

Date: **February 27, 2024**



**FL COA# 31011**

Tower Engineering Professionals  
326 Tryon Road  
Raleigh, NC 27603  
(919) 661-6351

**Subject: Structural Analysis Report**

|                                      |                                                                 |                  |
|--------------------------------------|-----------------------------------------------------------------|------------------|
| <b>Carrier Designation:</b>          | <b>T-Mobile Co-Locate</b>                                       |                  |
|                                      | <b>Site Number:</b>                                             | 9JK0371A         |
|                                      | <b>Site Name:</b>                                               | N/A              |
| <b>Crown Castle Designation:</b>     | <b>BU Number:</b>                                               | 825403           |
|                                      | <b>Site Name:</b>                                               | Little Gum Swamp |
|                                      | <b>JDE Job Number:</b>                                          | 2106059          |
|                                      | <b>Work Order Number:</b>                                       | 2285530          |
|                                      | <b>Order Number:</b>                                            | 661290 Rev. 0    |
| <b>Engineering Firm Designation:</b> | <b>TEP Project Number:</b>                                      | 26551.933960     |
| <b>Site Data:</b>                    | <b>8381 Ne Molino Rd., Lake City, Columbia County, FL 32055</b> |                  |
|                                      | <b>Latitude 30° 15' 39.98", Longitude -82° 28' 25.07"</b>       |                  |
|                                      | <b>150 Foot - Monopole Tower</b>                                |                  |

*Tower Engineering Professionals* is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above-mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC5: Proposed Equipment Configuration

**Sufficient Capacity**

This analysis utilizes an ultimate 3-second gust wind speed of 119 mph as required by the 2023 Florida Building Code, 8th Edition. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

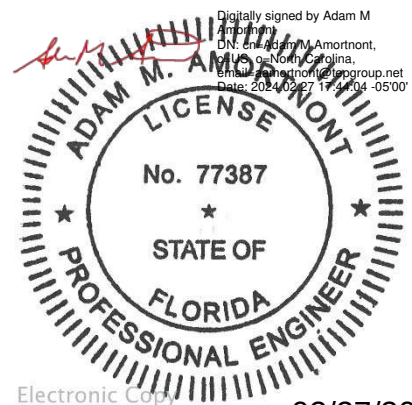
Structural analysis prepared by: PPS / WAT

Respectfully submitted by:

Adam M. Amortnont, P.E.

This item has been digitally signed and sealed by Adam M. Amortnont, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.



Electronic Copy

02/27/2024

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## 1) INTRODUCTION

This is a 150-ft monopole tower designed by Transamerican Power Products.

## 2) ANALYSIS CRITERIA

**TIA-222 Revision:** TIA-222-H  
**Risk Category:** II  
**Wind Speed:** 119 mph  
**Exposure Category:** B  
**Topographic Factor:** 1.0  
**Service Wind Speed:** 60 mph

**Table 1 - Proposed Equipment Configuration**

| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model                    | Number of Feed Lines | Feed Line Size (in)   |
|---------------------|----------------------------|--------------------|----------------------|----------------------------------|----------------------|-----------------------|
| 145.0               | 146.0                      | 1                  | Commscope            | VHLP3-11W/A                      | 1<br>9<br>1          | 1/2<br>1-5/8<br>2-1/8 |
|                     |                            | 3                  | Commscope            | FFVV-65C-R3-V1_TMO w/ Mount Pipe |                      |                       |
|                     |                            | 3                  | Ericsson             | RADIO 4480 B71_TMO               |                      |                       |
|                     |                            | 3                  | Ericsson             | RADIO 4460 B2/B25 B66_TMO        |                      |                       |
|                     |                            | 2                  | Ceragon              | FIBEAIR IP-20A_RFU-D             |                      |                       |
|                     | 145.0                      | 1                  | Kenwood              | T1507KTHD-996C9-M-H              |                      |                       |

**Table 2 - Other Considered Equipment**

| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model                | Number of Feed Lines | Feed Line Size (in) |
|---------------------|----------------------------|--------------------|----------------------|------------------------------|----------------------|---------------------|
| 133.0               | 134.0                      | 4                  | Csa Wireless         | PCSA030-19-2 w/ Mount Pipe   | 12                   | 1-5/8               |
|                     |                            | 3                  | JMA Wireless         | X7CQAP-665-VR0 w/ Mount Pipe |                      |                     |
|                     |                            | 2                  | Csa Wireless         | PCSA090-19-2 w/ Mount Pipe   |                      |                     |
|                     |                            | 3                  | Commscope            | ATSBT-TOP-FM                 |                      |                     |
|                     | 133.0                      | 1                  | Tower Mounts         | T-Arm Mount [TA 602-3]       |                      |                     |
| 128.0               | 129.0                      | 1                  | Andrew               | PAR6-59                      | 1                    | EW52                |
|                     | 128.0                      | 1                  | Tower Mounts         | Pipe Mount [PM 601-1]        |                      |                     |
| 112.0               | 113.0                      | 1                  | Andrew               | VHLPX4-6W                    | 1                    | EW52                |
|                     | 112.0                      | 2                  | Tower Mounts         | Pipe Mount [PM 601-1]        |                      |                     |
| 109.0               | 109.0                      | 1                  | Andrew               | TMBX-6517-R2M w/ Mount Pipe  | 2                    | 1-5/8               |
|                     |                            | 1                  | Cellmax Technologies | CMA-B/3324 w/ Mount Pipe     |                      |                     |
|                     |                            | 1                  | Tower Mounts         | Side Arm Mount [SO 104-3]    |                      |                     |

### 3) ANALYSIS PROCEDURE

**Table 3 - Documents Provided**

| Document                    | Reference | Source   |
|-----------------------------|-----------|----------|
| Geotechnical Report         | 3481778   | CCISites |
| Tower Foundation Drawings   | 3481777   | CCISites |
| Tower Manufacturer Drawings | 3481780   | CCISites |
| Tower Manufacturer Drawings | 3773245   | CCISites |

#### 3.1) Analysis Method

tnxTower (version 8.2.2.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A. When applicable, Crown Castle has calculated and provided the effective area for panel antennas using approved methods following the intent of the TIA-222 Standard.

#### 3.2) Assumptions

- 1) The tower and structures were maintained in accordance with the TIA-222 Standard.
- 2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2, and the referenced drawings.
- 3) The foundation steel reinforcement was assumed to be the minimum required per ACI 318.
- 4) The following material grades were assumed:
  - a) Concrete compressive strength:  $f'_c = 4$  ksi
  - b) Foundation flexural reinforcement:  $f_y = 60$  ksi

This analysis may be affected if any assumptions are not valid or have been made in error. Tower Engineering Professionals should be notified to determine the effect on the structural integrity of the tower.

### 4) ANALYSIS RESULTS

**Table 4 - Section Capacity (Summary)**

| Section No. | Elevation (ft) | Component Type | Size                  | Critical Element | P (k)  | $\phi P_{allow}$ (k) | % Capacity  | Pass / Fail |
|-------------|----------------|----------------|-----------------------|------------------|--------|----------------------|-------------|-------------|
| L1          | 150 - 109.75   | Pole           | TP31.111x24x0.1875    | 1                | -8.11  | 1104.59              | 30.5        | Pass        |
| L2          | 109.75 - 70.75 | Pole           | TP37.626x30.0293x0.25 | 2                | -14.49 | 1780.83              | 45.7        | Pass        |
| L3          | 70.75 - 37.5   | Pole           | TP43x36.2868x0.3125   | 3                | -21.36 | 2541.58              | 45.7        | Pass        |
| L4          | 37.5 - 0       | Pole           | TP49x41.4034x0.375    | 4                | -33.31 | 3555.03              | 45.0        | Pass        |
|             |                |                |                       |                  |        |                      | Summary     |             |
|             |                |                |                       |                  |        | Pole (L2)            | 45.7        | Pass        |
|             |                |                |                       |                  |        | <b>RATING =</b>      | <b>45.7</b> | <b>Pass</b> |

**Table 5 - Tower Component Stresses vs. Capacity - LC5**

| Notes | Component                        | Elevation (ft) | % Capacity | Pass / Fail |
|-------|----------------------------------|----------------|------------|-------------|
| 1,2   | Anchor Rods                      | -              | 42.3       | Pass        |
| 1,2   | Base Plate                       | -              | 26.3       | Pass        |
| 1,2   | Base Foundation Structural       | -              | 22.6       | Pass        |
| 1,2   | Base Foundation Soil Interaction | -              | 54.9       | Pass        |

|                                                     |              |
|-----------------------------------------------------|--------------|
| <b>Structure Rating (max from all components) =</b> | <b>54.9%</b> |
|-----------------------------------------------------|--------------|

Notes:

- 1) See additional documentation in "Appendix C - Additional Calculations" for calculations supporting the % capacity listed.
- 2) Rating per TIA-222-H Section 15.5

**Table 6 - Dish Twist/Sway Results for 60 mph Service Wind Speed**

| Elevation (ft) | Dish Model            | Beam Deflection |            |             |
|----------------|-----------------------|-----------------|------------|-------------|
|                |                       | Deflection (in) | Tilt (deg) | Twist (deg) |
| 146.0          | Commscope VHLP3-11W/A | 15.985          | 0.9425     | 0.0137      |

#### 4.1) Recommendations

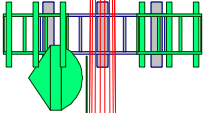
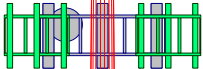
- 1) The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

## **APPENDIX A**

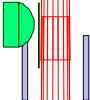
### **TNXTOWER OUTPUT**

|                    |         |         |         |         |      |
|--------------------|---------|---------|---------|---------|------|
| Section            | 1       | 2       | 3       | 4       |      |
| Length (ft)        | 40.25   | 43.00   | 38.00   | 43.00   |      |
| Number of Sides    | 18      | 18      | 18      | 18      |      |
| Thickness (in)     | 0.1875  | 0.2500  | 0.3125  | 0.3750  |      |
| Socket Length (ft) | 4.00    | 4.75    | 5.50    |         |      |
| Top Dia (in)       | 24.0000 | 30.0293 | 36.2868 | 41.4034 |      |
| Bot Dia (in)       | 31.1110 | 37.6260 | 43.0000 | 49.0000 |      |
| Grade              | A572-65 |         |         |         |      |
| Weight (K)         | 2.2     | 3.9     | 5.0     | 7.8     | 19.0 |

150.0 ft



109.8 ft



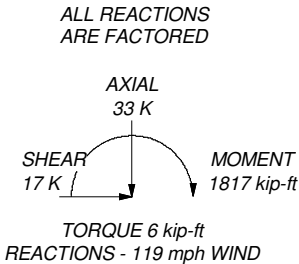
70.8 ft



37.5 ft



0.0 ft

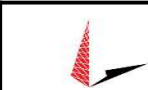


MATERIAL STRENGTH

| GRADE   | Fy     | Fu     | GRADE | Fy | Fu |
|---------|--------|--------|-------|----|----|
| A572-65 | 65 ksi | 80 ksi |       |    |    |

TOWER DESIGN NOTES

1. Tower is located in Columbia County, Florida.
2. Tower designed for Exposure B to the TIA-222-H Standard.
3. Tower designed for a 119 mph basic wind in accordance with the TIA-222-H Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 45.7%



**Tower Engineering Professionals**

326 Tryon Road  
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Phone: (919) 661-6351  
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Job: **Little Gum Swamp (BU# 825403)**

Project: **TEP No. 26551.933960**

|                      |                |             |
|----------------------|----------------|-------------|
| Client: Crown Castle | Drawn by: PPS  | App'd:      |
| Code: TIA-222-H      | Date: 02/25/24 | Scale: NTS  |
| Path:                |                | Dwg No. E-1 |

|                                                                                                                                                                    |                                             |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b><br>Little Gum Swamp (BU# 825403) | <b>Page</b><br>1 of 13           |
|                                                                                                                                                                    | <b>Project</b><br>TEP No. 26551.933960      | <b>Date</b><br>22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b><br>Crown Castle               | <b>Designed by</b><br>PPS        |

## Tower Input Data

The tower is a monopole.  
This tower is designed using the TIA-222-H standard.  
The following design criteria apply:  
Tower is located in Columbia County, Florida.  
Tower base elevation above sea level: 154.00 ft.  
Basic wind speed of 119 mph.  
Risk Category II.  
Exposure Category B.  
Simplified Topographic Factor Procedure for wind speed-up calculations is used.  
Topographic Category: 1.  
Crest Height: 0.00 ft.  
Deflections calculated using a wind speed of 60 mph.  
A non-linear (P-delta) analysis was used.  
Pressures are calculated at each section.  
Stress ratio used in pole design is 1.  
Tower analysis based on target reliabilities in accordance with Annex S.  
Load Modification Factors used:  $K_{es}(F_w) = 0.95$ .  
Maximum demand-capacity ratio is: 1.05.  
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

## Options

|                                     |                                       |                                           |
|-------------------------------------|---------------------------------------|-------------------------------------------|
| Consider Moments - Legs             | Assume Legs Pinned                    | Calculate Redundant Bracing Forces        |
| Consider Moments - Horizontals      | √ Assume Rigid Index Plate            | Ignore Redundant Members in FEA           |
| Consider Moments - Diagonals        | √ Use Clear Spans For Wind Area       | SR Leg Bolts Resist Compression           |
| Use Moment Magnification            | Use Clear Spans For KL/r              | All Leg Panels Have Same Allowable        |
| √ Use Code Stress Ratios            | Retension Guys To Initial Tension     | Offset Girt At Foundation                 |
| √ Use Code Safety Factors - Guys    | √ Bypass Mast Stability Checks        | √ Consider Feed Line Torque               |
| Escalate Ice                        | √ Use Azimuth Dish Coefficients       | Include Angle Block Shear Check           |
| Always Use Max Kz                   | √ Project Wind Area of Appurtenances  | Use TIA-222-H Bracing Resist. Exemption   |
| Use Special Wind Profile            | √ Alternative Appurt. EPA Calculation | Use TIA-222-H Tension Splice Exemption    |
| Include Bolts In Member Capacity    | Autocalc Torque Arm Areas             | Poles                                     |
| Leg Bolts Are At Top Of Section     | Add IBC .6D+W Combination             | √ Include Shear-Torsion Interaction       |
| Secondary Horizontal Braces Leg     | √ Sort Capacity Reports By Component  | Always Use Sub-Critical Flow              |
| Use Diamond Inner Bracing (4 Sided) | Triangulate Diamond Inner Bracing     | Use Top Mounted Sockets                   |
| SR Members Have Cut Ends            | Treat Feed Line Bundles As Cylinder   | √ Pole Without Linear Attachments         |
| SR Members Are Concentric           | Ignore KL/ry For 60 Deg. Angle Legs   | Pole With Shroud Or No Appurtenances      |
| Distribute Leg Loads As Uniform     | Use ASCE 10 X-Brace Ly Rules          | Outside and Inside Corner Radii Are Known |

## Tapered Pole Section Geometry

| Section | Elevation<br>ft | Section<br>Length<br>ft | Splice<br>Length<br>ft | Number<br>of<br>Sides | Top<br>Diameter<br>in | Bottom<br>Diameter<br>in | Wall<br>Thickness<br>in | Bend<br>Radius<br>in | Pole Grade          |
|---------|-----------------|-------------------------|------------------------|-----------------------|-----------------------|--------------------------|-------------------------|----------------------|---------------------|
| L1      | 150.00-109.75   | 40.25                   | 4.00                   | 18                    | 24.0000               | 31.1110                  | 0.1875                  | 0.7500               | A572-65<br>(65 ksi) |
| L2      | 109.75-70.75    | 43.00                   | 4.75                   | 18                    | 30.0293               | 37.6260                  | 0.2500                  | 1.0000               | A572-65<br>(65 ksi) |
| L3      | 70.75-37.50     | 38.00                   | 5.50                   | 18                    | 36.2868               | 43.0000                  | 0.3125                  | 1.2500               | A572-65<br>(65 ksi) |



|                                                                                                                                                      |         |                               |             |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Tower Engineering Professionals</b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | Job     | Little Gum Swamp (BU# 825403) | Page        | 2 of 13           |
|                                                                                                                                                      | Project | TEP No. 26551.933960          | Date        | 22:47:28 02/25/24 |
|                                                                                                                                                      | Client  | Crown Castle                  | Designed by | PPS               |

| Section | Elevation<br>ft | Section Length<br>ft | Splice Length<br>ft | Number of Sides | Top Diameter<br>in | Bottom Diameter<br>in | Wall Thickness<br>in | Bend Radius<br>in | Pole Grade          |
|---------|-----------------|----------------------|---------------------|-----------------|--------------------|-----------------------|----------------------|-------------------|---------------------|
| L4      | 37.50-0.00      | 43.00                |                     | 18              | 41.4034            | 49.0000               | 0.3750               | 1.5000            | A572-65<br>(65 ksi) |

### Tapered Pole Properties

| Section | Tip Dia.<br>in | Area<br>in <sup>2</sup> | I<br>in <sup>4</sup> | r<br>in | C<br>in | I/C<br>in <sup>3</sup> | J<br>in <sup>4</sup> | It/Q<br>in <sup>2</sup> | w<br>in | w/t    |
|---------|----------------|-------------------------|----------------------|---------|---------|------------------------|----------------------|-------------------------|---------|--------|
| L1      | 24.3413        | 14.1714                 | 1015.2211            | 8.4534  | 12.1920 | 83.2694                | 2031.7780            | 7.0871                  | 3.8940  | 20.768 |
|         | 31.5620        | 18.4033                 | 2223.3691            | 10.9778 | 15.8044 | 140.6805               | 4449.6638            | 9.2034                  | 5.1455  | 27.443 |
| L2      | 31.1716        | 23.6299                 | 2647.4549            | 10.5717 | 15.2549 | 173.5479               | 5298.3934            | 11.8172                 | 4.8452  | 19.381 |
|         | 38.1679        | 29.6579                 | 5234.3510            | 13.2685 | 19.1140 | 273.8490               | 10475.5896           | 14.8317                 | 6.1822  | 24.729 |
| L3      | 37.6505        | 35.6820                 | 5834.0828            | 12.7709 | 18.4337 | 316.4899               | 11675.8423           | 17.8444                 | 5.8365  | 18.677 |
|         | 43.6151        | 42.3407                 | 9747.5744            | 15.1541 | 21.8440 | 446.2358               | 19507.9749           | 21.1744                 | 7.0180  | 22.458 |
| L4      | 42.9709        | 48.8340                 | 10385.5147           | 14.5651 | 21.0329 | 493.7746               | 20784.6949           | 24.4216                 | 6.6270  | 17.672 |
|         | 49.6981        | 57.8759                 | 17288.3873           | 17.2619 | 24.8920 | 694.5359               | 34599.5231           | 28.9435                 | 7.9640  | 21.237 |

| Tower Elevation<br>ft | Gusset Area<br>(per face)<br>ft <sup>2</sup> | Gusset Thickness<br>in | Gusset Grade | Adjust. Factor<br>A <sub>f</sub> | Adjust. Factor<br>A <sub>r</sub> | Weight Mult. | Double Angle<br>Stitch Bolt<br>Spacing<br>Diagonals<br>in | Double Angle<br>Stitch Bolt<br>Spacing<br>Horizontals<br>in | Double Angle<br>Stitch Bolt<br>Spacing<br>Redundants<br>in |
|-----------------------|----------------------------------------------|------------------------|--------------|----------------------------------|----------------------------------|--------------|-----------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------|
| L1<br>150.00-109.75   |                                              |                        |              | 1                                | 1                                | 1            |                                                           |                                                             |                                                            |
| L2<br>109.75-70.75    |                                              |                        |              | 1                                | 1                                | 1            |                                                           |                                                             |                                                            |
| L3 70.75-37.50        |                                              |                        |              | 1                                | 1                                | 1            |                                                           |                                                             |                                                            |
| L4 37.50-0.00         |                                              |                        |              | 1                                | 1                                | 1            |                                                           |                                                             |                                                            |

### Feed Line/Linear Appurtenances - Entered As Round Or Flat

| Description | Face or Leg | Allow Shield | Exclude From Torque Calculation | Component Type | Placement<br>ft | Total Number | Number Per Row | Clear Spacing<br>in | Width or Diameter<br>in | Perimeter<br>in | Weight<br>klf |
|-------------|-------------|--------------|---------------------------------|----------------|-----------------|--------------|----------------|---------------------|-------------------------|-----------------|---------------|
| ***         |             |              |                                 |                |                 |              |                |                     |                         |                 |               |

### Feed Line/Linear Appurtenances - Entered As Area

| Description      | Face or Leg | Allow Shield | Exclude From Torque Calculation | Component Type     | Placement<br>ft | Total Number |        | C <sub>A</sub> A <sub>A</sub><br>ft <sup>2</sup> /ft | Weight<br>klf |
|------------------|-------------|--------------|---------------------------------|--------------------|-----------------|--------------|--------|------------------------------------------------------|---------------|
| Safety Line 3/8  | A           | No           | No                              | CaAa (Out Of Face) | 150.00 - 0.00   | 1            | No Ice | 0.04                                                 | 0.00          |
| **145**          |             |              |                                 |                    |                 |              |        |                                                      |               |
| LDF7-50A(1-5/8") | B           | No           | No                              | Inside Pole        | 145.00 - 0.00   | 7            | No Ice | 0.00                                                 | 0.00          |
| HB158-21U6S24-xx | B           | No           | No                              | Inside Pole        | 145.00 - 0.00   | 2            | No Ice | 0.00                                                 | 0.00          |
| M_TMO(1-5/8)     |             |              |                                 |                    |                 |              |        |                                                      |               |
| LDF4-50A(1/2)    | B           | No           | No                              | Inside Pole        | 145.00 - 0.00   | 1            | No Ice | 0.00                                                 | 0.00          |

|                                                                                                                                                      |                |                               |                    |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
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|                                                                                                                                                      | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                      | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| Description                                | Face<br>or<br>Leg | Allow<br>Shield | Exclude<br>From<br>Torque<br>Calculation | Component<br>Type | Placement<br>ft | Total<br>Number |        | C <sub>A</sub> A <sub>A</sub><br>ft <sup>2</sup> /ft | Weight<br>klf |
|--------------------------------------------|-------------------|-----------------|------------------------------------------|-------------------|-----------------|-----------------|--------|------------------------------------------------------|---------------|
| NTM 201 3929/2<br>56.9MM(2-1/8)<br>**133** | B                 | No              | No                                       | Inside Pole       | 145.00 - 0.00   | 1               | No Ice | 0.00                                                 | 0.00          |
| LDF7-50A(1-5/8")<br>**128**                | B                 | No              | No                                       | Inside Pole       | 133.00 - 0.00   | 12              | No Ice | 0.00                                                 | 0.00          |
| EW52(ELLIPTICA<br>L)<br>**112**            | B                 | No              | No                                       | Inside Pole       | 128.00 - 0.00   | 1               | No Ice | 0.00                                                 | 0.00          |
| EW52(ELLIPTICA<br>L)<br>**109**            | B                 | No              | No                                       | Inside Pole       | 112.00 - 0.00   | 1               | No Ice | 0.00                                                 | 0.00          |
| LDF7-50A(1-5/8")<br>***                    | B                 | No              | No                                       | Inside Pole       | 109.00 - 0.00   | 2               | No Ice | 0.00                                                 | 0.00          |

### Feed Line/Linear Appurtenances Section Areas

| Tower<br>Section | Tower<br>Elevation<br>ft | Face | A <sub>R</sub><br>ft <sup>2</sup> | A <sub>F</sub><br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>In Face<br>ft <sup>2</sup> | C <sub>A</sub> A <sub>A</sub><br>Out Face<br>ft <sup>2</sup> | Weight<br>K |
|------------------|--------------------------|------|-----------------------------------|-----------------------------------|-------------------------------------------------------------|--------------------------------------------------------------|-------------|
| L1               | 150.00-109.75            | A    | 0.000                             | 0.000                             | 0.000                                                       | 1.509                                                        | 0.01        |
|                  |                          | B    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.69        |
|                  |                          | C    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.00        |
| L2               | 109.75-70.75             | A    | 0.000                             | 0.000                             | 0.000                                                       | 1.462                                                        | 0.01        |
|                  |                          | B    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.99        |
|                  |                          | C    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.00        |
| L3               | 70.75-37.50              | A    | 0.000                             | 0.000                             | 0.000                                                       | 1.247                                                        | 0.01        |
|                  |                          | B    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.85        |
|                  |                          | C    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.00        |
| L4               | 37.50-0.00               | A    | 0.000                             | 0.000                             | 0.000                                                       | 1.406                                                        | 0.01        |
|                  |                          | B    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.95        |
|                  |                          | C    | 0.000                             | 0.000                             | 0.000                                                       | 0.000                                                        | 0.00        |

### Feed Line Center of Pressure

| Section | Elevation<br>ft | CP <sub>x</sub><br>in | CP <sub>z</sub><br>in | CP <sub>x</sub><br>Ice<br>in | CP <sub>z</sub><br>Ice<br>in |
|---------|-----------------|-----------------------|-----------------------|------------------------------|------------------------------|
| L1      | 150.00-109.75   | 0.0000                | -0.3433               | 0.0000                       | -0.1987                      |
| L2      | 109.75-70.75    | 0.0000                | -0.3450               | 0.0000                       | -0.1993                      |
| L3      | 70.75-37.50     | 0.0000                | -0.3461               | 0.0000                       | -0.1997                      |
| L4      | 37.50-0.00      | 0.0000                | -0.3468               | 0.0000                       | -0.1999                      |

Note: For pole sections, center of pressure calculations do not consider feed line shielding.

### Discrete Tower Loads

|                                                                                                                                                                    |                |                               |                    |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b>     | Little Gum Swamp (BU# 825403) | <b>Page</b>        | 4 of 13           |
|                                                                                                                                                                    | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| <i>Description</i>                  | <i>Face<br/>or<br/>Leg</i> | <i>Offset<br/>Type</i>    | <i>Offsets:<br/>Horz<br/>Lateral<br/>Vert<br/>ft<br/>ft<br/>ft</i> | <i>Azimuth<br/>Adjustment<br/>°</i> | <i>Placement<br/>ft</i> |        | <i>C<sub>AA</sub><br/>Front<br/>ft<sup>2</sup></i> | <i>C<sub>AA</sub><br/>Side<br/>ft<sup>2</sup></i> | <i>Weight<br/>K</i> |
|-------------------------------------|----------------------------|---------------------------|--------------------------------------------------------------------|-------------------------------------|-------------------------|--------|----------------------------------------------------|---------------------------------------------------|---------------------|
| Lightning rod (5/8"x7")<br>**145**  | C                          | None                      |                                                                    | 0.0000                              | 153.50                  | No Ice | 0.44                                               | 0.44                                              | 0.01                |
| FFVV-65C-R3-V1_TMO w/<br>Mount Pipe | A                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 12.97                                              | 6.20                                              | 0.16                |
| FFVV-65C-R3-V1_TMO w/<br>Mount Pipe | B                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 12.97                                              | 6.20                                              | 0.16                |
| FFVV-65C-R3-V1_TMO w/<br>Mount Pipe | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 12.97                                              | 6.20                                              | 0.16                |
| RADIO 4480 B71_TMO                  | A                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.85                                               | 1.38                                              | 0.09                |
| RADIO 4480 B71_TMO                  | B                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.85                                               | 1.38                                              | 0.09                |
| RADIO 4480 B71_TMO                  | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.85                                               | 1.38                                              | 0.09                |
| RADIO 4460 B2/B25<br>B66_TMO        | A                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.14                                               | 1.69                                              | 0.11                |
| RADIO 4460 B2/B25<br>B66_TMO        | B                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.14                                               | 1.69                                              | 0.11                |
| RADIO 4460 B2/B25<br>B66_TMO        | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 2.14                                               | 1.69                                              | 0.11                |
| (2) FIBEAIR IP-20A_RFU-D            | A                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>1.00                                               | 0.0000                              | 145.00                  | No Ice | 0.69                                               | 0.29                                              | 0.01                |
| (2) 2.4" x 8' Pipe                  | A                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 1.90                                               | 1.90                                              | 0.03                |
| (2) 2.4" x 8' Pipe                  | B                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 1.90                                               | 1.90                                              | 0.03                |
| (2) 2.4" x 8' Pipe                  | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 1.90                                               | 1.90                                              | 0.03                |
| 1.9" Dia x 5 ft                     | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 0.95                                               | 0.95                                              | 0.01                |
| 2.4" Dia.x10"                       | B                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 0.08                                               | 0.08                                              | 0.00                |
| Kenwood T1516KT Platform            | C                          | From<br>Centroid-Fa<br>ce | 4.00<br>0.00<br>0.00                                               | 0.0000                              | 145.00                  | No Ice | 24.33                                              | 24.33                                             | 1.65                |
| **133**                             |                            |                           |                                                                    |                                     |                         |        |                                                    |                                                   |                     |
| (2) PCSA030-19-2 w/ Mount<br>Pipe   | A                          | From Face                 | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.35                                               | 8.61                                              | 0.06                |
| PCSA030-19-2 w/ Mount<br>Pipe       | B                          | From Face                 | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.35                                               | 8.61                                              | 0.06                |

|                                                                                                                                                                    |                |                               |                    |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b>     | Little Gum Swamp (BU# 825403) | <b>Page</b>        | 5 of 13           |
|                                                                                                                                                                    | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| <i>Description</i>                | <i>Face<br/>or<br/>Leg</i> | <i>Offset<br/>Type</i> | <i>Offsets:<br/>Horz<br/>Lateral<br/>Vert<br/>ft<br/>ft<br/>ft</i> | <i>Azimuth<br/>Adjustment<br/>°</i> | <i>Placement<br/>ft</i> |        | <i>C<sub>AA</sub><br/>Front<br/>ft<sup>2</sup></i> | <i>C<sub>AA</sub><br/>Side<br/>ft<sup>2</sup></i> | <i>Weight<br/>K</i> |
|-----------------------------------|----------------------------|------------------------|--------------------------------------------------------------------|-------------------------------------|-------------------------|--------|----------------------------------------------------|---------------------------------------------------|---------------------|
| PCSA030-19-2 w/ Mount Pipe        | C                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.35                                               | 8.61                                              | 0.06                |
| X7CQAP-665-VR0 w/ Mount Pipe      | A                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.51                                               | 6.34                                              | 0.08                |
| X7CQAP-665-VR0 w/ Mount Pipe      | B                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.51                                               | 6.34                                              | 0.08                |
| X7CQAP-665-VR0 w/ Mount Pipe      | C                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 9.51                                               | 6.34                                              | 0.08                |
| PCSA090-19-2 w/ Mount Pipe        | B                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 5.14                                               | 4.71                                              | 0.06                |
| PCSA090-19-2 w/ Mount Pipe        | C                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 5.14                                               | 4.71                                              | 0.06                |
| ATSBT-TOP-FM                      | A                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 0.17                                               | 0.09                                              | 0.00                |
| ATSBT-TOP-FM                      | B                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 0.17                                               | 0.09                                              | 0.00                |
| ATSBT-TOP-FM                      | C                          | From Face              | 6.00<br>0.00<br>1.00                                               | 0.0000                              | 133.00                  | No Ice | 0.17                                               | 0.09                                              | 0.00                |
| T-Arm Mount [TA 602-3]<br>**128** | C                          | None                   |                                                                    | 0.0000                              | 133.00                  | No Ice | 13.40                                              | 13.40                                             | 0.77                |
| Pipe Mount [PM 601-1]             | C                          | From Leg               | 0.50<br>0.00<br>0.00                                               | 0.0000                              | 128.00                  | No Ice | 1.32                                               | 1.32                                              | 0.07                |
| 1.9" Dia. x 6-ft                  | C                          | From Leg               | 1.00<br>0.00<br>0.00                                               | 0.0000                              | 128.00                  | No Ice | 1.14                                               | 1.14                                              | 0.02                |
| **112**                           |                            |                        |                                                                    |                                     |                         |        |                                                    |                                                   |                     |
| (2) Pipe Mount [PM 601-1]         | C                          | From Leg               | 0.50<br>0.00<br>0.00                                               | 0.0000                              | 112.00                  | No Ice | 1.32                                               | 1.32                                              | 0.07                |
| 1.9" Dia. x 4-ft                  | C                          | From Leg               | 1.00<br>0.00<br>0.00                                               | 0.0000                              | 112.00                  | No Ice | 0.76                                               | 0.76                                              | 0.01                |
| **109**                           |                            |                        |                                                                    |                                     |                         |        |                                                    |                                                   |                     |
| TMBX-6517-R2M w/ Mount Pipe       | A                          | From Face              | 2.00<br>0.00<br>0.00                                               | 0.0000                              | 109.00                  | No Ice | 3.22                                               | 2.80                                              | 0.04                |
| CMA-B/3324 w/ Mount Pipe          | B                          | From Face              | 2.00<br>0.00<br>0.00                                               | 0.0000                              | 109.00                  | No Ice | 7.76                                               | 5.17                                              | 0.08                |
| 2.4" Dia. x 6-ft                  | C                          | From Face              | 2.00<br>0.00<br>0.00                                               | 0.0000                              | 109.00                  | No Ice | 1.43                                               | 1.43                                              | 0.02                |
| Side Arm Mount [SO 104-3]<br>***  | C                          | None                   |                                                                    | 0.0000                              | 109.00                  | No Ice | 2.62                                               | 2.62                                              | 0.29                |

|                                                                                                                                                                    |                |                               |                    |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b>     | Little Gum Swamp (BU# 825403) | <b>Page</b>        | 6 of 13           |
|                                                                                                                                                                    | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

## Dishes

| <i>Description</i> | <i>Face<br/>or<br/>Leg</i> | <i>Dish<br/>Type</i>        | <i>Offset<br/>Type</i>    | <i>Offsets:<br/>Horz<br/>Lateral<br/>Vert<br/>ft</i> | <i>Azimuth<br/>Adjustment<br/>°</i> | <i>3 dB<br/>Beam<br/>Width<br/>°</i> | <i>Elevation<br/>ft</i> | <i>Outside<br/>Diameter<br/>ft</i> |        | <i>Aperture<br/>Area<br/>ft²</i> | <i>Weight<br/>K</i> |
|--------------------|----------------------------|-----------------------------|---------------------------|------------------------------------------------------|-------------------------------------|--------------------------------------|-------------------------|------------------------------------|--------|----------------------------------|---------------------|
| VHLP3-11W/A        | A                          | Paraboloid<br>w/Shroud (HP) | From<br>Centroid<br>-Face | 4.00<br>0.00<br>1.00                                 | -55.0000                            |                                      | 145.00                  | 3.27                               | No Ice | 8.42                             | 0.04                |
| ***                |                            |                             |                           |                                                      |                                     |                                      |                         |                                    |        |                                  |                     |
| PAR6-59            | C                          | Paraboloid<br>w/Radome      | From<br>Leg               | 1.00<br>0.00<br>1.00                                 | 30.0000                             |                                      | 128.00                  | 6.00                               | No Ice | 28.27                            | 0.14                |
| ***                |                            |                             |                           |                                                      |                                     |                                      |                         |                                    |        |                                  |                     |
| VHLPX4-6W          | C                          | Paraboloid<br>w/Shroud (HP) | From<br>Leg               | 1.00<br>0.00<br>1.00                                 | 30.0000                             |                                      | 112.00                  | 4.23                               | No Ice | 14.07                            | 0.10                |
| ***                |                            |                             |                           |                                                      |                                     |                                      |                         |                                    |        |                                  |                     |

## Load Combinations

| <i>Comb.<br/>No.</i> | <i>Description</i>                 |
|----------------------|------------------------------------|
| 1                    | Dead Only                          |
| 2                    | 1.2 Dead+1.0 Wind 0 deg - No Ice   |
| 3                    | 0.9 Dead+1.0 Wind 0 deg - No Ice   |
| 4                    | 1.2 Dead+1.0 Wind 30 deg - No Ice  |
| 5                    | 0.9 Dead+1.0 Wind 30 deg - No Ice  |
| 6                    | 1.2 Dead+1.0 Wind 60 deg - No Ice  |
| 7                    | 0.9 Dead+1.0 Wind 60 deg - No Ice  |
| 8                    | 1.2 Dead+1.0 Wind 90 deg - No Ice  |
| 9                    | 0.9 Dead+1.0 Wind 90 deg - No Ice  |
| 10                   | 1.2 Dead+1.0 Wind 120 deg - No Ice |
| 11                   | 0.9 Dead+1.0 Wind 120 deg - No Ice |
| 12                   | 1.2 Dead+1.0 Wind 150 deg - No Ice |
| 13                   | 0.9 Dead+1.0 Wind 150 deg - No Ice |
| 14                   | 1.2 Dead+1.0 Wind 180 deg - No Ice |
| 15                   | 0.9 Dead+1.0 Wind 180 deg - No Ice |
| 16                   | 1.2 Dead+1.0 Wind 210 deg - No Ice |
| 17                   | 0.9 Dead+1.0 Wind 210 deg - No Ice |
| 18                   | 1.2 Dead+1.0 Wind 240 deg - No Ice |
| 19                   | 0.9 Dead+1.0 Wind 240 deg - No Ice |
| 20                   | 1.2 Dead+1.0 Wind 270 deg - No Ice |
| 21                   | 0.9 Dead+1.0 Wind 270 deg - No Ice |
| 22                   | 1.2 Dead+1.0 Wind 300 deg - No Ice |
| 23                   | 0.9 Dead+1.0 Wind 300 deg - No Ice |
| 24                   | 1.2 Dead+1.0 Wind 330 deg - No Ice |
| 25                   | 0.9 Dead+1.0 Wind 330 deg - No Ice |
| 26                   | Dead+Wind 0 deg - Service          |
| 27                   | Dead+Wind 30 deg - Service         |
| 28                   | Dead+Wind 60 deg - Service         |
| 29                   | Dead+Wind 90 deg - Service         |
| 30                   | Dead+Wind 120 deg - Service        |
| 31                   | Dead+Wind 150 deg - Service        |
| 32                   | Dead+Wind 180 deg - Service        |
| 33                   | Dead+Wind 210 deg - Service        |

|                                                                                                                                                      |                |                               |                    |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
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|                                                                                                                                                      | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                      | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| Comb. No. | Description                 |
|-----------|-----------------------------|
| 34        | Dead+Wind 240 deg - Service |
| 35        | Dead+Wind 270 deg - Service |
| 36        | Dead+Wind 300 deg - Service |
| 37        | Dead+Wind 330 deg - Service |

## Maximum Member Forces

| Section No. | Elevation ft   | Component Type | Condition        | Gov. Load Comb. | Axial K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|-------------|----------------|----------------|------------------|-----------------|---------|--------------------------|--------------------------|
| L1          | 150 - 109.75   | Pole           | Max Tension      | 1               | 0.00    | 0.00                     | 0.00                     |
|             |                |                | Max. Compression | 24              | -8.19   | 103.05                   | 165.33                   |
|             |                |                | Max. Mx          | 8               | -8.10   | -215.71                  | -4.86                    |
|             |                |                | Max. My          | 14              | -8.17   | 1.91                     | -210.39                  |
|             |                |                | Max. Vy          | 8               | 9.34    | -215.71                  | -4.86                    |
|             |                |                | Max. Vx          | 14              | 8.64    | 1.91                     | -210.39                  |
|             |                |                | Max. Torque      | 25              |         |                          | 4.75                     |
| L2          | 109.75 - 70.75 | Pole           | Max Tension      | 1               | 0.00    | 0.00                     | 0.00                     |
|             |                |                | Max. Compression | 2               | -14.57  | -18.34                   | 602.53                   |
|             |                |                | Max. Mx          | 8               | -14.49  | -665.09                  | -0.41                    |
|             |                |                | Max. My          | 14              | -14.56  | 4.04                     | -619.16                  |
|             |                |                | Max. Vy          | 8               | 13.05   | -665.09                  | -0.41                    |
|             |                |                | Max. Vx          | 14              | 11.96   | 4.04                     | -619.16                  |
|             |                |                | Max. Torque      | 25              |         |                          | 6.04                     |
| L3          | 70.75 - 37.5   | Pole           | Max Tension      | 1               | 0.00    | 0.00                     | 0.00                     |
|             |                |                | Max. Compression | 2               | -21.41  | -27.93                   | 1024.39                  |
|             |                |                | Max. Mx          | 8               | -21.36  | -1122.23                 | 3.64                     |
|             |                |                | Max. My          | 14              | -21.40  | 5.65                     | -1041.01                 |
|             |                |                | Max. Vy          | 8               | 15.02   | -1122.23                 | 3.64                     |
|             |                |                | Max. Vx          | 2               | -13.94  | -27.93                   | 1024.39                  |
|             |                |                | Max. Torque      | 25              |         |                          | 5.71                     |
| L4          | 37.5 - 0       | Pole           | Max Tension      | 1               | 0.00    | 0.00                     | 0.00                     |
|             |                |                | Max. Compression | 2               | -33.31  | -40.37                   | 1673.54                  |
|             |                |                | Max. Mx          | 8               | -33.31  | -1817.06                 | 9.01                     |
|             |                |                | Max. My          | 14              | -33.31  | 7.68                     | -1689.95                 |
|             |                |                | Max. Vy          | 8               | 17.24   | -1817.06                 | 9.01                     |
|             |                |                | Max. Vx          | 2               | -16.20  | -40.37                   | 1673.54                  |
|             |                |                | Max. Torque      | 25              |         |                          | 5.68                     |

## Maximum Reactions

| Location | Condition           | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|----------|---------------------|-----------------|------------|-----------------|-----------------|
| Pole     | Max. Vert           | 8               | 33.32      | -17.22          | 0.12            |
|          | Max. H <sub>x</sub> | 20              | 33.32      | 16.82           | -0.10           |
|          | Max. H <sub>z</sub> | 2               | 33.32      | -0.28           | 16.18           |
|          | Max. M <sub>x</sub> | 2               | 1673.54    | -0.28           | 16.18           |
|          | Max. M <sub>z</sub> | 8               | 1817.06    | -17.22          | 0.12            |
|          | Max. Torsion        | 25              | 5.64       | 8.31            | 13.90           |
|          | Min. Vert           | 25              | 24.99      | 8.31            | 13.90           |
|          | Min. H <sub>x</sub> | 8               | 33.32      | -17.22          | 0.12            |
|          | Min. H <sub>z</sub> | 14              | 33.32      | 0.05            | -16.18          |
|          | Min. M <sub>x</sub> | 14              | -1689.95   | 0.05            | -16.18          |
|          | Min. M <sub>z</sub> | 20              | -1766.63   | 16.82           | -0.10           |

|                                                                                                                                                      |         |                               |             |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------|-------------|-------------------|
| <b>tnxTower</b><br><br><b>Tower Engineering Professionals</b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | Job     | Little Gum Swamp (BU# 825403) | Page        | 8 of 13           |
|                                                                                                                                                      | Project | TEP No. 26551.933960          | Date        | 22:47:28 02/25/24 |
|                                                                                                                                                      | Client  | Crown Castle                  | Designed by | PPS               |

| Location | Condition    | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|----------|--------------|-----------------|------------|-----------------|-----------------|
|          | Min. Torsion | 13              | -5.18      | -8.66           | -14.04          |

## Tower Mast Reaction Summary

| Load Combination                   | Vertical K | Shear <sub>x</sub> K | Shear <sub>z</sub> K | Overturning Moment, M <sub>x</sub> kip-ft | Overturning Moment, M <sub>z</sub> kip-ft | Torque kip-ft |
|------------------------------------|------------|----------------------|----------------------|-------------------------------------------|-------------------------------------------|---------------|
| Dead Only                          | 27.76      | 0.00                 | 0.00                 | 7.19                                      | 0.93                                      | 0.00          |
| 1.2 Dead+1.0 Wind 0 deg - No Ice   | 33.32      | 0.28                 | -16.18               | -1673.54                                  | -40.37                                    | -4.72         |
| 0.9 Dead+1.0 Wind 0 deg - No Ice   | 24.99      | 0.28                 | -16.18               | -1659.63                                  | -40.21                                    | -4.72         |
| 1.2 Dead+1.0 Wind 30 deg - No Ice  | 33.32      | 8.89                 | -14.13               | -1464.78                                  | -944.13                                   | -1.12         |
| 0.9 Dead+1.0 Wind 30 deg - No Ice  | 24.99      | 8.89                 | -14.13               | -1452.86                                  | -935.26                                   | -1.08         |
| 1.2 Dead+1.0 Wind 60 deg - No Ice  | 33.32      | 15.02                | -8.36                | -869.11                                   | -1587.22                                  | 2.00          |
| 0.9 Dead+1.0 Wind 60 deg - No Ice  | 24.99      | 15.02                | -8.36                | -862.92                                   | -1572.14                                  | 2.05          |
| 1.2 Dead+1.0 Wind 90 deg - No Ice  | 33.32      | 17.22                | -0.12                | -9.01                                     | -1817.06                                  | 3.44          |
| 0.9 Dead+1.0 Wind 90 deg - No Ice  | 24.99      | 17.22                | -0.12                | -11.13                                    | -1799.76                                  | 3.50          |
| 1.2 Dead+1.0 Wind 120 deg - No Ice | 33.32      | 14.99                | 8.10                 | 849.61                                    | -1583.36                                  | 4.00          |
| 0.9 Dead+1.0 Wind 120 deg - No Ice | 24.99      | 14.99                | 8.10                 | 839.21                                    | -1568.32                                  | 4.05          |
| 1.2 Dead+1.0 Wind 150 deg - No Ice | 33.32      | 8.66                 | 14.04                | 1470.23                                   | -910.60                                   | 5.15          |
| 0.9 Dead+1.0 Wind 150 deg - No Ice | 24.99      | 8.66                 | 14.04                | 1453.83                                   | -902.09                                   | 5.18          |
| 1.2 Dead+1.0 Wind 180 deg - No Ice | 33.32      | -0.05                | 16.18                | 1689.95                                   | 7.68                                      | 4.85          |
| 0.9 Dead+1.0 Wind 180 deg - No Ice | 24.99      | -0.05                | 16.18                | 1671.44                                   | 7.31                                      | 4.84          |
| 1.2 Dead+1.0 Wind 210 deg - No Ice | 33.32      | -8.43                | 13.95                | 1456.98                                   | 885.82                                    | 2.38          |
| 0.9 Dead+1.0 Wind 210 deg - No Ice | 24.99      | -8.43                | 13.95                | 1440.70                                   | 876.98                                    | 2.35          |
| 1.2 Dead+1.0 Wind 240 deg - No Ice | 33.32      | -14.56               | 8.14                 | 857.89                                    | 1527.53                                   | -0.90         |
| 0.9 Dead+1.0 Wind 240 deg - No Ice | 24.99      | -14.56               | 8.14                 | 847.38                                    | 1512.49                                   | -0.95         |
| 1.2 Dead+1.0 Wind 270 deg - No Ice | 33.32      | -16.82               | 0.10                 | 22.77                                     | 1766.63                                   | -3.47         |
| 0.9 Dead+1.0 Wind 270 deg - No Ice | 24.99      | -16.82               | 0.10                 | 20.31                                     | 1749.27                                   | -3.52         |
| 1.2 Dead+1.0 Wind 300 deg - No Ice | 33.32      | -14.54               | -7.97                | -815.64                                   | 1525.66                                   | -4.91         |
| 0.9 Dead+1.0 Wind 300 deg - No Ice | 24.99      | -14.54               | -7.97                | -810.01                                   | 1510.64                                   | -4.96         |
| 1.2 Dead+1.0 Wind 330 deg - No Ice | 33.32      | -8.31                | -13.90               | -1432.44                                  | 868.89                                    | -5.62         |
| 0.9 Dead+1.0 Wind 330 deg - No Ice | 24.99      | -8.31                | -13.90               | -1420.85                                  | 860.23                                    | -5.64         |
| Dead+Wind 0 deg - Service          | 27.76      | 0.07                 | -3.87                | -393.22                                   | -8.93                                     | -1.13         |

|                                                                                                                                                      |                |                               |                    |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
| <b>tnxTower</b><br><br><b>Tower Engineering Professionals</b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b>     | Little Gum Swamp (BU# 825403) | <b>Page</b>        | 9 of 13           |
|                                                                                                                                                      | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                      | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| Load Combination            | Vertical<br>K | Shear <sub>x</sub><br>K | Shear <sub>z</sub><br>K | Overturning<br>Moment, M <sub>x</sub><br>kip-ft | Overturning<br>Moment, M <sub>z</sub><br>kip-ft | Torque<br>kip-ft |
|-----------------------------|---------------|-------------------------|-------------------------|-------------------------------------------------|-------------------------------------------------|------------------|
| Dead+Wind 30 deg - Service  | 27.76         | 2.13                    | -3.38                   | -343.54                                         | -224.07                                         | -0.26            |
| Dead+Wind 60 deg - Service  | 27.76         | 3.60                    | -2.00                   | -201.75                                         | -377.18                                         | 0.49             |
| Dead+Wind 90 deg - Service  | 27.76         | 4.12                    | -0.03                   | 3.00                                            | -431.89                                         | 0.84             |
| Dead+Wind 120 deg - Service | 27.76         | 3.59                    | 1.94                    | 207.40                                          | -376.25                                         | 0.97             |
| Dead+Wind 150 deg - Service | 27.76         | 2.07                    | 3.36                    | 355.13                                          | -216.09                                         | 1.24             |
| Dead+Wind 180 deg - Service | 27.76         | -0.01                   | 3.87                    | 407.42                                          | 2.50                                            | 1.17             |
| Dead+Wind 210 deg - Service | 27.76         | -2.02                   | 3.34                    | 351.96                                          | 211.53                                          | 0.57             |
| Dead+Wind 240 deg - Service | 27.76         | -3.49                   | 1.95                    | 209.36                                          | 364.29                                          | -0.22            |
| Dead+Wind 270 deg - Service | 27.76         | -4.03                   | 0.02                    | 10.56                                           | 421.21                                          | -0.84            |
| Dead+Wind 300 deg - Service | 27.76         | -3.48                   | -1.91                   | -189.01                                         | 363.84                                          | -1.19            |
| Dead+Wind 330 deg - Service | 27.76         | -1.99                   | -3.33                   | -335.83                                         | 207.50                                          | -1.36            |

## Solution Summary

| Load Comb. | Sum of Applied Forces |         |         | Sum of Reactions |         |         | % Error |
|------------|-----------------------|---------|---------|------------------|---------|---------|---------|
|            | PX<br>K               | PY<br>K | PZ<br>K | PX<br>K          | PY<br>K | PZ<br>K |         |
| 1          | 0.00                  | -27.76  | 0.00    | 0.00             | 27.76   | -0.00   | 0.000%  |
| 2          | 0.28                  | -33.32  | -16.18  | -0.28            | 33.32   | 16.18   | 0.000%  |
| 3          | 0.28                  | -24.99  | -16.18  | -0.28            | 24.99   | 16.18   | 0.000%  |
| 4          | 8.89                  | -33.32  | -14.13  | -8.89            | 33.32   | 14.13   | 0.000%  |
| 5          | 8.89                  | -24.99  | -14.13  | -8.89            | 24.99   | 14.13   | 0.000%  |
| 6          | 15.02                 | -33.32  | -8.36   | -15.02           | 33.32   | 8.36    | 0.000%  |
| 7          | 15.02                 | -24.99  | -8.36   | -15.02           | 24.99   | 8.36    | 0.000%  |
| 8          | 17.22                 | -33.32  | -0.12   | -17.22           | 33.32   | 0.12    | 0.000%  |
| 9          | 17.22                 | -24.99  | -0.12   | -17.22           | 24.99   | 0.12    | 0.000%  |
| 10         | 14.99                 | -33.32  | 8.10    | -14.99           | 33.32   | -8.10   | 0.000%  |
| 11         | 14.99                 | -24.99  | 8.10    | -14.99           | 24.99   | -8.10   | 0.000%  |
| 12         | 8.66                  | -33.32  | 14.04   | -8.66            | 33.32   | -14.04  | 0.000%  |
| 13         | 8.66                  | -24.99  | 14.04   | -8.66            | 24.99   | -14.04  | 0.000%  |
| 14         | -0.05                 | -33.32  | 16.18   | 0.05             | 33.32   | -16.18  | 0.000%  |
| 15         | -0.05                 | -24.99  | 16.18   | 0.05             | 24.99   | -16.18  | 0.000%  |
| 16         | -8.43                 | -33.32  | 13.95   | 8.43             | 33.32   | -13.95  | 0.000%  |
| 17         | -8.43                 | -24.99  | 13.95   | 8.43             | 24.99   | -13.95  | 0.000%  |
| 18         | -14.56                | -33.32  | 8.14    | 14.56            | 33.32   | -8.14   | 0.000%  |
| 19         | -14.56                | -24.99  | 8.14    | 14.56            | 24.99   | -8.14   | 0.000%  |
| 20         | -16.82                | -33.32  | 0.10    | 16.82            | 33.32   | -0.10   | 0.000%  |
| 21         | -16.82                | -24.99  | 0.10    | 16.82            | 24.99   | -0.10   | 0.000%  |
| 22         | -14.54                | -33.32  | -7.97   | 14.54            | 33.32   | 7.97    | 0.000%  |
| 23         | -14.54                | -24.99  | -7.97   | 14.54            | 24.99   | 7.97    | 0.000%  |
| 24         | -8.31                 | -33.32  | -13.90  | 8.31             | 33.32   | 13.90   | 0.000%  |
| 25         | -8.31                 | -24.99  | -13.90  | 8.31             | 24.99   | 13.90   | 0.000%  |
| 26         | 0.07                  | -27.76  | -3.87   | -0.07            | 27.76   | 3.87    | 0.000%  |
| 27         | 2.13                  | -27.76  | -3.38   | -2.13            | 27.76   | 3.38    | 0.000%  |
| 28         | 3.60                  | -27.76  | -2.00   | -3.60            | 27.76   | 2.00    | 0.000%  |
| 29         | 4.12                  | -27.76  | -0.03   | -4.12            | 27.76   | 0.03    | 0.000%  |
| 30         | 3.59                  | -27.76  | 1.94    | -3.59            | 27.76   | -1.94   | 0.000%  |
| 31         | 2.07                  | -27.76  | 3.36    | -2.07            | 27.76   | -3.36   | 0.000%  |
| 32         | -0.01                 | -27.76  | 3.87    | 0.01             | 27.76   | -3.87   | 0.000%  |
| 33         | -2.02                 | -27.76  | 3.34    | 2.02             | 27.76   | -3.34   | 0.000%  |
| 34         | -3.49                 | -27.76  | 1.95    | 3.49             | 27.76   | -1.95   | 0.000%  |
| 35         | -4.03                 | -27.76  | 0.02    | 4.03             | 27.76   | -0.02   | 0.000%  |
| 36         | -3.48                 | -27.76  | -1.91   | 3.48             | 27.76   | 1.91    | 0.000%  |
| 37         | -1.99                 | -27.76  | -3.33   | 1.99             | 27.76   | 3.33    | 0.000%  |



|                                                                                                                                                                    |                                             |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b><br>Little Gum Swamp (BU# 825403) | <b>Page</b><br>10 of 13          |
|                                                                                                                                                                    | <b>Project</b><br>TEP No. 26551.933960      | <b>Date</b><br>22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b><br>Crown Castle               | <b>Designed by</b><br>PPS        |

## Non-Linear Convergence Results

| <i>Load Combination</i> | <i>Converged?</i> | <i>Number of Cycles</i> | <i>Displacement Tolerance</i> | <i>Force Tolerance</i> |
|-------------------------|-------------------|-------------------------|-------------------------------|------------------------|
| 1                       | Yes               | 4                       | 0.00000001                    | 0.00000001             |
| 2                       | Yes               | 5                       | 0.00000001                    | 0.00013047             |
| 3                       | Yes               | 5                       | 0.00000001                    | 0.00006574             |
| 4                       | Yes               | 5                       | 0.00000001                    | 0.00040627             |
| 5                       | Yes               | 5                       | 0.00000001                    | 0.00019457             |
| 6                       | Yes               | 5                       | 0.00000001                    | 0.00039371             |
| 7                       | Yes               | 5                       | 0.00000001                    | 0.00018664             |
| 8                       | Yes               | 5                       | 0.00000001                    | 0.00012152             |
| 9                       | Yes               | 5                       | 0.00000001                    | 0.00006008             |
| 10                      | Yes               | 5                       | 0.00000001                    | 0.00051952             |
| 11                      | Yes               | 5                       | 0.00000001                    | 0.00024978             |
| 12                      | Yes               | 5                       | 0.00000001                    | 0.00037027             |
| 13                      | Yes               | 5                       | 0.00000001                    | 0.00017631             |
| 14                      | Yes               | 5                       | 0.00000001                    | 0.00016457             |
| 15                      | Yes               | 5                       | 0.00000001                    | 0.00008212             |
| 16                      | Yes               | 5                       | 0.00000001                    | 0.00044014             |
| 17                      | Yes               | 5                       | 0.00000001                    | 0.00021067             |
| 18                      | Yes               | 5                       | 0.00000001                    | 0.00043046             |
| 19                      | Yes               | 5                       | 0.00000001                    | 0.00020533             |
| 20                      | Yes               | 5                       | 0.00000001                    | 0.00014216             |
| 21                      | Yes               | 5                       | 0.00000001                    | 0.00007041             |
| 22                      | Yes               | 5                       | 0.00000001                    | 0.00031517             |
| 23                      | Yes               | 5                       | 0.00000001                    | 0.00015169             |
| 24                      | Yes               | 5                       | 0.00000001                    | 0.00048710             |
| 25                      | Yes               | 5                       | 0.00000001                    | 0.00024036             |
| 26                      | Yes               | 4                       | 0.00000001                    | 0.00017854             |
| 27                      | Yes               | 4                       | 0.00000001                    | 0.00013335             |
| 28                      | Yes               | 4                       | 0.00000001                    | 0.00012512             |
| 29                      | Yes               | 4                       | 0.00000001                    | 0.00016891             |
| 30                      | Yes               | 4                       | 0.00000001                    | 0.00028954             |
| 31                      | Yes               | 4                       | 0.00000001                    | 0.00021157             |
| 32                      | Yes               | 4                       | 0.00000001                    | 0.00020819             |
| 33                      | Yes               | 4                       | 0.00000001                    | 0.00020937             |
| 34                      | Yes               | 4                       | 0.00000001                    | 0.00018069             |
| 35                      | Yes               | 4                       | 0.00000001                    | 0.00017430             |
| 36                      | Yes               | 4                       | 0.00000001                    | 0.00017898             |
| 37                      | Yes               | 4                       | 0.00000001                    | 0.00028880             |

## Maximum Tower Deflections - Service Wind

| <i>Section No.</i> | <i>Elevation<br/>ft</i> | <i>Horz.<br/>Deflection<br/>in</i> | <i>Gov.<br/>Load<br/>Comb.</i> | <i>Tilt<br/>°</i> | <i>Twist<br/>°</i> |
|--------------------|-------------------------|------------------------------------|--------------------------------|-------------------|--------------------|
| L1                 | 150 - 109.75            | 16.783                             | 30                             | 0.9523            | 0.0135             |
| L2                 | 113.75 - 70.75          | 9.857                              | 29                             | 0.8263            | 0.0078             |
| L3                 | 75.5 - 37.5             | 4.277                              | 29                             | 0.5388            | 0.0033             |
| L4                 | 43 - 0                  | 1.386                              | 29                             | 0.2928            | 0.0014             |

## Critical Deflections and Radius of Curvature - Service Wind

|                                                                                                                                                                    |                |                               |                    |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b>     | Little Gum Swamp (BU# 825403) | <b>Page</b>        | 11 of 13          |
|                                                                                                                                                                    | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| <i>Elevation</i> | <i>Appurtenance</i>              | <i>Gov. Load Comb.</i> | <i>Deflection</i> | <i>Tilt</i> | <i>Twist</i> | <i>Radius of Curvature</i> |
|------------------|----------------------------------|------------------------|-------------------|-------------|--------------|----------------------------|
| <i>ft</i>        |                                  |                        | <i>in</i>         | <i>°</i>    | <i>°</i>     | <i>ft</i>                  |
| 153.50           | Lightning rod (5/8"x7')          | 30                     | 16.783            | 0.9523      | 0.0143       | 58888                      |
| 146.00           | VHLP3-11W/A                      | 30                     | 15.985            | 0.9425      | 0.0137       | 58888                      |
| 145.00           | FFVV-65C-R3-V1_TMO w/ Mount Pipe | 30                     | 15.786            | 0.9401      | 0.0135       | 58888                      |
| 133.00           | (2) PCSA030-19-2 w/ Mount Pipe   | 30                     | 13.422            | 0.9071      | 0.0116       | 17320                      |
| 129.00           | PAR6-59                          | 30                     | 12.652            | 0.8940      | 0.0110       | 14021                      |
| 128.00           | Pipe Mount [PM 601-1]            | 30                     | 12.461            | 0.8904      | 0.0108       | 13383                      |
| 113.00           | VHLPX4-6W                        | 29                     | 9.727             | 0.8221      | 0.0085       | 8227                       |
| 112.00           | (2) Pipe Mount [PM 601-1]        | 29                     | 9.556             | 0.8163      | 0.0083       | 8157                       |
| 109.00           | TMBX-6517-R2M w/ Mount Pipe      | 29                     | 9.051             | 0.7980      | 0.0078       | 8083                       |

### Maximum Tower Deflections - Design Wind

| <i>Section No.</i> | <i>Elevation</i> | <i>Horz. Deflection</i> | <i>Gov. Load Comb.</i> | <i>Tilt</i> | <i>Twist</i> |
|--------------------|------------------|-------------------------|------------------------|-------------|--------------|
|                    | <i>ft</i>        | <i>in</i>               |                        | <i>°</i>    | <i>°</i>     |
| L1                 | 150 - 109.75     | 70.392                  | 8                      | 3.9327      | 0.0558       |
| L2                 | 113.75 - 70.75   | 41.556                  | 8                      | 3.4701      | 0.0325       |
| L3                 | 75.5 - 37.5      | 18.020                  | 8                      | 2.2717      | 0.0136       |
| L4                 | 43 - 0           | 5.837                   | 8                      | 1.2336      | 0.0057       |

### Critical Deflections and Radius of Curvature - Design Wind

| <i>Elevation</i> | <i>Appurtenance</i>              | <i>Gov. Load Comb.</i> | <i>Deflection</i> | <i>Tilt</i> | <i>Twist</i> | <i>Radius of Curvature</i> |
|------------------|----------------------------------|------------------------|-------------------|-------------|--------------|----------------------------|
| <i>ft</i>        |                                  |                        | <i>in</i>         | <i>°</i>    | <i>°</i>     | <i>ft</i>                  |
| 153.50           | Lightning rod (5/8"x7')          | 8                      | 70.392            | 3.9327      | 0.0601       | 15833                      |
| 146.00           | VHLP3-11W/A                      | 8                      | 67.079            | 3.9005      | 0.0574       | 15833                      |
| 145.00           | FFVV-65C-R3-V1_TMO w/ Mount Pipe | 8                      | 66.252            | 3.8923      | 0.0567       | 15833                      |
| 133.00           | (2) PCSA030-19-2 w/ Mount Pipe   | 8                      | 56.429            | 3.7791      | 0.0486       | 4655                       |
| 129.00           | PAR6-59                          | 8                      | 53.224            | 3.7313      | 0.0459       | 3768                       |
| 128.00           | Pipe Mount [PM 601-1]            | 8                      | 52.430            | 3.7183      | 0.0452       | 3596                       |
| 113.00           | VHLPX4-6W                        | 8                      | 41.011            | 3.4531      | 0.0354       | 2195                       |
| 112.00           | (2) Pipe Mount [PM 601-1]        | 8                      | 40.288            | 3.4299      | 0.0347       | 2168                       |
| 109.00           | TMBX-6517-R2M w/ Mount Pipe      | 8                      | 38.155            | 3.3557      | 0.0328       | 2120                       |

### Compression Checks

### Pole Design Data

| <i>Section No.</i> | <i>Elevation</i>    | <i>Size</i>        | <i>L</i>  | <i>L<sub>u</sub></i> | <i>Kl/r</i> | <i>A</i>              | <i>P<sub>u</sub></i> | $\phi P_n$ | <i>Ratio</i>           |
|--------------------|---------------------|--------------------|-----------|----------------------|-------------|-----------------------|----------------------|------------|------------------------|
|                    | <i>ft</i>           |                    | <i>ft</i> | <i>ft</i>            |             | <i>in<sup>2</sup></i> | <i>K</i>             | <i>K</i>   | $\frac{P_u}{\phi P_n}$ |
| L1                 | 150 - 109.75<br>(1) | TP31.111x24x0.1875 | 40.25     | 0.00                 | 0.0         | 17.9828               | -8.11                | 1051.99    | 0.008                  |

|                                                                                                                                                      |                |                               |                    |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------|--------------------|-------------------|
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|                                                                                                                                                      | <b>Project</b> | TEP No. 26551.933960          | <b>Date</b>        | 22:47:28 02/25/24 |
|                                                                                                                                                      | <b>Client</b>  | Crown Castle                  | <b>Designed by</b> | PPS               |

| Section No. | Elevation<br>ft       | Size                  | L<br>ft | L <sub>u</sub><br>ft | Kl/r | A<br>in <sup>2</sup> | P <sub>u</sub><br>K | φP <sub>n</sub><br>K | Ratio<br>$\frac{P_u}{\phi P_n}$ |
|-------------|-----------------------|-----------------------|---------|----------------------|------|----------------------|---------------------|----------------------|---------------------------------|
| L2          | 109.75 - 70.75<br>(2) | TP37.626x30.0293x0.25 | 43.00   | 0.00                 | 0.0  | 28.9920              | -14.49              | 1696.03              | 0.009                           |
| L3          | 70.75 - 37.5 (3)      | TP43x36.2868x0.3125   | 38.00   | 0.00                 | 0.0  | 41.3769              | -21.36              | 2420.55              | 0.009                           |
| L4          | 37.5 - 0 (4)          | TP49x41.4034x0.375    | 43.00   | 0.00                 | 0.0  | 57.8759              | -33.31              | 3385.74              | 0.010                           |

### Pole Bending Design Data

| Section No. | Elevation<br>ft       | Size                  | M <sub>ux</sub><br>kip-ft | φM <sub>rx</sub><br>kip-ft | Ratio<br>$\frac{M_{ux}}{\phi M_{rx}}$ | M <sub>uy</sub><br>kip-ft | φM <sub>ny</sub><br>kip-ft | Ratio<br>$\frac{M_{uy}}{\phi M_{ny}}$ |
|-------------|-----------------------|-----------------------|---------------------------|----------------------------|---------------------------------------|---------------------------|----------------------------|---------------------------------------|
| L1          | 150 - 109.75<br>(1)   | TP31.111x24x0.1875    | 216.32                    | 693.70                     | 0.312                                 | 0.00                      | 693.70                     | 0.000                                 |
| L2          | 109.75 - 70.75<br>(2) | TP37.626x30.0293x0.25 | 665.09                    | 1412.42                    | 0.471                                 | 0.00                      | 1412.42                    | 0.000                                 |
| L3          | 70.75 - 37.5 (3)      | TP43x36.2868x0.3125   | 1122.23                   | 2383.77                    | 0.471                                 | 0.00                      | 2383.77                    | 0.000                                 |
| L4          | 37.5 - 0 (4)          | TP49x41.4034x0.375    | 1817.08                   | 3926.91                    | 0.463                                 | 0.00                      | 3926.91                    | 0.000                                 |

### Pole Shear Design Data

| Section No. | Elevation<br>ft       | Size                  | Actual<br>V <sub>u</sub><br>K | φV <sub>n</sub><br>K | Ratio<br>$\frac{V_u}{\phi V_n}$ | Actual<br>T <sub>u</sub><br>kip-ft | φT <sub>n</sub><br>kip-ft | Ratio<br>$\frac{T_u}{\phi T_n}$ |
|-------------|-----------------------|-----------------------|-------------------------------|----------------------|---------------------------------|------------------------------------|---------------------------|---------------------------------|
| L1          | 150 - 109.75<br>(1)   | TP31.111x24x0.1875    | 9.24                          | 315.60               | 0.029                           | 3.46                               | 835.15                    | 0.004                           |
| L2          | 109.75 - 70.75<br>(2) | TP37.626x30.0293x0.25 | 13.05                         | 508.81               | 0.026                           | 3.59                               | 1628.04                   | 0.002                           |
| L3          | 70.75 - 37.5 (3)      | TP43x36.2868x0.3125   | 15.02                         | 726.16               | 0.021                           | 3.52                               | 2652.88                   | 0.001                           |
| L4          | 37.5 - 0 (4)          | TP49x41.4034x0.375    | 17.24                         | 1015.72              | 0.017                           | 3.44                               | 4325.28                   | 0.001                           |

### Pole Interaction Design Data

| Section No. | Elevation<br>ft       | Ratio<br>$\frac{P_u}{\phi P_n}$ | Ratio<br>$\frac{M_{ux}}{\phi M_{rx}}$ | Ratio<br>$\frac{M_{uy}}{\phi M_{ny}}$ | Ratio<br>$\frac{V_u}{\phi V_n}$ | Ratio<br>$\frac{T_u}{\phi T_n}$ | Comb.<br>Stress<br>Ratio | Allow.<br>Stress<br>Ratio | Criteria |
|-------------|-----------------------|---------------------------------|---------------------------------------|---------------------------------------|---------------------------------|---------------------------------|--------------------------|---------------------------|----------|
| L1          | 150 - 109.75<br>(1)   | 0.008                           | 0.312                                 | 0.000                                 | 0.029                           | 0.004                           | 0.321                    | 1.050                     |          |
| L2          | 109.75 - 70.75<br>(2) | 0.009                           | 0.471                                 | 0.000                                 | 0.026                           | 0.002                           | 0.480                    | 1.050                     |          |
| L3          | 70.75 - 37.5 (3)      | 0.009                           | 0.471                                 | 0.000                                 | 0.021                           | 0.001                           | 0.480                    | 1.050                     |          |
| L4          | 37.5 - 0 (4)          | 0.010                           | 0.463                                 | 0.000                                 | 0.017                           | 0.001                           | 0.473                    | 1.050                     |          |

|                                                                                                                                                                    |                                             |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------|
| <b><i>tnxTower</i></b><br><br><b><i>Tower Engineering Professionals</i></b><br>326 Tryon Road<br>Raleigh, NC 27603<br>Phone: (919) 661-6351<br>FAX: (919) 661-6350 | <b>Job</b><br>Little Gum Swamp (BU# 825403) | <b>Page</b><br>13 of 13          |
|                                                                                                                                                                    | <b>Project</b><br>TEP No. 26551.933960      | <b>Date</b><br>22:47:28 02/25/24 |
|                                                                                                                                                                    | <b>Client</b><br>Crown Castle               | <b>Designed by</b><br>PPS        |

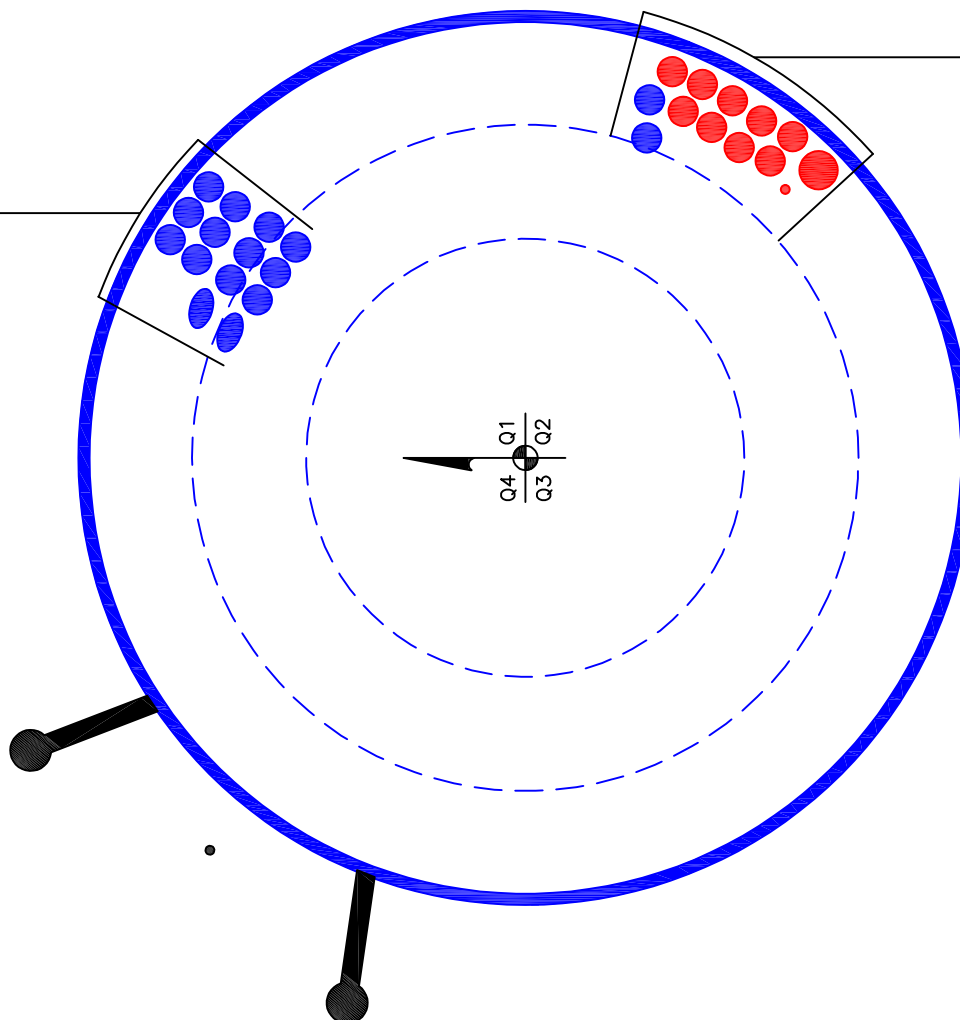
Section Capacity Table

| Section No. | Elevation ft   | Component Type | Size                  | Critical Element | P K    | $\phi P_{allow}$ K | % Capacity      | Pass Fail   |
|-------------|----------------|----------------|-----------------------|------------------|--------|--------------------|-----------------|-------------|
| L1          | 150 - 109.75   | Pole           | TP31.111x24x0.1875    | 1                | -8.11  | 1104.59            | 30.5            | Pass        |
| L2          | 109.75 - 70.75 | Pole           | TP37.626x30.0293x0.25 | 2                | -14.49 | 1780.83            | 45.7            | Pass        |
| L3          | 70.75 - 37.5   | Pole           | TP43x36.2868x0.3125   | 3                | -21.36 | 2541.58            | 45.7            | Pass        |
| L4          | 37.5 - 0       | Pole           | TP49x41.4034x0.375    | 4                | -33.31 | 3555.03            | 45.0            | Pass        |
|             |                |                |                       |                  |        |                    | Summary         |             |
|             |                |                |                       |                  |        |                    | Pole (L2)       | Pass        |
|             |                |                |                       |                  |        |                    | <b>RATING =</b> | <b>Pass</b> |

**APPENDIX B**  
**BASE LEVEL DRAWING**



(OTHER CONSIDERED EQUIPMENT)  
(1) ELLIPTICAL TO 112 FT LEVEL  
(1) ELLIPTICAL TO 128 FT LEVEL  
(12) 1-5/8" TO 133 FT LEVEL



(OTHER CONSIDERED EQUIPMENT)  
(2) 1-5/8" TO 109 FT LEVEL  
(PROPOSED EQUIPMENT CONFIGURATION)  
(1) 1/2" TO 145 FT LEVEL  
(9) 1-5/8" TO 145 FT LEVEL  
(1) 2-1/8" TO 145 FT LEVEL

CLIMBING PEGS  
W/ SAFETY CLIMB

## **APPENDIX C**

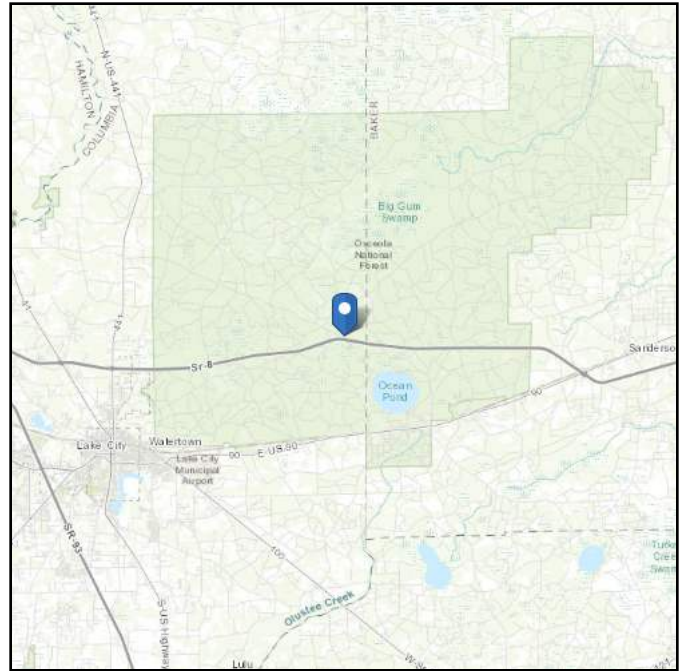
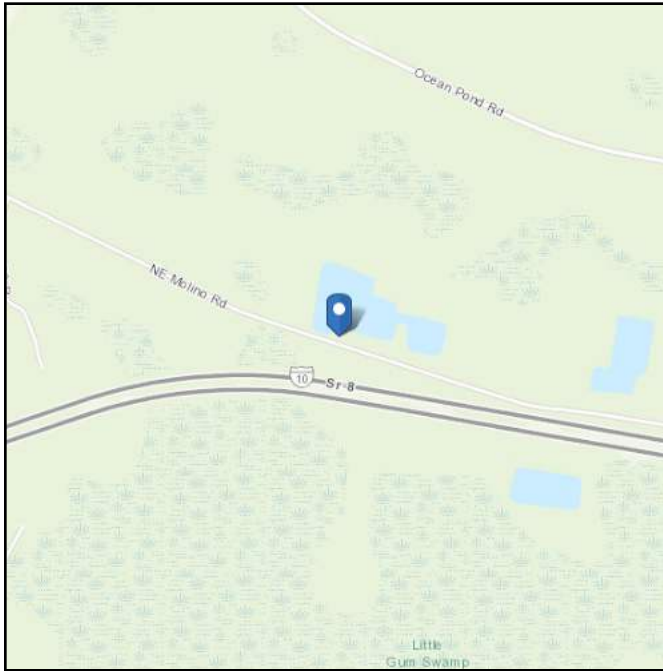
### **ADDITIONAL CALCULATIONS**

# ASCE Hazards Report

**Address:**  
No Address at This Location

**Standard:** ASCE/SEI 7-22  
**Risk Category:** II  
**Soil Class:** D - Stiff Soil

**Latitude:** 30.261106  
**Longitude:** -82.473631  
**Elevation:** 153.7353084234667 ft (NAVD 88)



## Wind

### Results:

|                    |          |
|--------------------|----------|
| Wind Speed         | 119 Vmph |
| 10-year MRI        | 75 Vmph  |
| 25-year MRI        | 83 Vmph  |
| 50-year MRI        | 90 Vmph  |
| 100-year MRI       | 98 Vmph  |
| 300-year MRI       | 109 Vmph |
| 700-year MRI       | 119 Vmph |
| 1,700-year MRI     | 128 Vmph |
| 3,000-year MRI     | 134 Vmph |
| 10,000-year MRI    | 144 Vmph |
| 100,000-year MRI   | 155 Vmph |
| 1,000,000-year MRI | 169 Vmph |

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2  
Date Accessed: Sun Feb 25 2024





Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

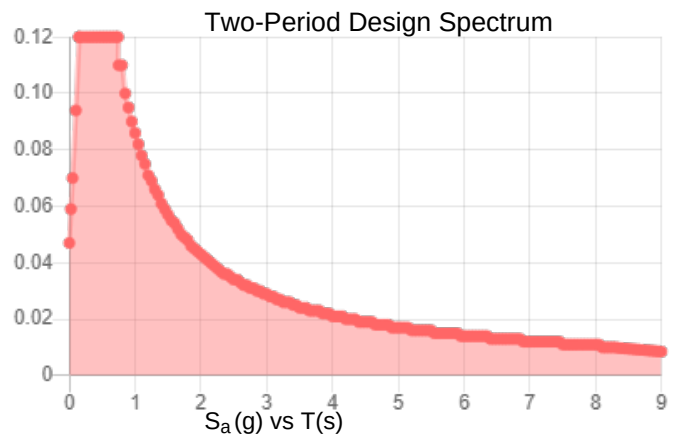
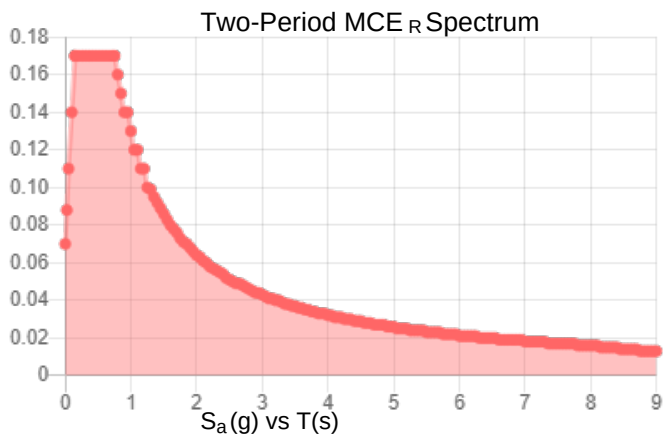
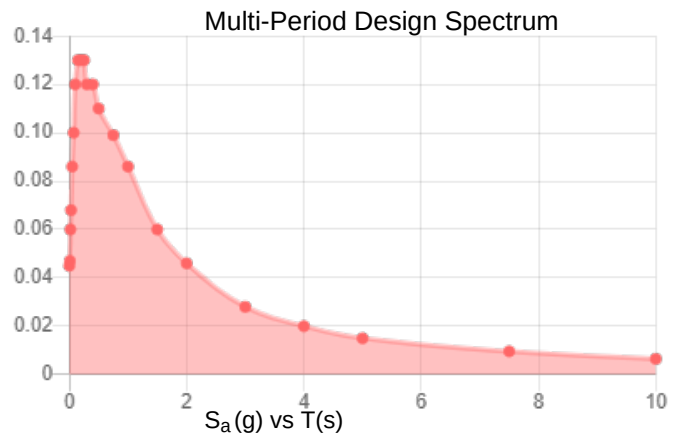
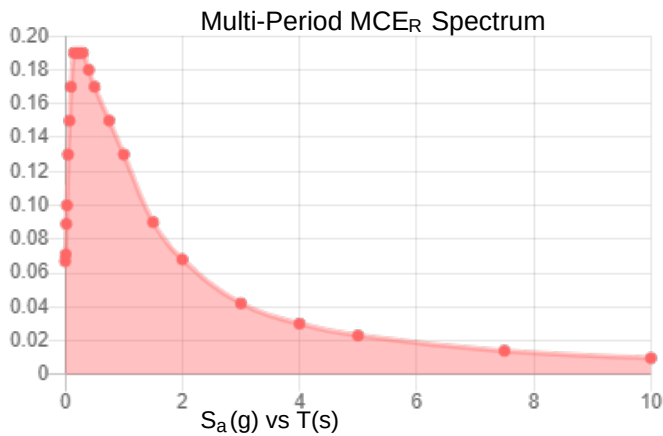
Site is in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2. Glazed openings need not be protected against wind-borne debris.

**Site Soil Class:** D - Stiff Soil

**Results:**

|                    |       |                    |      |
|--------------------|-------|--------------------|------|
| PGA <sub>M</sub> : | 0.063 | T <sub>L</sub> :   | 8    |
| S <sub>MS</sub> :  | 0.17  | S <sub>S</sub> :   | 0.14 |
| S <sub>M1</sub> :  | 0.13  | S <sub>1</sub> :   | 0.06 |
| S <sub>DS</sub> :  | 0.12  | V <sub>S30</sub> : | 260  |
| S <sub>D1</sub> :  | 0.086 |                    |      |

**Seismic Design Category: B**



MCE<sub>R</sub> Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

**Data Accessed:** Sun Feb 25 2024

**Date Source:**

**USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.**

---

**Results:**

|                         |     |
|-------------------------|-----|
| Ice Thickness:          | N/A |
| Concurrent Temperature: | N/A |
| 3-s Gust Speed          | N/A |

**Data Source:** Standard ASCE/SEI 7-22, Figs. 10-2 through 10-8

**Date Accessed:** Sun Feb 25 2024

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain for 250, 500, 1,000, and 1,400-year mean recurrence intervals along with concurrent 3-s gust speeds and concurrent air temperatures. The shading indicates special icing regions, with elevations above 2,100 ft (640 m) in the east, 6,000 ft (1829 m) in the west, and 1,600 ft (488 m) in Alaska, with sparse weather station data for determining design ice loads. In these regions, as well as in regions with complex terrain causing unusual icing conditions and regions where snow or in-cloud icing results in larger loads, the mapped values should be adjusted based on a combination of local historical records and experience, reanalysis data, and numerical weather prediction systems.

---

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Monopole Base Plate Connection

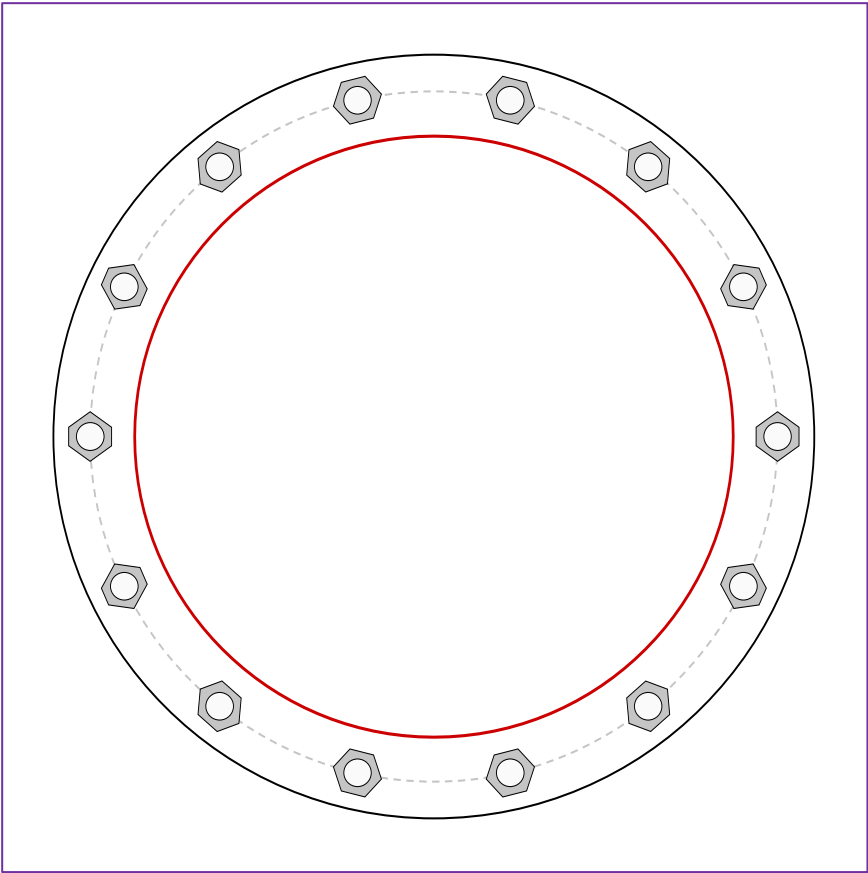


| Site Info |                  |
|-----------|------------------|
| BU #      | 825403           |
| Site Name | Little Gum Swamp |
| Order #   | 661290 Rev. 0    |

| Analysis Considerations |      |
|-------------------------|------|
| TIA-222 Revision        | H    |
| Grout Considered:       | No   |
| $I_{ar}$ (in)           | 0.75 |

| Applied Loads      |         |
|--------------------|---------|
| Moment (kip-ft)    | 1817.00 |
| Axial Force (kips) | 33.08   |
| Shear Force (kips) | 17.00   |

\*TIA-222-H Section 15.5 Applied



| Connection Properties                                                            |  | Analysis Results                                         |                                               |
|----------------------------------------------------------------------------------|--|----------------------------------------------------------|-----------------------------------------------|
| <b>Anchor Rod Data</b>                                                           |  | <b>Anchor Rod Summary</b> <i>(units of kips, kip-in)</i> |                                               |
| (14) 2-1/4" $\phi$ bolts (A615-75 N; $F_y$ =75 ksi, $F_u$ =100 ksi) on 56.25" BC |  | $P_{u\_t}$ = 108.32                                      | $\phi P_{n\_t}$ = 243.75 <b>Stress Rating</b> |
| <b>Base Plate Data</b>                                                           |  | $V_u$ = 1.21                                             | $\phi V_n$ = 149.1 <b>42.3%</b>               |
| 62.25" OD x 2.5" Plate (A572-60; $F_y$ =60 ksi, $F_u$ =75 ksi)                   |  | $M_u$ = n/a                                              | $\phi M_n$ = n/a <b>Pass</b>                  |
| <b>Stiffener Data</b>                                                            |  | <b>Base Plate Summary</b>                                |                                               |
| N/A                                                                              |  | Max Stress (ksi):                                        | 14.92 (Flexural)                              |
| <b>Pole Data</b>                                                                 |  | Allowable Stress (ksi):                                  | 54                                            |
| 49" x 0.375" 18-sided pole (A572-65; $F_y$ =65 ksi, $F_u$ =80 ksi)               |  | Stress Rating:                                           | <b>26.3%</b> <b>Pass</b>                      |

## Drilled Pier Foundation

|                   |                  |
|-------------------|------------------|
| BU # :            | 825403           |
| Site Name:        | Little Gum Swamp |
| Order Number:     | 661290 Rev. 0    |
| TIA-222 Revision: | H                |
| Tower Type:       | Monopole         |

| Applied Loads      |       |        |
|--------------------|-------|--------|
|                    | Comp. | Uplift |
| Moment (kip-ft)    | 1817  |        |
| Axial Force (kips) | 33    |        |
| Shear Force (kips) | 17    |        |

| Material Properties      |    |     |
|--------------------------|----|-----|
| Concrete Strength, f'c:  | 4  | ksi |
| Rebar Strength, Fy:      | 60 | ksi |
| Tie Yield Strength, Fyt: | 40 | ksi |

| Pier Design Data                             |       |    |
|----------------------------------------------|-------|----|
| Depth                                        | 22.83 | ft |
| Ext. Above Grade                             | 1.67  | ft |
| Pier Section 1                               |       |    |
| From 1.67' above grade to 22.83' below grade |       |    |
| Pier Diameter                                | 9.5   | ft |
| Rebar Quantity                               | 44    |    |
| Rebar Size                                   | 8     |    |
| Clear Cover to Ties                          | 3     | in |
| Tie Size                                     | 3     |    |
| Tie Spacing                                  | 12.5  | in |

[Rebar & Pier Options](#)

[Embedded Pole Inputs](#)

[Belled Pier Inputs](#)

| Analysis Results               |             |        |
|--------------------------------|-------------|--------|
| Soil Lateral Check             |             |        |
|                                | Compression | Uplift |
| D <sub>v=0</sub> (ft from TOC) | 8.58        | -      |
| Soil Safety Factor             | 2.70        | -      |
| Max Moment (kip-ft)            | 1963.91     | -      |
| Rating*                        | 46.9%       | -      |
| Soil Vertical Check            |             |        |
|                                | Compression | Uplift |
| Skin Friction (kips)           | 88.77       | -      |
| End Bearing (kips)             | 333.05      | -      |
| Weight of Concrete (kips)      | 209.99      | -      |
| Total Capacity (kips)          | 421.83      | -      |
| Axial (kips)                   | 242.99      | -      |
| Rating*                        | 54.9%       | -      |
| Reinforced Concrete Flexure    |             |        |
|                                | Compression | Uplift |
| Critical Depth (ft from TOC)   | 8.50        | -      |
| Critical Moment (kip-ft)       | 1963.86     | -      |
| Critical Moment Capacity       | 8287.70     | -      |
| Rating*                        | 22.6%       | -      |
| Reinforced Concrete Shear      |             |        |
|                                | Compression | Uplift |
| Critical Depth (ft from TOC)   | 17.60       | -      |
| Critical Shear (kip)           | 240.53      | -      |
| Critical Shear Capacity        | 1070.05     | -      |
| Rating*                        | 21.4%       | -      |

|                               |       |
|-------------------------------|-------|
| Structural Foundation Rating* | 22.6% |
| Soil Interaction Rating*      | 54.9% |

Min. Steel is assumed

\*Rating per TIA-222-H Section 15.5

| Soil Profile      |     |             |   |  |  |  |  |  |  |
|-------------------|-----|-------------|---|--|--|--|--|--|--|
| Groundwater Depth | 3.5 | # of Layers | 4 |  |  |  |  |  |  |

| Layer | Top (ft) | Bottom (ft) | Thickness (ft) | γ <sub>soil</sub> (pcf) | γ <sub>concrete</sub> (pcf) | Cohesion (ksf) | Angle of Friction (degrees) | Calculated Ultimate Skin Friction Comp (ksf) | Calculated Ultimate Skin Friction Uplift (ksf) | Ultimate Skin Friction Comp Override (ksf) | Ultimate Skin Friction Uplift Override (ksf) | Ult. Net Bearing Capacity (ksf) | SPT Blow Count | Soil Type    |
|-------|----------|-------------|----------------|-------------------------|-----------------------------|----------------|-----------------------------|----------------------------------------------|------------------------------------------------|--------------------------------------------|----------------------------------------------|---------------------------------|----------------|--------------|
| 1     | 0        | 3.5         | 3.5            | 117                     | 150                         | 0              | 0                           | 0.000                                        | 0.000                                          | 0.00                                       | 0.00                                         |                                 |                | Cohesionless |
| 2     | 3.5      | 6           | 2.5            | 54.6                    | 87.6                        | 0              | 0                           | 0.000                                        | 0.000                                          | 0.00                                       | 0.00                                         |                                 |                | Cohesionless |
| 3     | 6        | 12          | 6              | 54.6                    | 87.6                        | 0              | 31                          | 0.000                                        | 0.000                                          | 0.30                                       | 0.23                                         |                                 |                | Cohesionless |
| 4     | 12       | 22.83       | 10.83          | 54.6                    | 87.6                        | 0              | 29                          | 0.000                                        | 0.000                                          | 0.20                                       | 0.15                                         | 4.8                             |                | Cohesionless |



| Check Limitation                      |                                     |
|---------------------------------------|-------------------------------------|
| Apply TIA-222-H Section 15.5:         | <input checked="" type="checkbox"/> |
| N/A                                   | <input type="checkbox"/>            |
| Design Options                        |                                     |
| Input Effective Depths (else Actual): | <input type="checkbox"/>            |
| Consider non-tapered moment capacity: | <input type="checkbox"/>            |
| Check Shear along Depth of Pier:      | <input checked="" type="checkbox"/> |
| Utilize Shear-Friction Methodology:   | <input type="checkbox"/>            |
| Override Critical Depth:              | <input type="checkbox"/>            |

[Go to Soil Calculations](#)