)	4.0
Non-Recoverable Deflection (in)	2.0
Total Rotation Limit (deg)	2.0
Non-Recoverable Rotation Limit (deg)	1.0
Backfill Material	Crushed Rock
Backfill Material (Optional)	1,500 psi Concrete
Load Factor[1]	1.1

1. Load factor applied to groundline reactions for use in geotechnical design.

11.4 Drilled Shaft Foundation Design

Drilled shaft foundation design shall be based on the parameters outlined in Table 26. Structural design will follow the guidelines established in ACI 336.3R and the applicable requirements of ACI 318. The first 2 ft of the soil profile shall be ignored.

Drilled shaft foundations shall use #4 to #11 steel bars, where feasible, with a minimum difference of two bar sizes between the longitudinal steel and shear ties.

Drilled shaft foundations shall have a minimum reveal of 2 ft.

Table 26 Drilled Pier Foundation Design Criteria

Attribute	Design Value
Analysis Tool	MFAD
Total Deflection (in)	4.0
Non-Recoverable Deflection (in)	2.0
Total Rotation Limit (deg)	2.0
Non-Recoverable Rotation Limit (deg)	1.0
Design Concrete Compressive Strength (psi)	3,000
Construction Concrete Compressive Strength (psi)	4,000
Maximum Shaft Diameter (ft)	12
Minimum Longitudinal Reinforcement (% steel)	0.75%
Design Reinforcement Yield Strength (ksi)	60
Structural Load Factor[1]	1.0
Geotechnical Load Factor[2]	1.0

1. Load factor applied to groundline reactions for use in geotechnical design.
2. Load factor applied to internal reactions developed during geotechnical analysis for use in structural reinforcement design.

12.0 REFERENCES

12.1 Codes

- IEEE National Electrical Safety Code, C2-2017.

12.2 Design References

- U.S. Department of Agriculture Rural Utilities Service Bulletin 1724E-200: Design Manual for High Voltage Transmission Lines, December 2015.
- ASCE Manuals and Reports on Engineering Practice No. 48: Design of Steel Transmission Pole Structures, 2019
- ASCE Manual and Reports on Engineering Practice 74: Guidelines for Electrical Transmission Line Structural Loading, 4th Edition, 2020.
- ASCE Manuals and Reports on Engineering Practice No. 91: Design of Guyed Electrical Transmission Structures.
- ACI 318 Building Code Requirements for Structural Concrete and Commentary, 2008
- ACI 336.3R Design and Construction of Drilled Piers, 2014

APPENDIX A – VERTICAL AND HORIZONTAL CLEARANCES TO GROUND AND OBSTACLES

Table 27 Vertical Clearances to Ground Under NESC Rule 232

VERTICAL CLEARANCE ABOVE GROUND, ROADWAY, RAIL, OR WATER SURFACES

NESC only requires a 1.05 multiplier for voltages exceeding 50kV and 1.10 multiplier for 500kV.

Rule 232-1 Base Clearance from Table 232-1 NESC 2017 Pg. 103

Assumed elevation of 7,300 ft-MSL.

	Code	Phase to Phase (kV)							Neutral	Shield Wire
		500	345	230	115	69	46	34.5[3]		
Tracks, Rails of Railroads (except electrified railroads using overhead trolly conductors)[1]	PNM	**40.0**	**36.0**	**36.0**	**36.0**	**36.0**	**36.0**	**36.0**	**26.5**	**26.0**
	NESC RULE 232	37.5	33.5	30.9	28.3	27.2	26.7	26.5	24.0	23.5
Roads, Streets, and other areas subject to truck traffic	PNM	**32.0**	**28.0**	**25.4**	**22.8**	**21.7**	**21.2**	**21.0**	**18.5**	**18.0**
	NESC RULE 232	29.5	25.5	22.9	20.3	19.2	18.7	18.5	16.0	15.5
Driveways, Parking Lots, and Alleys	PNM	**32.0**	**28.0**	**25.4**	**22.8**	**21.7**	**21.2**	**21.0**	**18.5**	**18.0**
	NESC RULE 232	29.5	25.5	22.9	20.3	19.2	18.7	18.5	16.0	15.5
Other land traversed by vehicles, such as cultivated, grazing, forest, orchards, etc.	PNM	**32.0**	**28.0**	**25.4**	**22.8**	**21.7**	**21.2**	**21.0**	**18.5**	**18.0**
	NESC RULE 232	29.5	25.5	22.9	20.3	19.2	18.7	18.5	16.0	15.5
Spaces and ways subject to pedestrian or restricted traffic only	PNM	**28.0**	**24.0**	**21.4**	**18.8**	**17.7**	**17.2**	**17.0**	**14.5**	**12.0**
	NESC RULE 232	25.5	21.5	18.9	16.3	15.2	14.7	14.5	12.0	9.5
Water areas not suitable for sail boating or where sail boating is prohibited	PNM	**30.5**	**26.5**	**23.9**	**21.3**	**20.2**	**19.7**	**19.5**	**17.0**	**16.5**
	NESC RULE 232	28.0	24.0	21.4	18.8	17.7	17.2	17.0	14.5	14.0
Water Areas suitable of sail boating including lakes, ponds, reservoirs, tidal waters, rivers, streams, and canals with unobstructed surface area of:										
a. Less than 20 acres	PNM	**34.0**	**30.0**	**27.4**	**24.8**	**23.7**	**23.2**	**23.0**	**20.5**	**20.0**
	NESC RULE 232	31.5	27.5	24.9	22.3	21.2	20.7	20.5	18.0	17.5
b. Over 20 to 200 acres	PNM	**42.0**	**38.0**	**35.4**	**32.8**	**31.7**	**31.2**	**31.0**	**28.5**	**28.0**
	NESC RULE 232	39.5	35.5	32.9	30.3	29.2	28.7	28.5	26.0	25.5
c. Over 200 to 2000 acres	PNM	**48.0**	**44.0**	**41.4**	**38.8**	**37.7**	**37.2**	**37.0**	**34.5**	**34.0**
	NESC RULE 232	45.5	41.5	38.9	36.3	35.2	34.7	34.5	32.0	31.5
d. Over 2000 acres	PNM	**54.0**	**50.0**	**47.4**	**44.8**	**43.7**	**43.2**	**43.0**	**40.5**	**40.0**
	NESC RULE 232	51.5	47.5	44.9	42.3	41.2	40.7	40.5	38.0	37.5

Note:
1. PNM Standard 36' of vertical clearance for tracks, rails of railroads (except electrified railroads using overhead trolly conductors) for energized wire.
2. Local authorities may require additional clearance on a per-project basis. Refer to Section 5.0 for additional information.
3. For energized conductor less than 34.5kV, use the 34.5kV clearance values.

Table 28 Vertical and Horizontal Clearances to Obstacles under NESC Rule 234

CLEARANCE OF CONDUCTORS FROM BUILDINGS, BRIDGES, RAIL CARS, SWIMMING POOLS, AND OTHER INSTALLATIONS

NESC only requires a 1.05 multiplier for voltages exceeding 50kV and 1.10 multiplier for 500kV.
Rule 234 Base Clearance from Table 234-1 & 2 & 3 NESC 2017 Pg. 145-154
Assumed elevation of 7,300 ft-MSL.

	Clearance Direction	Code	Phase to Phase (kV)								
			500	345	230	115	69	46	34.5[2]	Neutral	Shield Wire
Supporting structures (lighting support, traffic signal support, intermediate poles, etc.)	Horizontal (No Wind)	PNM	**18.6**	**14.5**	**11.9**	**9.3**	**8.3**	**7.8**	**7.5**	**7.5**	**7.5**
		NESC RULE 234 -B1a	16.1	12.0	9.4	6.8	5.8	5.3	5.0	5.0	5.0
	Vertical	PNM	**18.1**	**14.0**	**11.4**	**8.8**	**7.8**	**7.3**	**7.0**	**7.0**	**7.0**
		NESC RULE 234 -B2	15.6	11.5	8.9	6.3	5.3	4.8	4.5	4.5	4.5
Buildings with balconies, decks, areas, etc. readily accessible to pedestrians	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**27.1**	**23.0**	**20.4**	**17.8**	**16.8**	**16.3**	**16.0**	**16.0**	**16.0**
		NESC Table 234-1	24.6	20.5	17.9	15.3	14.3	13.8	13.5	13.5	13.5
Buildings with balconies, decks, areas, etc. not readily accessible to pedestrians	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**26.1**	**22.0**	**19.4**	**16.8**	**15.8**	**15.3**	**15.0**	**15.0**	**15.0**
		NESC Table 234-1	23.6	19.5	16.9	14.3	13.3	12.8	12.5	12.5	12.5
Buildings; over roofs, ramps, decks, and loading docks accessible to vehicles but not subject to truck traffic	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**27.1**	**23.0**	**20.4**	**17.8**	**16.8**	**16.3**	**16.0**	**16.0**	**16.0**
		NESC Table 234-1	24.6	20.5	17.9	15.3	14.3	13.8	13.5	13.5	13.5
Buildings; over roofs, ramps, decks, and loading docks accessible to truck traffic	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**32.1**	**28.0**	**25.4**	**22.8**	**21.8**	**21.3**	**21.0**	**21.0**	**21.0**
		NESC Table 234-1	29.6	25.5	22.9	20.3	19.3	18.8	18.5	18.5	18.5
Signs, chimneys, billboards, antennas, flagpoles, banners, tanks, and other installations not classified as buildings or bridges readily accessible to pedestrians	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**27.1**	**23.0**	**20.4**	**17.8**	**16.8**	**16.3**	**16.0**	**16.0**	**16.0**
		NESC Table 234-1	24.6	20.5	17.9	15.3	14.3	13.8	13.5	13.5	13.5
Tracks, Rails of Railroads (except electrified railroads using overhead trolly conductors)	Horizontal (No Wind)	PNM	**25.1**	**21.0**	**18.4**	**15.8**	**14.8**	**14.3**	**14.0**	**14.0**	**14.0**
		NESC Table 234-1	22.6	18.5	15.9	13.3	12.2	11.7	11.5	11.5	11.5

Note:
1. Local authorities may require additional clearance on a per-project basis. Refer to Section 5.0 for additional information.
2. For energized conductor less than 34.5kV, use the 34.5kV clearance values.

Table 29 Vertical and Horizontal Clearances to Obstacles under NESC Rule 234 (Continued)

CLEARANCE OF CONDUCTORS FROM BUILDINGS, BRIDGES, RAIL CARS, SWIMMING POOLS, AND OTHER INSTALLATIONS

NESC only requires a 1.05 multiplier for voltages exceeding 50kV and 1.10 multiplier for 500kV.
Rule 234 Base Clearance from Table 234-1 & 2 & 3 NESC 2017 Pg. 145-154
Assumed elevation of 7,300 ft-MSL.

	Clearance Direction	Code	Phase to Phase (kV)								
			500	345	230	115	69	46	34.5[2]	Neutral	Shield Wire
Signs, chimneys, billboards, antennas, flagpoles, banners, tanks, and other installations not classified as buildings or bridges not readily accessible to pedestrians	Horizontal (No Wind)	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**10.0**
		NESC Table 234-1	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	7.5
	Vertical	PNM	**21.6**	**17.5**	**14.9**	**12.3**	**11.3**	**10.8**	**10.5**	**10.5**	**10.5**
		NESC Table 234-1	19.1	15.0	12.4	9.8	8.8	8.3	8.0	8.0	8.0
Over bridge structure; horizontal (no wind) and vertical clearances	Attached	PNM	**19.1**	**15.0**	**12.4**	**9.8**	**8.8**	**8.3**	**8.0**	**8.0**	**6.0**
		NESC Table 234-2	16.6	12.5	9.9	7.3	6.3	5.8	5.5	5.5	3.5
	Not Attached	PNM	**26.1**	**22.0**	**19.4**	**16.8**	**15.8**	**15.3**	**15.0**	**15.0**	**13.0**
		NESC Table 234-2	23.6	19.5	16.9	14.3	13.3	12.8	12.5	12.5	10.5
Beside, under, or within bridge structure with readily accessible portions; horizontal (no wind) and vertical clearances	Attached	PNM	**19.1**	**15.0**	**12.4**	**9.8**	**8.8**	**8.3**	**8.0**	**8.0**	**6.0**
		NESC Table 234-2	16.6	12.5	9.9	7.3	6.3	5.8	5.5	5.5	3.5
	Not Attached	PNM	**21.1**	**17.0**	**14.4**	**11.8**	**10.8**	**10.3**	**10.0**	**10.0**	**8.0**
		NESC Table 234-2	18.6	14.5	11.9	9.3	8.3	7.8	7.5	7.5	5.5
Beside, under, or within bridge structure with ordinarily inaccessible portions; horizontal (no wind) and vertical clearances	Attached	PNM	**19.1**	**15.0**	**12.4**	**9.8**	**8.8**	**8.3**	**8.0**	**8.0**	**6.0**
		NESC Table 234-2	16.6	12.5	9.9	7.3	6.3	5.8	5.5	5.5	3.5
	Not Attached	PNM	**20.1**	**16.0**	**13.4**	**10.8**	**9.8**	**9.3**	**9.0**	**9.0**	**7.0**
		NESC Table 234-2	17.6	13.5	10.9	8.3	7.3	6.8	6.5	6.5	4.5
Any installation listed above	Horizontal (Wind)	PNM	**18.1**	**14.0**	**11.4**	**8.8**	**7.8**	**7.3**	**7.0**	**7.0**	**7.0**
		234B1b, 234C1b, 234D1b	15.6	11.5	8.9	6.3	5.3	4.8	4.5	4.5	4.5
Water level, pool edges, base of diving platform, or anchored raft	Clearance in any Direction	PNM	**38.6**	**34.5**	**31.9**	**29.3**	**28.3**	**27.8**	**27.5**	**27.5**	**27.5**
		NESC Table 234-3	36.1	32.0	29.4	26.8	25.8	25.3	25.0	25.0	25.0
Diving board platform, tower, water slide, or other fixed pool-related structures	Clearance in any Direction	PNM	**30.6**	**26.5**	**23.9**	**21.3**	**20.3**	**19.8**	**19.5**	**19.5**	**19.5**
		NESC Table 234-3	28.1	24.0	21.4	18.8	17.8	17.3	17.0	17.0	17.0

Note:
1. Local authorities may require additional clearance on a per-project basis. Refer to Section 5.0 for additional information.
2. For energized conductor less than 34.5kV, use the 34.5kV clearance values.

APPENDIX B – VERTICAL AND HORIZONTAL CLEARANCES BETWEEN WIRES ON DIFFERENT STRUCTURES

Table 30 Vertical Clearances between Wires on Different Structures

VERTICAL CLEARANCES BETWEEN WIRES, CONDUCTORS AND CABLES CARRIED ON DIFFERENT STRUCTURES

Rule 233 Base Clearance from 233-C NESC 2017 Pg. 115-116 and Table 233 NESC 2017 Pg. 122-126
Assumed elevation of 7,300 ft-MSL.

Nominal Voltage Factor	Base Clearance (ft)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	2	500	PNM	**27.4**	--	--	--	--	--	--	--
			NESC RULE 233-C	24.9	--	--	--	--	--	--	--
1.05	2	345	PNM	**23.3**	**19.3**	--	--	--	--	--	--
			NESC RULE 233-C	20.8	16.8	--	--	--	--	--	--
1.05	2	230	PNM	**20.7**	**16.7**	**14.1**	--	--	--	--	--
			NESC RULE 233-C	18.2	14.2	11.6	--	--	--	--	--
1.05	2	115	PNM	**18.1**	**14.1**	**11.5**	**8.9**	--	--	--	--
			NESC RULE 233-C	15.6	11.6	9.0	6.4	--	--	--	--
1.05	2	69	PNM	**17.1**	**13.0**	**10.4**	**7.8**	**6.8**	--	--	--
			NESC RULE 233-C	14.6	10.5	7.9	5.3	4.3	--	--	--
1.00	2	46	PNM	**16.5**	**12.5**	**9.9**	**7.3**	**6.2**	**5.7**	--	--
			NESC RULE 233-C	14.0	10.0	7.4	4.8	3.7	3.2	--	--
1.00	2	34.5	PNM	**16.4**	**12.3**	**9.7**	**7.1**	**6.1**	**5.5**	**5.3**	--
			NESC RULE 233-C	13.9	9.8	7.2	4.6	3.6	3.0	2.8	--
1.00	2	12.5	PNM	**15.5**	**12.0**	**9.4**	**6.8**	**5.8**	**4.9**	**4.7**	**4.5**
			NESC RULE 233-C	13.0	9.5	6.9	4.3	3.3	2.4	2.2	2.0
1.00	2	Neutral/ Shield Wire	PNM	**15.5**	**11.5**	**8.9**	**6.3**	**5.2**	**4.7**	**4.5**	**4.5**
			NESC RULE 233-C	13.0	9.0	6.4	3.8	2.7	2.2	2.0	2.0
1.00	5	Comm	PNM	**18.5**	**14.5**	**11.9**	**9.3**	**8.2**	**7.7**	**7.5**	**7.5**
			NESC RULE 233-C	16.0	12.0	9.4	6.8	5.7	5.2	5.0	5.0

Note:
1. NESC Rule 233-B states that the base clearance is designed to have a minimum of 5 ft clearance for anything below 38kV phase to phase (22kV phase to ground).
2. Comm includes all communication conductors that do not serve as an overhead shield wire.

Table 31 Horizontal Clearances between Wires on Different Structures

HORIZONTAL CLEARANCES BETWEEN WIRES, CONDUCTORS AND CABLES CARRIED ON DIFFERENT STRUCTURES											
Rule 233 Base Clearance from 233-B NESC 2015 Pg. 116 and Table 233 NESC 2017 Pg. 122-126 Assumed elevation of 7,300 ft-MSL.											
Nominal Voltage Factor	Base Clearance (ft)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	5	500	PNM	**30.4**	--	--	--	--	--	--	--
			NESC RULE 233-B	27.9	--	--	--	--	--	--	--
1.05	5	345	PNM	**26.3**	**22.3**	--	--	--	--	--	--
			NESC RULE 233-B	23.8	19.8	--	--	--	--	--	--
1.05	5	230	PNM	**23.7**	**19.7**	**17.1**	--	--	--	--	--
			NESC RULE 233-B	21.2	17.2	14.6	--	--	--	--	--
1.05	5	115	PNM	**21.1**	**17.1**	**14.5**	**11.9**	--	--	--	--
			NESC RULE 233-B	18.6	14.6	12.0	9.4	--	--	--	--
1.05	5	69	PNM	**20.1**	**16.0**	**13.4**	**10.8**	**9.8**	--	--	--
			NESC RULE 233-B	17.6	13.5	10.9	8.3	7.3	--	--	--
1.00	5	46	PNM	**19.5**	**15.5**	**12.9**	**10.3**	**9.2**	**8.7**	--	--
			NESC RULE 233-B	17.0	13.0	10.4	7.8	6.7	6.2	--	--
1.00	5	34.5	PNM	**19.4**	**15.3**	**12.7**	**10.1**	**9.1**	**8.5**	**8.3**	--
			NESC RULE 233-B	16.9	12.8	10.2	7.6	6.6	6.0	5.8	--
1.00	5	12.5	PNM	**18.5**	**15.0**	**12.4**	**9.8**	**8.8**	**7.9**	**7.7**	**7.5**
			NESC RULE 233-B	16.0	12.5	9.9	7.3	6.3	5.4	5.2	5.0
1.00	5	Neutral/ Shield Wire	PNM	**18.5**	**14.5**	**11.9**	**9.3**	**8.2**	**7.7**	**7.5**	**7.5**
			NESC RULE 233-B	16.0	12.0	9.4	6.8	5.7	5.2	5.0	5.0
1.00	5	Comm	PNM	**18.5**	**14.5**	**11.9**	**9.3**	**8.2**	**7.7**	**7.5**	**7.5**
			NESC RULE 233-B	16.0	12.0	9.4	6.8	5.7	5.2	5.0	5.0

Note:
1. NESC Rule 233-B states that the base clearance is designed to have a minimum of 5 ft clearance for anything below 38kV phase to phase (22kV phase to ground).
2. Comm includes all communication conductors that do not serve as an overhead shield wire.

APPENDIX C – VERTICAL CLEARANCES BETWEEN WIRES OF THE SAME STRUCTURE – DIFFERENT CIRCUIT (SAME UTILITY)

Table 32 Vertical Clearances between Wires of the Same Structure – Different Circuit (Same Utility)

VERTICAL CLEARANCES BETWEEN WIRES, CONDUCTORS AND CABLES CARRIED ON THE SAME STRUCTURES (SAME UTILITY)											
Rule 235-C1 NESC 2017 Pg. 160 and Base Clearance from Table 235-5 NESC 2017 Pg. 175-176 Assumed elevation of 7,300 ft-MSL.											
AT THE STRUCTURE											
Nominal Voltage Factor	Base Clearance (in)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.00	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	16	500	PNM	**27.1**	--	--	--	--	--	--	--
			NESC RULE 235-C	24.6	--	--	--	--	--	--	--
1.05	16	345	PNM	**23.0**	**19.0**	--	--	--	--	--	--
			NESC RULE 235-C	20.5	16.5	--	--	--	--	--	--
1.05	16	230	PNM	**20.4**	**16.4**	**13.8**	--	--	--	--	--
			NESC RULE 235-C	17.9	13.9	11.3	--	--	--	--	--
1.05	16	115	PNM	**17.8**	**13.8**	**11.2**	**8.5**	--	--	--	--
			NESC RULE 235-C	15.3	11.3	8.7	6.0	--	--	--	--
1.00	16	69	PNM	**16.8**	**12.7**	**10.1**	**7.5**	**6.5**	--	--	--
			NESC RULE 235-C	14.3	10.2	7.6	5.0	4.0	--	--	--
1.00	16	46	PNM	**16.2**	**12.1**	**9.5**	**6.9**	**5.9**	**5.3**	--	--
			NESC RULE 235-C	13.7	9.6	7.0	4.4	3.4	2.8	--	--
1.00	16	34.5	PNM	**15.9**	**11.9**	**9.3**	**6.7**	**5.6**	**5.1**	**4.9**	--
			NESC RULE 235-C	13.4	9.4	6.8	4.2	3.1	2.6	2.4	--
1.00	16	12.5	PNM	**15.5**	**11.4**	**8.8**	**6.2**	**5.2**	**4.7**	**4.4**	**4.0**
			NESC RULE 235-C	13.0	8.9	6.3	3.7	2.7	2.2	1.9	1.5
1.00	16	Neutral/ Shield Wire	PNM	**15.2**	**11.2**	**8.5**	**5.9**	**4.9**	**4.4**	**4.2**	**3.8**
			NESC RULE 235-C	12.7	8.7	6.0	3.4	2.4	1.9	1.7	1.3
1.00	16	Comm	PNM	**15.2**	**11.2**	**8.5**	**5.9**	**4.9**	**4.4**	**4.2**	**3.8**
			NESC RULE 235-C	12.7	8.7	6.0	3.4	2.4	1.9	1.7	1.3

Note: Comm includes all communication conductors that do not serve as an overhead shield wire.

Table 33 Vertical Clearances between Wires of the Same Structure – Different Circuit at Midspan (Same Utility)

MIDSPAN											
Nominal Voltage Factor	Base Clearance (in)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.00	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	16	500	PNM	**26.4**	--	--	--	--	--	--	--
			NESC RULE 235-C	23.9	--	--	--	--	--	--	--
1.05	16	345	PNM	**22.3**	**18.3**	--	--	--	--	--	--
			NESC RULE 235-C	19.8	15.8	--	--	--	--	--	--
1.05	16	230	PNM	**19.7**	**15.7**	**13.1**	--	--	--	--	--
			NESC RULE 235-C	17.2	13.2	10.6	--	--	--	--	--
1.05	16	115	PNM	**17.1**	**13.1**	**10.5**	**7.9**	--	--	--	--
			NESC RULE 235-C	14.6	10.6	8.0	5.4	--	--	--	--
1.00	16	69	PNM	**16.1**	**12.0**	**9.4**	**6.8**	**5.8**	--	--	--
			NESC RULE 235-C	13.6	9.5	6.9	4.3	3.3	--	--	--
1.00	16	46	PNM	**15.5**	**11.5**	**8.9**	**6.3**	**5.2**	**4.6**	--	--
			NESC RULE 235-C	13.0	9.0	6.4	3.8	2.7	2.1	--	--
1.00	16	34.5	PNM	**15.3**	**11.2**	**8.6**	**6.0**	**5.0**	**4.4**	**4.3**	--
			NESC RULE 235-C	12.8	8.7	6.1	3.5	2.5	1.9	1.8	--
1.00	16	12.5	PNM	**14.8**	**10.7**	**8.1**	**5.5**	**4.5**	**4.1**	**4.0**	**3.6**
			NESC RULE 235-C	12.3	8.2	5.6	3.0	2.0	1.6	1.5	1.1
1.00	16	Neutral/ Shield Wire	PNM	**14.5**	**10.5**	**7.9**	**5.3**	**4.3**	**3.9**	**3.8**	**3.5**
			NESC RULE 235-C	12.0	8.0	5.4	2.8	1.8	1.4	1.3	1.0
1.00	16	Comm	PNM	**14.5**	**10.5**	**7.9**	**5.3**	**4.3**	**3.9**	**3.8**	**3.5**
			NESC RULE 235-C	12.0	8.0	5.4	2.8	1.8	1.4	1.3	1.0

Note: Comm includes all communication conductors that do not serve as an overhead shield wire.

APPENDIX D – VERTICAL CLEARANCES BETWEEN WIRES OF THE SAME STRUCTURE – DIFFERENT CIRCUIT (DIFFERENT UTILITIES)

Table 34 Vertical Clearances between Wires of the Same Structure – Different Circuit (Different Utilities)

VERTICAL CLEARANCES BETWEEN WIRES, CONDUCTORS AND CABLES CARRIED ON THE SAME STRUCTURES (DIFFERENT UTILITIES)											
Rule 235-C1 NESC 2017 Pg. 160 and Base Clearance from Table 235-5 NESC 2017 Pg. 175-176 Assumed elevation of 7,300 ft-MSL.											
AT THE STRUCTURE											
Nominal Voltage Factor	Base Clearance (in)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.00	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	40	500	PNM	**29.1**	--	--	--	--	--	--	--
			NESC RULE 235-C	**26.6**	--	--	--	--	--	--	--
1.05	40	345	PNM	**25.0**	**21.0**	--	--	--	--	--	--
			NESC RULE 235-C	22.5	18.5	--	--	--	--	--	--
1.05	40	230	PNM	**22.4**	**18.4**	**15.8**	--	--	--	--	--
			NESC RULE 235-C	19.9	15.9	13.3	--	--	--	--	--
1.05	40	115	PNM	**19.8**	**15.8**	**13.2**	**10.5**	--	--	--	--
			NESC RULE 235-C	17.3	13.3	10.7	8.0	--	--	--	--
1.00	40	69	PNM	**18.8**	**14.7**	**12.1**	**9.5**	**8.5**	--	--	--
			NESC RULE 235-C	16.3	12.2	9.6	7.0	6.0	--	--	--
1.00	40	46	PNM	**18.2**	**14.1**	**11.5**	**8.9**	**7.9**	**7.3**	--	--
			NESC RULE 235-C	15.7	11.6	9.0	6.4	5.4	4.8	--	--
1.00	40	34.5	PNM	**17.9**	**13.9**	**11.3**	**8.7**	**7.6**	**7.1**	**6.9**	--
			NESC RULE 235-C	15.4	11.4	8.8	6.2	5.1	4.6	4.4	--
1.00	40	12.5	PNM	**17.5**	**13.4**	**10.8**	**8.2**	**7.2**	**6.7**	**6.4**	**6.0**
			NESC RULE 235-C	15.0	10.9	8.3	5.7	4.7	4.2	3.9	3.5
1.00	40	Neutral/ Shield Wire	PNM	**17.2**	**13.2**	**10.5**	**7.9**	**6.9**	**6.4**	**6.2**	**5.8**
			NESC RULE 235-C	14.7	10.7	8.0	5.4	4.4	3.9	3.7	3.3
1.00	40	Comm	PNM	**17.2**	**13.2**	**10.5**	**7.9**	**6.9**	**6.4**	**6.2**	**5.8**
			NESC RULE 235-C	14.7	10.7	8.0	5.4	4.4	3.9	3.7	3.3

Note: Comm includes all communication conductors that do not serve as an overhead shield wire.

Table 35 Vertical Clearances between Wires of the Same Structure – Different Circuit at Midspan (Different Utilities)

MIDSPAN											
Nominal Voltage Factor	Base Clearance (in)	Line to Line Voltage (kV)		Open Supply Conductors							
			Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.00	1.00	1.00	1.00
			Line to Line Voltage	500	345	230	115	69	46	34.5	12.5
			Code	kV	kV	kV	kV	kV	kV	kV	kV
1.10	40	500	PNM	**27.9**	--	--	--	--	--	--	--
			NESC RULE 235-C	25.4	--	--	--	--	--	--	--
1.05	40	345	PNM	**23.8**	**19.8**	--	--	--	--	--	--
			NESC RULE 235-C	21.3	17.3	--	--	--	--	--	--
1.05	40	230	PNM	**21.2**	**17.2**	**14.6**	--	--	--	--	--
			NESC RULE 235-C	18.7	14.7	12.1	--	--	--	--	--
1.05	40	115	PNM	**18.6**	**14.6**	**12.0**	**9.4**	--	--	--	--
			NESC RULE 235-C	16.1	12.1	9.5	6.9	--	--	--	--
1.00	40	69	PNM	**17.6**	**13.5**	**10.9**	**8.3**	**7.3**	--	--	--
			NESC RULE 235-C	15.1	11.0	8.4	5.8	4.8	--	--	--
1.00	40	46	PNM	**17.0**	**13.0**	**10.4**	**7.8**	**6.7**	**6.1**	--	--
			NESC RULE 235-C	14.5	10.5	7.9	5.3	4.2	3.6	--	--
1.00	40	34.5	PNM	**16.8**	**12.7**	**10.1**	**7.5**	**6.5**	**5.9**	**5.8**	--
			NESC RULE 235-C	14.3	10.2	7.6	5.0	4.0	3.4	3.3	--
1.00	40	12.5	PNM	**16.3**	**12.2**	**9.6**	**7.0**	**6.0**	**5.6**	**5.5**	**5.1**
			NESC RULE 235-C	13.8	9.7	7.1	4.5	3.5	3.1	3.0	2.6
1.00	40	Neutral/ Shield Wire	PNM	**16.0**	**12.0**	**9.4**	**6.8**	**5.8**	**5.4**	**5.3**	**5.0**
			NESC RULE 235-C	13.5	9.5	6.9	4.3	3.3	2.9	2.8	2.5
1.00	40	Comm	PNM	**16.0**	**12.0**	**9.4**	**6.8**	**5.8**	**5.4**	**5.3**	**5.0**
			NESC RULE 235-C	13.5	9.5	6.9	4.3	3.3	2.9	2.8	2.5

Note: Comm includes all communication conductors that do not serve as an overhead shield wire.

APPENDIX E – HORIZONTAL CLEARANCES BETWEEN WIRES OF THE SAME STRUCTURE – DIFFERENT CIRCUIT

Table 36 Horizontal Clearances between Wires of the Same Structure – Different Circuit

HORIZONTAL CLEARANCES BETWEEN WIRES, CONDUCTORS AND CABLES CARRIED ON THE SAME STRUCTURES (DIFFERENT CIRCUIT)										
Rule 235-B1 NESC 2017 Pg. 158 and Base Clearance from Table 235-1 NESC 2017 Pg. 167 Assumed elevation of 7,300 ft-MSL.										
AT THE STRUCTURE										
Nominal Voltage Factor	Line to Line Voltage (kV)		Open Supply Conductors							
		Nominal Voltage Factor	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00
		Line to Line voltage	500	345	230	115	69	46	34.5	12.5
		CODE	kV	kV	kV	kV	kV	kV	kV	kV
1.10	500	PNM	**26.8**	--	--	--	--	--	--	--
		NESC RULE 235-C	24.3	--	--	--	--	--	--	--
1.05	345	PNM	**22.7**	**18.7**	--	--	--	--	--	--
		NESC RULE 235-C	20.2	16.2	--	--	--	--	--	--
1.05	230	PNM	**20.1**	**16.1**	**13.5**	--	--	--	--	--
		NESC RULE 235-C	17.6	13.6	11.0	--	--	--	--	--
1.05	115	PNM	**17.5**	**13.5**	**10.9**	**8.3**	--	--	--	--
		NESC RULE 235-C	15.0	11.0	8.4	5.8	--	--	--	--
1.05	69	PNM	**16.5**	**12.4**	**9.8**	**7.2**	**6.2**	--	--	--
		NESC RULE 235-C	14.0	9.9	7.3	4.7	3.7	--	--	--
1.05	46	PNM	**15.9**	**11.9**	**9.3**	**6.7**	**5.7**	**5.1**	--	--
		NESC RULE 235-C	13.4	9.4	6.8	4.2	3.2	2.6	--	--
1.00	34.5	PNM	**15.6**	**11.6**	**9.0**	**6.4**	**5.4**	**4.8**	**4.5**	--
		NESC RULE 235-C	13.1	9.1	6.5	3.9	2.9	2.3	2.0	--
1.00	12.5	PNM	**15.2**	**11.1**	**8.5**	**5.9**	**4.8**	**4.4**	**4.1**	**3.7**
		NESC RULE 235-C	12.7	8.6	6.0	3.4	2.3	1.9	1.6	1.2
1.00	Neutral/ Shield Wire	PNM	**14.9**	**10.9**	**8.3**	**5.7**	**4.6**	**4.1**	**3.9**	**3.5**
		NESC RULE 235-C	12.4	8.4	5.8	3.2	2.1	1.6	1.4	1.0
1.00	Comm	PNM	**14.9**	**10.9**	**8.3**	**5.7**	**4.6**	**4.1**	**3.9**	**3.5**
		NESC RULE 235-C	12.4	8.4	5.8	3.2	2.1	1.6	1.4	1.0

Note: Comm includes all communication conductors that do not serve as an overhead shield wire.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF PUBLIC SERVICE COMPANY OF NEW MEXICO'S APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT, OWN AND OPERATE THE RIO PUERCO TO PAJARITO TO PROSPERITY 345 KV TRANSMISSION PROJECT	)	**Docket No. 26-00000__**
PUBLIC SERVICE COMPANY OF NEW MEXICO,	)	
Applicant.	)	

AFFIDAVIT

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

Julia L. Munoz, Engineer IV, Public Service Company of New Mexico upon being duly sworn according to law, under oath, deposes and states: I have read the foregoing **Direct Testimony of Julia L. Munoz,** and it is true and accurate based on my own personal knowledge and belief.

Dated this 25th day of February, 2026.

/s/ Julia L. Munoz
JULIA L. MUNOZ

GCG # 534781