MATANUSKA-SUSITNA BOROUGH
PLANNING COMMISSION AGENDA

Edna DeVries, Mayor

PLANNING COMMISSION
Doug Glenn, District 1
Richard Allen, District 2
C. J. Koan, District 3 - Chair
Andrew Shane, District 4 – Vice-Chair
Linn McCabe, District 5
Wilfred Fernandez, District 6
Curt Scoggin, District 7

Michael Brown, Borough Manager

PLANNING & LAND USE DEPARTMENT
Alex Strawn, Planning & Land Use Director
Maija DiSalvo, Planning Services Manager
Jason Ortiz, Development Services Manager
Fred Wagner, Platting Officer
Lacie Olivieri, Planning Clerk

Assembly Chambers of the
Dorothy Swanda Jones Building
350 E. Dahlia Avenue, Palmer

October 7, 2024
REGULAR MEETING
6:00 p.m.

Ways to participate in the meeting:

IN PERSON: You will have 3 minutes to state your oral comment.

IN WRITING: You can submit written comments to the Planning Commission Clerk at msb.planning.commission@matsugov.us.

Written comments are due at noon on the Friday prior to the meeting.

TELEPHONIC TESTIMONY:

- Dial 1-855-290-3803; you will hear "joining conference" when you are admitted to the meeting.
- You will be automatically muted and able to listen to the meeting.
- When the Chair announces audience participation or a public hearing you would like to speak to, press *3; you will hear, "Your hand has been raised."
- When it is your turn to testify, you will hear, "Your line has been unmuted."
- State your name for the record, spell your last name, and provide your testimony.

OBSERVE: observe the meeting via the live stream video at:

- https://www.facebook.com/MatSuBorough
- Matanuska-Susitna Borough - YouTube

I. CALL TO ORDER, ROLL CALL, AND DETERMINATION OF QUORUM

II. APPROVAL OF AGENDA

III. PLEDGE OF ALLEGIANCE

IV. CONSENT AGENDA

A. MINUTES
Regular Meeting Minutes: September 16, 2024

B. INTRODUCTION FOR PUBLIC HEARING: QUASI-JUDICIAL MATTERS

Resolution 24-30 A Conditional Use Permit In Accordance With MSB 17.67 — Tall Structures Including Telecommunications Facilities, Wind Energy Conversion Systems, And Other Tall Structures, For Six Meteorological Towers Up To 197 Feet Tall, Located On Little Mount Susitna, Within Township 15 North, Range 9 West, Section 5, Township 16 North, Range 9 West, Sections 16, 29, 32 And 33, And Township 16 North, Range 10 West, Section 13, Seward Meridian. (Applicant: Chad Allen For Little Mount Susitna Wind, LLC; Staff: Rick Benedict, Current Planner)

C. INTRODUCTION FOR PUBLIC HEARING: LEGISLATIVE MATTERS

Resolution 24-29 A Resolution Of The Matanuska-Susitna Brough Planning Commission Recommending Approval Of An Ordinance Amending MSB 17.73 To Clarify That Mobile Home Parks Are Not Permitted In The Matanuska-Susitna Borough. (Staff: Alex Strawn, Planning And Land Use Director)

V. COMMITTEE REPORTS

VI. AGENCY/STAFF REPORTS

VII. LAND USE CLASSIFICATIONS

VIII. AUDIENCE PARTICIPATION (*Three minutes per person, for items not scheduled for public hearing*)

IX. PUBLIC HEARING: QUASI-JUDICIAL MATTERS
Commission members may not receive or engage in ex-parte contact with the applicant, other parties interested in the application, or members of the public concerning the application or issues presented in the application.

X. PUBLIC HEARING: LEGISLATIVE MATTERS

Resolution 24-28 A Resolution Of The Matanuska-Susitna Borough Planning Commission Recommending Adoption Of The Fiscal Year (FY) 2026 Capital Improvement Program (CIP). (Staff: Alex Strawn, Planning And Land Use Director)

XI. CORRESPONDENCE & INFORMATION

XII. UNFINISHED BUSINESS

XIII. NEW BUSINESS

XIV. COMMISSION BUSINESS

A. Upcoming Planning Commission Agenda Items

XV. DIRECTOR AND COMMISSIONER COMMENTS

XVI. ADJOURNMENT (*Mandatory Midnight*)

Disabled persons needing reasonable accommodation in order to participate at a Planning Commission Meeting should contact the Borough ADA Coordinator at 861-8432 at least one week in advance of the meeting.

MINUTES

September 16, 2024

(Pages 5-8)

The Matanuska-Susitna Borough Planning Commission's regular meeting was held on September 16, 2024, at the Matanuska-Susitna Borough Assembly Chambers, 350 E. Dahlia Avenue, Palmer, Alaska. Chair CJ Koan called the meeting to order at 6:00 p.m.

I. CALL TO ORDER, ROLL CALL, AND DETERMINATION OF QUORUM

Planning Commission members present and establishing a quorum:
- Mr. Doug Glenn, Assembly District #1
- Mr. Richard Allen, Assembly District #2
- Ms. C. J. Koan, Assembly District #3
- Mr. Andrew Shane, Assembly District #4
- Ms. Linn McCabe, Assembly District #5
- Mr. Curt Scoggin, Assembly District #7
- Mr. Wilfred Fernandez, Assembly District #6*

Planning Commission members absent and excused were:

Staff in attendance:
- Mr. Alex Strawn, Planning and Land Use Director
- Ms. Lacie Olivieri, Planning Department Admin. Specialist/ Planning Commission Clerk
- Ms. Julie Spackman, Long Range Planner

*Indicates that the individual attended telephonically.

II. APPROVAL OF AGENDA

Chair Koan inquired if there were any changes or objections to approving the agenda.

GENERAL CONSENT: The agenda was approved without objection.

III. PLEDGE OF ALLEGIANCE

Commissioner Allen led the pledge of allegiance.

IV. CONSENT AGENDA

A. Minutes Regular Meeting Minutes: August 19, 2024

B. INTRODUCTION FOR PUBLIC HEARING: QUASI-JUDICIAL MATTERS

C. INTRODUCTION FOR PUBLIC HEARING: LEGISLATIVE MATTERS

Resolution 24-28 A Resolution of the Matanuska-Susitna Borough Planning Commission Recommending Adoption of the Fiscal Year (FY) 2026 Capital Improvement Program (CIP). (Staff: Rodney Fodge, Long Range Planner)

GENERAL CONSENT: The consent agenda was approved as written without objection.

V. COMMITTEE REPORTS - *(There were no committee reports.)*

VI. AGENCY/STAFF REPORTS - *(There were no Agency/Staff Reports.)*

VII. LAND USE CLASSIFICATIONS - *(There were no land use classifications.)*

VIII. AUDIENCE PARTICIPATION (Three minutes per person.)

(There were no persons to be heard.)

Audience Participation was closed without objection.

IX. PUBLIC HEARING: QUASI-JUDICIAL MATTERS

X. PUBLIC HEARING LEGISLATIVE MATTERS

Resolution 24-21 A Resolution of the Matanuska-Susitna Borough Planning Commission Recommending Adoption of Processes for Community Councils to Develop a Community Comprehensive Plan or Special Land Use District. (Staff: Julie Spackman, Long Range Planner) Chair Koan read the resolution title into the record.

Ms. Julie Spackman provided a staff report.

No questions from commissioners.

Chair Koan opened the public hearing.

The following persons spoke regarding Planning Commission Resolution 24-21:

Chad Emswiler*, Chris Chiavetta, Marshall Alexander, Esther Huddleston, John Nystrom, Karen Hoffman, Trudy Lorenzen, Craig Price, and Amy Read.

Chair Koan invited staff to respond to questions and statements from the audience.

Ms. Julie Spackman did not have anything to add.

There being no one else to be heard, Chair Koan closed the public hearing, and the discussion moved to the Planning Commission.

MOTION: Commissioner McCabe moved to approve Planning Commission Resolution 24-21. The motion was seconded by Commissioner Scoggin.

Discussion ensued

MOTION: Commissioner Allen moved a primary amendment to only recommend option 3. The motion was seconded by Commissioner Shane.

VOTE: The primary amendment passed unanimously.

VOTE: The main motion passed as amended with Commissioners Shane, Allen, McCabe, Glen, Scoggin, and Frenandez in favor and Commissioner Koan opposed.

XI. CORRESPONDENCE AND INFORMATION

(There was no correspondence and information.)

XII. UNFINISHED BUSINESS - *(There was no unfinished business.)*

XIII. NEW BUSINESS

XIV. COMMISSION BUSINESS

A. Upcoming Planning Commission Agenda Items (*Staff: Alex Strawn*)
(Commission Business was presented, and no comments were noted.)

XV. DIRECTOR AND COMMISSIONER COMMENTS

Mr. Alex Strawn: The planning commission has had two appeals; please do not discuss those cases. The planning department lost a long-range planner.

Commissioner Shane: Sorry about losing a planner.

Commissioner Allen: No Comment.

Commissioner Glen: No Comment.

Commissioner McCabe: Hunting season is almost over, go get your moose.

Commissioner Scoggin: No comment

Commissioner Koan: Good work tonight. Thank you staff for all that you do. Sorry you are losing a planner.

XVI. ADJOURNMENT

The regular meeting adjourned at 7:14 p.m.

____

C J KOAN
Planning Commission Chair

ATTEST:

LACIE OLIVIERI
Planning Commission Clerk

Minutes approved:

INTRODUCTION FOR PUBLIC HEARING
QUASI-JUDICIAL

Resolution No. 24-30

Little Mount Susitna Wind

(Pages 10-402)

INTRODUCTION FOR PUBLIC HEARING

MATANUSKA-SUSITNA BOROUGH

Planning and Land Use Department
Development Services Division

350 East Dahlia Avenue • Palmer, AK 99645
Phone (907) 861-7822 • Fax (907) 861-8158
Email: permitcenter@matsugov.us

RECEIVED
AUG 07 2024
Mat-Su Borough
Development Services

APPLICATION FOR A TALL STRUCTURE – MSB 17.67

Carefully read instructions and applicable borough code. Fill out forms completely. Attach information as needed. Incomplete applications will not be processed.

Application fee must be attached:
X **$1,500** for **Conditional Use Permit** - > 125 feet in height
_____**$ 500** for **Administrative Permit** – 85' to 125' in height
_____**$ 100** for **Network Improvement Permit** – In accordance with MSB 17.67.110.

Prior to the public hearing, the applicant must also pay the mailing and advertising fees associated with the application. Applicants will be provided with a statement of advertising and mailing charges. Payment must be made ***prior*** *to the application presentation before the Borough Planning Commission or Planning Director decision.*

Subject Property Township: _________, Range: ________, Section: _________, Meridian____
MSB Tax Account # S16N10W13, S16N09W16, S16N09W29, S16N09W33, S16N09W32
SUBDIVISION: STATE OF ALASKA BLOCK(S): _________, LOT(S): S15N09W05
STREET ADDRESS: ______________________
(US Survey, Aliquot Part, Lat. /Long. etc) ______________________

Ownership A *written authorization by the owner must be attached for an agent or contact person, if the owner is using one for the application.* Is authorization attached? X Yes o No o N/A

Name of Property Owner	**Name of Agent/ Contact for application**
State of Alaska, DNR	Chad Allen, Little Mount Susitna Wind LLC
Address: 550 7th Ave, 900c	Address: 125 High St, 17th Floor High St Suite 1705. Boston, MA 02110
Phne: Hm _______ Fax _______	Phne: Hm _______ Fax _______
Wk 907-269-5032 Cell _______	Work 207-210-1175 Cell _______
E-mail john.forbes@alaska.gov	E-mail _______

Special Land Use District *(if applicable)*: N/A

Pre-Application Requirements for New Tall Structures that Require a Conditional Use Permit

Prior to applying for a conditional use permit for a new tall structure, the applicant shall hold at least one community meeting.

1. The meeting shall be held at the nearest facility where community council meetings are regularly scheduled. If the facility is not available, the nearest available public facility that is capable of seating a minimum of 20 people shall be utilized.
2. The meeting shall be held at least 15 calendar days after mailing of the notification.
3. The meeting shall not start prior to 5:00 p.m. and no later than 7:00 p.m.
4. Notification of the meeting shall, at a minimum, include the following:
   - Legal description and map of the general parcel, or parcels, within the coverage area under consideration for the telecommunication facility.
   - Description of the proposed development including height, design, lighting, potential access to the site and proposed service.
   - Date, time, and location of the informational meeting.
   - Contact name, telephone number, and address of applicant.
   - Comment form created by the borough that has a comment submittal deadline and provides options for submitting comments.
5. At a minimum, the notification area for the meeting shall include the following:
   - Property owners within one-half mile of the parcels under consideration for the proposed tall structure.
   - The nearest community council and any community council whose boundary is within 1200 feet of the parcels under consideration for the tall structure.

A written report summarizing the results of the community meeting shall be prepared that includes the following information:	**Attached**
1. Dates and locations of all meetings where citizens were invited to discuss the potential applicant's proposal.	X
2. Content, dates mailed, and numbers of mailings, including letters, meeting notices, newsletters and other publications.	X
3. Sign-in sheet(s) used at the meeting, that includes places for names, address, phone numbers and other contact information such as e-mail addresses.	X
4. A list of residents, property owners, and interested parties who have requested in writing that they keep informed of the proposed development through notices, newsletters, or other written materials.	X
5. The number of people who attended meetings.	X
6. Copies of written comments received at the meeting.	X
7. A certificate of mailing identifying all who were notified of the meeting.	X
8. A written summary that addresses the following: • The substance of the public's written concerns, issues, and problems. • How the applicant has addressed, or intends to address, concerns, issues and problems expressed during the process. • Concerns issues, and problems the applicant has not addressed or does not intend to address and why.	X

General application requirements for <u>Administrative</u> and <u>Conditional Use</u> <u>Permits</u>	Attached
1. Design drawings for the proposed tall structure, drawn to scale, and certified by a registered engineer or architect.	X
2. Citizen participation report *(if applying for a Conditional Use Permit)*	X
3. Certified site plan *(As defined in MSB 17.125.010)*	X
4. Copy of a determination of no hazard to air navigation from the Federal Aviation Administration.	X
5. If breakpoint technology is intended to be utilized, a written statement specifying the height at which the engineered structural weakness will be located.	No breakpoint

In order to grant a <u>Conditional Use Permit</u> or <u>Administrative Permit</u> the Planning Commission or Planning Director must find that each of the following criteria has been met. Explain the following in detail:	Attached
1. To the extent that is technically feasible and potentially available, the location of the tall structure is such that its negative effects on the visual and scenic resources of all surrounding properties have been minimized.	X
2. Visibility of the tall structure from public parks, trails recognized within adopted MSB plans, and waterbodies has been minimized to the extent that is technically feasible and potentially available.	X
3. The tall structure will not interfere with the approaches to any existing airport or airfield that are identified in the MSB Regional Aviation System Plan or by the Alaska State Aviation System Plan.	X
4. That granting the permit will not be harmful to the public health, safety, convenience, and welfare.	X

Application requirements for a <u>Network Improvement Permit</u>	Attached
1. A description of the proposed modifications to the telecommunication tower, including a description of the height, type, and lighting of the new or modified structure and the existing structure.	N/A
2. A certified site *(as defined in MSB 17.125.010)* for purposes of setback verification.	N/A
3. Design drawings for the proposed modified or new structure, drawn to scale, and certified by a registered engineer or architect.	N/A

In order to grant a <u>Network Improvement Permit</u> the Planning Director must find that each of the following criteria has been met. Explain the following in detail.	Attached
1. The proposed development conforms to setback requirements of MSB 17.55.	N/A
2. The telecommunication tower being extended was lawfully constructed at the time of application for a Network Improvement Permit.	N/A
3. The proposed modification does not violate permit conditions of any valid permits that have been issued to the existing facility, provided that the condition being violated does not limit height of the structure.	N/A

Operation Standards for New Tall Structures – Conditional Use Permit, Administrative Permit, and Network Improvement Permit	**Attached**
1. The equipment compound shall meet minimum setback distances from all property lines in accordance with MSB 17.55	X
2. Setbacks shall be determined from the dimensions of the entire lot, even though the tower may be located on lease areas within the lot.	X
3. Adequate vehicle parking shall be provided on the subject property, outside of public use easements and rights-of-way to enable emergency vehicle access. No more than two spaces per provider shall be required.	X
4. Information signs for the purpose of identifying the tower such as the antenna structure registration number required by the Federal Communications Commission, as well as the party responsible for the operation and maintenance of the facility shall be visibly posted at the equipment compound.	X
5. If more than 220 volts are necessary for the operation of the facility, warning signs shall be located at the base of the facility and shall display in large, bold, high contrast letters the following: "HIGH VOLTAGE – DANGER".	N/A
6. A 24-hour emergency contact number shall be visibly posted at the equipment compound.	X
7. A fence or wall not less than six (6) feet in height with a secured gate shall be maintained around the base of the tower.	N/A

Additional Standards for Wind Energy Conversion Systems (WECS) – In addition to the operations standards for new tall structures, the following standards shall apply to WECS	**Attached**
1. WECS shall be equipped with an automatic overspeed control device designed to protect the system form sustaining structural failure such as splintered or thrown blades and the overturning or breaking of towers due to an uncontrolled condition brought on by high winds.	N/A
2. WECS shall have a manually operable method that assures the WECS can be brought to a safe condition in high winds. Acceptable methods include mechanical or hydraulic brakes or tailvane deflection systems which turn the rotor out of the wind.	N/A

OWNER'S STATEMENT: I am owner of the following property:

MSB Tax parcel ID #(s) ______________________________ and,
I hereby apply for approval conditional use permit on that property as described in this application.

I understand all activity must be conducted in compliance with all applicable standards of MSB _____ and with all other applicable borough, state or federal laws.

I understand that other rules such as local, state and federal regulations, covenants, plat notes, and deed restrictions may be applicable and other permits or authorization may be required. I understand that the borough may also impose conditions and safeguards designed to protect the public's health, safety and welfare and ensure the compatibility of the use with other adjacent uses.

I understand that it is my responsibility to identify and comply with all applicable rules and conditions, covenants, plat notes, and deed restrictions, including changes that may occur in such requirements.

I understand that this permit and zoning status may transfer to subsequent owners of this land and that it is my responsibility to disclose the requirements of this status to the buyer when I sell the land.

I understand that changes from the approved conditional use permit may require further authorization by the Borough Planning Commission. I understand that failure to provide applicable documentation of compliance with approved requirements, or violation of such requirements will nullify legal status, and may result in penalties.

I grant permission for borough staff members to enter onto the property as needed to process this application and monitor compliance. Such access will at a minimum, be allowed when the activity is occurring and, with prior notice, at other times necessary to monitor compliance.

The information submitted in this application is accurate and complete to the best of my knowledge.

Signature: Property Owner	Printed Name	Date
Michael U. Alvarez	Michael U. Alvarez	7/24/2024
Signature: Agent	**Printed Name**	**Date**
Legal		

MSB USE ONLY

Date application submitted:

Date application determined complete: ____________________

PERMIT CENTER – FEE RECEIPT FORM

Property Location: SOA Locations (DNR) Applicant: Little Mount Susitna Wind LLC

61.473061N, 150.988809W - 61.476704N, 150.895905W - 61.444640N, 150.927867W

61.429372N, 150.900878W

61.430890N, 150.916978W

61.421817N, 150.920003W

	USE PERMITS {100.000.000.341.300}	Fee
	8.35 Public Display of Fireworks	**$25.00**
	8.40.010 Liquor License - Alcohol & Marijuana Control Office (AMCO) Referrals for Matanuska Susitna Borough Review of Issuance, renewal or transfer (location, owner)	**$100.00**
	8.40.060 Liquor License Relocation	**$500.00**
	8.41.010 Marijuana License - Alcohol & Marijuana Control Office (AMCO) Referrals for Matanuska Susitna Borough Review of Issuance, renewal or transfer (location, owner)	**$100.00**
	8.52 Temporary Noise Permit	**$1000.00**
	8.55 Special Events Permit 500 – 1000 Attendees 1000+ Attendees **8.55** Special Events Permit Site Monitor Fee / Per Day	 **$500.00** **$1,000.00** **$300.00**
	17.02 Mandatory Land Use Permits Commercial	**$50.00**
	17.04 Nancy Lake Special Land Use District CUP	**$1,500.00**
	17.06 Electrical Generating & Delivery Facility Application	**$500.00**
	17.08 Hay Flats Special Land Use District Exception Application	**$1000.00**
	17.17 Denali State Park Conditional Use Permit	**$1500.00**
	17.18 Chickaloon Special Land Use District CUP	**$1500.00**
	17.19 Glacier View Special Land Use District CUP	**$1500.00**
	17.23 Port MacKenzie Development Permit	**$1000.00**
	17.25 Talkeetna Special Land Use CUP	**$1500.00**
	17.25 Talkeetna Conditional Use Permit – Variance	**$1500.00**
	17.27 Sutton Special Land Use District CUP	**$1500.00**
	17.29 Flood Damage Prevention Development Permit	**$100.00**
	17.29 Flood Damage Prevention Development Permit –Variance	**$500.00**
	17.30.040 Earth Materials Extraction Admin. Permit	**$1000.00**
	17.30.050 Earth Materials Extraction CUP	**$1500.00**
	17.36 Residential Planned Unit Development Application – Concept Plan – up to 50 Lots Additional Lots or tracts being created – Per Lot	 **$500.00** **$100.00**
	17.48 Mobile Home Park Application	**$500.00**
	17.52 Residential Land Use District App (Rezone)	**$1,000.00**
	17.52 Residential Land Use District CUP	**$1,500.00**
	17.55 Shoreline Setback Exception Application	**$300.00**
	17.60 Conditional Use Permit Application	**$1500.00**
	17.60 Transfer of Junkyard CUP	**$500.00**

	17.61 Commercial/Industrial Core Area Conditional Use Permit	**$1500.00**
	17.62 Coal Bed Methane Conditional Use Permits	**$1500.00**
	17.63 Racetracks Conditional Use Permit	**$1500.00**
	17.64 Waste Incinerator Conditional Use Permit	
	17.65 Variance	**$1500.00**
X	**17.67** Tall Structures - Network Improvement Permit Nonconforming Use Administrative Permit Conditional Use Permit	**$100.00** **$200.00** **$500.00** **$1500.00**
	17.70 Regulation of Alcoholic Beverage Conditional Use Permit	**$1500.00**
	17.73 Multi-Family Land Use Permit – add $25.00 for each additional unit beyond 5 units.	**$500.00**
	17.75 Single-Family Residential Land Use District CUP	**$1500.00**
	17.76 Large Lot Single-Family Residential Land Use District	**$1500.00**
	17.80 Nonconforming Structures (Amnesty) Pre-Existing Legal Nonconforming (Grandfather)	**$300.00** **$300.00**
	17.90 Regulation of Adult Businesses – Conditional Use Permit	**$1500.00**

	RIGHT-OF-WAY FEES:	
	Driveway	**$50.00**
☐	Driveway Deposit {100.226.100}	**$150.00**
	Construction	**$200.00**
	Utility (Application Fee = $100 ~ Distance Fee $0.25/per lineal foot)	
	Encroachment	**$150.00**
	Construction Bond {100.227.000}	

	PLATTING PRE-APPLICATION CONFERENCE:	
	Pre-Application Fee	**$50.00**

	FEES:	
	Flood Plain Development Survey CD	**$10.00**
	CD/DVD/DVD-R	**$7.50**
	Construction Manual/Title 43	**$5.00**
	Plat Map/Tax Map Copies/Mylar	**$5.00**
	Color Maps	**$12.00**
	Xerox Copies (B/W = $0.25 ~ Color $1.00/page 11X17 Color $1.75/page)	
	Advertising Fees	
	Cultural Resources Books or Maps	
☐	Citation Payment (If sent to collections – use total due from Courtview)	
	Thumb Drive 8GB = $10; 16GB = $15; 32GB = $20	

$ 1,500.00 **Amount Paid** **Date:** 8/7/2024 **Receipt #** 92022536 **By:** [illegible]

check #001501

Revised: 11/28/23

Matanuska Susitna Borough

Payment Date Friday, August 9, 2024
Deposit Number 54394
Operator thom1274

Real 2024 (Total) $0.00
MCR (Planning/Platting) $1,500.00
Misc Rec
Tax Map # 2MISC

Total Paid $1,500.00
Check $1,500.00
Change $0.00

Receipt Number msb92022538
8/9/2024 10:19:09 AM
Paid By LONGROAD DEVELOPMENT CO
Cashier Id. thom1274

v

From: Faith Tyson
To: Rick Benedict
Cc: Matthew Perkins; Andrew McDonnell; Jeff Armbruster; Chad Allen
Subject: Re: LMSW - Tall Tower CUP Application & Materials
Date: Tuesday, August 27, 2024 11:17:23 AM
Attachments: CUP Nearest Trail.png
20240701_NRG 60m Super XHD Std Footprint Met Towers_LMS 105 thru LMS 110_Alaska Drawings_S&S_070124_noparking.pdf
20240701_NRG 50m XHD Std Footprint Met Towers_LMS 105 thru LMS 110_Alaska Drawings_S&S_070124_noparking.pdf

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[**EXTERNAL EMAIL** - CAUTION: Do not open unexpected attachments or links.]
Hi Rick,

Thanks for getting this over! Please find the responses below.

1. MSB 17.67.080(B)(2) requires the commission to consider whether the proposed towers will
be visible from public parks.
a. The application does not identify the nearest public park to the proposed towers, and/or whether any of the proposed towers will be visible from that park. Provide a narrative clarifying this subject.
Given the remote locations, the proposed towers are not expected to be visible from any Matanuska Susitna Borough public park (all more than 30 miles away). The nearest "trail" is on Mount Susitna, at a distance of 4.7 miles from the nearest proposed tower (see attached map). The towers may be marginally visible from these distances in weather and lighting conditions that offer excellent visibility, but given their small diameter and the distances involved, it is unlikely that a casual observer will notice them on the landscape.

2. MSB 17.67.090(B)(1) requires a minimum of two parking spaces for emergency vehicle access.
a. Two parking spaces are reflected on the provided site plans; however, the application narrative indicates that no parking will be provided due to the remoteness of the locations.
b. Remove the proposed parking spaces from the site plans and provide a narrative addressing how emergency vehicles and personnel can access the site.
The parking spaces have been removed, and updated site plans are attached. If emergency personnel are required on the tower sites, the sites can be accessed by helicopter. Landing sites are readily available on the open tundra adjacent to all towers. On-site personnel will be trained to direct emergency helicopters to an appropriate landing spot.

3. Provide a narrative detailing the timeline for the erection of each of the six proposed towers.
a. Explain whether the locations identified in the application are final or approximate.
b. If approximate, describe the maximum distance from each proposed tower location. It may help to provide a map identifying the radius of the area of consideration that will not exceed for the installation of each of the six proposed towers.

Under this permit, we plan to install up to six towers in total, with up to two of those installed in 2024, and any remaining towers in 2025. This schedule is approximate and may be subject to changes based on operational needs.

Tower Locations: The tower sites are approximate and will be finalized when taking into account ground conditions during the installation process. The towers may be sited anywhere within their respective PLSS section boundaries, while respecting a one tower- height setback from the PLSS section boundaries. Visuals of the intended locations and the surrounding section boundaries within which the tower will be located are displayed in the engineer's site plans.

4. MSB 17.67.050(B) requires specific criteria be described in a written report in the application
submittal to summarize the results of the community meeting:
a. Summarize the public notification content, dates mailed, and numbers of mailings, including letters, meeting notices, newsletters, and other publications.
b. A list of residents, property owners, and interested parties who have requested in writing that they be kept informed of the proposed development through notices, newsletters, or other written materials.
c. A written summary that addresses the following:
i. The substance of the public's written concerns, issues, and problems.
ii. How the applicant has addressed, or intends to address, concerns, issues, and problems expressed during the process; and
iii. Concerns, issues, and problems
In the dropbox folder that was originally submitted, there is a subfolder titled Community Meeting Materials—the specific criteria of MSB 17.67.050(B) are addressed in the report.

If more questions arise, please feel free to reach out. Thank you!

/ft

On Thu, Aug 22, 2024 at 6:01 PM Rick Benedict <Rick.Benedict@matsugov.us> wrote:

> Good afternoon all,
>
> I have attached a request for additional information for you. If you have any questions, please contact me.
>
> Respectfully,
>
> Rick Benedict – Current Planner
>
> Development Services Division
>
> Matanuska-Susitna Borough
>
> (907)861-8527 direct

From: Faith Tyson <faith@alaskarenewables.com>
Sent: Wednesday, August 7, 2024 9:54 AM
To: Rick Benedict <Rick.Benedict@matsugov.us>
Cc: Peggy Horton <Peggy.Horton@matsugov.us>; Chad Allen <chad.allen@longroadenergy.com>; Andrew McDonnell <andrew@alaskarenewables.com>; Jeff Armbruster <jeff.armbruster@longroadenergy.com>; Matthew Perkins <matt@alaskarenewables.com>
Subject: Re: LMSW - Tall Tower CUP Application & Materials

[**EXTERNAL EMAIL** - CAUTION: Do not open unexpected attachments or links.]

Goodmorning Rick, happy Wednesday!

I wanted to reach out to you and let you know that the check was mailed from the PNW last Friday. The check number is 1501, and it is from Longroad Development Company. Could you confirm that you've received it?

Additionally, I wanted to follow up and see if you would be interested in meeting to review the application in depth with us. If so, please send some dates and times that work for you in the next week or so.

Talk soon!

/ft

On Tue, Jul 30, 2024 at 10:52 AM Faith Tyson <faith@alaskarenewables.com> wrote:

> Hi Rick!
>
> Happy Tuesday. The application was paid by check - the purchase order was just approved, so the check will be mailed on Thursday!

Best,

Faith

/ft

On Mon, Jul 29, 2024 at 12:49 PM Rick Benedict <Rick.Benedict@matsugov.us> wrote:

> Hello Faith,
>
> How was the application fee paid? I don't see a payment in our transaction history for online payments. If paid through the Borough's online portal, do you know who made the payment, the date, and the amount? I will conduct another search once I have more information.
>
> Respectfully,
>
> Rick Benedict – Current Planner
>
> Development Services Division
>
> Matanuska-Susitna Borough
>
> (907)861-8527 direct
>
> ---
>
> **From:** Faith Tyson <faith@alaskarenewables.com>
> **Sent:** Thursday, July 25, 2024 1:54 PM
> **To:** Peggy Horton <Peggy.Horton@matsugov.us>; Rick Benedict <Rick.Benedict@matsugov.us>
> **Cc:** Chad Allen <chad.allen@longroadenergy.com>; Andrew McDonnell <andrew@alaskarenewables.com>; Jeff Armbruster <jeff.armbruster@longroadenergy.com>; Matthew Perkins <matt@alaskarenewables.com>
> **Subject:** LMSW - Tall Tower CUP Application & Materials

[**EXTERNAL EMAIL** - CAUTION: Do not open unexpected attachments or links.]

Dear Peggy & Rick,

I am writing you to officially submit a Tall Tower CUP application on behalf of Little Mount Susitna Wind LLC. Due to the size of files, I have compiled all documents in a dropbox link for download. The application fee was processed on our end as of yesterday. Please reach out with any questions or concerns. We are looking forward to working with you all!

Best,

Faith Tyson (she/they)

Community Engagement and Accountability Manager

Alaska Renewables LLC

[c] +1-907-202-0507 [e] faith@alaskarenewables.com

Alaska Renewables LLC occupies the ancestral, traditional, and contemporary lands of Alaska Native people that have resided, occupied, and called this land home. I recognize the historic Indigenous individuals and communities who live here now and those who were forcibly removed from their homes. In offering this land acknowledgement, I affirm Indigenous sovereignty, history and experiences.

Conditional Use Permit Request for Remote Meteorological Towers on Little Mount Susitna

Little Mount Susitna Wind LLC

Little Mount Susitna Wind LLC seeks a Conditional Use Permit for up to six temporary meteorological tower installations at sites on a remote plateau (Little Mount Susitna) in the far southwest corner of the Matanuska Susitna Borough. The purpose of these installations is to allow for the quantitative assessment of the wind resources in order to enable the development of a future utility-scale wind energy generation project that would provide reliable, low-cost renewable energy to Southcentral Alaska.

Proposed Locations:

Site Name	Lat/Lon (WGS84)	Elevation (ft)	MTRS
LMS_Met_5	61.473061N, 150.988809W	2466	S016N010W13
LMS_Met_6	61.476704N, 150.895905W	2200	S016N009W16
LMS_Met_7	61.444640N, 150.927867W	2339	S016N009W29
LMS_Met_8	61.429372N, 150.900878W	1934	S016N009W33
LMS_Met_9	61.430890N, 150.916978W	2037	S016N009W32
LMS_Met_10	61.421817N, 150.928003W	1903	S015N009W05

The meteorological towers will each consist of a Super 60m XHD TallTower manufactured by NRG Systems consisting of 8-10 inch diameter tube sections and six levels of supporting guy wires. The tower has FAA-compliant industrial paint, guy guards, and marker balls. Because it is below the 200 ft height requirement for FAA lighting, the tower does not have a light on it. This tower model is designed for the wind resource assessment industry and is engineered specifically for harsh climates like Alaska with wind and ice load limits that meet the ANSI/TIA-222-G Standard.

Little Mount Susitna Wind LLC has engaged a number of experts including NRG Systems (tower manufacturer), RESPEC (engineering feasibility and design), Northern Geotechnical Engineering (anchoring geotechnical assessment), Alaska Line Builders (anchor and tower installation), V3 Energy LLC and Lou Bowers (meteorological consultants), and KB Energy (qualified NRG Super-60 installer), as well as a number of Mat-Su based helicopter operators including Heli Alaska, Soloy, Pollux, and Northern Pioneer in order to ensure a safe, well-designed, and reliable meteorological tower installation at this challenging and remote location.

A stamped engineering analysis and report is attached, along with the required site plans, all stamped by an engineer authorized to do so in Alaska.

The tower sites are located on lands managed by the State of Alaska. The tower installations were permitted by the Department of Natural Resources under LAS 34057.

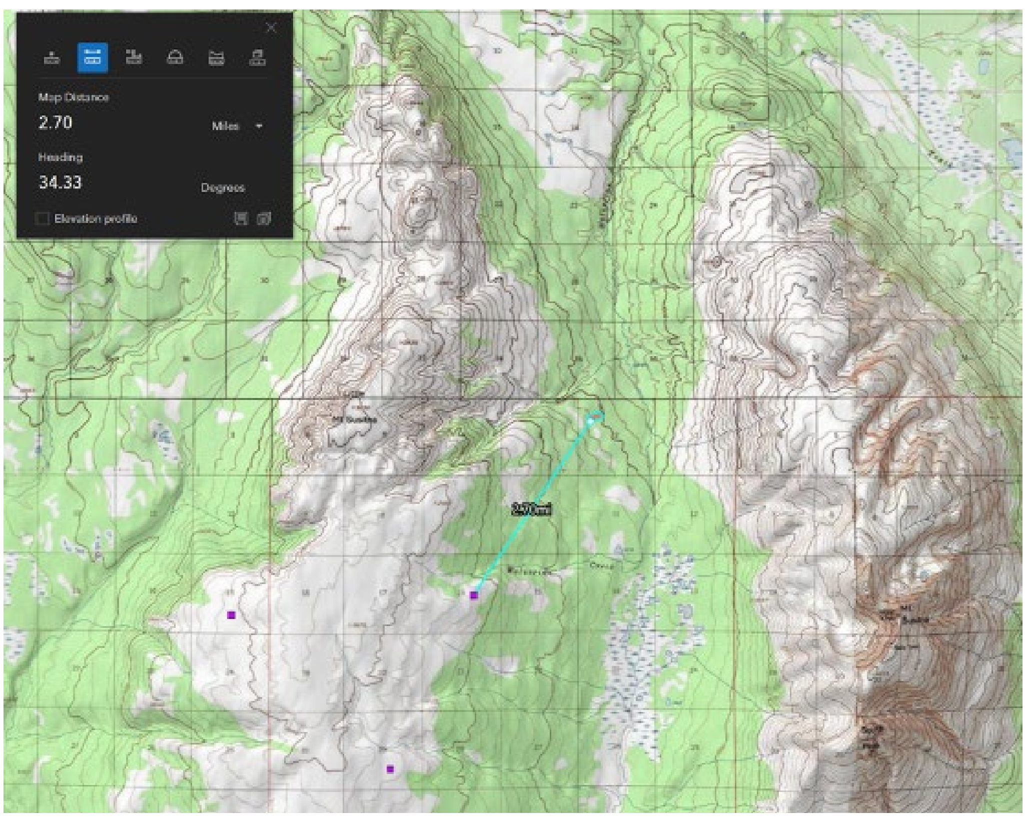
The Conditional Use Permit for Tall Towers requires a pre-application community meeting to be held at the facility where community council meetings are held. Notifications for the meeting are required to be delivered to property owners within one-half mile of the tower site and the nearest community council and any community council whose boundary is within 1200 feet of the tower site. The tower sites are over 2.75 miles from the nearest private parcel, and 19 miles from the nearest active community council (Willow) boundary. Using the contact information provided by MSB, we notified the nearest land owners.

The community meeting was held on June 3rd, 2024 at 5:30 pm. The gathering took place at the Willow Area Community Center, located at 69 Parks Highway, Willow, AK 99688. The written report is attached.

Responses to Specific Criteria:

1. To the extent that is technically feasible and potentially available, the location of the tall structures is such that its negative effects on the visual and scenic resources of all surrounding properties have been minimized.

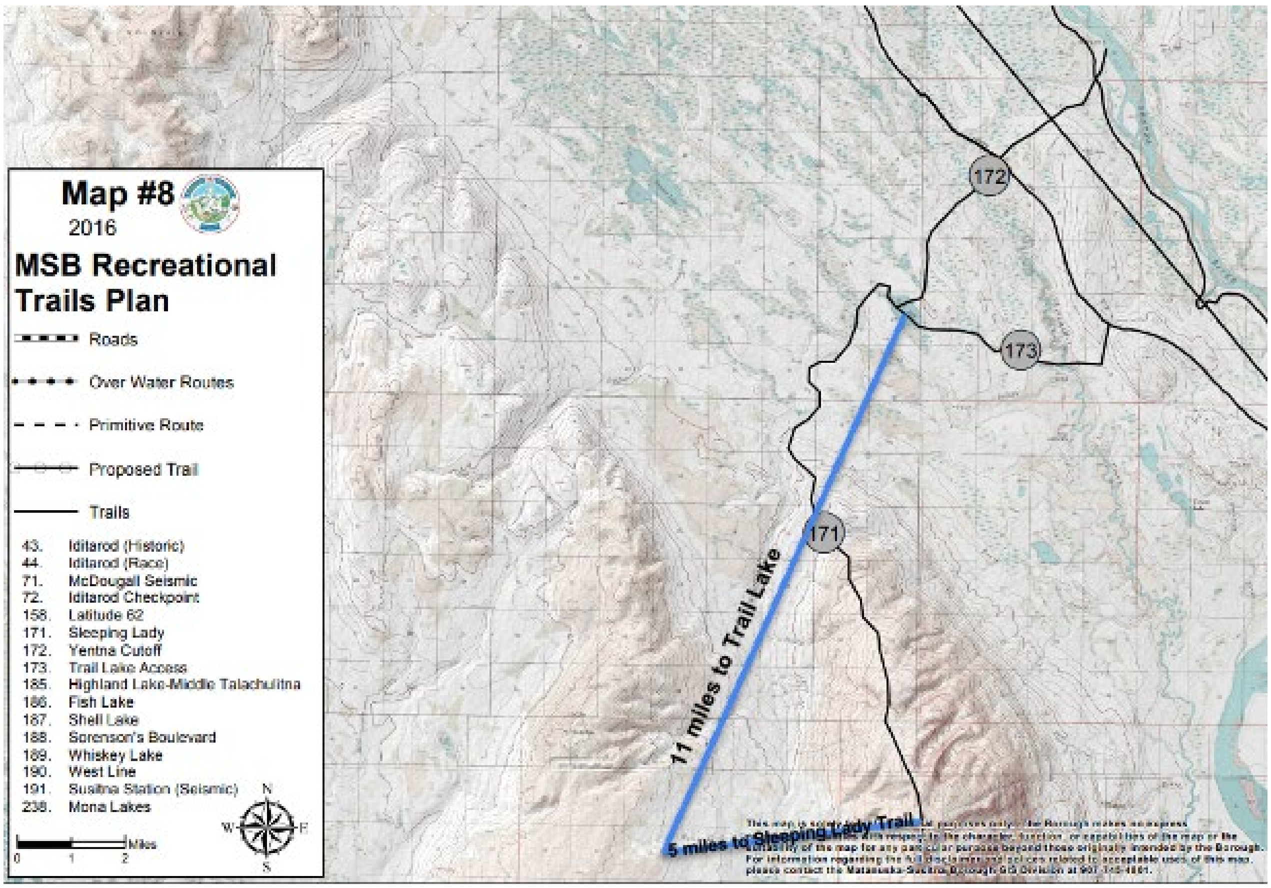
The towers are not expected to have any significant visual impacts for surrounding properties. The nearest property is 2.7 miles away from the northernmost tower site, and is not expected to be visible from this location. One tower may be visible from Trail Lake at a distance of over 11 miles.



2. Visibility of the tall structure from public parks, trails recognized within adopted MSB

plans, and waterbodies has been minimized to the extent that is technically feasible and potentially available.

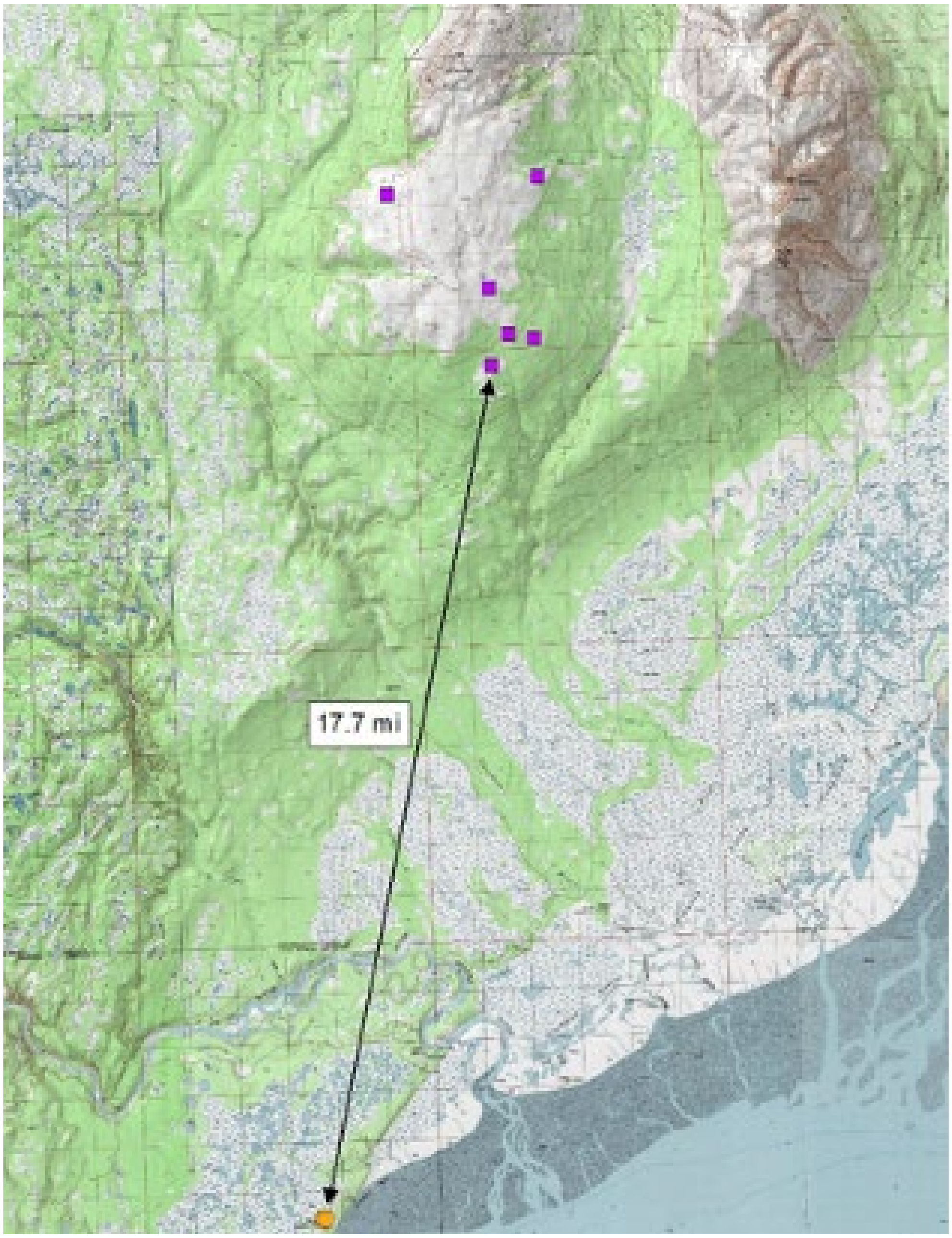
Given that the tower diameter is only 8-10 inches, but does carry high visibility paint and marker balls for aviation safety, the tower is estimated to be visible to casual observers at distances up to approximately 5 miles. Given this, the towers are not expected to have any visual impacts for any public parks, trails, or waterbodies, as there are none within this range of visibility for these remote towers.



Map illustrating the distances of 5 miles and 11 miles from the northernmost tower location to the nearest trail (Sleeping Lady and named lake (Trail Lake), respectively.

3. The tall structure will not interfere with the approaches to any existing airport or airfield that are identified in the MSB Regional Aviation System Plan or by the Alaska State Aviation System Plan.

There are no nearby airfields and the tower installations are outside of the study area for the MSB Regional Aviation System Plan. The tower sites and specifications were evaluated with the FAA Notice Criteria Tool which found that the structure does not exceed notice criteria.



The nearest airport is the Beluga, 17.77 miles away from the nearest proposed meteorological tower.

4. That granting the permit will not be harmful to the public health, safety, convenience, and welfare.

Given the remote nature of the towers, very few members of the public will even be aware that the towers exist. They will not be harmful to public health, safety, convenience or welfare, especially given their remote nature. The most relevant impact is for remote bush pilots that will have to avoid the tower if navigating in the area of Little Mount Susitna. For these purposes, the tower and its guy wires have been marked with FAA compliant paint, guy guards, and marker balls.

At the base of the towers there will be a power supply shelter that will hold power supply electronics (PV modules, batteries, methanol or propane fuel cell, and data logger box) that will be fenced and locked with a padlock. Contact information markings will be added to the power supply shelter and tower.

No parking will be provided due to the remote nature of the locations.

Attached are other supporting documents such as the DNR Land Use Permit, Written Community Meeting Report, Site Drawings, Maps, and others.

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Natural Resources

DIVISION OF MINING, LAND & WATER
Southcentral Regional Land Office

550 W. 7th Ave., Suite 900C
Anchorage, Alaska 99501-3577
Main: (907) 269-8503
TTY: 711 or 880.770.8973
Fax: (907) 269-8913

LAND USE PERMIT
AS 38.05.850

PERMIT # LAS 34057

Little Mount Susitna Wind LLC herein known as the Grantee, is issued this permit from the Department of Natural Resources, herein known as the Grantor, authorizing the use of state land within:

Legal Description:

- LMS_101: Section 19, Township 16 North, Range 9 West, Seward Meridian 61.4639N, 150.9664W
- LMS_102: Section 8, Township 16 North, Range 9 West, Seward Meridian 61.4863N, 150.9399W
- LMS_103: Section 32, Township 17 North, Range 9 West, Seward Meridian 61.5134N, 150.9352W
- LMS_104: Section 25, Township 16 North, Range 10 West, Seward Meridian 61.4434N, 150.9928W
- LMS_105: Section 13, Township 16 North, Range 10 West, Seward Meridian 61.473061N, 150.988809W
- LMS_106: Section 16, Township 16 North, Range 9 West, Seward Meridian 61.476704N, 150.895905W
- LMS_107: Section 29, Township 16 North, Range 9 West, Seward Meridian 61.444640N, 150.927867W
- LMS_108: Section 33, Township 16 North, Range 9 West, Seward Meridian 61.429372N, 150.900878W
- LMS_109: Section 32, Township 16 North, Range 9 West, Seward Meridian 61.430890N, 150.916978W
- LMS_110: Section 5, Township 15 North, Range 9 West, Seward Meridian 61.421817N, 150.928003W

This permit is issued for the purpose of authorizing the following:

The temporary placement of up to ten meteorological towers (met towers) on state lands atop Little Mount Susitna to gather meteorological data and on-site wind conditions. Each tower is between 60 - 80 meters in height and is supported by three sets of guy wires at different intervals. Each tower and co-located LIDAR unit requires a footprint of up to five acres. Brush clearing will be kept to a minimum, but would not exceed five acres at each site.

This permit is for the term beginning **June 15, 2022** and ending **June 14, 2027** unless sooner terminated at the state's discretion, effective the date of signature by the Authorized State Representative. This permit does not convey an interest in state land and as such is revocable, with or without cause. The Grantor will give 30 days' notice before revoking a permit at will. A revocation for cause is effective immediately. No preference right for use or conveyance of the land is granted or implied by this authorization.

This permit is issued subject to the following:

- Remittance of a performance guaranty in the amount of $5,000.00 as required in the stipulations below.
- Proof of insurance as described in stipulations below.
- Payment of the annual use fee in the amount of $1,560.00 per each 5-acre met-tower site, due on or before the annual anniversary date and any additional fees identified in the stipulations below.

The non-receipt of a courtesy billing notice does not relieve the Grantee from the responsibility of paying fees on or before the due date.

All activities shall be conducted in accordance with the following stipulations:

1. **Authorized Officer:** The Authorized Officer (AO) for the State of Alaska (State), Department of Natural Resources (DNR), Division of Mining, Land and Water (DMLW), is the Regional Manager or designee.

2. **Change of Contact Information:** The Grantee shall maintain current contact information with the AO. Any change of contact information must be submitted in writing to the AO.

3. **Valid Existing Rights:** This authorization is subject to all valid existing rights and reservations in and to the authorized area. The State makes no representations or warranties, whatsoever, either expressed or implied, as to the existence, number, or nature of such valid existing rights.

4. **Preference Right:** No preference right for subsequent authorizations is granted or implied by this authorization.

5. **Inspections:** The AO shall have reasonable access to the authorized area for inspection, which may be conducted without prior notice. If the Grantee is found to be in noncompliance the authorized area may be subject to reinspection. The Grantee may be charged for actual expenses of any inspection.

6. **Public Access:** The construction, operation, use, and maintenance of the authorized area shall not interfere with public use of roads, trails, waters, landing areas, and public access easements. The ability to use or access state land or public waters may not be restricted in any manner. However, if a specific activity poses a safety concern, the AO may allow the restriction of public access for a specific period of time. The Grantee is required to contact the AO in advance for approval. No restriction is allowed unless specifically authorized in writing by the AO.

7. **Public Trust Doctrine:** This authorization is subject to the principles of the Public Trust Doctrine regarding navigable or public waters which guarantees public access to, and the public right to use, navigable and public waters and the land beneath them for navigation, commerce, fishing, and other purposes. The AO reserves the right to grant other interests consistent with the Public Trust Doctrine.

8. **Alaska Historic Preservation Act:** The Alaska Historic Preservation Act, AS 41.35.200, prohibits the appropriation, excavation, removal, injury, or destruction of any state owned historic, prehistoric, archaeological or paleontological site without written approval from the DNR Commissioner. Should any sites be discovered, the Grantee shall cease any activities that may cause damage and immediately contact the AO and the Office of History and Archaeology in the Division of Parks and Recreation.

9. **Compliance with Government Requirements:** The Grantee shall, at its expense, comply with all federal, state, and local laws, regulations, and ordinances directly or indirectly related to this authorization. The Grantee shall ensure compliance by its employees, agents, contractors, subcontractors, licensees, or invitees.

10. **Incurred Expenses:** The Grantor shall in no way be held liable for expenses incurred by the Grantee connected with the activities directly or indirectly related to this authorization.

11. **Waiver of Forbearance:** Any failure on the part of the AO to enforce the terms of this authorization, or the waiver of any right under this authorization by the Grantee, unless in writing, shall not discharge or invalidate the authorization of such terms. No forbearance or written waiver affects the right of the AO to enforce any terms in the event of any subsequent violations of terms of this authorization.

12. **Severability Clause:** If any clause or provision of this authorization is, in a final judicial proceeding, determined illegal, invalid, or unenforceable under present or future laws, then the Grantor and the Grantee agree that the remainder of this authorization will not be affected, and in lieu of each clause or provision of this authorization that is illegal, invalid, or unenforceable, there will be added as a part of this authorization a clause or provision as similar in terms to the illegal, invalid, or unenforceable clause or provision as may be possible, legal, valid, and enforceable.

13. **Permit Extensions/Reissuance:** Any request for permit extension or reissuance should be submitted at least 90 days prior to the end of the authorized term. A written statement requesting a one-year extension confirming there will be no changes to the development/operations plan, including photographs clearly depicting the current condition of the site and any improvements, must be submitted to the AO with any required filing fee. A new Land Use Permit application and any required filing fee is required when requesting reissuance of up to five years or for modifications to the approved development/operations plan on file with DMLW.

14. **Assignment:** This permit may not be transferred or assigned.

15. **Reservation of Rights:**
    a. The AO reserves the right to grant additional authorizations to third parties for compatible uses on or adjacent to the land under this authorization.

b. Authorized concurrent users of state land, their agents, employees, contractors, subcontractors, and licensees, shall not interfere with the operation or maintenance activities of each user.
c. The AO may require authorized concurrent users of state land to enter into an equitable operation or maintenance agreement.

16. **Violations:** A violation of this authorization is subject to any action available to the State for enforcement and remedies, including revocation of the permit, civil action for forcible entry and detainer, ejectment, trespass, damages, and associated costs, or arrest and prosecution for criminal trespass in the second degree. The State may seek damages available under a civil action, including restoration damages, compensatory damages, and treble damages under AS 09.45.730 or AS 09.45.735 for violations involving injuring or removing trees or shrubs, gathering geotechnical data, or taking mineral resources.

17. **Directives:** Directives may be issued for corrective actions that are required to correct a deviation from design criteria, project specifications, stipulations, State statutes or regulations. Work at the area subject to the Directive may continue while implementing the corrective action. Corrective action may include halting or avoiding specific conduct, implementing alternative measures, repairing any damage to state resources that may have resulted from the conduct, or other action as determined by DNR.

18. **Stop Work Orders:** Stop Work Orders may be issued if there is a deviation from design criteria, project specifications, stipulations, State statutes or regulations and that deviation is causing or is likely to cause significant damage to state resources. Under a Stop Work Order, work at the area subject to the Stop Work Order may not resume until the deviation is cured and corrective action is taken. Corrective action may include halting or avoiding specific conduct, implementing alternative measures, repairing any damage to state resources that may have resulted from the conduct, or other action as determined by DNR.

19. **Notification of Discharge:** Notification of Discharge: The Grantee shall immediately notify the Department of Environmental Conservation (DEC) and AO of any unauthorized discharge of oil to water, any discharge of hazardous substances (other than oil), and any discharge of oil greater than 55 gallons on land. All fires and explosions must also be reported immediately. If a discharge, including a cumulative discharge, of oil is greater than 10 gallons but less than 55 gallons, or a discharge of oil greater than 55 gallons is made to an impermeable secondary containment area, the Grantee shall report the discharge within 48 hours. Any discharge of oil greater than one gallon up to 10 gallons, including a cumulative discharge, solely to land, must be reported in writing on a monthly basis.
Notification of discharge during normal business hours must be made to the nearest DEC Area Response Team: Anchorage (907) 269-3063, fax (907) 269-7648; Fairbanks (907) 451-2121, fax (907) 451-2362; Juneau (907) 465-5340, fax (907) 465-5245. To report a spill outside of normal business hours, call toll free 1-800-478-9300 or international 1-907-269-0667.
Notification of discharge must be made to the appropriate DNR Office, preferably by e-mail: Anchorage email dnr.scro.spill@alaska.gov, (907) 269-8528; Fairbanks email dnr.nro.spill@alaska.gov, (907) 451-2739; Juneau email sero@alaska.gov, (907) 465-3513. The Grantee shall supply the AO with all incident reports submitted to DEC.

20. **Batteries:** Batteries which contain hazardous liquids should be completely sealed valve regulated, spill-proof, leak-proof and mounted in an appropriate container. Batteries lacking the preceding properties must have an appropriate drip pan designed to hold 110% of the total

liquids held by the battery/batteries. Batteries, new or used, may not be stored or warehoused. Any battery/batteries that are not in use must be removed and disposed of in accordance with existing federal, state and local laws, regulations and ordinances. All hazardous material containers shall be marked with the Grantee's or contractor's name, dated, and transported in accordance with 49 CRF 172 (EPA Hazardous Material Regulations) and 18 AAC 62.

21. **Returned Check Penalty:** A returned check penalty of $50.00 will be charged for any check on which the bank refuses payment. Late payment penalties shall continue to accrue.

22. **Late Payment Penalty Charges:** The Grantee shall pay a fee for any late payment. The amount is the greater of either $50.00 or interest accrued daily at the rate of 10.5% per annum and will be assessed on each past-due payment until paid in full.

23. **Use Fees:** The Grantee shall pay to DMLW an annual use fee of $1,560.00 for each tower deployed. The use fee is due on or before the annual anniversary of the effective date of this permit without the necessity of any billing by DMLW. The annual use fee is subject to adjustments in any relevant fee schedule.

24. **Request for Information:** The AO, at any time, may require the Grantee to provide any information directly or indirectly related to this authorization, in a manner prescribed by the AO.

25. **Completion Report:** A completion report shall be submitted prior to relinquishment, or within 30 days after expiration or termination of the authorization. Failure to submit a satisfactory report subjects the site to a field inspection requirement for which the Grantee may be assessed an inspection fee, as outlined herein. The report shall contain the following information:
    a. a statement of restoration activities and methods of debris disposal;
    b. a statement that the Grantee has removed all improvements and personal property from the authorized area;
    c. a report covering any known incidents of damage to the vegetative mat and underlying substrate, and follow-up corrective actions that may have taken place while operating under this authorization;
    d. and, photographs of the permitted site taken before, during and after the proposed activity to document permit compliance. Photographs must consist of a series of aerial view or ground-level view photographs that clearly depict compliance with site cleanup and restoration guidelines;

26. **Site Disturbance:** Site disturbance shall be kept to a minimum to protect local habitats. All activities at the site shall be conducted in a manner that will minimize the disturbance of soil and vegetation and changes in the character of natural drainage systems.
    a. Brush clearing is allowed but should be kept to the minimum necessary. Removal or destruction of the vegetative mat is not authorized under this permit.
    b. Establishment of, or improvements to, landing areas (i.e. leveling the ground or removing or modifying a substantial amount of vegetation) is prohibited.
    c. Attention must be paid to prevent pollution and siltation of streams, lakes, ponds, wetlands, and disturbances to fish and wildlife habitat.
    d. Any ground disturbances which may have occurred shall be contoured to blend with the natural topography to protect human and wildlife health and safety.

27. **Site Restoration:** On or before permit expiration (if a reissuance application has not been submitted) or termination of this authorization by the Grantee, the Grantee shall remove all improvements, personal property, and other chattels, and return the permitted area to a clean and safe condition. In the event the Grantee fails to comply with this requirement, the Grantee shall be held liable for any and all costs incurred by the State to return the permitted area to a clean and safe condition.

28. **Ground Disturbance Restoration:** The Grantee shall immediately restore areas where soil has been disturbed, or the vegetative mat has been damaged or destroyed. Restoration shall be accomplished in accordance with the directives of the DNR Plant Materials Center, 5310 S. Bodenburg Road, Palmer, AK 99645, (907) 745-4469. All rehabilitation shall be completed to the satisfaction of the AO.

29. **Indemnification:** The Grantee assumes all responsibility, risk and liability for its activities and those of its employees, agents, contractors, subcontractors, licensees, or invitees, directly or indirectly related to this permit, including environmental and hazardous substance risk and liability, whether accruing during or after the term of this permit. The Grantee shall defend, indemnify, and hold harmless the State, its agents and employees, from and against any and all suits, claims, actions, losses, costs, penalties, and damages of whatever kind or nature, including all attorney's fees and litigation costs, arising out of , in connection with, or incident to any act or omission by the Grantee, its employees, agents, contractors, subcontractors, licensees, or invitees, unless the proximate cause of the injury or damage is the sole negligence or willful misconduct of the State or a person acting on the State's behalf. Within 15 days, the Grantee shall accept any such cause, action or proceeding upon tender by the State. This indemnification shall survive the termination of the permit.

30. **Insurance:** Pursuant to 11 AAC 96.065 the Grantee shall secure or purchase at its own expense, and maintain in force at all times during the term of this permit, liability coverage and limits consistent with what is professionally recommended as adequate to protect the Grantee (the insured) and Grantor (the State, its officers, agents and employees) from the liability exposures of ALL the insured's operations on state land. Certificates of Insurance must be furnished to the AO prior to the issuance of this permit and must provide for a notice of cancellation, non-renewal, or material change of conditions in accordance with policy provisions. The Grantee must provide for a 60-day prior notice to the State before they cancel, not renew or make material changes to conditions to the policy. Failure to furnish satisfactory evidence of insurance, or lapse of the policy, are material breaches of this permit and shall be grounds, at the option of the State, for termination of the permit. All insurance policies shall comply with, and be issued by, insurers licensed to transact the business of insurance under Alaska Statute, Title 21. The policy shall be written on an "occurrence" form and shall not be written as a "claims-made" form unless specifically reviewed and agreed to by the Division of Risk Management, Department of Administration. The State must be named as an additional named insured on the policy with respect to the operations of the Grantee on or in conjunction with the permitted premises, referred to as LAS 34057.

31. **Performance Guaranty:** Pursuant to 11 AAC 96.060, the Grantee shall provide a surety bond or other form of security acceptable to the DMLW in the amount of $5,000.00 payable to the State of Alaska. Such performance guaranty shall remain in effect for the term of this authorization and shall secure performance of the Grantee's obligations hereunder. The amount of the performance guaranty may be adjusted by the AO in the event of approved amendments to this authorization, changes in the development plan, or any change in the

activities or operations conducted on the premises. The guaranty may be utilized by the State to cover actual costs incurred by the State to pay for any necessary corrective actions in the event the Grantee does not comply with the site utilization, restoration requirements and other stipulations contained in this permit agreement. If the Grantee fails to perform the obligations under this permit within a reasonable timeframe, the State may perform the Grantee's obligations at the Grantee's expense. The Grantee agrees to pay within 20 days following demand, all costs and expenses incurred by the State as a result of the failure of the Grantee to comply with the terms and conditions of this permit. Failure to do so may result in the termination of an authorization and/or forfeiture of the performance guaranty. The provisions of this permit shall not prejudice the State's right to obtain a remedy under any law or regulation. If the AO determines that the Grantee has satisfied the terms and conditions of this authorization, the performance guaranty will be subject to release. The performance guaranty may only be released in writing by the AO.

32. **Fuel and Hazardous Substances:** No fuel or hazardous substances may be stored on state land.

33. **Fuel and Hazardous Substances:**
    a. The use and/or storage of hazardous substances by the Grantee must be done in accordance with existing federal, state and local laws, regulations and ordinances. Debris (such as soil) contaminated with used motor oil, solvents, or other chemicals may be classified as a hazardous substance and must be removed and disposed of in accordance with existing federal, state and local laws, regulations and ordinances.
    b. Drip pans and materials, such as sorbent pads, must be on hand to contain and clean up spills from any transfer or handling of fuel.
    c. Vehicle refueling shall not occur within the annual floodplain or tidelands. This restriction does not apply to water-borne vessels provided no more than 30 gallons of fuel are transferred at any given time.
    d. During equipment maintenance operations, the site shall be protected from leaking or dripping hazardous substances or fuel. The Grantee shall place drip pans or other surface liners designed to catch and hold fluids under the equipment or develop a maintenance area by using an impermeable liner or other suitable containment mechanism. Secondary containment shall be provided for fuel or hazardous substances. All fuel and hazardous substance containers shall be inspected for defects and marked with the contents and the Grantee's name using paint or a permanent label. Secondary containment shall be provided for fuel or hazardous substances. All fuel and hazardous substance containers shall be marked with the contents and the Grantee's name using paint or a permanent label.

34. **Fuel and Hazardous Substance Storage:**
    a. The storage of petroleum products below Ordinary High Water (OHW) or Mean High Water Mark (MHWM) is prohibited.
    b. Fuel containers which exceed a total combined capacity of 110 gallons must be stored within an impermeable diked area or portable impermeable containment structure capable of containing 110 percent (115 Percent in the Aleutians West CRSA) capacity of the largest independent container (plus 12 inches of freeboard in the Kenai Peninsula Coastal District and Aleutians West CRSA).
    c. Fuel storage containers, including flow test holding tanks and hazardous substances, with a total combined capacity larger than 55 gallons shall not be placed within 100

feet (500 feet in the Bering Straits CRSA) from the ordinary high water mark of waterbodies.

d. All fuel storage containers and associated materials must be removed by the permit expiration date.
e. Secondary containment shall be provided for fuel or hazardous substances.
f. All fuel and hazardous substance containers shall be marked with the contents and the permittee's name using paint or a permanent label.
g. The AO may under unique or special circumstances grant exceptions to this stipulation on a case-by-case basis. Requests for exceptions should be made to the AO.
h. Definitions.
    i. Containers means any item which is used to hold fuel or hazardous substances. This includes tanks, drums, double-walled tanks, portable testing facilities, fuel tanks on small equipment such as light plants and generators, flow test holding tanks, slop oil tanks, bladders, and bags. Manifolded tanks or any tanks in a series must be considered as single independent containers. Vehicles, including mobile seismic tanks, are not intended to be included under this definition.
    ii. Hazardous substances are defined under AS 46.03.826(5) as (a) an element or compound which, when it enters the atmosphere, water, or land, presents an imminent and substantial danger to the public health or welfare, including fish, animals, or vegetation; (b) oil; or (c) a substance defined as a hazardous substance under 42 U.S.C. 9601(14).
    iii. Secondary containment means an impermeable diked area or portable impermeable containment structure capable of containing 110 percent of the volume of the largest independent container. Double-walled tanks do not qualify as secondary containment unless an exception is granted for a particular tank. All piping and manifolds shall be within secondary containment.
    iv. Surface liner means any safe, non-permeable container (e.g., drips pans, fold-a-tanks, etc.) designed to catch and hold fluids for the purpose of preventing spills. Surface liners should be of adequate size and volume based on worst-case spill risk.

35. **Waste Disposal:** On-site refuse disposal is prohibited, unless specifically authorized. All waste generated during operation, maintenance, and termination activities under this authorization shall be removed and disposed of at an off-site DEC approved disposal facility. Waste, in this paragraph, means all discarded matter, including but not limited to human waste, trash, garbage, refuse, oil drums, petroleum products, ashes and discarded equipment.

36. **Wastewater Disposal:** No pit privies are authorized.

37. **Solid Waste:**
    a. All solid waste and debris, including dog waste, generated from the activities conducted under this authorization shall be removed to a facility approved by DEC on a regular basis such that the premise be maintained to ensure a healthy and safe environment.
    b. Putrescible waste (waste that can decompose and cause obnoxious odor) shall be stored in a manner that prevents the attraction of or access to wildlife or disease vectors; and

c. Paper products may be burned on site if measures (e.g. burn barrels, clearing of burn area to mineral soil) are taken to prevent wildfires.

38. **Destruction of Markers:** The Grantee shall protect all survey monuments, witness corners, reference monuments, mining claim posts, bearing trees, and unsurveyed corner posts against damage, destruction, or obliteration. The Grantee shall notify the AO of any damaged, destroyed, or obliterated markers and shall reestablish the markers at the Grantee's expense in accordance with accepted survey practices of the DMLW.

39. **Site Maintenance:** The authorized area shall be maintained in a neat, clean, and safe condition, free of any solid waste, debris, or litter, except as specifically authorized herein. Nothing may be stored that would be an attractive nuisance to wildlife or create a potentially hazardous situation.

40. **Maintenance of Improvements:** The Grantor is not responsible for maintenance of authorized improvements or liable for injuries or damages related to those improvements. No action or inaction of the Grantor is to be construed as assumption of responsibility.

41. **Amendment or Modification:** The Grantee may request an amendment or modification of this authorization; the Grantee's request must be in writing. Any amendment or modification must be approved by the AO in advance and may require additional fees and changes to the terms of this authorization.

42. **Development Plan:** Development shall be limited to the authorized area and improvements specified in the approved development plan or subsequent modifications approved by the AO. The Grantee is responsible for accurately siting development and operations within the authorized area. Any proposed revisions to the development plan must be approved in writing by the AO before the change in use or development occurs.

43. **Proper Location:** This authorization is for activities on state lands or interests managed by DMLW. It does not authorize any activities on private, federal, native, and municipal lands, or lands which are owned or solely managed by other offices and agencies of the State. The Grantee is responsible for proper location within the authorized area.

44. **Improvements:** Any improvements/structures that may be authorized under this permit must be constructed in a manner that will allow for removal from the permitted site within 48 hours of receiving a notice to vacate. The establishment of permanent foundations and structures is prohibited under this permit. Authorized temporary improvements must be sited in a manner which impacts the least amount of ground consistent with the purpose of the facility. Any use of these improvements for purposes other than those explicitly authorized by this permit are prohibited.

45. **Visual Screening:** The Grantee shall limit the visual impact of their activity. Examples include, but are not limited to, using non-reflective roof cover material, applying dark paint to all metal or light-colored plywood or other surfaces and storing all equipment in an acceptable, well-kept manner. Improvements should be screened from sight whenever possible using vegetation or other natural features.

46. **Fire Prevention, Protection and Liability:** The Grantee shall take all reasonable precautions to prevent and suppress forest, structure, brush and grass fires, and shall assume full liability

for any damage to state land and structures resulting from the negligent use of fire. The State is not liable for damage to the Grantee's personal property and is not responsible for forest fire protection of the Grantee's activity. To report a wildfire, call 911 or 1-800-237-3633.

47. Tower Hazard: All improvements on site must be clearly marked in a manner which will reduce the likelihood of conflict with other users. Guy wires and tower structure must be clearly visible. Commercially available full round guy wire markers will be used on all guy wires and will be installed at the time of installation of the tower. Full round guy wire markers will be a minimum of 10 feet (above ground level) in length and of a color that dramatically contrast with the local environment. Anchors or other project features that could be struck by other users in the area will be clearly marked. The guy wire markers and other markings shall be routinely inspected, and any defective or missing markers shall be replaced immediately. In substitution of guy wire markers, plastic fencing of a color that dramatically contrasts with the local environment can be used to mark the improvements on site.

Permit Advisories:

1. For any MET towers remaining on the project site throughout the project's lifespan (per ADL 233892 Development Plan), it is strongly recommended to utilize monopole over lattice construction, discouraging guywires when feasible. This measure aims to deter nesting and perching birds, ultimately reducing the risk of bird strikes in wind turbines.

The Authorized Officer reserves the right to modify these stipulations or use additional stipulations as deemed necessary. The Grantee will be advised before any such modifications or additions are finalized. DNR has the authority to implement and enforce these conditions under AS 38.05.850. Any correspondence on this authorization may be directed to the Department of Natural Resources, Division of Mining, Land and Water, Southcentral Regional Land Office, 550 W. 7th Ave., Suite 900C, Anchorage, AK 99501-3577, (907) 269-8503.

I have read and understand all of the foregoing and attached stipulations. By signing this authorization, I agree to conduct the authorized activity in accordance with the terms and conditions of this authorization.

Michael U. Alvarez   Chief Operating Officer   8/16/2024

Signature of Grantee or Authorized Representative   Title   Date

125 High St, 17th Floor High St Tower, Suite 1705   Boston   MA   02110

Grantee's Address   City   State   Zip

Chad Allen   207-210-1175

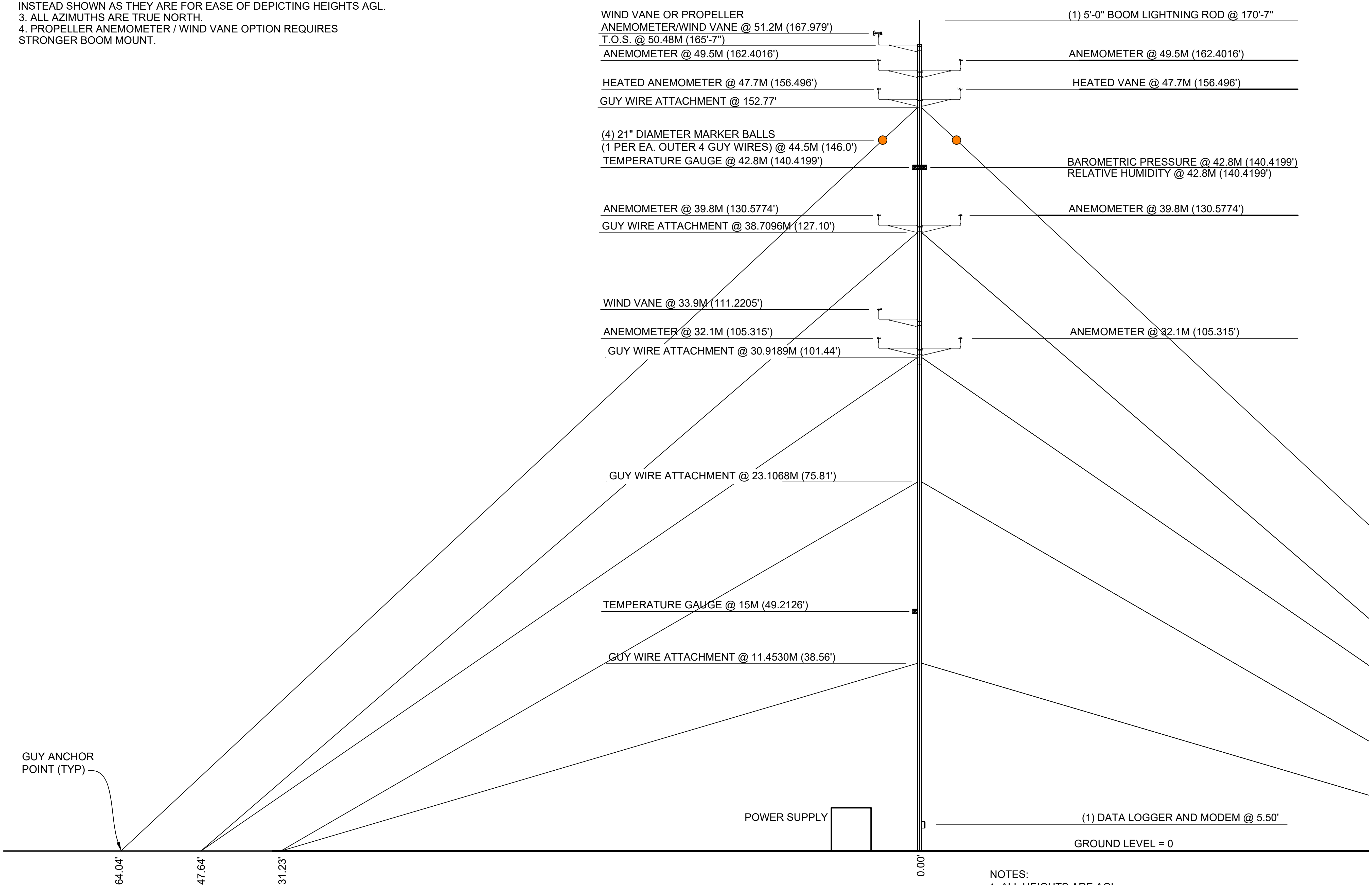
Contact Person   Home Phone   Work Phone

Rachel Longacre   8/20/2024

Signature of Authorized State Representative   Title   Date

NOTES:

1. ALL HEIGHTS ARE AGL.
2. DEPICTED BOOM ORIENTATIONS ARE NOT ACCURATE BUT ARE INSTEAD SHOWN AS THEY ARE FOR EASE OF DEPICTING HEIGHTS AGL.
3. ALL AZIMUTHS ARE TRUE NORTH.
4. PROPELLER ANEMOMETER / WIND VANE OPTION REQUIRES STRONGER BOOM MOUNT.



TOWER ELEVATION

SCALE : 1" = 20'-0"

10' 0 10' 20'

SCALE : 1" = 20'

NOTES:
1. ALL HEIGHTS ARE AGL.
2. DEPICTED BOOM ORIENTATIONS ARE NOT ACCURATE BUT ARE INSTEAD SHOWN AS THEY ARE FOR EASE OF DEPICTING HEIGHTS AGL.
3. ALL AZIMUTHS ARE TRUE NORTH.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
1		
0	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
TOWER ELEVATION

SHEET NO.
1 OF 9

NOTES:
1. MET TOWERS WINCHED UPRIGHT FROM APPROXIMATELY THE NORTH SIDE.

GUYED TOWER NOTES

1) GUY WIRE INSTALLATION:
ALL GUY WIRES ARE TO BE INSTALLED PER MANUFACTURER'S GUIDELINES AND TENSIONED TO MANUFACTURER'S SPECIFIED LIMITS AND CONFIRMED BY THE USE OF A CALIBRATED TENSIONOMETER. THE TOWER MUST BE PLUMBED TO MANUFACTURER'S SPECIFICATIONS UTILIZING AN ENGINEER TRANSIT AND MUST NOT VARY MORE THAN ONE INCH PER 100 FT OF TOWER HEIGHT. FINAL TENSIONS ARE TO BE RECORDED IN TOWER ERECTION MANUAL AND SUBMITTED TO CONSTRUCTION MANAGER UPON COMPLETION.

2) GUY WIRES:
ALL CUT GUY WIRES WILL BE LASHED WITH A NON-FERROUS MATERIAL AND PAINTED WITH ZINC RICH COMPOUND UPON COMPLETION.

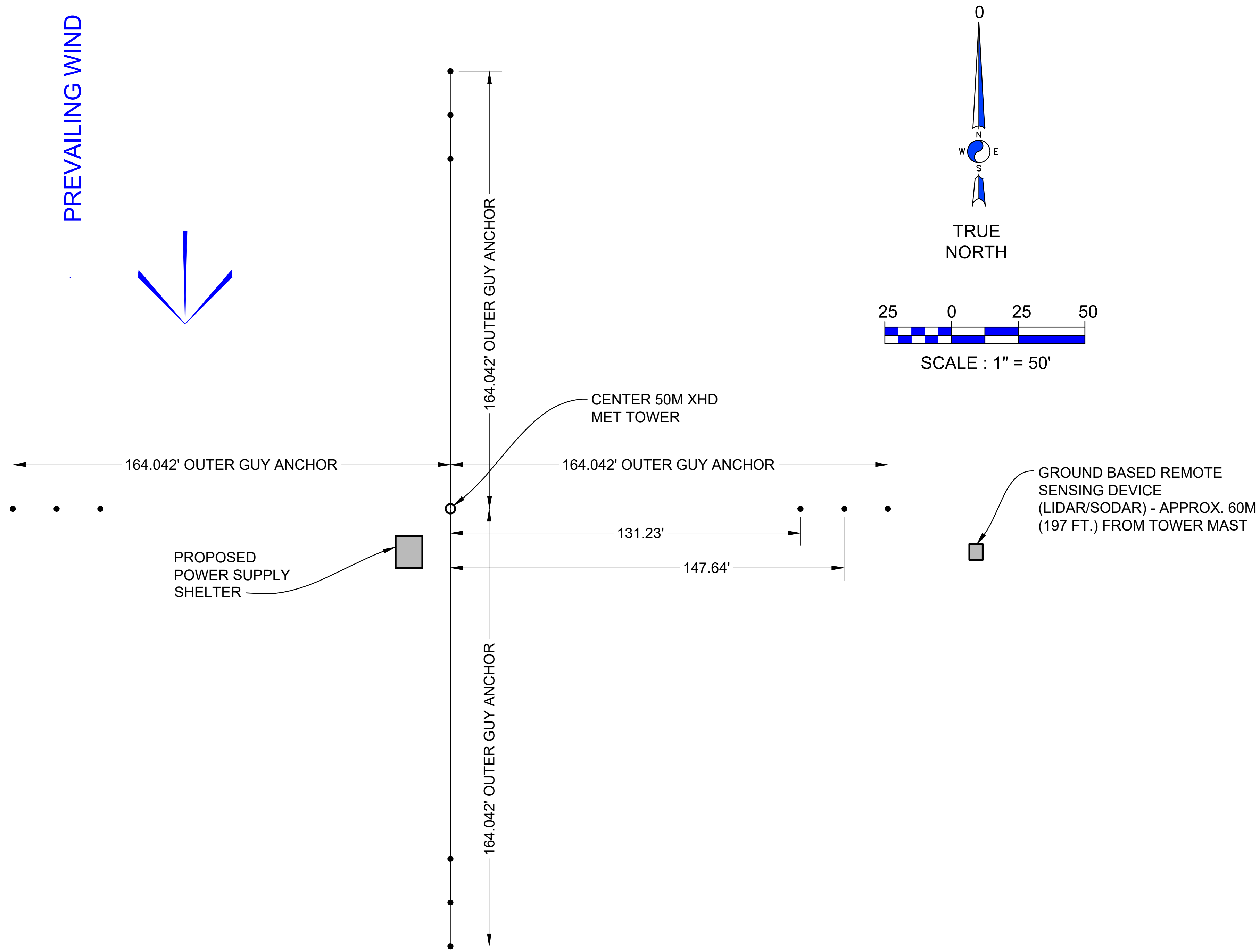
3) TURNBUCKLES:
ALL TURNBUCKLES ARE TO BE INSTALLED IN THE SAME ORIENTATION (WHEN BEHIND ANCHOR AND FACING TOWER, A CLOCKWISE TURN OF THE ADJUSTER WILL TIGHTEN THE TENSION AND A COUNTER-CLOCKWISE TURN OF THE ADJUSTER WILL LOOSEN TENSION). ALL ATTACHMENTS (BOLTS, PINS, CLEVISES) ARE TO BE INSTALLED IN THE SAME DIRECTION. DURING ERECTION, EACH GUY WIRE ADJUSTMENT WILL HAVE A TEMPORARY SAFETY INSTALLED. UPON COMPLETION, FOLLOWING FINAL PLUMB AND TENSION OF TOWER, ALL TURNBUCKLE ADJUSTERS WILL HAVE A SAFETY CABLE ROUTED THROUGHOUT THEM AND SECURED TOGETHER WITH A WIRE ROPE CLIP, TO ENSURE NO MOVEMENT OF ADJUSTER.

4) PREFORM GRIPS:
UPON COMPLETION ALL GUY WIRES WILL HAVE AN ICE CLIP DEVICE INSTALLED AS DIRECTED AND SUPPLIED BY TOWER MANUFACTURER. ANY ABRASIONS ARE TO BE PAINTED WITH ZINC RICH PAINT.

5) GUY WIRE GROUNDS:
ALL GUY WIRES ARE TO BE GROUNDED IN UNISON UTILIZING #2 STRANDED WIRE AND MANUFACTURER SUPPLIED CONNECTORS AND COPPER SHIELD ON CABLE TO WIRE CONNECTIONS TO THE ANCHOR'S EARTHEN GROUND RING.

6) CONTRACTOR SHALL PROVIDE THE MINIMUM NUMBER OF GROUND RODS INDICATED, SEE GROUNDING PLAN FOR APPROXIMATE LOCATIONS.

7) GUY TOWER INSTALLATIONS MUST MEET OR EXCEED THE LATEST TIA/EIA-222-H STANDARDS.



50M XHD TOWER PLAN

SCALE : 1" = 50'-0"

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
0	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

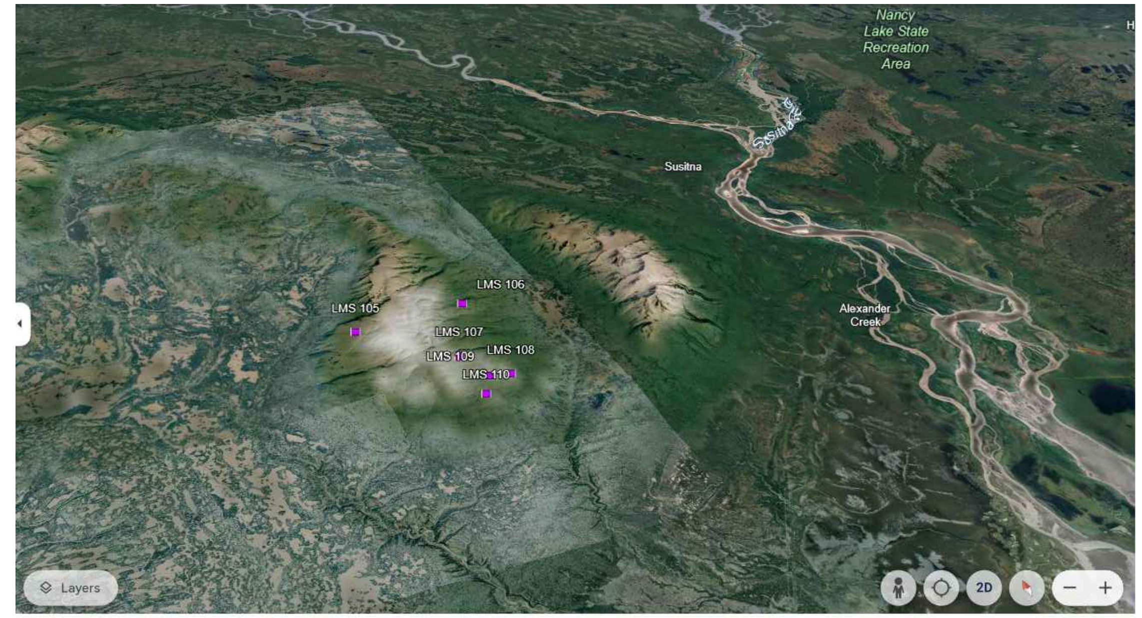
DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
SITE PLAN

SHEET NO.
2 OF 9

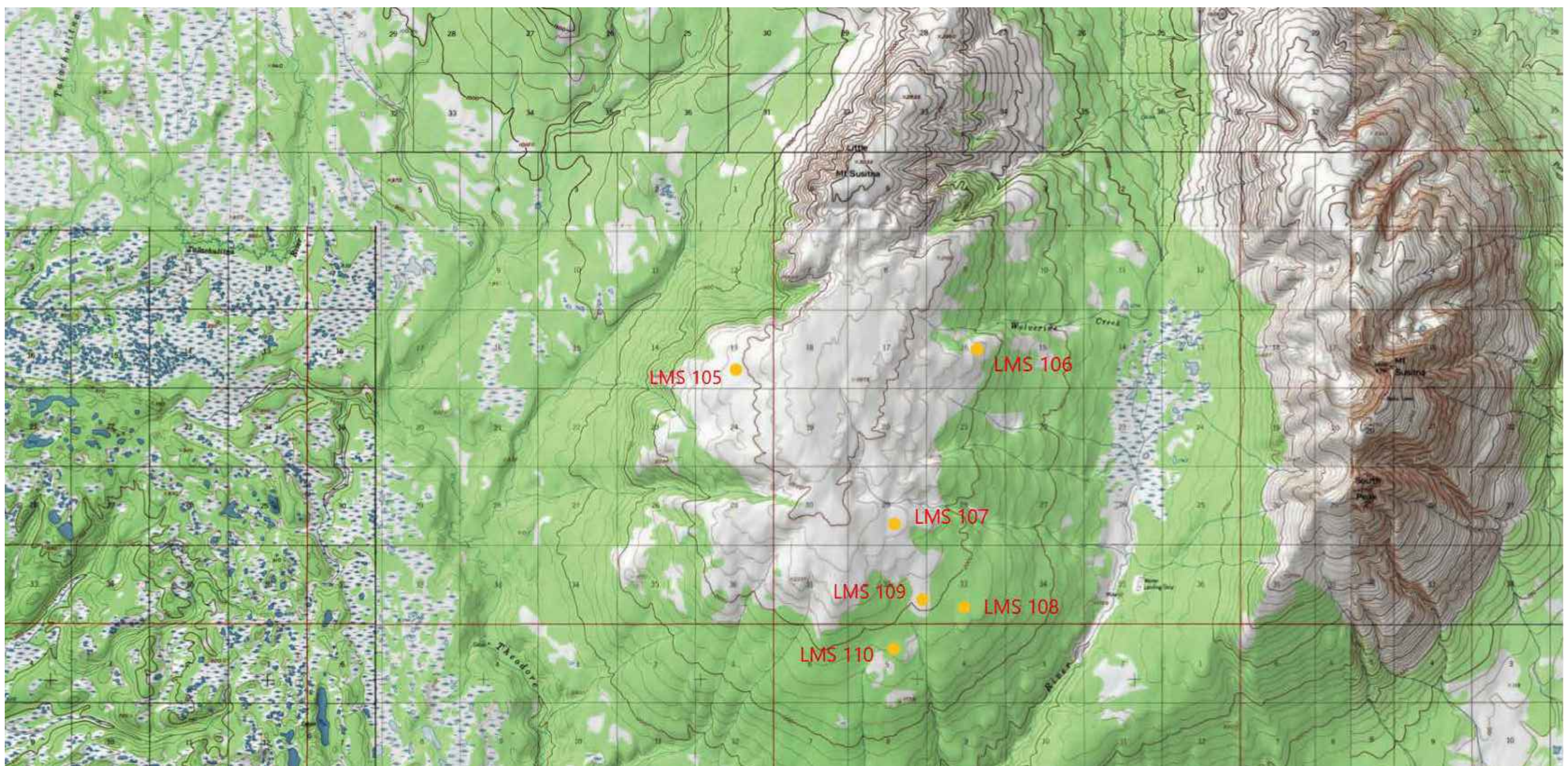
20240430				
LMS met twrs to be permitted				
dataset	littleMountSusitna_toBePermittedMetTwrs_20240430_ja.shp			
	UTM WGS84 z5 meters		WGS84	
id	X	Y	LATITUDE	LONGITUDE
LMS 105	607144	6817133	61.47306128° N	150.98880926° W
LMS 106	612079	6817695	61.47670353° N	150.89590508° W
LMS 107	610490	6814070	61.44464000° N	150.92786700° W
LMS 108	611983	6812416	61.42937215° N	150.90087803° W
LMS 109	611119	6812558	61.43089025° N	150.91697790° W
LMS 110	610563	6811529	61.42181675° N	150.92800343° W

AK MET TOWER LATITUDE & LONGITUDE COORDINATE TABLE



LMS 105 THRU 110 GOOGLE MAPS LOCATIONS

SCALE : N.T.S.



LMS 105 THRU 110 LOCATIONS

SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
1	06.26.2024	I.F.C.

STATE OF ALASKA 49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
SITE LOCATIONS

SHEET NO.
3 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N010W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	438610.156, 837190.354	**NE:**	448157.576, 837035.014
SW:	438439.045, 827536.254	**SE:**	448013.17, 827380.568

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720902342723964	61 25 34.48445 N
E Longitude:	-2.6349935005514356	150 58 26.42385 W
N Latitude:	1.0736025151373458	61 30 46.41477 N
W Longitude:	-2.6381243219055466	151 09 12.20211 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

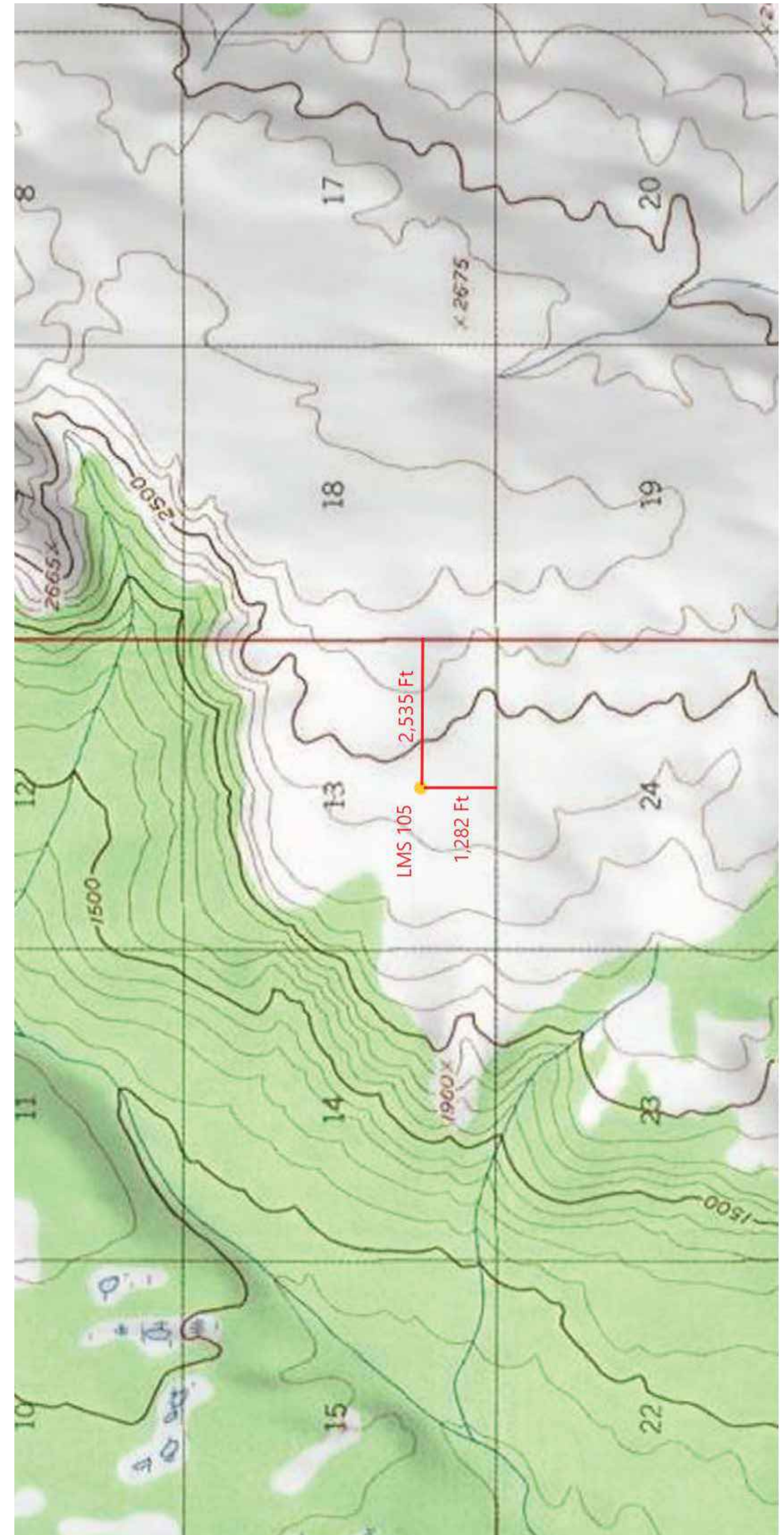
NW ITM Name:	TYONEK C-4	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-4	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:10 PM)

LMS 105 TOWNSHIP DATA



LMS 105 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA
BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER
STANDARD FOOTPRINT

SHEET TITLE:
LMS 105

SHEET NO.
4 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
W Longitude:	-2.6349934345081767	150 58 26.41023 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

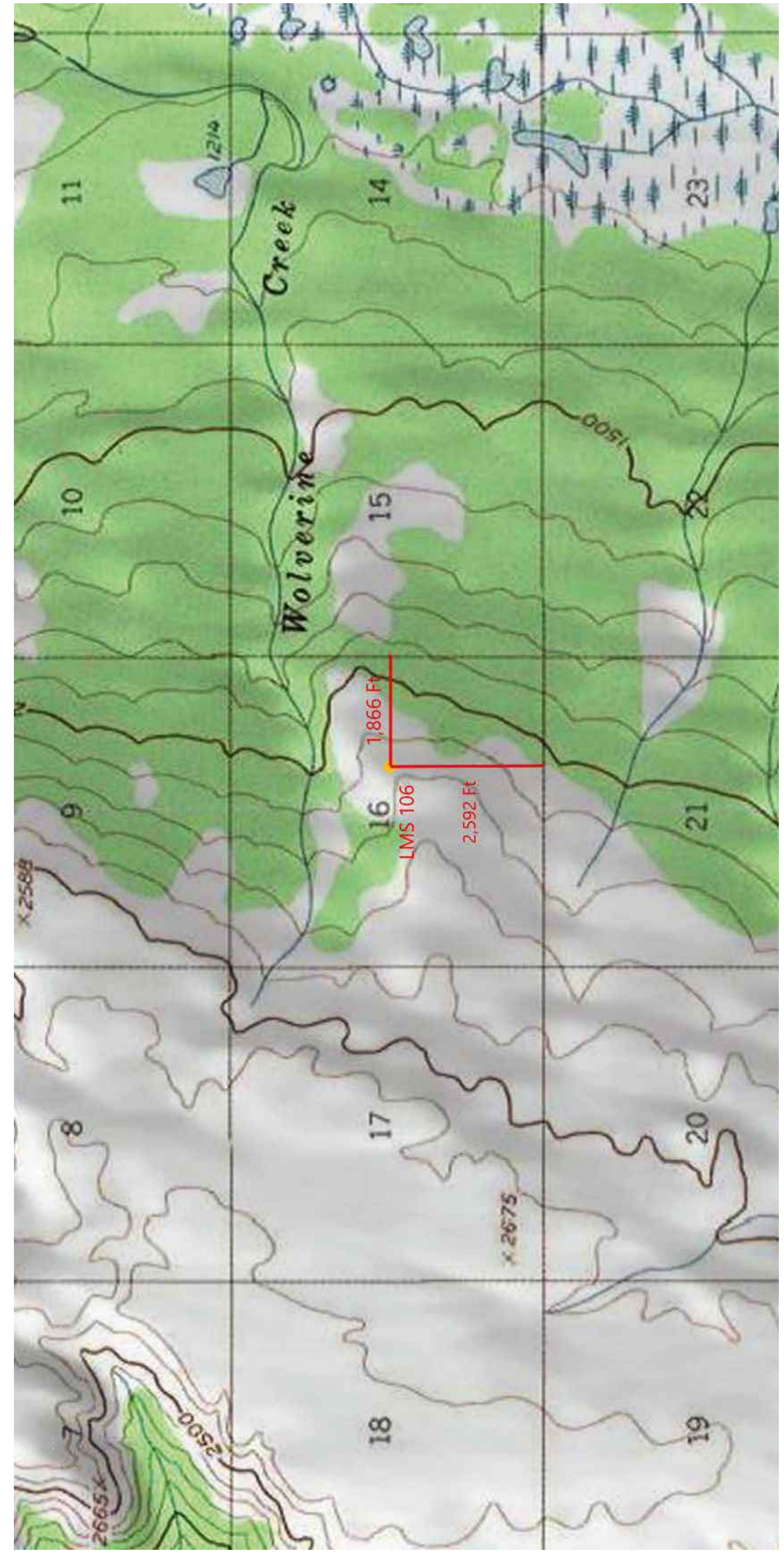
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:13 PM)

LMS 106 TOWNSHIP DATA



LMS 106 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA 49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
LMS 106

SHEET NO.
5 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
W Longitude:	-2.6349934345081767	150 58 26.41023 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

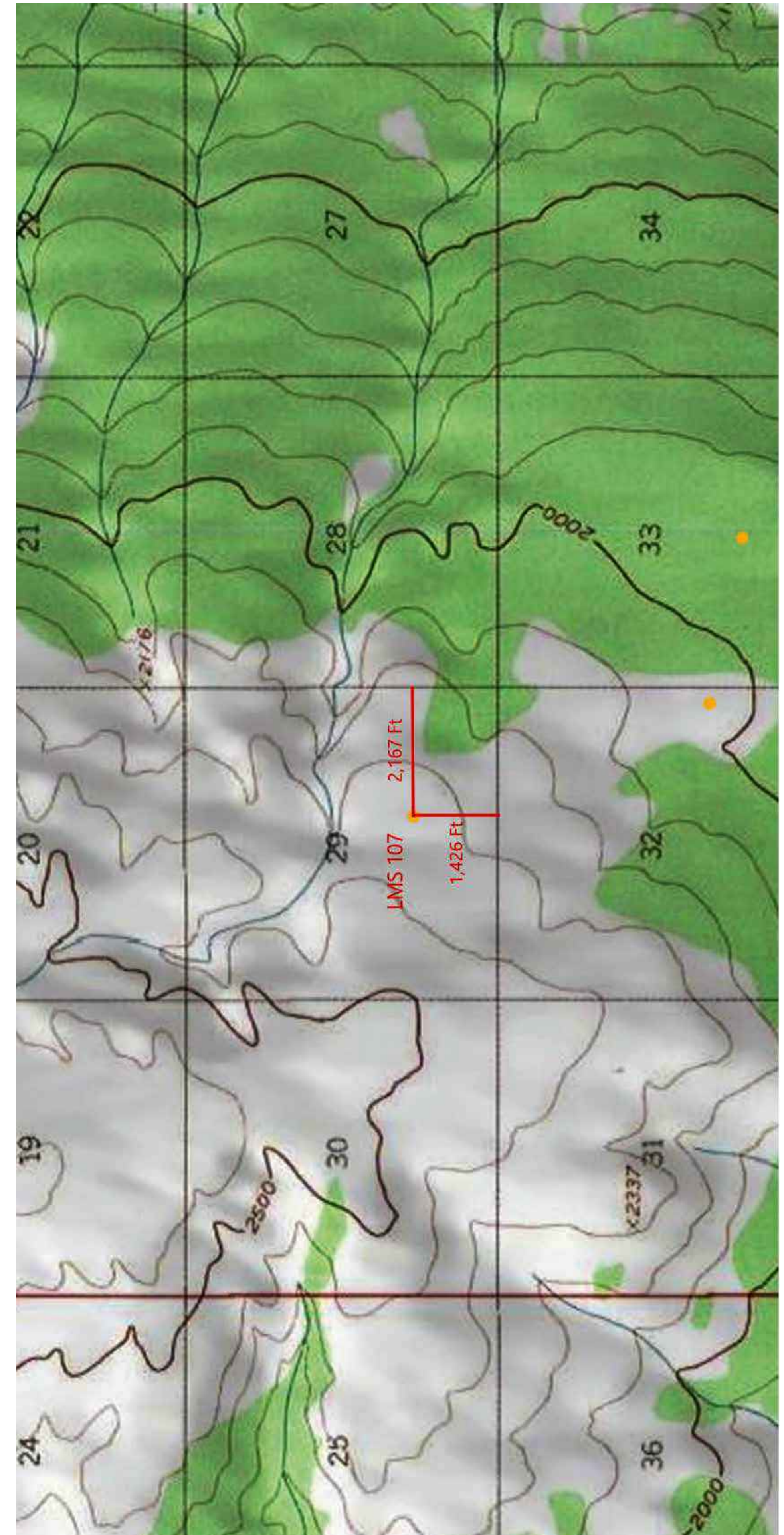
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 1:58 PM)

LMS 107 TOWNSHIP DATA



LMS 107 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA 49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
LMS 107

SHEET NO.
6 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S015N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448013.17, 827380.568	**NE:**	457587.577, 827251.266
SW:	447868.883, 817726.177	**SE:**	457469.991, 817596.635

Township Gracticule:

	Radians	DMS
S Latitude:	1.0705779481540059	61 20 22.55305 N
E Longitude:	-2.631862575612033	150 47 40.62423 W
N Latitude:	1.0720902342723964	61 25 34.48445 N
W Longitude:	-2.6349935005514356	150 58 26.42385 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

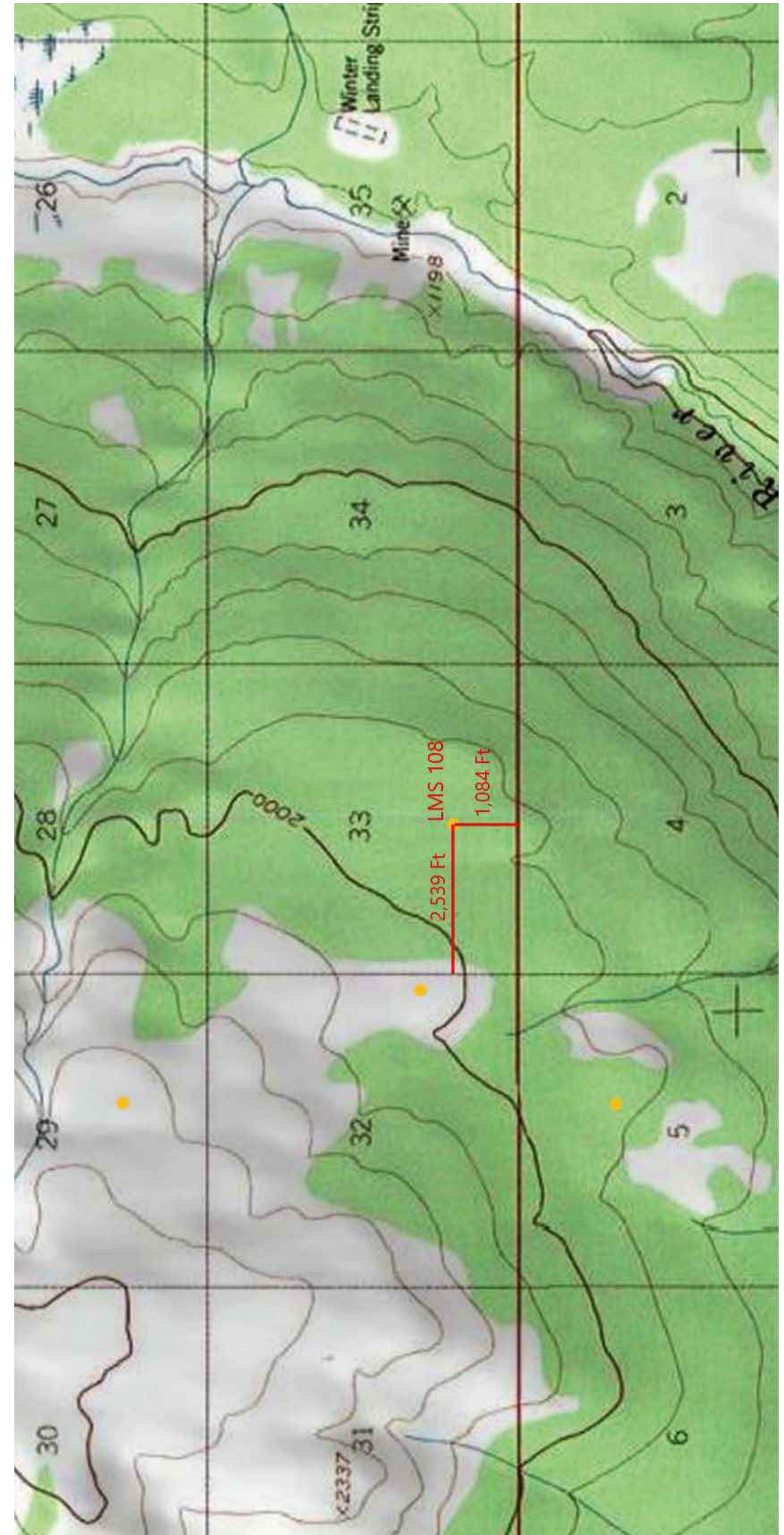
NW ITM Name:	TYONEK B-3	**NE ITM Name:**	TYONEK B-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:16 PM)

LMS 108 TOWNSHIP DATA



LMS 108 SETBACK DISTANCES TO SECTION LINES

SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
LMS 108

SHEET NO.
7 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
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BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

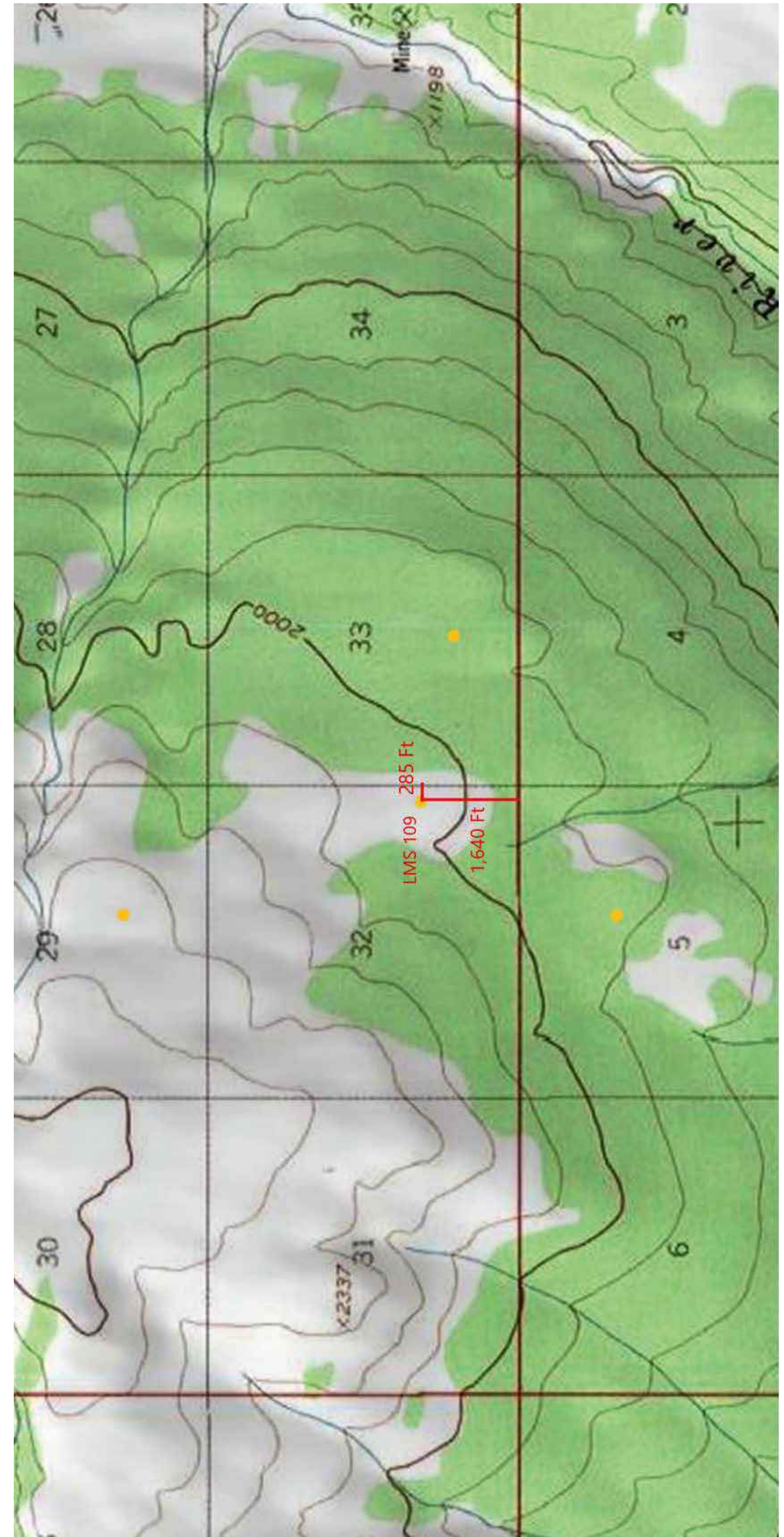
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:17 PM)

LMS 109 TOWNSHIP DATA



LMS 109 SETBACK DISTANCES TO SECTION LINES

SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA
BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER
STANDARD FOOTPRINT

SHEET TITLE:
LMS 109

SHEET NO.
8 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S015N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448013.17, 827380.568	**NE:**	457587.577, 827251.266
SW:	447868.883, 817726.177	**SE:**	457469.991, 817596.635

Township Gracticule:

	Radians	DMS
S Latitude:	1.0705779481540059	61 20 22.55305 N
E Longitude:	-2.631862575612033	150 47 40.62423 W
N Latitude:	1.0720902342723964	61 25 34.48445 N
W Longitude:	-2.6349935005514356	150 58 26.42385 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

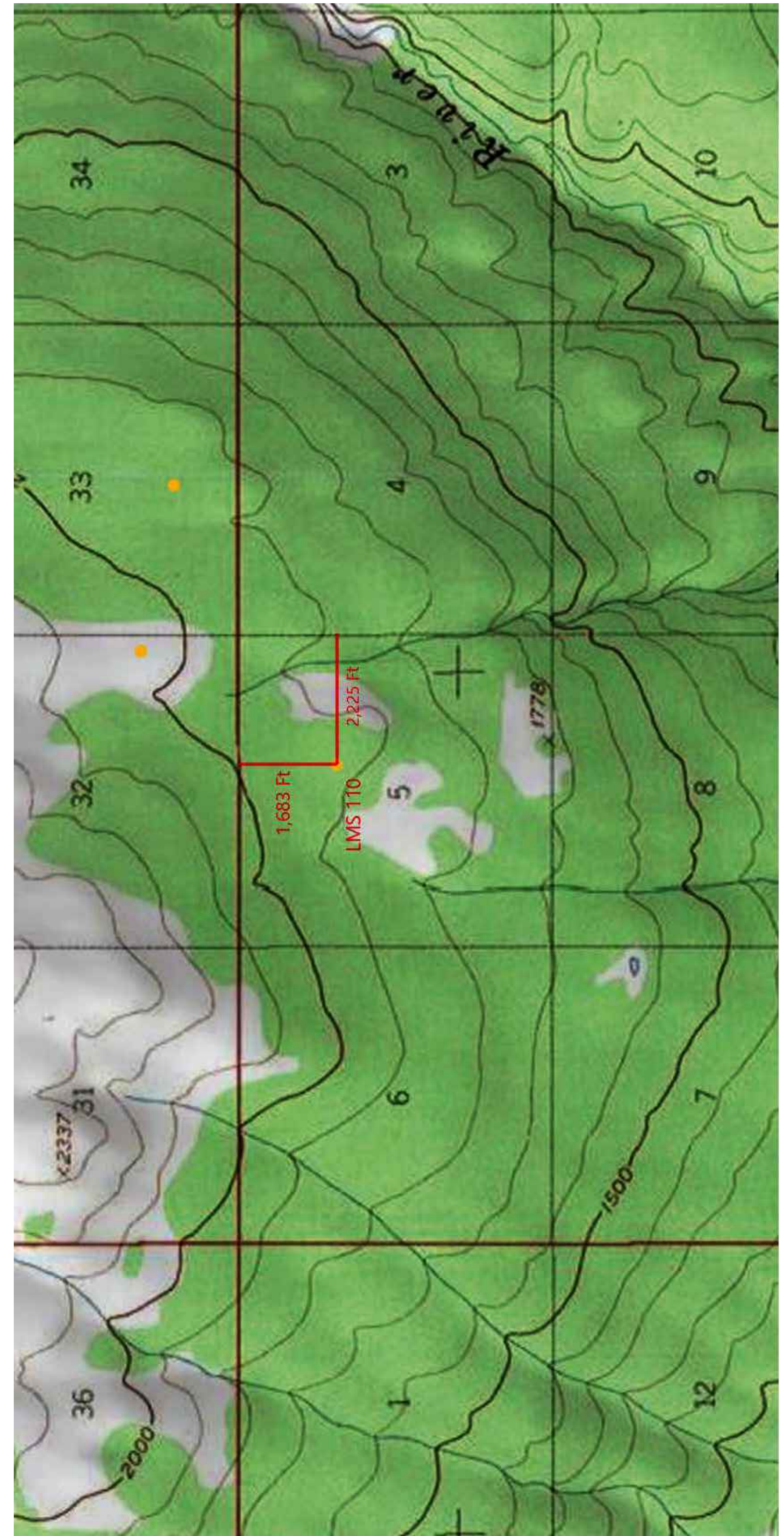
NW ITM Name:	TYONEK B-3	**NE ITM Name:**	TYONEK B-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:07 PM)

LMS 110 TOWNSHIP DATA



LMS 110 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	50M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
50M XHD MET TOWER
MATANUSKA-SUSITNA BOROUGH, AK

DESIGN TYPE:
50M XHD MET TOWER STANDARD FOOTPRINT

SHEET TITLE:
LMS 110

SHEET NO.
9 OF 9

NewTower Engineering LLC

Date: **July 01, 2024**

Jeff Armbruster
Longroad Energy
125 High Street, Boston, MA 02210
Phone: (857) 202-7475

Subject: **Matanuska Susitna Borough Met Tower Conditional Use Permit**

Applicant: ***Longroad Energy / Alaska Renewables***

Land Owner: ***State of Alaska***

Engineering Project No.: **Project Number:** 101-24-002

Tower Data: **(6) NRG Systems 50m XHD Tall Meteorological Towers**
Matanuska-Susitna Borough, AK

	UTM WGS84 z5 meters		WGS84	
id	X	Y	LATITUDE	LONGITUDE
LMS 105	607144	6817133	61.47306128° N	150.98880926° W
LMS 106	612079	6817695	61.47670353° N	150.89590508° W
LMS 107	610490	6814070	61.44464000° N	150.92786700° W
LMS 108	611983	6812416	61.42937215° N	150.90087803° W
LMS 109	611119	6812558	61.43089025° N	150.91697790° W
LMS 110	610563	6811529	61.42181675° N	150.92800343° W

Dear Mr. Armbruster,

Please find enclosed the following for the subject six (6) NRG 50m XHD Met Towers with Standard Footprint permit application:

1. A full tower structural analysis is provided (refer attached report and Appendix A output results) in accordance with the 2021 Alaska Building Code, 2021 International Building Code, ASCE 7-16 Code, and ANSI TIA 222-Rev H, based upon an ultimate 3-second gust wind speed of 115 mph (V_{ult}), Risk Category I, and Exposure Category C. Seismic analysis not required for Risk Category I structures.
2. Refer Appendix C and the Conclusions/Recommendations for recommended Manta Ray (MR-2) guy anchor, 8" double helix (or approved equal) along with details and minimum pull forces required (Table 4). No soils report is available for the site. As such, anchor pull tests will be required to meet the minimum resultant anchor loads as listed in Table 4 of this report.
3. Refer Appendix D for typical tower grounding and tower installation details.

Structural analysis prepared by: Mikko P. Ahola, PE

Respectfully submitted by:

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

Aaron Boonstra, PE
Professional Engineer

TABLE OF CONTENTS

1) INTRODUCTION

The purpose of this report is to investigate the structural adequacy of proposed (6) NRG Systems 50m XHD guyed pole temporary meteorological towers to be located in the Matanuska-Susitna Borough, Alaska (refer Appendix D map locations). The met towers will support wind monitoring devices. The computer plots & output based on a 3D structural analysis using tnxTOWER (Version 8.2.2) is provided in Appendix A.

The 50m XHD tall guyed pole MET towers are designed and manufactured by NRG Systems.

The finite element program "tnxTower" used in this analysis is developed by Tower Numerics in Lexington, MA. It is a specialized 3D structural analysis program widely used and accepted in the tower industry.

2) ANALYSIS CRITERIA

The analysis has been performed in accordance with the 2021 Alaska Building Code, 2021 International Building Code, and ANSI TIA-222-Rev H for the tower site locations in Alaska based upon an ultimate 3-second gust wind speed of 115 mph (V_{ult}). Exposure Category C, Risk Category I along with topographic category 2 and crest height of 1,500 feet were used in this analysis (typical for all 6 tower sites). Met towers are temporary structures (1 to 3-year installation duration typical) and analyzed as Risk Category I structures with 115 mph ultimate gust wind speed at the met tower site locations per the 2021 IBC/ASCE 7-16 (refer Appendix A ASCE7-16 Hazard Map). Table 1 below shows the proposed MET tower loading.

Table 1 - Proposed 50m XHD Tall Super XHD Met Tower Equipment Loading

Center Line Elevation (ft)	Number of Antennas	Antenna/Mount Manufacturer	Antenna/Mount Model	Number of Feed Lines	Feed Line Size (in)	Note
167.98 (51.2 m)	1	Young	Propellor Anemometer/ Wind Vane	1	0.14"ϕ cable	1
167.98 (51.2 m)	1	NRG Systems	NRG No. 4214 (95" Long Side Boom)	-	-	1
162.40 (49.5 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1
162.40 (49.5 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
156.496 (47.7 m)	2	NRG Systems	Heated Anemometer	2	0.14"ϕ cables	1
156.496 (47.7 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
145.997 (44.5 m)	4	NRG Systems	21" ϕ Orange Marker Balls (3.1m From Top Guy Ring)	-	-	1
140.42 (42.8 m)	1 1 1	Campbell Scientific	Barometric Pressure Gauge Relative Humidity Sensor Temperature Sensor	3	0.14"ϕ cables	1
130.58 (39.8 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1
130.58 (39.8 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
111.22 (33.9 m)	1	NRG Systems	NRG 200P Wind Vane	1	0.14"ϕ cable	1
111.22 (33.9 m)	1	NRG Systems	NRG No. 4214 (95" Long Side Boom)	-	-	1
105.32 (32.1 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1
105.32	2	NRG Systems	NRG No. 4214	-	-	1

Center Line Elevation (ft)	Number of Antennas	Antenna/Mount Manufacturer	Antenna/Mount Model	Number of Feed Lines	Feed Line Size (in)	Note
(32.1 m)			(95” Long Side Booms)			
49.21 (15.0 m)	1	Unknown	Temperature Sensor	1	0.14”ϕ cable	1
4.92 (1.5 m)	1	NRG Systems	Data Logger & Modem	-	-	1

Notes: 1. Proposed Equipment

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Remarks	Reference	Source
Met Tower Equipment Loading	Anemometers, Wind Vanes, Marker Balls	06/20/2024	Longroad Energy
50M XHD & 60M XHD Tall Tower Installation	User’s Manual (Rev 10)	11/02/2018	NRG Systems

3.1) Analysis Method

tnxTower (version 8.2.2), a commercially available analysis software package, was used to analyze the 50m XHD MET tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1. The pole steel is 45 ksi yield.
2. The 50m XHD MET tower is supported by 1/4" diameter Aircraft guy wiring with breaking strength of 7.0 kips with 0.182 kips (2.6%) initial tension (refer 50M & 60M XHD Installation Manual for instructions on proper guy wire tensioning and recommended methods to utilize).
3. The proposed MET tower is temporary (typically 1 to 3-year installation duration)
4. The met tower and guy anchors are to be installed by a professional contractor with prior experience in met tower erection and will be installed following the instructions in the NRG 50m & 60m XHD Installation Manual & Specifications & other manufacturer specifications.

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$øP_{allow}$ lb	% Capacity	Pass Fail
L1	165.604 - 152.771	Pole	Guyed Pole 8" OD	2	-152.147	91413.297	35.5	Pass
L2	152.771 - 127.104	Pole	Guyed Pole 8" OD	3	-5902.010	91413.297	36.6	Pass
L3	127.104 - 101.437	Pole	Guyed Pole 8" OD	4	-11052.500	91413.297	44.7	Pass
L4	101.437 - 75.812	Pole	Guyed Pole 10" OD	5	-14517.000	113300.000	35.7	Pass
L5	75.812 - 38.562	Pole	Guyed Pole 10" OD	6	-17002.199	113300.000	36.5	Pass
L6	38.562 - 0	Pole	Guyed Pole 10" OD	7	-19226.801	113300.000	49.9	Pass

tnxTower Report - version 8.2.2

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$øP_{allow}$ lb	% Capacity	Pass Fail
L2	152.771 - 127.104	Guy A@152.771	NRG 0.030125	11	4029.750	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy A@127.104	NRG 0.030125	15	2847.590	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy A@101.437	NRG 0.030125	19	2124.400	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy A@75.812	NRG 0.030125	23	2050.680	4200.000	48.8	Pass
L6	38.562 - 0	Guy A@38.562	NRG 0.030125	27	1976.560	4200.000	47.1	Pass
L2	152.771 - 127.104	Guy B@152.771	NRG 0.030125	10	4027.520	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy B@127.104	NRG 0.030125	14	2848.480	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy B@101.437	NRG 0.030125	18	2125.370	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy B@75.812	NRG 0.030125	22	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy B@38.562	NRG 0.030125	26	1975.270	4200.000	47.0	Pass
L2	152.771 - 127.104	Guy C@152.771	NRG 0.030125	9	4027.030	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy C@127.104	NRG 0.030125	13	2849.140	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy C@101.437	NRG 0.030125	17	2125.700	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy C@75.812	NRG 0.030125	21	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy C@38.562	NRG 0.030125	25	1974.240	4200.000	47.0	Pass
L2	152.771 - 127.104	Guy D@152.771	NRG 0.030125	8	4027.610	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy D@127.104	NRG 0.030125	12	2848.430	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy D@101.437	NRG 0.030125	16	2125.330	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy D@75.812	NRG 0.030125	20	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy D@38.562	NRG 0.030125	24	1975.280	4200.000	47.0	Pass
							Summary	
						Pole (L6)	49.9	Pass
						Guy A (L2)	95.9	Pass
						Guy B (L2)	95.9	Pass
						Guy C (L2)	95.9	Pass
						Guy D (L2)	95.9	Pass
						RATING =	**95.9**	**Pass**

Table 4 – Guy Anchor Reactions

Anchor Radius	Factored Uplift Force (Vertical)	Factored Shear Force (Horizontal)	Factored Resultant Force
Inner Anchor (Radius = 131.234 ft)	1,501 lbs	3,689 lbs	3,983 lbs
Middle Anchor (Radius = 147.638 ft)	2,863 lbs	4,017 lbs	4,933 lbs
Outer Anchor (Radius = 164.042 ft)	2,610 lbs	3,046 lbs	4,011 lbs

1. Anchor reactions are factored.

4.1) Conclusions & Recommendations

The proposed NRG 50m XHD MET towers with standard footprint were analyzed with the proposed new wind monitoring devices and marker balls (Refer Table 1) per the 2021 International Building Code/ASCE 7-16 and ANSI TIA 222 Rev H codes for the typical site conditions at the 6 tower site locations in Matanuska-Susitna Borough, AK based upon an ultimate 3-second gust wind speed of 115 mph (V_{ult}). Exposure Category C, Risk Category I along with topographic category 2 and crest height of 1,500 feet were used in this analysis. Seismic loading is not required for Risk Category I Structures.

The analysis results show that:

1. The overall tower pole structure and guy wires are structurally adequate to support the proposed equipment. A maximum tower steel usage of 95.9% was computed (Refer Table 3).

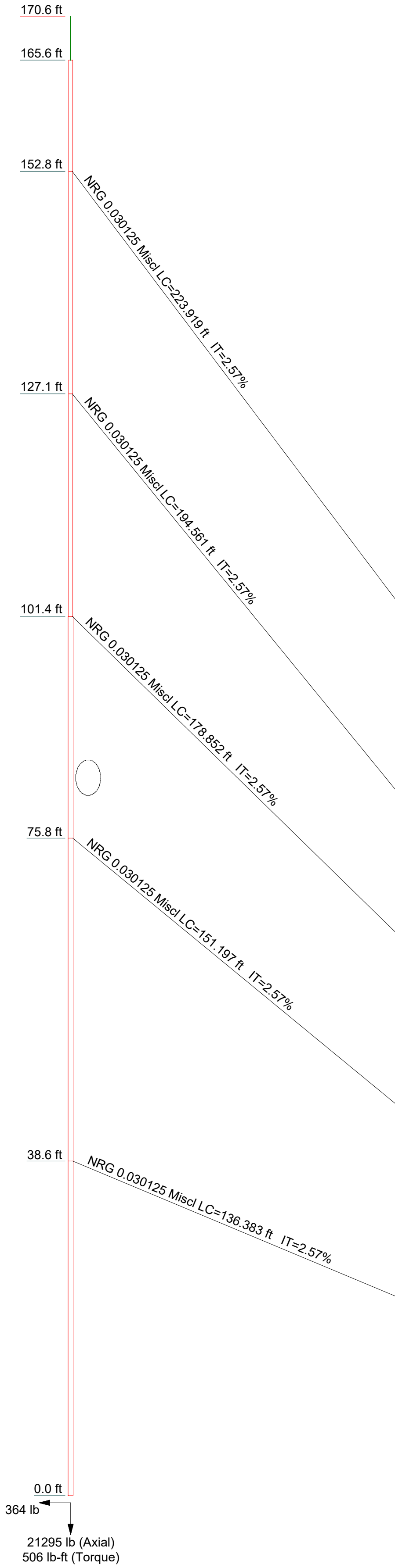
2. The maximum factored guy anchor resultant force computed was 4,933 lbs (Refer Table 4). The Manta Ray Earth Anchor (Model MR-2) has holding capacities up to 36,000 lbs or 8" double helix anchors (depending on soil type – Refer Appendix C earth anchor details & ultimate capacites) and would be adequate to secure the guy anchors in place under the wind loads shown in this analysis. However, no soils report was available to confirm the soil type at the proposed location of the towers. As such, a standard pull test will be required to ensure they meet the minimum factored resultant anchor loads in Table 4 above.

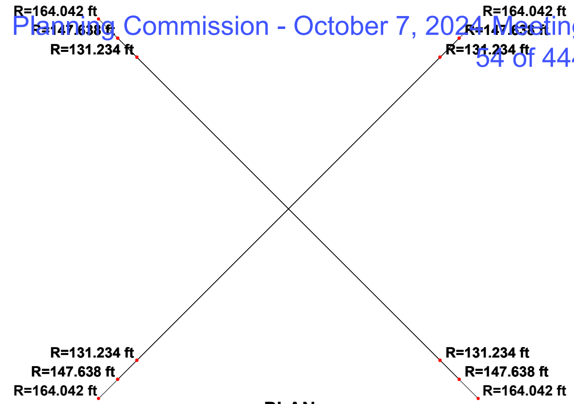
3. The maximum factored axial compression force at the base of the met tower is computed to be 21,295 lbs. Per the NRG tower specs, the 50m XHD standard footprint steel base plate has a surface area of 7.7 ft^2. Assuming a typical 1,500 psf allowable soil bearing stress per the IBC code with a Safety of Factor of 2.0 in soil bearing, the ultimate soil bearing stress would be 3,000 psf. Thus, based on factored loads the computed maximum soil bearing stress is 2,766 psf < 3,000 psf and acceptable.

APPENDIX A

TNXTOWER OUTPUT

Section	Size	Length (ft)	Grade	Weight (lb)
1	Guyed Pole 8" OD	12.833	C1020	103.0
2	Guyed Pole 8" OD	25.667	C1020	206.1
3	Guyed Pole 8" OD	25.667	C1020	206.1
4	Guyed Pole 10" OD	25.625	C1020	268.5
5	Guyed Pole 10" OD	37.250	C1020	390.3
6	Guyed Pole 10" OD	38.562	C1020	404.1
				1578.0





PLAN

DESIGNED APPURTENANCE LOADING

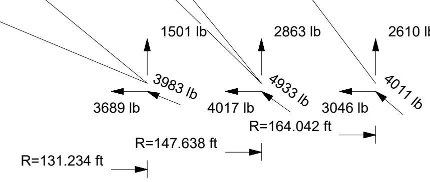
TYPE	ELEVATION	TYPE	ELEVATION
Propellor Anemometer/Wind Vane	167.979	Relative Humidity Sensor	140.42
95" Boom Mount	164.979	Barometric Pressure Sensor	140.42
NRG #40C Anemometer	162.402	NRG #40C Anemometer	130.577
NRG #40C Anemometer	162.402	NRG #40C Anemometer	130.577
95" Boom Mount	159.402	95" Boom Mount	127.577
95" Boom Mount	159.402	95" Boom Mount	127.577
NRG 200P Wind Vane	156.496	NRG 200P Wind Vane	111.22
NRG #40C Anemometer	156.496	95" Boom Mount	108.22
95" Boom Mount	153.496	NRG #40C Anemometer	105.315
95" Boom Mount	153.496	NRG #40C Anemometer	105.315
21" Dia. Aircraft Marker Ball (Orange)	145.997	95" Boom Mount	102.315
21" Dia. Aircraft Marker Ball (Orange)	145.997	95" Boom Mount	102.315
21" Dia. Aircraft Marker Ball (Orange)	145.997	Temperature Sensor	49.213
21" Dia. Aircraft Marker Ball (Orange)	145.997	Data Logger	4.92
Temperature Sensor	140.42		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
C1020	45 ksi	65 ksi			

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-H Standard.
2. Tower designed for a 115 mph basic wind in accordance with the TIA-222-H Standard.
3. Tower is also designed for a 60 mph basic wind with 0.50 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category I.
6. Topographic Category 2 with Crest Height of 1500.000 ft
7. 5.000 ft Lightning Rod is included for load transfer only.
8. TOWER RATING: 95.9%



ALL REACTIONS ARE FACTORED

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job: **165.6' (50 meters) XHD MET Tower with Standard Footprint**		
Project: **Matanuska-Susitna Borough, AK**		
Client: NRG	Drawn by: Mikko Ahola, PE	App'd:
Code: TIA-222-H	Date: 07/01/24	Scale: NTS
Path:		Dwg No. E-1

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

- Tower base elevation above sea level: 2461.000 ft.
- Basic wind speed of 115 mph.
- Risk Category I.
- Exposure Category C.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 2.
- Crest Height: 1500.000 ft.
- Nominal ice thickness of 0.500 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 60 mph is used in combination with ice.
- Deflections calculated using a wind speed of 60 mph.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Safety factor used in guy design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Pole Size*	*Pole Grade*	*Socket Length* *ft*
L1	165.604-152.771	12.833	Guyed Pole 8" OD	C1020 (45 ksi)	
L2	152.771-127.104	25.667	Guyed Pole 8" OD	C1020 (45 ksi)	
L3	127.104-101.437	25.667	Guyed Pole 8" OD	C1020 (45 ksi)	
L4	101.437-75.812	25.625	Guyed Pole 10" OD	C1020 (45 ksi)	
L5	75.812-38.562	37.250	Guyed Pole 10" OD	C1020 (45 ksi)	
L6	38.562-0.000	38.562	Guyed Pole 10" OD	C1020 (45 ksi)	

Tower Elevation *ft*	*Gusset Area (per face)* ft^2	*Gusset Thickness* *in*	*Gusset Grade*	*Adjust. Factor* A_f	*Adjust. Factor* A_r	*Weight Mult.*	*Double Angle Stitch Bolt Spacing Diagonals* *in*	*Double Angle Stitch Bolt Spacing Horizontals* *in*	*Double Angle Stitch Bolt Spacing Redundants* *in*
L1 165.604-152.771				1	1	1			
L2 152.771-127.1				1	1	1			

Tower Elevation *ft*	*Gusset Area (per face)* *ft²*	*Gusset Thickness* *in*	*Gusset Grade*	*Adjust. Factor* A_f	*Adjust. Factor* A_r	*Weight Mult.*	*Double Angle Stitch Bolt Spacing Diagonals* *in*	*Double Angle Stitch Bolt Spacing Horizontals* *in*	*Double Angle Stitch Bolt Spacing Redundants* *in*
04									
L3 127.104-101.437				1	1	1			
L4 101.437-75.812				1	1	1			
L5 75.812-38.562				1	1	1			
L6 38.562-0.000				1	1	1			

Guy Data

Guy Elevation *ft*	*Guy Grade*		*Guy Size*	*Initial Tension* *lb*	*%*	*Guy Modulus* *ksi*	*Guy Weight* *plf*	L_u *ft*	*Anchor Radius* *ft*	*Anchor Azimuth Adj.* *°*	*Anchor Elevation* *ft*	*End Fitting Efficiency* *%*
152.771	Miscl	A	NRG 0.030125	179.900	2.57%	15000.000	0.111	223.957	164.042	0.000	0.000	100%
		B	NRG 0.030125	179.900	2.57%	15000.000	0.111	223.957	164.042	0.000	0.000	100%
		C	NRG 0.030125	179.900	2.57%	15000.000	0.111	223.957	164.042	0.000	0.000	100%
		D	NRG 0.030125	179.900	2.57%	15000.000	0.111	223.957	164.042	0.000	0.000	100%
127.104	Miscl	A	NRG 0.030125	179.900	2.57%	15000.000	0.111	194.647	147.638	0.000	0.000	100%
		B	NRG 0.030125	179.900	2.57%	15000.000	0.111	194.647	147.638	0.000	0.000	100%
		C	NRG 0.030125	179.900	2.57%	15000.000	0.111	194.647	147.638	0.000	0.000	100%
		D	NRG 0.030125	179.900	2.57%	15000.000	0.111	194.647	147.638	0.000	0.000	100%
101.437	Miscl	A	NRG 0.030125	179.900	2.57%	15000.000	0.111	178.872	147.638	0.000	0.000	100%
		B	NRG 0.030125	179.900	2.57%	15000.000	0.111	178.872	147.638	0.000	0.000	100%
		C	NRG 0.030125	179.900	2.57%	15000.000	0.111	178.872	147.638	0.000	0.000	100%
		D	NRG 0.030125	179.900	2.57%	15000.000	0.111	178.872	147.638	0.000	0.000	100%
75.812	Miscl	A	NRG 0.030125	179.900	2.57%	15000.000	0.111	151.199	131.234	0.000	0.000	100%
		B	NRG 0.030125	179.900	2.57%	15000.000	0.111	151.199	131.234	0.000	0.000	100%
		C	NRG 0.030125	179.900	2.57%	15000.000	0.111	151.199	131.234	0.000	0.000	100%
		D	NRG 0.030125	179.900	2.57%	15000.000	0.111	151.199	131.234	0.000	0.000	100%

38.562	Miscl	A	NRG	179.900	2.57%	15000.000	0.111	136.466	131.234	0.000	0.000	100%
		B	0.030125	179.900	2.57%	15000.000	0.111	136.466	131.234	0.000	0.000	100%
		C	NRG	179.900	2.57%	15000.000	0.111	136.466	131.234	0.000	0.000	100%
		D	0.030125	179.900	2.57%	15000.000	0.111	136.466	131.234	0.000	0.000	100%
			NRG									
			0.030125									
			NRG									
			0.030125									

Guy Data *(cont'd)*

Guy Elevation *ft*	*Mount Type*	*Torque-Arm Spread* *ft*	*Torque-Arm Leg Angle* *°*	*Torque-Arm Style*	*Torque-Arm Grade*	*Torque-Arm Type*	*Torque-Arm Size*
152.771	Corner						
127.104	Corner						
101.437	Corner						
75.812	Corner						
38.562	Corner						

Guy Data *(cont'd)*

Guy Elevation *ft*	*Diagonal Grade*	*Diagonal Type*	*Upper Diagonal Size*	*Lower Diagonal Size*	*Is Strap.*	*Pull-Off Grade*	*Pull-Off Type*	*Pull-Off Size*
152.771	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
127.104	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
101.437	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
75.812	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
38.562	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	

Guy Data *(cont'd)*

Guy Elevation *ft*	*Cable Weight A* *lb*	*Cable Weight B* *lb*	*Cable Weight C* *lb*	*Cable Weight D* *lb*	*Tower Intercept A* *ft*	*Tower Intercept B* *ft*	*Tower Intercept C* *ft*	*Tower Intercept D* *ft*
152.771	30.939	30.939	30.939	30.939	18.222 7.4 sec/pulse	18.222 7.4 sec/pulse	18.222 7.4 sec/pulse	18.222 7.4 sec/pulse
127.104	36.418	36.418	36.418	36.418	18.523 7.4 sec/pulse	18.523 7.4 sec/pulse	18.523 7.4 sec/pulse	18.523 7.4 sec/pulse
101.437	25.467	25.467	25.467	25.467	12.191 6.0 sec/pulse	12.191 6.0 sec/pulse	12.191 6.0 sec/pulse	12.191 6.0 sec/pulse
75.812	21.459	21.459	21.459	21.459	8.767	8.767	8.767	8.767

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
38.562	29.963	29.963	29.963	29.963	5.1 sec/pulse 11.131 5.8 sec/pulse	5.1 sec/pulse 11.131 5.8 sec/pulse	5.1 sec/pulse 11.131 5.8 sec/pulse	5.1 sec/pulse 11.131 5.8 sec/pulse

Guy Data *(cont'd)*

			Torque Arm		Pull Off		Diagonal	
Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K_x	K_y	K_x	K_y	K_x	K_y
152.771	No	No			1	1	1	1
127.104	No	No			1	1	1	1
101.437	No	No			1	1	1	1
75.812	No	No			1	1	1	1
38.562	No	No			1	1	1	1

Guy Data *(cont'd)*

	Torque-Arm				Pull Off				Diagonal			
Guy Elevation ft	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U
152.771	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
127.104	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
101.437	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
75.812	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
38.562	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75

Guy Insulator Data

Guy Elevation ft	#	Length in	Diameter in	Weight lb		Equivalent Unit Weight plf	Equivalent Diameter in	Equivalent Diameter w/Ice in
152.771	13	3.500	6.000	0.500	A	0.138	0.313	1.487
					B	0.138	0.313	1.487
					C	0.138	0.313	1.487
					D	0.138	0.313	1.487
127.104	1	21.000	21.000	15.000	A	0.187	0.374	1.599
					B	0.187	0.374	1.599
					C	0.187	0.374	1.599
					D	0.187	0.374	1.599

101.437	12	3.500	6.000	0.500	A	0.142	0.323	1.467
					B	0.142	0.323	1.467
					C	0.142	0.323	1.467
					D	0.142	0.323	1.467
75.812	10	3.500	6.000	0.500	A	0.142	0.322	1.437
					B	0.142	0.322	1.437
					C	0.142	0.322	1.437
					D	0.142	0.322	1.437
38.562	1	21.000	21.000	15.000	A	0.220	0.426	1.588
					B	0.220	0.426	1.588
					C	0.220	0.426	1.588
					D	0.220	0.426	1.588

Guy Pressures

Guy Elevation ft	*Guy Location*	*z ft*	*q_z ksf*	*q_z Ice ksf*	*Ice Thickness in*
152.771	A	76.386	0.069	0.019	0.590
	B	76.386	0.069	0.019	0.590
	C	76.386	0.069	0.019	0.590
	D	76.386	0.069	0.019	0.590
127.104	A	63.552	0.067	0.018	0.615
	B	63.552	0.067	0.018	0.615
	C	63.552	0.067	0.018	0.615
	D	63.552	0.067	0.018	0.615
101.437	A	50.719	0.064	0.018	0.576
	B	50.719	0.064	0.018	0.576
	C	50.719	0.064	0.018	0.576
	D	50.719	0.064	0.018	0.576
75.812	A	37.906	0.061	0.017	0.561
	B	37.906	0.061	0.017	0.561
	C	37.906	0.061	0.017	0.561
	D	37.906	0.061	0.017	0.561
38.562	A	19.281	0.053	0.015	0.583
	B	19.281	0.053	0.015	0.583
	C	19.281	0.053	0.015	0.583
	D	19.281	0.053	0.015	0.583

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation ft	*Guy Location*	*Chord Angle °*	*Guy Tension Top Bottom lb*	*F_x lb*	*F_y lb*	*F_z lb*	*M_x lb-ft*	*M_y lb-ft*	*M_z lb-ft*
152.771	A	43.021	200.996 179.900	-98.181	145.328	-98.181	-34.254	0.000	34.254
	B	43.021	200.996 179.900	98.181	145.328	-98.181	-34.254	0.000	-34.254
	C	43.021	200.996 179.900	98.181	145.328	98.181	34.254	0.000	-34.254
	D	43.021	200.996 179.900	-98.181	145.328	98.181	34.254	0.000	34.254
			Sum:	0.000	581.313	0.000	0.000	0.000	0.000
127.104	A	40.790	203.671 179.900	-102.276	143.390	-102.276	-33.797	0.000	33.797

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
	B	40.790	203.671 179.900	102.276	143.390	-102.276	-33.797	0.000	-33.797
	C	40.790	203.671 179.900	102.276	143.390	102.276	33.797	0.000	-33.797
	D	40.790	203.671 179.900	-102.276	143.390	102.276	33.797	0.000	33.797
			Sum:	0.000	573.561	0.000	0.000	0.000	0.000
101.437	A	34.552	194.333 179.897	-108.747	118.800	-108.747	-28.002	0.000	28.002
	B	34.552	194.333 179.897	108.747	118.800	-108.747	-28.002	0.000	-28.002
	C	34.552	194.333 179.897	108.747	118.800	108.747	28.002	0.000	-28.002
	D	34.552	194.333 179.897	-108.747	118.800	108.747	28.002	0.000	28.002
			Sum:	0.000	475.201	0.000	0.000	0.000	0.000
75.812	A	30.093	190.257 179.501	-112.933	103.391	-112.933	-30.462	0.000	30.462
	B	30.093	190.257 179.501	112.933	103.391	-112.933	-30.462	0.000	-30.462
	C	30.093	190.257 179.501	112.933	103.391	112.933	30.462	0.000	-30.462
	D	30.093	190.257 179.501	-112.933	103.391	112.933	30.462	0.000	30.462
			Sum:	0.000	413.563	0.000	0.000	0.000	0.000
38.562	A	16.424	188.363 179.900	-124.485	66.991	-124.485	-19.737	0.000	19.737
	B	16.424	188.363 179.900	124.485	66.991	-124.485	-19.737	0.000	-19.737
	C	16.424	188.363 179.900	124.485	66.991	124.485	19.737	0.000	-19.737
	D	16.424	188.363 179.900	-124.485	66.991	124.485	19.737	0.000	19.737
			Sum:	0.000	267.965	0.000	0.000	0.000	0.000

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
152.771	A	43.021	646.731 542.822	-305.339	481.453	-305.339	-113.480	0.000	113.480
	B	43.021	646.731 542.822	305.339	481.453	-305.339	-113.480	0.000	-113.480
	C	43.021	646.731 542.822	305.339	481.453	305.339	113.480	0.000	-113.480
	D	43.021	646.731 542.822	-305.339	481.453	305.339	113.480	0.000	113.480
			Sum:	0.000	1925.813	0.000	0.000	0.000	0.000
127.104	A	40.790	634.026 532.412	-309.832	458.255	-309.832	-108.012	0.000	108.012
	B	40.790	634.026	309.832	458.255	-309.832	-108.012	0.000	-108.012

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Guy Elevation *ft*	*Guy Location*	*Chord Angle* *°*	*Guy Tension Top Bottom lb*	F_x *lb*	F_y *lb*	F_z *lb*	M_x *lb-ft*	M_y *lb-ft*	M_z *lb-ft*
			532.412						
	C	40.790	634.026	309.832	458.255	309.832	108.012	0.000	-108.012
			532.412						
	D	40.790	634.026	-309.832	458.255	309.832	108.012	0.000	108.012
			532.412						
			Sum:	0.000	1833.019	0.000	0.000	0.000	0.000
101.437	A	34.552	577.844	-315.617	366.981	-315.617	-86.498	0.000	86.498
			511.654						
	B	34.552	577.844	315.617	366.981	-315.617	-86.498	0.000	-86.498
			511.654						
	C	34.552	577.844	315.617	366.981	315.617	86.498	0.000	-86.498
			511.654						
	D	34.552	577.844	-315.617	366.981	315.617	86.498	0.000	86.498
			511.654						
			Sum:	0.000	1467.924	0.000	0.000	0.000	0.000
75.812	A	30.093	527.557	-306.890	299.924	-306.890	-88.366	0.000	88.366
			479.825						
	B	30.093	527.557	306.890	299.924	-306.890	-88.366	0.000	-88.366
			479.825						
	C	30.093	527.557	306.890	299.924	306.890	88.366	0.000	-88.366
			479.825						
	D	30.093	527.557	-306.890	299.924	306.890	88.366	0.000	88.366
			479.825						
			Sum:	0.000	1199.695	0.000	0.000	0.000	0.000
38.562	A	16.424	512.372	-335.665	192.829	-335.665	-56.813	0.000	56.813
			482.803						
	B	16.424	512.372	335.665	192.829	-335.665	-56.813	0.000	-56.813
			482.803						
	C	16.424	512.372	335.665	192.829	335.665	56.813	0.000	-56.813
			482.803						
	D	16.424	512.372	-335.665	192.829	335.665	56.813	0.000	56.813
			482.803						
			Sum:	0.000	771.317	0.000	0.000	0.000	0.000

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation *ft*	*Guy Location*	*Chord Angle* *°*	*Guy Tension Top Bottom lb*	F_x *lb*	F_y *lb*	F_z *lb*	M_x *lb-ft*	M_y *lb-ft*	M_z *lb-ft*
152.771	A	43.021	200.996	-98.181	145.328	-98.181	-34.254	0.000	34.254
			179.900						
	B	43.021	200.996	98.181	145.328	-98.181	-34.254	0.000	-34.254
			179.900						
	C	43.021	200.996	98.181	145.328	98.181	34.254	0.000	-34.254
			179.900						
	D	43.021	200.996	-98.181	145.328	98.181	34.254	0.000	34.254
			179.900						
			Sum:	0.000	581.313	0.000	0.000	0.000	0.000
127.104	A	40.790	203.671	-102.276	143.390	-102.276	-33.797	0.000	33.797
			179.900						
	B	40.790	203.671	102.276	143.390	-102.276	-33.797	0.000	-33.797
			179.900						

tnxTower *Ahola Engineering LLC* *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Job** 165.6' (50 meters) XHD MET Tower with Standard Footprint	**Page** 8 of 32
	Project Matanuska-Susitna Borough, AK	**Date** 08:34:34 07/01/24
	Client NRG	**Designed by** Mikko Ahola, PE

Guy Elevation *ft*	*Guy Location*	*Chord Angle* *°*	*Guy Tension Top Bottom lb*	*F_x* *lb*	*F_y* *lb*	*F_z* *lb*	*M_x* *lb-ft*	*M_y* *lb-ft*	*M_z* *lb-ft*
	C	40.790	203.671 179.900	102.276	143.390	102.276	33.797	0.000	-33.797
	D	40.790	203.671 179.900	-102.276	143.390	102.276	33.797	0.000	33.797
			Sum:	0.000	573.561	0.000	0.000	0.000	0.000
101.437	A	34.552	194.333 179.897	-108.747	118.800	-108.747	-28.002	0.000	28.002
	B	34.552	194.333 179.897	108.747	118.800	-108.747	-28.002	0.000	-28.002
	C	34.552	194.333 179.897	108.747	118.800	108.747	28.002	0.000	-28.002
	D	34.552	194.333 179.897	-108.747	118.800	108.747	28.002	0.000	28.002
			Sum:	0.000	475.201	0.000	0.000	0.000	0.000
75.812	A	30.093	190.257 179.501	-112.933	103.391	-112.933	-30.462	0.000	30.462
	B	30.093	190.257 179.501	112.933	103.391	-112.933	-30.462	0.000	-30.462
	C	30.093	190.257 179.501	112.933	103.391	112.933	30.462	0.000	-30.462
	D	30.093	190.257 179.501	-112.933	103.391	112.933	30.462	0.000	30.462
			Sum:	0.000	413.563	0.000	0.000	0.000	0.000
38.562	A	16.424	188.363 179.900	-124.485	66.991	-124.485	-19.737	0.000	19.737
	B	16.424	188.363 179.900	124.485	66.991	-124.485	-19.737	0.000	-19.737
	C	16.424	188.363 179.900	124.485	66.991	124.485	19.737	0.000	-19.737
	D	16.424	188.363 179.900	-124.485	66.991	124.485	19.737	0.000	19.737
			Sum:	0.000	267.965	0.000	0.000	0.000	0.000

Guy-Tensioning Information

				Temperature At Time Of Tensioning													
				0 F		*20 F*		*40 F*		*60 F*		*80 F*		*100 F*		*120 F*	
Guy Elevation *ft*		*H* *ft*	*V* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*	*Initial Tension* *lb*	*Intercept* *ft*
152.771	A	163.71	152.77	208.611	15.82	197.519	16.67	188.548	17.43	179.900	18.22	171.990	19.02	164.899	19.79	158.130	20.59
	B	163.71	152.77	208.611	15.82	197.519	16.67	188.548	17.43	179.900	18.22	171.990	19.02	164.899	19.79	158.130	20.59
	C	163.71	152.77	208.611	15.82	197.519	16.67	188.548	17.43	179.900	18.22	171.990	19.02	164.899	19.79	158.130	20.59
	D	163.71	152.77	208.611	15.82	197.519	16.67	188.548	17.43	179.900	18.22	171.990	19.02	164.899	19.79	158.130	20.59
127.104	A	147.30	127.10	202.355	16.57	194.550	17.20	187.057	17.85	179.900	18.52	173.715	19.15	167.917	19.77	162.529	20.39
	B	147.30	127.10	202.355	16.57	194.550	17.20	187.057	17.85	179.900	18.52	173.715	19.15	167.917	19.77	162.529	20.39
	C	147.30	127.10	202.355	16.57	194.550	17.20	187.057	17.85	179.900	18.52	173.715	19.15	167.917	19.77	162.529	20.39
	D	147.30	127.10	202.355	16.57	194.550	17.20	187.057	17.85	179.900	18.52	173.715	19.15	167.917	19.77	162.529	20.39
101.437	A	147.30	101.44	221.503	9.96	205.901	10.70	192.152	11.44	179.900	12.19	169.430	12.92	160.286	13.63	151.863	14.35
	B	147.30	101.44	221.503	9.96	205.901	10.70	192.152	11.44	179.900	12.19	169.430	12.92	160.286	13.63	151.863	14.35
	C	147.30	101.44	221.503	9.96	205.901	10.70	192.152	11.44	179.900	12.19	169.430	12.92	160.286	13.63	151.863	14.35
	D	147.30	101.44	221.503	9.96	205.901	10.70	192.152	11.44	179.900	12.19	169.430	12.92	160.286	13.63	151.863	14.35
75.812	A	130.82	75.81	233.605	6.79	212.798	7.44	194.834	8.11	179.900	8.77	166.165	9.47	154.849	10.15	144.738	10.83
	B	130.82	75.81	233.605	6.79	212.798	7.44	194.834	8.11	179.900	8.77	166.165	9.47	154.849	10.15	144.738	10.83
	C	130.82	75.81	233.605	6.79	212.798	7.44	194.834	8.11	179.900	8.77	166.165	9.47	154.849	10.15	144.738	10.83
	D	130.82	75.81	233.605	6.79	212.798	7.44	194.834	8.11	179.900	8.77	166.165	9.47	154.849	10.15	144.738	10.83
38.562	A	130.82	38.56	212.634	9.44	199.544	10.05	189.342	10.58	179.900	11.13	171.471	11.67	163.423	12.24	156.937	12.73
	B	130.82	38.56	212.634	9.44	199.544	10.05	189.342	10.58	179.900	11.13	171.471	11.67	163.423	12.24	156.937	12.73
	C	130.82	38.56	212.634	9.44	199.544	10.05	189.342	10.58	179.900	11.13	171.471	11.67	163.423	12.24	156.937	12.73

tnxTower	Job: 165.6' (50 meters) XHD MET Tower with Standard Footprint	Page: 9 of 32
	Project: Matanuska-Susitna Borough, AK	Date: 08:34:34 07/01/24
	Client: NRG	Designed by: Mikko Ahola, PE

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

			Temperature At Time Of Tensioning													
			0 F		20 F		40 F		60 F		80 F		100 F		120 F	
Guy Elevation ft	H ft	V ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft	Initial Tension lb	Intercept ft
D	130.82	38.56	212.634	9.44	199.544	10.05	189.342	10.58	179.900	11.13	171.471	11.67	163.423	12.24	156.937	12.73

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
Cat5 (0.473" Dia.)	C	No	Yes	Inside Pole	165.604 - 0.000	14	No Ice	0.000	0.150
							1/2" Ice	0.000	0.150

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	165.604-152.771	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	26.949
		D	0.000	0.000	0.000	0.000	0.000
L2	152.771-127.104	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	53.901
		D	0.000	0.000	0.000	0.000	0.000
L3	127.104-101.437	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	53.901
		D	0.000	0.000	0.000	0.000	0.000
L4	101.437-75.812	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	53.812
		D	0.000	0.000	0.000	0.000	0.000
L5	75.812-38.562	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	78.225
		D	0.000	0.000	0.000	0.000	0.000
L6	38.562-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	80.980
		D	0.000	0.000	0.000	0.000	0.000

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	165.604-152.771	A	0.586	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	26.949
		D		0.000	0.000	0.000	0.000	0.000
L2	152.771-127.104	A	0.580	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	53.901
		D		0.000	0.000	0.000	0.000	0.000
L3	127.104-101.437	A	0.571	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	53.901
		D		0.000	0.000	0.000	0.000	0.000
L4	101.437-75.812	A	0.559	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	53.812
		D		0.000	0.000	0.000	0.000	0.000
L5	75.812-38.562	A	0.538	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	78.225
		D		0.000	0.000	0.000	0.000	0.000
L6	38.562-0.000	A	0.487	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	80.980
		D		0.000	0.000	0.000	0.000	0.000

Antenna Pole Forces *Lightning Rod*

Length of Pole ft	Ix in^4	Iy in^4	Modulus E ksi		Antenna Pole C_AA_A ft^2/ft	Antenna Pole Weight plf	Length of Beacon ft	Beacon C_AA_A ft^2	Beacon Weight lb
5.000	1000.000	1000.000	29000.000	No Ice	0.010	0.000	0.000	0.000	0.000
				With Ice	0.020	0.000		0.000	0.000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
*************									
Propellor Anemometer/Wind Vane	C	From Leg	7.920 0.000 0.000	0.000	167.979	No Ice 1/2" Ice	0.350 0.500	0.350 0.500	2.200 5.000
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	164.979	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
*************									
NRG #40C Anemometer	C	From Leg	7.920	0.000	162.402	No Ice	0.200	0.250	0.200

tnxTower	**Job** 165.6' (50 meters) XHD MET Tower with Standard Footprint	**Page** 11 of 32
Ahola Engineering LLC *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Project** Matanuska-Susitna Borough, AK	**Date** 08:34:34 07/01/24
	Client NRG	**Designed by** Mikko Ahola, PE

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft²*	*C_AA_A Side* *ft²*	*Weight* *lb*
			0.000 0.000			1/2" Ice	0.350	0.350	0.500
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	159.402	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.000	162.402	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.000	159.402	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
***									
21" Dia. Aircraft Marker Ball (Orange)	A	From Leg	0.000 0.000 0.000	0.000	145.997	No Ice 1/2" Ice	1.130 1.241	1.130 1.241	15.000 20.000
21" Dia. Aircraft Marker Ball (Orange)	B	From Leg	0.000 0.000 0.000	0.000	145.997	No Ice 1/2" Ice	1.130 1.241	1.130 1.241	15.000 20.000
21" Dia. Aircraft Marker Ball (Orange)	C	From Leg	0.000 0.000 0.000	0.000	145.997	No Ice 1/2" Ice	1.130 1.241	1.130 1.241	15.000 20.000
21" Dia. Aircraft Marker Ball (Orange)	D	From Leg	0.000 0.000 0.000	0.000	145.997	No Ice 1/2" Ice	1.130 1.241	1.130 1.241	15.000 20.000
***									
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.000	130.577	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	127.577	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.000	130.577	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.000	127.577	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
***									
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.000	105.315	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	102.315	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.000	105.315	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.000	102.315	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
***									
NRG 200P Wind Vane	C	From Leg	7.920 0.000 0.000	0.000	156.496	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.250 0.500
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	153.496	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* (*ft ft ft*)	*Azimuth Adjustment* (*°*)	*Placement* (*ft*)		*C_AA_A Front* (*ft^2*)	*C_AA_A Side* (*ft^2*)	*Weight* (*lb*)
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.000	156.496	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.200 0.500
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.000	153.496	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
***									
NRG 200P Wind Vane	C	From Leg	7.920 0.000 0.000	0.000	111.220	No Ice 1/2" Ice	0.200 0.350	0.250 0.350	0.250 0.500
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.000	108.220	No Ice 1/2" Ice	0.250 0.350	1.000 1.250	8.000 10.000
***									
Data Logger	C	From Leg	0.000 0.000 0.000	0.000	4.920	No Ice 1/2" Ice	4.000 4.250	4.000 4.250	50.000 55.000
Temperature Sensor	C	From Leg	0.000 0.000 0.000	0.000	49.213	No Ice 1/2" Ice	0.250 0.350	0.250 0.350	10.000 15.000
*****									
Temperature Sensor	C	From Leg	0.000 0.000 0.000	0.000	140.420	No Ice 1/2" Ice	0.250 0.350	0.250 0.350	5.000 10.000
Relative Humidity Sensor	A	From Leg	0.000 0.000 0.000	0.000	140.420	No Ice 1/2" Ice	0.350 0.500	0.350 0.500	5.000 10.000
Barometric Pressure Sensor	B	From Leg	0.000 0.000 0.000	0.000	140.420	No Ice 1/2" Ice	0.350 0.500	0.350 0.500	2.500 5.000

222-H Verification Constants

Constant	*Value*
K_d	0.95
Ice Thickness Importance Factor	0.8
Z_g	900
α	9.5
K_{zmin}	0.85
K_c	1
K_t	0.43
f	1.25
K_e	0.915

222-H Section Verification ArRr By Element

tnxTower

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job	Page
165.6' (50 meters) XHD MET Tower with Standard Footprint	13 of 32
Project	**Date**
Matanuska-Susitna Borough, AK	08:34:34 07/01/24
Client	**Designed by**
NRG	Mikko Ahola, PE

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
L1 165.604-152.771	2	Guyed Pole 8" OD	119.253	71.327		1	1	8.555	9.808	8.555	9.808
							Sum:	8.555	9.808	8.555	9.808
L2 152.771-127.104	3	Guyed Pole 8" OD	118.166	70.589		1	1	17.111	19.592	17.111	19.592
							Sum:	17.111	19.592	17.111	19.592
L3 127.104-101.437	4	Guyed Pole 8" OD	116.364	69.372		1	1	17.111	19.552	17.111	19.552
							Sum:	17.111	19.552	17.111	19.552
L4 101.437-75.812	5	Guyed Pole 10" OD	142.475	82.64		1	1	21.354	23.740	21.354	23.740
							Sum:	21.354	23.740	21.354	23.740
L5 75.812-38.562	6	Guyed Pole 10" OD	137.146	79.25		1	1	31.042	34.380	31.042	34.380
							Sum:	31.042	34.380	31.042	34.380
L6 38.562-0.000	7	Guyed Pole 10" OD	123.791	70.874		1	1	32.135	35.263	32.135	35.263
							Sum:	32.135	35.263	32.135	35.263

222-H Section Verification Tables - No Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z ksf	Face	e	A_rR_r ft^2
L1 165.604-152.771	159.188		1.396	1.142	1.895		0.078		1	8.555
L2 152.771-127.104	139.938		1.358	1.124	1.912		0.076		1	17.111
L3 127.104-101.437	114.271		1.302	1.1	1.935		0.074		1	17.111
L4 101.437-75.812	88.625		1.234	1.077	1.958		0.071		1	21.354
L5 75.812-38.562	57.467		1.126	1.049	1.988		0.066		1	31.042
L6 38.562-0.000	19.894		0.901	1.017	2.025		0.054		1	32.135

222-H Section Verification Tables - Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z ksf	Face	e	A_rR_r ft^2
L1 165.604-152.771	159.188	159.188	1.396	1.142	1.895	0.586	0.021		1	9.808
L2 152.771-127.104	139.938	139.938	1.358	1.124	1.912	0.580	0.021		1	19.592
L3 127.104-101.437	114.271	114.271	1.302	1.1	1.935	0.571	0.020		1	19.552
L4 101.437-75.812	88.625	88.625	1.234	1.077	1.958	0.559	0.019		1	23.740
L5 75.812-38.562	57.467	57.187	1.126	1.049	1.988	0.538	0.018		1	34.380
L6 38.562-0.000	19.894	19.281	0.901	1.017	2.025	0.487	0.015		1	35.263

222-H Section Verification Tables - Service

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z ksf	Face	e	A_rR_r ft^2
L1 165.604-152.771	159.188		1.396	1.142	1.895		0.019		1	8.555
L2 152.771-127.104	139.938		1.358	1.124	1.912		0.019		1	17.111
L3 127.104-101.437	114.271		1.302	1.1	1.935		0.018		1	17.111
L4 101.437-75.812	88.625		1.234	1.077	1.958		0.017		1	21.354
L5 75.812-38.562	57.467		1.126	1.049	1.988		0.016		1	31.042
L6 38.562-0.000	19.894		0.901	1.017	2.025		0.013		1	32.135

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 165.604-152.771	26.949	103.024	A	1	0.6	0.078	1	1	8.555	439.402	34.240	D
			B	1	0.6		1	1	8.555			
			C	1	0.6		1	1	8.555			
			D	1	0.6		1	1	8.555			
L2 152.771-127.104	53.901	206.055	A	1	0.6	0.076	1	1	17.111	862.897	33.619	D
			B	1	0.6		1	1	17.111			
			C	1	0.6		1	1	17.111			
			D	1	0.6		1	1	17.111			
L3 127.104-101.437	53.901	206.055	A	1	0.6	0.074	1	1	17.111	836.786	32.602	D
			B	1	0.6		1	1	17.111			
			C	1	0.6		1	1	17.111			
			D	1	0.6		1	1	17.111			
L4 101.437-75.812	53.812	268.511	A	1	0.6	0.071	1	1	21.354	1001.919	39.099	D
			B	1	0.6		1	1	21.354			
			C	1	0.6		1	1	21.354			
			D	1	0.6		1	1	21.354			
L5 75.812-38.562	78.225	390.323	A	1	0.6	0.066	1	1	31.042	1345.147	36.111	D
			B	1	0.6		1	1	31.042			
			C	1	0.6		1	1	31.042			
			D	1	0.6		1	1	31.042			
L6 38.562-0.000	80.980	404.071	A	1	0.6	0.054	1	1	32.135	1152.718	29.893	D
			B	1	0.6		1	1	32.135			
			C	1	0.6		1	1	32.135			
			D	1	0.6		1	1	32.135			
Sum Weight:	347.768	1578.039								5638.869		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 165.604-152.771	26.949	103.024	A	1	0.6	0.078	1	1	8.555	439.402	34.240	D
			B	1	0.6		1	1	8.555			
			C	1	0.6		1	1	8.555			
			D	1	0.6		1	1	8.555			
L2	53.901	206.055	A	1	0.6	0.076	1	1	17.111	862.897	33.619	D

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
152.771-127.1			B	1	0.6		1	1	17.111			
04			C	1	0.6		1	1	17.111			
			D	1	0.6		1	1	17.111			
L3	53.901	206.055	A	1	0.6	0.074	1	1	17.111	836.786	32.602	D
127.104-101.4			B	1	0.6		1	1	17.111			
37			C	1	0.6		1	1	17.111			
			D	1	0.6		1	1	17.111			
L4	53.812	268.511	A	1	0.6	0.071	1	1	21.354	1001.919	39.099	D
101.437-75.81			B	1	0.6		1	1	21.354			
2			C	1	0.6		1	1	21.354			
			D	1	0.6		1	1	21.354			
L5	78.225	390.323	A	1	0.6	0.066	1	1	31.042	1345.147	36.111	D
75.812-38.562			B	1	0.6		1	1	31.042			
			C	1	0.6		1	1	31.042			
			D	1	0.6		1	1	31.042			
L6	80.980	404.071	A	1	0.6	0.054	1	1	32.135	1152.718	29.893	D
38.562-0.000			B	1	0.6		1	1	32.135			
			C	1	0.6		1	1	32.135			
			D	1	0.6		1	1	32.135			
Sum Weight:	347.768	1578.039								5638.869		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1	26.949	181.843	A	1	1.2	0.021	1	1	9.808	274.239	21.370	D
165.604-152.7			B	1	1.2		1	1	9.808			
71			C	1	1.2		1	1	9.808			
			D	1	1.2		1	1	9.808			
L2	53.901	362.059	A	1	1.2	0.021	1	1	19.592	537.880	20.956	D
152.771-127.1			B	1	1.2		1	1	19.592			
04			C	1	1.2		1	1	19.592			
			D	1	1.2		1	1	19.592			
L3	53.901	359.404	A	1	1.2	0.020	1	1	19.552	520.550	20.281	D
127.104-101.4			B	1	1.2		1	1	19.552			
37			C	1	1.2		1	1	19.552			
			D	1	1.2		1	1	19.552			
L4	53.812	453.168	A	1	1.2	0.019	1	1	23.740	606.411	23.665	D
101.437-75.81			B	1	1.2		1	1	23.740			
2			C	1	1.2		1	1	23.740			
			D	1	1.2		1	1	23.740			
L5	78.225	648.210	A	1	1.2	0.018	1	1	34.380	811.092	21.774	D
75.812-38.562			B	1	1.2		1	1	34.380			
			C	1	1.2		1	1	34.380			
			D	1	1.2		1	1	34.380			
L6	80.980	644.554	A	1	1.2	0.015	1	1	35.263	688.661	17.859	D
38.562-0.000			B	1	1.2		1	1	35.263			
			C	1	1.2		1	1	35.263			
			D	1	1.2		1	1	35.263			
Sum Weight:	347.768	2649.238								3438.833		

tnxTower	Job	Page
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	165.6' (50 meters) XHD MET Tower with Standard Footprint	16 of 32
	Project Matanuska-Susitna Borough, AK	**Date** 08:34:34 07/01/24
	Client NRG	**Designed by** Mikko Ahola, PE

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 165.604-152.771	26.949	181.843	A	1	1.2	0.021	1	1	9.808	274.239	21.370	D
			B	1	1.2		1	1	9.808			
			C	1	1.2		1	1	9.808			
			D	1	1.2		1	1	9.808			
L2 152.771-127.104	53.901	362.059	A	1	1.2	0.021	1	1	19.592	537.880	20.956	D
			B	1	1.2		1	1	19.592			
			C	1	1.2		1	1	19.592			
			D	1	1.2		1	1	19.592			
L3 127.104-101.437	53.901	359.404	A	1	1.2	0.020	1	1	19.552	520.550	20.281	D
			B	1	1.2		1	1	19.552			
			C	1	1.2		1	1	19.552			
			D	1	1.2		1	1	19.552			
L4 101.437-75.812	53.812	453.168	A	1	1.2	0.019	1	1	23.740	606.411	23.665	D
			B	1	1.2		1	1	23.740			
			C	1	1.2		1	1	23.740			
			D	1	1.2		1	1	23.740			
L5 75.812-38.562	78.225	648.210	A	1	1.2	0.018	1	1	34.380	811.092	21.774	D
			B	1	1.2		1	1	34.380			
			C	1	1.2		1	1	34.380			
			D	1	1.2		1	1	34.380			
L6 38.562-0.000	80.980	644.554	A	1	1.2	0.015	1	1	35.263	688.661	17.859	D
			B	1	1.2		1	1	35.263			
			C	1	1.2		1	1	35.263			
			D	1	1.2		1	1	35.263			
Sum Weight:	347.768	2649.238								3438.833		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 165.604-152.771	26.949	103.024	A	1	0.752	0.019	1	1	8.555	134.165	10.455	D
			B	1	0.752		1	1	8.555			
			C	1	0.752		1	1	8.555			
			D	1	0.752		1	1	8.555			
L2 152.771-127.104	53.901	206.055	A	1	0.759	0.019	1	1	17.111	265.895	10.359	D
			B	1	0.759		1	1	17.111			
			C	1	0.759		1	1	17.111			
			D	1	0.759		1	1	17.111			
L3 127.104-101.437	53.901	206.055	A	1	0.771	0.018	1	1	17.111	261.841	10.201	D
			B	1	0.771		1	1	17.111			
			C	1	0.771		1	1	17.111			
			D	1	0.771		1	1	17.111			
L4 101.437-75.812	53.812	268.511	A	1	0.63	0.017	1	1	21.354	256.057	9.992	D
			B	1	0.63		1	1	21.354			
			C	1	0.63		1	1	21.354			
			D	1	0.63		1	1	21.354			
L5	78.225	390.323	A	1	0.654	0.016	1	1	31.042	357.132	9.587	D

tnxTower *Ahola Engineering LLC* *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Job** 165.6' (50 meters) XHD MET Tower with Standard Footprint	**Page** 17 of 32
	Project Matanuska-Susitna Borough, AK	**Date** 08:34:34 07/01/24
	Client NRG	**Designed by** Mikko Ahola, PE

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
75.812-38.562			B	1	0.654		1	1	31.042			
			C	1	0.654		1	1	31.042			
			D	1	0.654		1	1	31.042			
L6 38.562-0.000	80.980	404.071	A	1	0.725	0.013	1	1	32.135	339.062	8.793	D
			B	1	0.725		1	1	32.135			
			C	1	0.725		1	1	32.135			
			D	1	0.725		1	1	32.135			
Sum Weight:	347.768	1578.039								1614.150		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1 165.604-152.771	26.949	103.024	A	1	0.752	0.019	1	1	8.555	134.165	10.455	D
			B	1	0.752		1	1	8.555			
			C	1	0.752		1	1	8.555			
			D	1	0.752		1	1	8.555			
L2 152.771-127.104	53.901	206.055	A	1	0.759	0.019	1	1	17.111	265.895	10.359	D
			B	1	0.759		1	1	17.111			
			C	1	0.759		1	1	17.111			
			D	1	0.759		1	1	17.111			
L3 127.104-101.437	53.901	206.055	A	1	0.771	0.018	1	1	17.111	261.841	10.201	D
			B	1	0.771		1	1	17.111			
			C	1	0.771		1	1	17.111			
			D	1	0.771		1	1	17.111			
L4 101.437-75.812	53.812	268.511	A	1	0.63	0.017	1	1	21.354	256.057	9.992	D
			B	1	0.63		1	1	21.354			
			C	1	0.63		1	1	21.354			
			D	1	0.63		1	1	21.354			
L5 75.812-38.562	78.225	390.323	A	1	0.654	0.016	1	1	31.042	357.132	9.587	D
			B	1	0.654		1	1	31.042			
			C	1	0.654		1	1	31.042			
			D	1	0.654		1	1	31.042			
L6 38.562-0.000	80.980	404.071	A	1	0.725	0.013	1	1	32.135	339.062	8.793	D
			B	1	0.725		1	1	32.135			
			C	1	0.725		1	1	32.135			
			D	1	0.725		1	1	32.135			
Sum Weight:	347.768	1578.039								1614.150		

Force Totals (Does not include forces on guys)

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques lb-ft
Leg Weight	1578.039			
Bracing Weight	0.000			

Load Case	*Vertical Forces* *lb*	*Sum of Forces X* *lb*	*Sum of Forces Z* *lb*	*Sum of Torques* *lb-ft*
Total Member Self-Weight	1578.039			
Guy Weight	576.985			
Total Weight	2719.392			
Wind 0 deg - No Ice		0.000	-7324.152	410.134
Wind 45 deg - No Ice		5178.958	-5178.958	570.206
Wind 90 deg - No Ice		7324.152	0.000	396.260
Wind 135 deg - No Ice		5178.958	5178.958	-9.810
Wind 180 deg - No Ice		0.000	7324.152	-410.134
Wind 225 deg - No Ice		-5178.958	5178.958	-570.206
Wind 270 deg - No Ice		-7324.152	0.000	-396.260
Wind 315 deg - No Ice		-5178.958	-5178.958	9.810
Member Ice	1071.200			
Guy Ice	2123.596			
Total Weight Ice	5990.891			
Wind 0 deg - Ice		0.000	-4017.747	155.778
Wind 45 deg - Ice		2840.976	-2840.976	216.306
Wind 90 deg - Ice		4017.747	0.000	150.124
Wind 135 deg - Ice		2840.976	2840.976	-3.998
Wind 180 deg - Ice		0.000	4017.747	-155.778
Wind 225 deg - Ice		-2840.976	2840.976	-216.306
Wind 270 deg - Ice		-4017.747	0.000	-150.124
Wind 315 deg - Ice		-2840.976	-2840.976	3.998
Total Weight	2719.392			
Wind 0 deg - Service		0.000	-2024.614	99.891
Wind 45 deg - Service		1431.618	-1431.618	138.878
Wind 90 deg - Service		2024.614	0.000	96.512
Wind 135 deg - Service		1431.618	1431.618	-2.389
Wind 180 deg - Service		0.000	2024.614	-99.891
Wind 225 deg - Service		-1431.618	1431.618	-138.878
Wind 270 deg - Service		-2024.614	0.000	-96.512
Wind 315 deg - Service		-1431.618	-1431.618	2.389

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.0 Wind 45 deg - No Ice+1.0 Guy
4	1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy
5	1.2 Dead+1.0 Wind 135 deg - No Ice+1.0 Guy
6	1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy
7	1.2 Dead+1.0 Wind 225 deg - No Ice+1.0 Guy
8	1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy
9	1.2 Dead+1.0 Wind 315 deg - No Ice+1.0 Guy
10	1.2 Dead+1.0 Ice+Guy
11	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Guy
12	1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Guy
13	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Guy
14	1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Guy
15	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Guy
16	1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Guy
17	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Guy
18	1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Guy

Comb. No.	*Description*
19	Dead+Wind 0 deg - Service+Guy
20	Dead+Wind 45 deg - Service+Guy
21	Dead+Wind 90 deg - Service+Guy
22	Dead+Wind 135 deg - Service+Guy
23	Dead+Wind 180 deg - Service+Guy
24	Dead+Wind 225 deg - Service+Guy
25	Dead+Wind 270 deg - Service+Guy
26	Dead+Wind 315 deg - Service+Guy

Maximum Member Forces

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
L1	165.604 - 152.771	Pole	Max Tension	5	0.398	-10.313	-10.057
			Max. Compression	10	-302.793	-37.217	-37.240
			Max. Mx	4	-152.142	-6329.101	-54.897
			Max. My	6	-152.147	-57.033	-6329.083
			Max. Vy	4	998.750	-6329.101	-54.897
			Max. Vx	6	998.764	-57.033	-6329.083
			Max. Torque	3			-278.513
		Pole Antenna	Max Tension	5	4.040	-0.064	-2.969
			Max. Compression	12	-0.240	13.102	9.471
			Max. Mx	2	0.167	-51.694	-1.574
			Max. My	8	0.215	-1.448	-49.678
			Max. Vy	2	-20.676	-51.694	-1.574
			Max. Vx	8	-19.869	-1.448	-49.678
			Max. Torque	6			0.000
L2	152.771 - 127.104	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	13	-6543.403	-2953.497	-22.791
			Max. Mx	4	-5895.394	-5402.847	-61.533
			Max. My	6	-5895.337	-63.949	-5402.832
			Max. Vy	8	-697.702	4992.490	-43.864
			Max. Vx	2	-697.664	-46.011	4993.047
			Max. Torque	3			-256.307
		Guy A	Bottom Tension	5	4010.946		
			Top Tension	5	4029.750		
			Top Cable Vert	5	2823.018		
			Top Cable Norm	5	2875.667		
			Top Cable Tan	5	0.003		
			Bot Cable Vert	5	-2609.936		
			Bot Cable Norm	5	3045.640		
			Bot Cable Tan	5	0.003		
		Guy B	Bottom Tension	7	4008.714		
			Top Tension	7	4027.519		
			Top Cable Vert	7	2821.523		
			Top Cable Norm	7	2874.007		
			Top Cable Tan	7	0.037		
			Bot Cable Vert	7	-2608.442		
			Bot Cable Norm	7	3043.980		
			Bot Cable Tan	7	0.037		
		Guy C	Bottom Tension	9	4008.227		
			Top Tension	9	4027.032		
			Top Cable Vert	9	2821.197		
			Top Cable Norm	9	2873.645		
			Top Cable Tan	9	0.005		
			Bot Cable Vert	9	-2608.116		

tnxTower

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job	Page
165.6' (50 meters) XHD MET Tower with Standard Footprint	20 of 32
Project	**Date**
Matanuska-Susitna Borough, AK	08:34:34 07/01/24
Client	**Designed by**
NRG	Mikko Ahola, PE

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
			Bot Cable Norm	9	3043.618		
			Bot Cable Tan	9	0.005		
		Guy D	Bottom Tension	3	4008.804		
			Top Tension	3	4027.610		
			Top Cable Vert	3	2821.584		
			Top Cable Norm	3	2874.075		
			Top Cable Tan	3	0.029		
			Bot Cable Vert	3	-2608.502		
			Bot Cable Norm	3	3044.048		
			Bot Cable Tan	3	0.029		
L3	127.104 - 101.437	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	13	-11679.589	-4309.427	-11.796
			Max. Mx	4	-11052.515	-5849.436	-41.726
			Max. My	6	-11052.490	-43.476	-5849.502
			Max. Vy	8	-615.403	5848.720	-41.673
			Max. Vx	2	-615.368	-43.423	5848.645
			Max. Torque	3			-430.829
		Guy A	Bottom Tension	5	2825.258		
			Top Tension	5	2847.594		
			Top Cable Vert	5	1944.007		
			Top Cable Norm	5	2080.776		
			Top Cable Tan	5	0.000		
			Bot Cable Vert	5	-1734.188		
			Bot Cable Norm	5	2230.398		
			Bot Cable Tan	5	0.000		
		Guy B	Bottom Tension	7	2826.145		
			Top Tension	7	2848.481		
			Top Cable Vert	7	1944.579		
			Top Cable Norm	7	2081.455		
			Top Cable Tan	7	0.054		
			Bot Cable Vert	7	-1734.760		
			Bot Cable Norm	7	2231.077		
			Bot Cable Tan	7	0.054		
		Guy C	Bottom Tension	9	2826.800		
			Top Tension	9	2849.135		
			Top Cable Vert	9	1945.001		
			Top Cable Norm	9	2081.956		
			Top Cable Tan	9	0.002		
			Bot Cable Vert	9	-1735.183		
			Bot Cable Norm	9	2231.578		
			Bot Cable Tan	9	0.002		
		Guy D	Bottom Tension	3	2826.094		
			Top Tension	3	2848.430		
			Top Cable Vert	3	1944.546		
			Top Cable Norm	3	2081.416		
			Top Cable Tan	3	0.052		
			Bot Cable Vert	3	-1734.727		
			Bot Cable Norm	3	2231.038		
			Bot Cable Tan	3	0.052		
L4	101.437 - 75.812	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	13	-15622.832	-4265.920	-6.497
			Max. Mx	8	-14516.965	6567.278	-35.952
			Max. My	2	-14516.974	-37.349	6567.092
			Max. Vy	8	-444.794	6567.278	-35.952
			Max. Vx	2	-444.790	-37.349	6567.092
			Max. Torque	3			-420.346
		Guy A	Bottom Tension	5	2110.464		
			Top Tension	5	2124.403		
			Top Cable Vert	5	1261.452		

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
			Top Cable Norm	5	1709.335		
			Top Cable Tan	5	0.001		
			Bot Cable Vert	5	-1127.477		
			Bot Cable Norm	5	1784.056		
			Bot Cable Tan	5	0.001		
		Guy B	Bottom Tension	7	2111.434		
			Top Tension	7	2125.373		
			Top Cable Vert	7	1261.997		
			Top Cable Norm	7	1710.138		
			Top Cable Tan	7	0.041		
			Bot Cable Vert	7	-1128.023		
			Bot Cable Norm	7	1784.859		
			Bot Cable Tan	7	0.041		
		Guy C	Bottom Tension	9	2111.766		
			Top Tension	9	2125.704		
			Top Cable Vert	9	1262.183		
			Top Cable Norm	9	1710.412		
			Top Cable Tan	9	0.001		
			Bot Cable Vert	9	-1128.209		
			Bot Cable Norm	9	1785.133		
			Bot Cable Tan	9	0.001		
		Guy D	Bottom Tension	3	2111.392		
			Top Tension	3	2125.330		
			Top Cable Vert	3	1261.973		
			Top Cable Norm	3	1710.103		
			Top Cable Tan	3	0.041		
			Bot Cable Vert	3	-1127.999		
			Bot Cable Norm	3	1784.823		
			Bot Cable Tan	3	0.041		
L5	75.812 - 38.562	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	13	-19039.266	-215.522	-1.099
			Max. Mx	8	-16988.165	6139.853	-35.505
			Max. My	2	-16988.173	-36.884	6139.670
			Max. Vy	4	-852.585	-6138.081	-35.517
			Max. Vx	6	-852.584	-36.897	-6138.265
			Max. Torque	3			-418.095
		Guy A	Bottom Tension	5	2040.195		
			Top Tension	5	2050.680		
			Top Cable Vert	5	1066.760		
			Top Cable Norm	5	1751.374		
			Top Cable Tan	5	0.001		
			Bot Cable Vert	5	-974.254		
			Bot Cable Norm	5	1792.548		
			Bot Cable Tan	5	0.001		
		Guy B	Bottom Tension	7	2040.308		
			Top Tension	7	2050.792		
			Top Cable Vert	7	1066.816		
			Top Cable Norm	7	1751.471		
			Top Cable Tan	7	0.032		
			Bot Cable Vert	7	-974.310		
			Bot Cable Norm	7	1792.645		
			Bot Cable Tan	7	0.032		
		Guy C	Bottom Tension	9	2040.302		
			Top Tension	9	2050.786		
			Top Cable Vert	9	1066.813		
			Top Cable Norm	9	1751.466		
			Top Cable Tan	9	0.000		
			Bot Cable Vert	9	-974.307		
			Bot Cable Norm	9	1792.640		
			Bot Cable Tan	9	0.000		

tnxTower	Job: 165.6' (50 meters) XHD MET Tower with Standard Footprint	Page: 22 of 32
Ahola Engineering LLC, P.O. Box 989, Winter Park, CO 80482-0989, Phone: (719) 640-2408, FAX:	Project: Matanuska-Susitna Borough, AK	Date: 08:34:34 07/01/24
	Client: NRG	Designed by: Mikko Ahola, PE

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
		Guy D	Bottom Tension	3	2040.307		
			Top Tension	3	2050.791		
			Top Cable Vert	3	1066.816		
			Top Cable Norm	3	1751.471		
			Top Cable Tan	3	0.033		
			Bot Cable Vert	3	-974.309		
			Bot Cable Norm	3	1792.644		
			Bot Cable Tan	3	0.033		
L6	38.562 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	13	-21286.093	-0.013	3.299
			Max. Mx	4	-19212.861	9492.713	30.777
			Max. My	6	-19212.853	31.509	9492.722
			Max. Vy	8	-1057.041	0.010	13.331
			Max. Vx	2	-1057.041	13.782	0.010
			Max. Torque	3			-506.206
		Guy A	Bottom Tension	5	1968.176		
			Top Tension	5	1976.561		
			Top Cable Vert	5	582.770		
			Top Cable Norm	5	1888.696		
			Top Cable Tan	5	0.000		
			Bot Cable Vert	5	-526.635		
			Bot Cable Norm	5	1896.411		
			Bot Cable Tan	5	0.000		
		Guy B	Bottom Tension	7	1966.889		
			Top Tension	7	1975.273		
			Top Cable Vert	7	582.409		
			Top Cable Norm	7	1887.459		
			Top Cable Tan	7	0.014		
			Bot Cable Vert	7	-526.275		
			Bot Cable Norm	7	1895.174		
			Bot Cable Tan	7	0.014		
		Guy C	Bottom Tension	9	1965.852		
			Top Tension	9	1974.237		
			Top Cable Vert	9	582.119		
			Top Cable Norm	9	1886.464		
			Top Cable Tan	9	0.000		
			Bot Cable Vert	9	-525.985		
			Bot Cable Norm	9	1894.179		
			Bot Cable Tan	9	0.000		
		Guy D	Bottom Tension	3	1966.899		
			Top Tension	3	1975.283		
			Top Cable Vert	3	582.412		
			Top Cable Norm	3	1887.469		
			Top Cable Tan	3	0.013		
			Bot Cable Vert	3	-526.278		
			Bot Cable Norm	3	1895.184		
			Bot Cable Tan	3	0.013		

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Mast	Max. Vert	13	21294.697	-85.071	0.662
	Max. H_x	8	19557.715	311.891	0.219
	Max. H_z	2	19557.726	0.202	311.889
	Max. M_x	1	0.000	0.372	0.372

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
	Max. M_z	1	0.000	0.372	0.372
	Max. Torsion	7	503.424	256.820	-256.209
	Min. Vert	1	4454.768	0.372	0.372
	Min. H_x	4	19558.334	-310.519	0.218
	Min. H_z	6	19558.326	0.201	-310.522
	Min. M_x	1	0.000	0.372	0.372
	Min. M_z	1	0.000	0.372	0.372
	Min. Torsion	3	-506.481	-256.213	256.814
Guy D @ 164.042 ft Elev 0 ft Azimuth 225 deg	Max. Vert	24	-106.636	-61.234	61.234
	Max. H_x	24	-106.636	-61.234	61.234
	Max. H_z	3	-2608.502	-2152.487	2152.446
	Min. Vert	3	-2608.502	-2152.487	2152.446
	Min. H_x	3	-2608.502	-2152.487	2152.446
	Min. H_z	24	-106.636	-61.234	61.234
Guy C @ 164.042 ft Elev 0 ft Azimuth 135 deg	Max. Vert	22	-106.592	61.200	61.200
	Max. H_x	9	-2608.116	2152.159	2152.167
	Max. H_z	9	-2608.116	2152.159	2152.167
	Min. Vert	9	-2608.116	2152.159	2152.167
	Min. H_x	22	-106.592	61.200	61.200
	Min. H_z	22	-106.592	61.200	61.200
Guy B @ 164.042 ft Elev 0 ft Azimuth 45 deg	Max. Vert	20	-106.633	61.232	-61.231
	Max. H_x	7	-2608.442	2152.393	-2152.446
	Max. H_z	20	-106.633	61.232	-61.231
	Min. Vert	7	-2608.442	2152.393	-2152.446
	Min. H_x	20	-106.633	61.232	-61.231
	Min. H_z	7	-2608.442	2152.393	-2152.446
Guy A @ 164.042 ft Elev 0 ft Azimuth -45 deg	Max. Vert	26	-106.677	-61.265	-61.265
	Max. H_x	26	-106.677	-61.265	-61.265
	Max. H_z	26	-106.677	-61.265	-61.265
	Min. Vert	5	-2609.936	-2153.590	-2153.595
	Min. H_x	5	-2609.936	-2153.590	-2153.595
	Min. H_z	5	-2609.936	-2153.590	-2153.595
Guy D @ 147.638 ft Elev 0 ft Azimuth 225 deg	Max. Vert	24	-116.318	-81.090	81.092
	Max. H_x	24	-116.318	-81.090	81.092
	Max. H_z	3	-2862.726	-2839.708	2839.577
	Min. Vert	3	-2862.726	-2839.708	2839.577
	Min. H_x	3	-2862.726	-2839.708	2839.577
	Min. H_z	24	-116.318	-81.090	81.092
Guy C @ 147.638 ft Elev 0 ft Azimuth 135 deg	Max. Vert	22	-116.359	81.128	81.128
	Max. H_x	9	-2863.391	2840.241	2840.245
	Max. H_z	9	-2863.391	2840.241	2840.245
	Min. Vert	9	-2863.391	2840.241	2840.245
	Min. H_x	22	-116.359	81.128	81.128

Location	*Condition*	*Gov. Load Comb.*	*Vertical lb*	*Horizontal, X lb*	*Horizontal, Z lb*
	Min. H_z	22	-116.359	81.128	81.128
Guy B @ 147.638 ft Elev 0 ft Azimuth 45 deg	Max. Vert	20	-116.321	81.094	-81.093
	Max. H_x	7	-2862.783	2839.629	-2839.762
	Max. H_z	20	-116.321	81.094	-81.093
	Min. Vert	7	-2862.783	2839.629	-2839.762
	Min. H_x	20	-116.321	81.094	-81.093
	Min. H_z	7	-2862.783	2839.629	-2839.762
Guy A @ 147.638 ft Elev 0 ft Azimuth -45 deg	Max. Vert	26	-116.280	-81.056	-81.056
	Max. H_x	26	-116.280	-81.056	-81.056
	Max. H_z	26	-116.280	-81.056	-81.056
	Min. Vert	5	-2861.665	-2838.648	-2838.647
	Min. H_x	5	-2861.665	-2838.648	-2838.647
	Min. H_z	5	-2861.665	-2838.648	-2838.647
Guy D @ 131.234 ft Elev 0 ft Azimuth 225 deg	Max. Vert	24	-17.284	-64.382	64.382
	Max. H_x	24	-17.284	-64.382	64.382
	Max. H_z	3	-1500.587	-2607.721	2607.656
	Min. Vert	3	-1500.587	-2607.721	2607.656
	Min. H_x	3	-1500.587	-2607.721	2607.656
	Min. H_z	24	-17.284	-64.382	64.382
Guy C @ 131.234 ft Elev 0 ft Azimuth 135 deg	Max. Vert	22	-17.274	64.357	64.357
	Max. H_x	9	-1500.292	2606.974	2606.975
	Max. H_z	9	-1500.292	2606.974	2606.975
	Min. Vert	9	-1500.292	2606.974	2606.975
	Min. H_x	22	-17.274	64.357	64.357
	Min. H_z	22	-17.274	64.357	64.357
Guy B @ 131.234 ft Elev 0 ft Azimuth 45 deg	Max. Vert	20	-17.284	64.382	-64.382
	Max. H_x	7	-1500.585	2607.650	-2607.715
	Max. H_z	20	-17.284	64.382	-64.382
	Min. Vert	7	-1500.585	2607.650	-2607.715
	Min. H_x	20	-17.284	64.382	-64.382
	Min. H_z	7	-1500.585	2607.650	-2607.715
Guy A @ 131.234 ft Elev 0 ft Azimuth -45 deg	Max. Vert	26	-17.294	-64.406	-64.406
	Max. H_x	26	-17.294	-64.406	-64.406
	Max. H_z	26	-17.294	-64.406	-64.406
	Min. Vert	5	-1500.889	-2608.488	-2608.487
	Min. H_x	5	-1500.889	-2608.488	-2608.487
	Min. H_z	5	-1500.889	-2608.488	-2608.487

Tower Mast Reaction Summary

Load Combination	*Vertical* *lb*	*Shear$_x$* *lb*	*Shear$_z$* *lb*	*Overturning Moment, M_x* *lb-ft*	*Overturning Moment, M_z* *lb-ft*	*Torque* *lb-ft*
Dead Only	4454.768	-0.372	-0.372	0.000	0.000	-0.000
1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy	19557.726	-0.202	-311.889	0.000	0.000	361.599
1.2 Dead+1.0 Wind 45 deg - No Ice+1.0 Guy	19142.824	256.213	-256.814	0.000	0.000	506.481
1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy	19558.334	310.519	-0.218	0.000	0.000	349.748
1.2 Dead+1.0 Wind 135 deg - No Ice+1.0 Guy	19143.393	255.835	255.816	0.000	0.000	-9.919
1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy	19558.326	-0.201	310.522	0.000	0.000	-361.589
1.2 Dead+1.0 Wind 225 deg - No Ice+1.0 Guy	19142.823	-256.820	256.209	0.000	0.000	-503.424
1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy	19557.715	-311.891	-0.219	0.000	0.000	-349.758
1.2 Dead+1.0 Wind 315 deg - No Ice+1.0 Guy	19142.818	-257.158	-257.167	0.000	0.000	6.857
1.2 Dead+1.0 Ice+Guy	11321.660	-0.510	-0.511	0.000	0.000	0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Guy	21293.777	-0.662	-86.724	0.000	0.000	138.380
1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Guy	20772.530	86.706	-88.004	0.000	0.000	193.620
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Guy	21294.697	85.071	-0.662	0.000	0.000	133.522
1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Guy	20772.884	86.576	86.571	0.000	0.000	-4.221
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Guy	21294.677	-0.661	85.076	0.000	0.000	-138.376
1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Guy	20772.521	-88.011	86.708	0.000	0.000	-192.059
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Guy	21293.756	-86.729	-0.663	0.000	0.000	-133.526
1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Guy	20772.150	-88.141	-88.140	0.000	0.000	2.661
Dead+Wind 0 deg - Service+Guy	7948.089	-0.437	-173.782	0.000	0.000	95.897
Dead+Wind 45 deg - Service+Guy	7764.790	129.352	-130.205	0.000	0.000	133.553
Dead+Wind 90 deg - Service+Guy	7948.599	172.872	-0.438	0.000	0.000	92.694
Dead+Wind 135 deg - Service+Guy	7765.034	129.324	129.323	0.000	0.000	-2.306
Dead+Wind 180 deg - Service+Guy	7948.591	-0.437	172.872	0.000	0.000	-95.896
Dead+Wind 225 deg - Service+Guy	7764.784	-130.205	129.352	0.000	0.000	-133.477
Dead+Wind 270 deg - Service+Guy	7948.080	-173.782	-0.438	0.000	0.000	-92.695
Dead+Wind 315 deg - Service+Guy	7764.519	-130.246	-130.247	0.000	0.000	2.230

Solution Summary

	Sum of Applied Forces			*Sum of Reactions*			
Load Comb.	*PX* *lb*	*PY* *lb*	*PZ* *lb*	*PX* *lb*	*PY* *lb*	*PZ* *lb*	*% Error*
1	0.000	-2719.386	0.000	0.008	2719.386	0.008	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	*PX lb*	*PY lb*	*PZ lb*	*PX lb*	*PY lb*	*PZ lb*	*% Error*
2	0.000	-3147.867	-12028.785	-0.012	3147.910	12029.446	0.005%
3	8845.378	-3147.867	-8845.378	-8845.454	3147.875	8845.453	0.001%
4	12028.785	-3147.867	0.000	-12029.444	3147.910	-0.011	0.005%
5	8845.378	-3147.867	8845.378	-8845.707	3147.901	-8845.707	0.004%
6	0.000	-3147.867	12028.785	-0.012	3147.910	-12029.444	0.005%
7	-8845.378	-3147.867	8845.378	8845.453	3147.875	-8845.454	0.001%
8	-12028.785	-3147.867	0.000	12029.446	3147.910	-0.011	0.005%
9	-8845.378	-3147.867	-8845.378	8845.707	3147.901	8845.707	0.004%
10	0.000	-6419.342	0.000	0.027	6419.341	0.026	0.001%
11	0.000	-6419.342	-9679.287	-0.002	6419.328	9679.087	0.002%
12	7236.837	-6419.342	-7236.837	-7236.726	6419.329	7236.720	0.001%
13	9679.287	-6419.342	0.000	-9679.086	6419.328	-0.002	0.002%
14	7236.837	-6419.342	7236.837	-7236.722	6419.329	-7236.722	0.001%
15	0.000	-6419.342	9679.287	-0.002	6419.328	-9679.086	0.002%
16	-7236.837	-6419.342	7236.837	7236.720	6419.329	-7236.726	0.001%
17	-9679.287	-6419.342	0.000	9679.087	6419.328	-0.002	0.002%
18	-7236.837	-6419.342	-7236.837	7236.723	6419.329	7236.723	0.001%
19	0.000	-2719.386	-3170.465	-0.001	2719.390	3170.726	0.006%
20	2324.604	-2719.386	-2324.604	-2324.749	2719.389	2324.749	0.005%
21	3170.465	-2719.386	0.000	-3170.726	2719.390	-0.001	0.006%
22	2324.604	-2719.386	2324.604	-2324.749	2719.390	-2324.749	0.005%
23	0.000	-2719.386	3170.465	-0.001	2719.390	-3170.726	0.006%
24	-2324.604	-2719.386	2324.604	2324.749	2719.389	-2324.749	0.005%
25	-3170.465	-2719.386	0.000	3170.726	2719.390	-0.001	0.006%
26	-2324.604	-2719.386	-2324.604	2324.749	2719.389	2324.749	0.005%

Non-Linear Convergence Results

Load Combination	*Converged?*	*Number of Cycles*	*Displacement Tolerance*	*Force Tolerance*
1	Yes	13	0.00000001	0.00000001
2	Yes	29	0.00009197	0.00009029
3	Yes	35	0.00000001	0.00006963
4	Yes	29	0.00009164	0.00008671
5	Yes	32	0.00009724	0.00003794
6	Yes	29	0.00009166	0.00008991
7	Yes	35	0.00000001	0.00006909
8	Yes	29	0.00009197	0.00008709
9	Yes	32	0.00009724	0.00003741
10	Yes	13	0.00000001	0.00000001
11	Yes	35	0.00007026	0.00002507
12	Yes	33	0.00007112	0.00003302
13	Yes	35	0.00007073	0.00002433
14	Yes	33	0.00007144	0.00000780
15	Yes	35	0.00007072	0.00002526
16	Yes	33	0.00007110	0.00003270
17	Yes	35	0.00007025	0.00002413
18	Yes	33	0.00007076	0.00000761
19	Yes	28	0.00000001	0.00002851
20	Yes	30	0.00000001	0.00004387
21	Yes	28	0.00000001	0.00002817
22	Yes	30	0.00000001	0.00002120
23	Yes	28	0.00000001	0.00002856
24	Yes	30	0.00000001	0.00004384
25	Yes	28	0.00000001	0.00002811
26	Yes	30	0.00000001	0.00002114

tnxTower	Job: 165.6' (50 meters) XHD MET Tower with Standard Footprint	Page: 27 of 32
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 08:34:34 07/01/24
	Client: NRG	Designed by: Mikko Ahola, PE

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
Pole Antenna	170.604 - 165.604	12.572	21	0.894	0.196
L1	165.604 - 152.771	11.636	21	0.894	0.196
L2	152.771 - 127.104	9.323	21	0.771	0.179
L3	127.104 - 101.437	5.773	25	0.559	0.147
L4	101.437 - 75.812	3.499	25	0.253	0.107
L5	75.812 - 38.562	2.776	23	0.051	0.080
L6	38.562 - 0	2.749	21	0.105	0.041

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
167.979	Propellor Anemometer/Wind Vane	21	12.080	0.897	0.196	33469
164.979	95" Boom Mount	21	11.519	0.892	0.196	27357
162.402	NRG #40C Anemometer	21	11.040	0.876	0.194	13998
159.402	95" Boom Mount	21	10.489	0.848	0.190	8416
156.496	NRG 200P Wind Vane	21	9.967	0.815	0.185	6065
153.496	95" Boom Mount	21	9.446	0.779	0.180	4937
152.771	Guy	21	9.323	0.771	0.179	4812
145.997	21" Dia. Aircraft Marker Ball (Orange)	21	8.243	0.706	0.170	5023
140.420	Temperature Sensor	19	7.438	0.662	0.163	5588
130.577	NRG #40C Anemometer	25	6.177	0.589	0.151	6963
127.577	95" Boom Mount	25	5.827	0.564	0.147	7290
127.104	Guy	25	5.773	0.559	0.147	7297
111.220	NRG 200P Wind Vane	25	4.196	0.381	0.122	5141
108.220	95" Boom Mount	25	3.957	0.343	0.117	4784
105.315	NRG #40C Anemometer	25	3.746	0.304	0.112	4485
102.315	95" Boom Mount	25	3.551	0.265	0.108	4273
101.437	Guy	25	3.499	0.253	0.107	4246
75.812	Guy	23	2.776	0.051	0.080	6121
49.213	Temperature Sensor	21	2.913	0.064	0.053	5799
38.562	Guy	21	2.749	0.105	0.041	3415
4.920	Data Logger	22	0.458	0.026	0.005	24855

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
Pole Antenna	170.604 - 165.604	49.335	4	3.598	0.746
L1	165.604 - 152.771	45.569	4	3.598	0.746

Section No.	*Elevation ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*
L2	152.771 - 127.104	36.233	4	3.149	0.678
L3	127.104 - 101.437	21.799	8	2.214	0.553
L4	101.437 - 75.812	13.343	8	0.864	0.401
L5	75.812 - 38.562	10.822	8	0.143	0.300
L6	38.562 - 0	10.136	4	0.391	0.155

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	*Appurtenance*	*Gov. Load Comb.*	*Deflection in*	*Tilt °*	*Twist °*	*Radius of Curvature ft*
167.979	Propellor Anemometer/Wind Vane	4	47.356	3.609	0.748	9806
164.979	95" Boom Mount	4	45.099	3.590	0.745	7940
162.402	NRG #40C Anemometer	4	43.170	3.535	0.737	3936
159.402	95" Boom Mount	4	40.949	3.433	0.721	2328
156.496	NRG 200P Wind Vane	4	38.843	3.312	0.703	1665
153.496	95" Boom Mount	4	36.732	3.180	0.683	1344
152.771	Guy	4	36.233	3.149	0.678	1305
145.997	21" Dia. Aircraft Marker Ball (Orange)	4	31.824	2.890	0.640	1266
140.420	Temperature Sensor	2	28.524	2.702	0.614	1300
130.577	NRG #40C Anemometer	8	23.402	2.357	0.570	1365
127.577	95" Boom Mount	8	22.011	2.235	0.555	1377
127.104	Guy	8	21.799	2.214	0.553	1376
111.220	NRG 200P Wind Vane	8	15.834	1.391	0.458	1256
108.220	95" Boom Mount	8	14.970	1.225	0.440	1234
105.315	NRG #40C Anemometer	8	14.217	1.066	0.422	1213
102.315	95" Boom Mount	8	13.528	0.909	0.406	1207
101.437	Guy	8	13.343	0.864	0.401	1212
75.812	Guy	8	10.822	0.143	0.300	2510
49.213	Temperature Sensor	4	10.912	0.265	0.198	1887
38.562	Guy	4	10.136	0.391	0.155	1165
4.920	Data Logger	4	1.632	0.091	0.020	8505

Guy Design Data

Section No.	*Elevation ft*	*Size*	*Initial Tension lb*	*Breaking Load lb*	*Actual T_u lb*	*Allowable ϕT_n lb*	*Required S.F.*	*Actual S.F.*
L2	152.771 (A) (11)	NRG 0.030125 Miscl	179.900	6999.996	4029.750	4200.000	1.000	1.042 ✔
	152.771 (B) (10)	NRG 0.030125 Miscl	179.900	6999.996	4027.520	4200.000	1.000	1.043 ✔
	152.771 (C) (9)	NRG 0.030125 Miscl	179.900	6999.996	4027.030	4200.000	1.000	1.043 ✔
	152.771 (D) (8)	NRG 0.030125 Miscl	179.900	6999.996	4027.610	4200.000	1.000	1.043 ✔
L3	127.104 (A)	NRG	179.900	6999.996	2847.590	4200.000	1.000	1.475 ✔

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T_u lb	Allowable ϕT_n lb	Required S.F.	Actual S.F.
	(15)	0.030125 Miscl						
	127.104 (B) (14)	NRG 0.030125 Miscl	179.900	6999.996	2848.480	4200.000	1.000	1.474 ✔
	127.104 (C) (13)	NRG 0.030125 Miscl	179.900	6999.996	2849.140	4200.000	1.000	1.474 ✔
	127.104 (D) (12)	NRG 0.030125 Miscl	179.900	6999.996	2848.430	4200.000	1.000	1.474 ✔
L4	101.437 (A) (19)	NRG 0.030125 Miscl	179.900	6999.996	2124.400	4200.000	1.000	1.977 ✔
	101.437 (B) (18)	NRG 0.030125 Miscl	179.900	6999.996	2125.370	4200.000	1.000	1.976 ✔
	101.437 (C) (17)	NRG 0.030125 Miscl	179.900	6999.996	2125.700	4200.000	1.000	1.976 ✔
	101.437 (D) (16)	NRG 0.030125 Miscl	179.900	6999.996	2125.330	4200.000	1.000	1.976 ✔
L5	75.812 (A) (23)	NRG 0.030125 Miscl	179.900	6999.996	2050.680	4200.000	1.000	2.048 ✔
	75.812 (B) (22)	NRG 0.030125 Miscl	179.900	6999.996	2050.790	4200.000	1.000	2.048 ✔
	75.812 (C) (21)	NRG 0.030125 Miscl	179.900	6999.996	2050.790	4200.000	1.000	2.048 ✔
	75.812 (D) (20)	NRG 0.030125 Miscl	179.900	6999.996	2050.790	4200.000	1.000	2.048 ✔
L6	38.562 (A) (27)	NRG 0.030125 Miscl	179.900	6999.996	1976.560	4200.000	1.000	2.125 ✔
	38.562 (B) (26)	NRG 0.030125 Miscl	179.900	6999.996	1975.270	4200.000	1.000	2.126 ✔
	38.562 (C) (25)	NRG 0.030125 Miscl	179.900	6999.996	1974.240	4200.000	1.000	2.127 ✔
	38.562 (D) (24)	NRG 0.030125 Miscl	179.900	6999.996	1975.280	4200.000	1.000	2.126 ✔

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
L1	165.604 - 152.771 (2)	Guyed Pole 8" OD	12.833	0.000	0.0	2.359	-152.147	91413.297	0.002
L2	152.771 - 127.104 (3)	Guyed Pole 8" OD	25.667	0.000	0.0	2.359	-5902.010	91413.297	0.065
L3	127.104 - 101.437 (4)	Guyed Pole 8" OD	25.667	0.000	0.0	2.359	-11052.500	91413.297	0.121
L4	101.437 - 75.812 (5)	Guyed Pole 10" OD	25.625	0.000	0.0	3.079	-14517.000	113300.000	0.128
L5	75.812 - 38.562 (6)	Guyed Pole 10" OD	37.250	0.000	0.0	3.079	-17002.199	113300.000	0.150
L6	38.562 - 0 (7)	Guyed Pole 10" OD	38.562	0.000	0.0	3.079	-19226.801	113300.000	0.170

Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	165.604 - 152.771 (2)	Guyed Pole 8" OD	6329.342	18014.750	0.351	0.000	18014.750	0.000
L2	152.771 - 127.104 (3)	Guyed Pole 8" OD	5403.200	18014.750	0.300	0.000	18014.750	0.000
L3	127.104 - 101.437 (4)	Guyed Pole 8" OD	5849.667	18014.750	0.325	0.000	18014.750	0.000
L4	101.437 - 75.812 (5)	Guyed Pole 10" OD	6567.200	28837.083	0.228	0.000	28837.083	0.000
L5	75.812 - 38.562 (6)	Guyed Pole 10" OD	6139.783	28837.083	0.213	0.000	28837.083	0.000
L6	38.562 - 0 (7)	Guyed Pole 10" OD	9492.750	28837.083	0.329	0.000	28837.083	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	165.604 - 152.771 (2)	Guyed Pole 8" OD	998.766	28665.000	0.035	196.593	16627.667	0.012
L2	152.771 - 127.104 (3)	Guyed Pole 8" OD	689.166	28665.000	0.024	180.234	16627.667	0.011
L3	127.104 - 101.437 (4)	Guyed Pole 8" OD	614.524	28665.000	0.021	308.700	16641.250	0.019
L4	101.437 - 75.812 (5)	Guyed Pole 10" OD	444.795	30876.100	0.014	300.906	20674.583	0.015
L5	75.812 - 38.562 (6)	Guyed Pole 10" OD	852.537	30876.100	0.028	294.307	20674.583	0.014
L6	38.562 - 0 (7)	Guyed Pole 10" OD	31.899	30876.100	0.001	295.579	20674.583	0.014

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	165.604 - 152.771 (2)	0.002	0.351	0.000	0.035	0.012	0.355 ✓	1.000	✓
L2	152.771 - 127.104 (3)	0.065	0.300	0.000	0.024	0.011	0.366 ✓	1.000	✓
L3	127.104 - 101.437 (4)	0.121	0.325	0.000	0.021	0.019	0.447 ✓	1.000	✓
L4	101.437 - 75.812 (5)	0.128	0.228	0.000	0.014	0.015	0.357 ✓	1.000	✓
L5	75.812 - 38.562 (6)	0.150	0.213	0.000	0.028	0.014	0.365 ✓	1.000	✓
L6	38.562 - 0 (7)	0.170	0.329	0.000	0.001	0.014	0.499 ✓	1.000	✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	165.604 - 152.771	Pole	Guyed Pole 8" OD	2	-152.147	91413.297	35.5	Pass
L2	152.771 - 127.104	Pole	Guyed Pole 8" OD	3	-5902.010	91413.297	36.6	Pass
L3	127.104 - 101.437	Pole	Guyed Pole 8" OD	4	-11052.500	91413.297	44.7	Pass
L4	101.437 - 75.812	Pole	Guyed Pole 10" OD	5	-14517.000	113300.000	35.7	Pass
L5	75.812 - 38.562	Pole	Guyed Pole 10" OD	6	-17002.199	113300.000	36.5	Pass
L6	38.562 - 0	Pole	Guyed Pole 10" OD	7	-19226.801	113300.000	49.9	Pass
L2	152.771 - 127.104	Guy A@152.771	NRG 0.030125	11	4029.750	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy A@127.104	NRG 0.030125	15	2847.590	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy A@101.437	NRG 0.030125	19	2124.400	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy A@75.812	NRG 0.030125	23	2050.680	4200.000	48.8	Pass
L6	38.562 - 0	Guy A@38.562	NRG 0.030125	27	1976.560	4200.000	47.1	Pass
L2	152.771 - 127.104	Guy B@152.771	NRG 0.030125	10	4027.520	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy B@127.104	NRG 0.030125	14	2848.480	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy B@101.437	NRG 0.030125	18	2125.370	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy B@75.812	NRG 0.030125	22	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy B@38.562	NRG 0.030125	26	1975.270	4200.000	47.0	Pass
L2	152.771 - 127.104	Guy C@152.771	NRG 0.030125	9	4027.030	4200.000	95.9	Pass
L3	127.104 - 101.437	Guy C@127.104	NRG 0.030125	13	2849.140	4200.000	67.8	Pass
L4	101.437 - 75.812	Guy C@101.437	NRG 0.030125	17	2125.700	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy C@75.812	NRG 0.030125	21	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy C@38.562	NRG 0.030125	25	1974.240	4200.000	47.0	Pass
L2	152.771 - 127.104	Guy D@152.771	NRG 0.030125	8	4027.610	4200.000	95.9	Pass
L3	127.104 -	Guy D@127.104	NRG 0.030125	12	2848.430	4200.000	67.8	Pass

tnxTower	Job: 165.6' (50 meters) XHD MET Tower with Standard Footprint	Page: 32 of 32
	Project: Matanuska-Susitna Borough, AK	Date: 08:34:34 07/01/24
	Client: NRG	Designed by: Mikko Ahola, PE

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Section No.	*Elevation ft*	*Component Type*	*Size*	*Critical Element*	*P lb*	*øP$_{allow}$ lb*	*% Capacity*	*Pass Fail*
	101.437							
L4	101.437 - 75.812	Guy D@101.437	NRG 0.030125	16	2125.330	4200.000	50.6	Pass
L5	75.812 - 38.562	Guy D@75.812	NRG 0.030125	20	2050.790	4200.000	48.8	Pass
L6	38.562 - 0	Guy D@38.562	NRG 0.030125	24	1975.280	4200.000	47.0	Pass
							Summary	
						Pole (L6)	49.9	Pass
						Guy A (L2)	95.9	Pass
						Guy B (L2)	95.9	Pass
						Guy C (L2)	95.9	Pass
						Guy D (L2)	95.9	Pass
						RATING =	**95.9**	**Pass**

Program Version 8.2.2.0 - 10/2/2023 File:D:/New Tower/AK 50m XHD & 60m Super XHD Met Towers/tnxTower_AK_50m XHD Met Tower/50m XHD NRG_Standard Footprint Twr -0.5in Ice.eri

ASCE 7 Hazards Report

Address:		**Standard:**	ASCE/SEI 7-16	**Elevation:**	0 ft (NAVD 88)
No Address at This Location		**Risk Category:**	I	**Latitude:**	61.473061
		Soil Class:	D - Default (see Section 11.4.3)	**Longitude:**	-150.988809

Wind

Results:

Wind Speed	115 Vmph
10-year MRI	86 Vmph
25-year MRI	94 Vmph
50-year MRI	99 Vmph
100-year MRI	105 Vmph

Data Source:	ASCE/SEI 7-16, Fig. 26.5-1A and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed:	Wed May 29 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 7-16 Standard. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (annual exceedance probability = 0.00333, MRI = 300 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.618	S_{D1} :	N/A
S_1 :	0.757	T_L :	16
F_a :	1.2	PGA :	0.661
F_v :	N/A	PGA_M :	0.794
S_{MS} :	1.941	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.294	C_v :	1.424

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed May 29 2024

Date Source: USGS Seismic Design Maps

AMERICAN SOCIETY OF CIVIL ENGINEERS

Ice

Results:

Ice Thickness:	0.50 in.
Concurrent Temperature:	-15 F
Gust Speed	60 mph
Data Source:	Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8
Date Accessed:	Wed May 29 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 with concurrent 3-second gust speeds, for a 500-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

APPENDIX B

EQUIPMENT DETAILS

Products ▾ Support ▾ Applications ▾ Contact ▾ News

Home / Wind / All Wind Products / Heavy Duty Wind Monitor-HD-Alpine

Search

Heavy Duty Wind Monitor-HD-Alpine

05108-45

The Heavy Duty Wind Monitor HD-Alpine combines the features of the HD unit along with the ice resistant coating of our popular Alpine Wind Monitor. Robust, reliable, durable . . . . all words to describe the latest addition of the YOUNG family of wind monitors developed to endure the most extreme environments.

0	WIND MONITOR-HD ALPINE 3M Cable	05108-45	$1,710.00

Qty	Product	Model	Price
0	WIND MONITOR-HD ALPINE 8M Cable	05108-45-8M	$1,730.00
0	WIND MONITOR-HD ALPINE 12M Cable	05108-45-12M	$1,756.00
0	SURGE PROTECTION ASSEMBLY 6 Channel	19120	$220.00
0	WIND SENSOR INTERFACE (for use with Model 05108) 0-5 VDC Outputs (recommended cable: 18446)	05608C	$526.00
0	WIND LINE DRIVER (for use with Model 05108) 4-20 mA Outputs (recommended cable: 18723)	05638C	$572.00
0	SENSOR CABLE, 5 CONDUCTOR SHIELDED 22 AWG, Per Ft.	18446	$1.24
0	SENSOR CABLE, 2 PAIR SHIELDED 22 AWG, Per Ft.	18723	$1.02
0	SENSOR CABLE, 6 CONDUCTOR SHIELDED 22 AWG, Per Ft.	18721	$1.50

Add to cart

Quantity discounts applied during checkout. Excludes sensor cables.

Categories: **All Wind Products**, **Mechanical Wind Sensors**

Description

Specifications

Brochures & Manuals

Replacement Parts

Range:	*Wind speed: 0-100 m/s (224 mph)* *Azimuth: 360° mechanical, 355° electrical (5° open)*
Accuracy:	*Wind speed: ± 0.3 m/s (0.6 mph) or 1% of reading* *Wind direction: ± 3 degrees*
Threshold: *	*Propeller: 1.0 m/s (2.2 mph)* *Vane: 1.0 m/s (2.2 mph)*
Dynamic Response: *	*Propeller distance constant (63% recovery) 2.7 m (8.9 ft)* *Vane delay distance (50% recovery) 1.3 m (4.3 ft)* *Damping ratio: 0.3* *Damped natural wavelength: 7.4 m (24.3 ft)* *Undamped natural wavelength: 7.2 m (23.6 ft)*
Signal Output:	*Wind speed: magnetically induced AC voltage, 3 pulses per revolution. 1800 rpm (90 Hz) = 15.0 m/s (33.6 mph)* *Azimuth: analog DC voltage from conductive plastic potentiometer – resistance 10K Ω , linearity 0.25%, life expectancy – 50 million revolutions*
Power Requirement:	*Potentiometer excitation: 15 VDC maximum*
Operating Temperature:	*-50 to 60°C*
Sensor Cable:	*A water tight pigtail cable is supplied for electrical connections. Available in standard lengths of 3, 8 and 12 meters.* *For longer cable lengths a user supplied junction box or connector may be used.*
Dimensions:	*Overall height: 37 cm (14.6 in)* *Overall length: 55 cm (21.7 in)* *Propeller: 18 cm (7 in) diameter* *Mounting: 34 mm (1.34 in) diameter (standard 1 inch pipe)*
Weight:	*1.0 kg (2.2 lbs)*
Shipping Weight:	*2.3 kg (5 lbs)*
Model 05608C	*Wind Sensor Interface* *Signal outputs: 0-5.00 VDC full scale* *Power requirement: 8-24 VDC (5 mA @ 12 VDC)* *Operating temperature: -50 to 60°C*
Model 05638C:	*Wind Line Driver* *Signal outputs: 4-20 mA full scale* *Power Requirement: 12-30 VDC (40 mA max.)* *Operating Temperature: -50 to 60°C*
*	*Nominal values, determined in accordance with ASTM standard procedures.*

SPECIFICATIONS

NRG #40C Anemometer

FEATURES

- The standard anemometer used in the wind energy industry
- Short distance constant
- Simple, durable design

The NRG #40C anemometer is the industry standard anemometer used worldwide. NRG #40 anemometers have recorded wind speeds of 96 m/s (214 mph). Their low moment of inertia and unique bearings permit very rapid response to gusts and lulls. Because of their output linearity, these sensors are ideal for use with various data retrieval systems. A four pole magnet induces a sine wave voltage into a coil producing an output signal with a frequency proportional to wind speed. The #40C is constructed of rugged Lexan cups molded in one piece for repeatable performance. A protective rubber terminal boot is included.

SPECIFICATIONS

Description	Sensor type	3-cup anemometer
	Applications	• wind resource assessment • meteorological studies • environmental monitoring
	Sensor range	1 m/s to 96 m/s (2.2 mph to 214 mph) (highest recorded)
	Instrument compatibility	all NRG loggers
Output signal	Signal type	low level AC sine wave, frequency linearly proportional to windspeed
	Transfer function	m/s = (Hz x 0.765) + 0.35 [miles per hour = (Hz x 1.711) + 0.78]
	Accuracy	within 0.1 m/s (0.2 mph) for the range 5 m/s to 25 m/s (11 mph to 55 mph)
	Calibration	each anemometer individually calibrated, calibration reports provided via electronic download
	Output signal range	0 Hz to 125 Hz (highest recorded)

Global leaders in wind assessment technology

110 Riggs Road · Hinesburg · VT 05461 USA · TEL (802) 482-2255 · FAX (802) 482-2272 · EMAIL sales@nrgsystems.com

SPECIFICATIONS

Response characteristics	Threshold	0.78 m/s (1.75 miles per hour)
	Distance constant (63% recovery)	3.0 m (10 feet)
	Moment of inertia	68 x 10^{-6} S-ft^2
	Swept diameter of rotor	190 mm (7.5 inches)
Installation	Mounting	onto a 13 mm (0.5 inch) diameter mast with cotter pin and set screw
	Tools required	0.25 inch nut driver, petroleum jelly, electrical tape
Environmental	Operating temperature range	-55 °C to 60 °C (-67 °F to 140 °F)
	Operating humidity range	0 to 100% RH
Physical	Connections	4-40 brass hex nut/post terminals
	Weight	0.14 kg (0.3 pounds)
	Dimensions	• 3 cups of conical cross-section, 51 mm (2 inches) dia. • 81 mm (3.2 inches) overall assembly height
Materials	Cups	one piece injection-molded black polycarbonate
	Body	housing is black ABS plastic
	Shaft	beryllium copper, fully hardened
	Bearing	modified Teflon, self-lubricating
	Magnet	Indox 1, 25 mm (1 inch) diameter, 13 mm (0.5 inch) long, 4 poles
	Coil	single coil, bobbin wound, 4100 turns of #40 wire, shielded for ESD protection
	Boot	protective PVC sensor terminal boot included
	Terminals	brass

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200 SERIES WIND VANE

Wind Direction Sensor

MEASURING THE WIND'S ENERGY

■ The 200 Series Wind Direction Vane is a professional quality sensor, originally designed for use in some of the world's largest wind power plants. Its unique qualities make it ideal for use in many other applications in environmental testing and meteorology. ■ Although moderately priced, these sensors offer a level of quality and reliability often found only at a very high premium. The thermoplastic and stainless steel components resist corrosion, and contribute to a high strength-to-weight ratio. ■ As with all NRG Systems products, the 200 Series Vane is elegantly engineered, employing a minimum number of parts while maximizing functional performance. ■ The vane is directly connected to a precision conductive plastic potentiometer located in the main body. An analog voltage output directly proportional to the wind direction is produced when a constant DC excitation voltage is applied to the potentiometer. Several different yaw vane configurations are available for wind turbine control. ■ Field proven, the #200 is the wind industry de facto standard.

NRG SYSTEMS

110 Commerce Street

Hinesburg, VT 05461 USA

(802) 482-2255

FAX (802) 482-2272

Email: sales@nrgsystems.com

200 SERIES WIND VANE
Wind Direction Sensor

APPLICATIONS
- Wind direction sensor for wind data loggers
- Yaw control on wind turbines
- Environmental monitoring instrumentation
- Meteorological studies

FEATURES
- Simple mechanical construction
- Long life, professional quality potentiometer
- No slip rings or brushes result in high reliability, low cost
- Corrosion-resistant materials
- Multiple mechanical and contact seals
- No setscrews to vibrate loose
- Very stable and smooth response to wind changes
- Fully balanced sensor vane

SPECIFICATIONS
MECHANICAL:
Range: Direction–360° mechanical, continuous rotation
Sensitivity: Approx. 1 m/s (2.2 mph)
Materials:
Direction vane and housing–black UV stabilized injection molded plastic
Balance weight–stainless steel
Terminals–three #4-40 solid brass studs with nuts
Potentiometer–stainless steel shaft in two shielded precision grade, stainless steel ball bearings, conductive plastic potentiometer element mounted in a machined aluminum housing
Hardware–all stainless steel construction
Dimensions:
Overall length–21cm (8.3")
Swept diameter–27cm (10.5")
Overall height–12cm (4.3")
Vane size–6cm high x 10cm long (2.3" x 3.8")
Main housing diameter–5cm (2")
Mounting–13mm (0.5") diameter mast with cotter pin and mast set screw
Weight: 0.1kg (0.25 lb)
Shipping Weight: 0.5kg (1 lb)
ELECTRICAL:
Range:
Direction– #200: 340° elecrical (20° open); #200P: 352° electrical (8° open)
Signal:
Analog DC voltage from conductive plastic potentiometer 1K(#200), 10K(#200P); linearity 1.0%, life expectancy of 50 million revolutions (2-6 years normal operation)
Power Requirements:
Regulated potentiometer excitation of 1 to 15 VDC

#200YZ YAW CONTROL WIND VANE
The #200YZ Vane is built with standard #200 Series vane and body with an opto-interrupter type switching system. This yaw control sensor has an open collector, sinking output. Switch points are +/- 10° right or left. Also will control wind turbine yaw at 90° out of the wind.

SPECIFICATIONS MAY CHANGE WITHOUT NOTICE.

ORDERING INFORMATION:

Wind Direction Vane–1K	Cat. No. 200
Precision Wind Direction Vane–10K	Cat. No. 200P

NRG Systems

MEASURING THE WIND'S ENERGY

110 Commerce Street
Hinesburg, VT 05461 USA
(802) 482-2255
FAX (802) 482-2272
Email: sales@nrgsystems.com

Barometric Pressure Sensors

090D 091

Barometric Pressure Sensors convert absolute atmospheric pressure into a linear, proportional voltage, which may be used in any meteorological program.

Features

- Compact size
- Weatherproof enclosure
- Remote output
- Permanent calibration
- Robust construction

These sensors are inherently stable devices that do not require periodic service or routine recalibration.

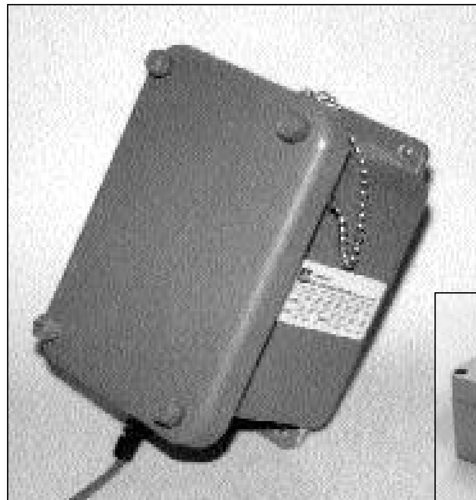
Operation

The enclosure houses a solid-state pressure transducer, with linearization and amplification electronics.

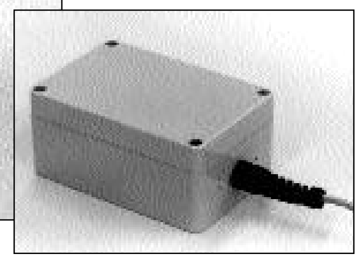
The Model 090D is housed in a heavy duty fiberglass enclosure, suitable for harsh and severe environments. A hose barb is provided to enable the connection of a 1/4" sampling tube to the outside environment.

The Model 091 is contained within a small polycarbonate enclosure, and may be mounted outside or inside a building or other enclosure. Small inlet holes allow the atmospheric pressure access to the sensing element.

The standard range of the 090D/ 091 is 26-32 in. Hg,* suitable for elevations sea level to 1500 ft. Other ranges are available.



090D



091

Specifications

Performance

Resolution:	Infinite
Temp. Operating Range:	-40°C to 65°C
Temp. Compensated Range:	-18°C to 65°C
Accuracy:	±0.04 in Hg (±1.35 mbar) or ±0.125% FS

Electrical Characteristics

Power Requirement:	11 mA @ 12 VDC, Typical
Sensor Output:	0-1 VDC, Standard 0-5 VDC, Optional

Physical Characteristics

090D	Weight:	2 lbs, 5 oz (1.05 Kg)
	Dimensions:	5.5 x 5 x 7.5 in (14 x 12 x 19 cm)
091	Weight:	8.8 oz. (250 g)
	Dimensions:	2.1 x 3.2 x 5 in (5.4 x 8.3 x 13 cm)

Ordering Information

	Specify elevation
	Specify output voltage
Cable:	#1169-xx (xx = length in feet)
	Specify length in feet

Specifications subject to change without notice.
*Conversions: 1 in. Hg = 3.3864 kPa, 1 in. Hg = 33.864 mbar, 1 in. Hg = 25.4 mm/Hg

Met One Instruments, Inc.
Corporate Sales & Service: 1600 Washington Blvd., Grants Pass, OR 97526, Phone (541) 471-7111, Fax (541) 471-7116
Distribution & Service: 3206 Main Street, Suite 106, Rowlett, TX 75088, Phone (972) 412-4747, Fax (972) 412-4716
http://www.metone.com

107 and 108

Temperature Probes

The 107 and 108 are rugged, accurate probes that measure air, soil, and water temperature in a variety of applications. These probes consist of a thermistor encapsulated in an epoxy-filled aluminum housing. The housing protects the thermistor allowing the probes to be buried or submerged. The 107 measures from -35° to +50°C, the 108 from -5° to +95°C.

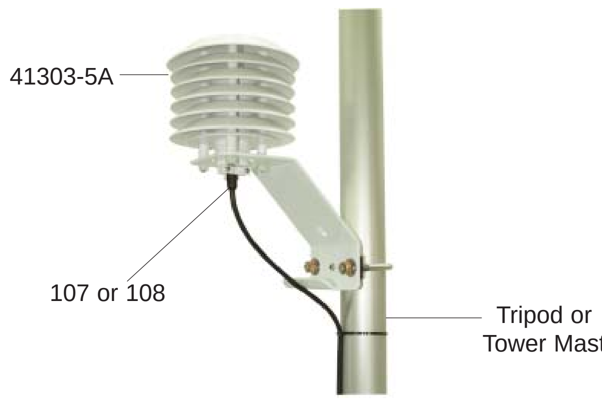
Please note that the 107 and 108 are not compatible with the CR200(X)-series dataloggers. However, a similar thermistor, the 109, has been developed specifically for our CR200(X)-series dataloggers.

Each 107 or 108 probe requires one single-ended channel for measurement.

Installation

Air Temperature

When exposed to sunlight, the 107 and 108 probes should be housed in a 41303-5A 6-plate Gill Radiation Shield. The 41303-5A's louvered construction allows air to pass freely through the shield thereby keeping the probe at or near ambient temperature. The shield's white color reflects solar radiation. The 41303-5A attaches to a crossarm, mast, or user-supplied pipe with a 1.0-in. to 2.1-in. outer diameter.



Above is a probe housed in the 41303-5A radiation shield. The U-bolt is placed in the holes on the side of the bracket to allow the 41303-5A to be attached to a mast or vertical pole.

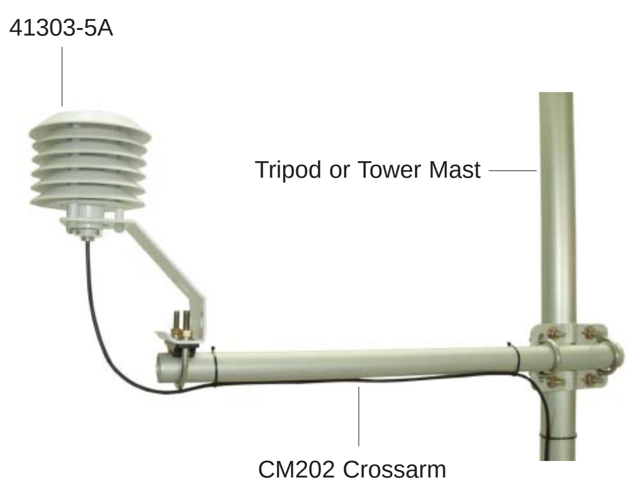
Water Temperature

The probes can be submerged to 50 feet (21 psi). Please note that neither the 107 nor 108 is weighted. Therefore, the installer should either add a weighting system or secure the probe to a fixed, submerged object, such as a piling.

Soil Temperature

The 107 and 108 are suitable for shallow burial only. Placement of the probe's cable inside a rugged conduit may be advisable for long cable runs—especially in locations subject to digging, mowing, traffic, use of power tools, or lightning strikes.

To attach the 41303-5A to a CM202, CM204, or CM206 crossarm, place the 41303-5A's U-bolt in the bottom holes. ▶



Recommended Cable Lengths for Air Temperature Measurements

2-m Height		Atop a tripod or tower via a 2-ft crossarm such as the CM202								
Mast/Leg	**CM202**	**CM6**	**CM106**	**CM10**	**CM110**	**CM115**	**CM120**	**UT10**	**UT20**	**UT30**
9 ft	11 ft	11 ft	14 ft	14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft

Note: *Add two feet to the cable length if mounting the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod.*

Ordering Information

Temperature Probes

107-L Temperature Probe (-35° to +50°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

108-L Temperature Probe (-5° to +95°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

Cable Termination Options (choose one)

-PT Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.

-PW Cable terminates in connector for attachment to a prewired enclosure.

Solar Radiation Shield for Air Temperature Measurements

41303-5A 6-Plate Gill Radiation Shield that houses a 107 or 108 for air temperature measurements.

Specifications

Sensor: BetaTherm 100K6A1B Thermistor

Tolerance
- **107:** ±0.2°C over 0° to 50°C range
- **108:** ±0.2°C over 0° to 70°C range

Temperature Measurement Range
- **107:** -35° to +50°C
- **108:** -5° to +95°C

Steinhart-Hart Equation Error
- **(CRBasic loggers only):** ≤±0.01°C over measurement range

Polynomial Linearization Error (Edlog loggers only)
- **107:** Typically <±0.5°C over measurement range
- **108:** Typically <±0.5°C over -5° to +90°C range

Time Constant in Air: 30 to 60 seconds in a wind speed of 5 m sec^{-1}

Maximum Cable Length: 1000 ft (305 m)

Probe Length: 4.1 in. (10.4 cm)

Probe Diameter: 0.3 in. (0.762 cm)

Weight with 10-ft cable: 5 oz (136 g)

Recommended Cable Lengths for Air Temperature Measurements

2-m Height		Atop a tripod or tower via a 2-ft crossarm such as the CM202								
Mast/Leg	**CM202**	**CM6**	**CM106**	**CM10**	**CM110**	**CM115**	**CM120**	**UT10**	**UT20**	**UT30**
9 ft	11 ft	11 ft	14 ft	14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft
Note: *Add two feet to the cable length if mounting the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod.*										

Ordering Information

Temperature Probes

107-L Temperature Probe (-35° to +50°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

108-L Temperature Probe (-5° to +95°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

Cable Termination Options (choose one)

-PT Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.

-PW Cable terminates in connector for attachment to a prewired enclosure.

Solar Radiation Shield for Air Temperature Measurements

41303-5A 6-Plate Gill Radiation Shield that houses a 107 or 108 for air temperature measurements.

Specifications

Sensor: BetaTherm 100K6A1B Thermistor

Tolerance
- **107:** ±0.2°C over 0° to 50°C range
- **108:** ±0.2°C over 0° to 70°C range

Temperature Measurement Range
- **107:** -35° to +50°C
- **108:** -5° to +95°C

Steinhart-Hart Equation Error
- **(CRBasic loggers only):** ≤±0.01°C over measurement range

Polynomial Linearization Error (Edlog loggers only)
- **107:** Typically <±0.5°C over measurement range
- **108:** Typically <±0.5°C over -5° to +90°C range

Time Constant in Air: 30 to 60 seconds in a wind speed of 5 m sec^{-1}

Maximum Cable Length: 1000 ft (305 m)

Probe Length: 4.1 in. (10.4 cm)

Probe Diameter: 0.3 in. (0.762 cm)

Weight with 10-ft cable: 5 oz (136 g)

Campbell Scientific, Inc. | 815 W 1800 N | Logan, Utah 84321-1784 | (435) 753-2342 | www.campbellsci.com
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NRG Side Mount Boom, 2.4 m (95")

Made of galvanized steel, the 2.4 m (95") side mount boom resists corrosion and is designed to securely mount NRG sensors away from NRG TallTowers to minimize tower shadowing effects.

FEATURES

- For use with NRG #40C or NRG #200P sensors
- Easy to assemble
- Robust, dual-beam support structure
- Mounting bracket tabs assure proper boom installation
- Self-aligning mounting bracket assures secure, 90-degree vertical orientation
- Meets or exceeds industry IEC 61400-12-1 recommendations for tower and boom offset distances
  - » *Horizontal mast offset:* 12.38D on 8" tube; 10D on 10" tube [1]
  - » *Vertical boom offset:* 20D above boom for an NRG #40C anemometer, exceeding IEC 61400-12-1 minimum recommendation of 15D [2]

Self-orienting mounting bracket

Mounting bracket tab

SPECIFICATIONS

Description	Boom type	Sensor mounting boom for standard NRG sensors on NRG TallTowers 8" or 10" diameter
	Applications	Wind resource assessment; for mounting NRG #40C anemometer or NRG #200P wind direction vane on NRG TallTowers
	Sensor compatibility	• NRG #40C anemometer • NRG #200P wind direction vane
	Tower compatibility	NRG TallTowers with 8" or 10" diameter tubing sections
Installation	Mounting	• Mounting bracket attaches to tower with three heavy-duty, stainless steel hose clamps • Sensor mounts to boom with set screw and cotter pin
	Tools required	• 5/16 inch hex driver or flat blade (-) screwdriver for hose clamps • Phillips head (+) screwdriver to mount sensor
	Recommended for installation	• Electric drill with 5/16 nut driver bit for tightening hose clamps • Sheet metal shears or similar for trimming hose clamps
Environmental	Lifespan	2 years +
Physical	Weight	3.6 kg (8 lbs)
	Boom diameter	15.875 mm (0.625 inch) dual beam support at mounting bracket location 19.05 mm (0.75 inch) at boom extension sleeve 12.7 mm (0.50 inch) at sensor mount location
	Offset distance	2.4 m (95 inches)
	Offset height	381 mm (15.0 inches)
Materials	Boom	15.8 mm (0.625 inch) galvanized steel tube
	Mounting bracket	Galvanized steel
Shipping	Shipping weight	3.8 kg (8.4 lbs) for one boom in one box

Note:

[1] *Horizontal offset value, D refers to diameter of the tube tower. Per IEC 61400-12-1 horizontal mast offset is defined as the boom distance from the center of a tubular mast divided by the mast diameter (R/d).*

[2] *Vertical offset value, D refers to the diameter of the mounting boom tube directly below the sensor. Per IEC 61400-12-1 vertical boom offset is defined as the distance from top of the mounting boom tube to the centerline of anemometer cup rotor.*

Global leader in wind measurement technology

110 Riggs Road · Hinesburg · VT 05461 USA · TEL (802) 482-2255 · FAX (802) 482-2272 · EMAIL sales@nrgsystems.com

High Visibility Cable Balls

Introduction

These instructions will assist you in installing high visibility cable balls on TallTower guy wires. The items included are:

- 8 orange plastic cable ball ½ (part number 3814)
- 24 bolts, truss-head #10-32x5/8, stainless steel (part number 3842)
- 48 washers, stainless steel (part number 3843)
- 24 nuts, #10-32 stainless steel Nylock (part number 3844)
- 1/4" cable kit
    - 4 short wire rope cables ¼", 26 inches long (part number 1513) [*compatible with 3/16" or ¼" guy wires*]
    - 8 wire rope clips for ¼" cable (part number 1596)

The tools required are:
(1) #2 Phillips head (+) screwdriver
(1) 3/8 inch nut driver or socket
(1) 1/2 inch nut driver or socket

Installing the Cable Balls

Balls should be installed on each guy wire 3 m (10 feet) below the guy ring on the top set of guy wires. An additional set of balls can be installed lower on the same guy wires at least 3 m (10 feet) above highest point vegetation is likely to reach.

Place one half of a cable ball (part number 3814) in position with the TallTower guy wire cable running through the two grooves molded into the plastic to accept the cable.

Position the short wire rope cable next to the tower guy wire cable (marked with white tape in the photo below) in the grooves. Electrical tape may be used to hold this cable in place (as shown in photo 1).

PHOTO 1

PHOTO 2

Position the top half of the ball over the two cables (photo 2).

Install the bolts, washers and locknuts to secure the plastic pieces together (photo 3). Use a washer under the head of each bolt and another under each locknut. Tighten only enough to secure the plastic pieces together. Avoid over-tightening because this will crack the plastic.

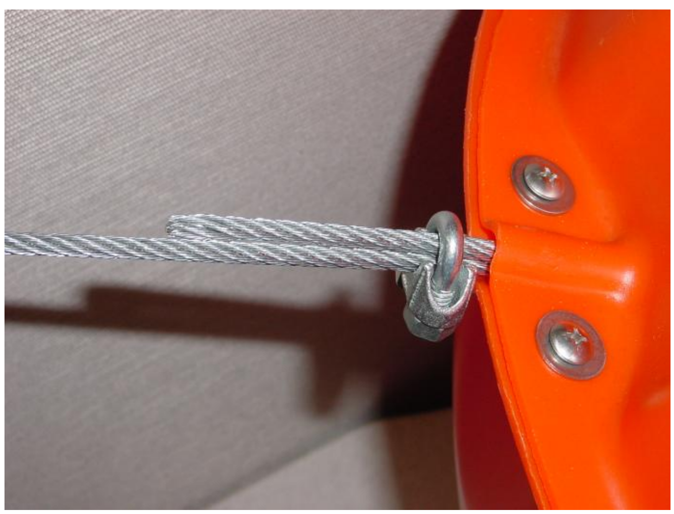


PHOTO 3

Place the u-bolt part of the wire rope clip over the 'dead' cable (the short wire rope cable). Place the saddle part of the wire rope clip over the 'live' cable (the TallTower guy wire cable) and tighten nuts. If you installed the wire rope clip correctly, the nuts will be on the same side as the TallTower guy wire cable (Photo 3). Pull the short cable tight and install another wire rope clip on the other side of the ball as described above.

CAUTION: Incorrect installation of the wire rope clip can severely weaken the cable and cause premature cable failure.

APPENDIX C

TYPICAL GUY ANCHORS AND TOWER BASE PLATE DETAIL

Appendix B: Anchoring Guidelines

B.1 DETERMINE SITE SOIL AND ANCHOR TYPE BEFORE YOU ORDER YOUR TOWER

Per ANSI/TIA-222-G, for design purposes, one can assume Class 6 soils. However, the Standard requires that soil parameters and assumptions be validated prior to installing the tower.

Before your tower is ordered, determine the soil type, preferably through soil sampling. Order the correct anchors based on the results of the soil sample.

The purpose of this section is to give you the information needed to provide suitable anchoring for your Super 60 m XHD TallTower. **Because anchor requirements are site specific, it is the responsibility of the customer to determine suitable anchors. If you are not sure what is required, seek professional guidance.**

Local utility companies can often provide useful information regarding anchoring used in the site area. Do not use rebar anchors, especially when the surface soils are loose or wet.

Table B-1: Soil Classes

Class	Common Soil Types	Geological Soil Classification
3	Dense clays, sands and gravel; hard silts and clays	Glacial till; weathered shales, schist, gneiss and siltstone
4	Medium dense sandy gravel; very stiff to hard silts and clays	Glacial till; hardpan; marls
5	Medium dense coarse sand and sandy gravels; stiff to very stiff silts and clays	Saprolites, residual soils
6	Loose to medium dense fine to coarse sand; firm to stiff clays and silts	Dense hydraulic fill; compacted fill; residual soils
7**	Loose fine sand; Alluvium; loess; soil-firm clays; varied clays; fill	Flood plain soils; lake clays; adobe; gumbo; fill

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.
Charts reproduced by permission, The A.B. Chance Company.

B.2 ANCHOR CHOICES AND OTHER CONSIDERATIONS

The choice of anchors must take into consideration soil type, maximum winds expected, icing or other weather that may affect the tower, and a safety factor suitable for the location and to meet any legal requirements. Considerations include but are not limited to: tornadoes, hurricanes or typhoons, locations where very high winds are expected, potential for flooding or periodic soaking of the soil, soil erosion, and icing events.

B.3 Screw-In Anchor Description

Screw-in anchors are the most commonly used anchors for normal clay soils without rocks. The 8 inch single helix anchors are installed by hand, using a cross bar to screw them into the earth like a corkscrew. The 8 inch twin helix anchors require machinery.

The Super 60 m XHD tower employs two (2), 8 inch diameter screw-in anchors and sixteen (12), 8 inch twin helix anchors.

Table B-2: Specifications for 203 mm (8 inches) diameter Screw-In Anchors

Length Overall:	**203 mm (8 inches) Anchor**
Helix diameter:	203 mm (8.0 inches)
Length Overall:	1.65 m (66 inches)
Rod diameter:	25 mm (1 inch)
Material:	Galvanized steel
Holding Power: (These anchors are not suitable for soils denser than class 5.)	
Class 5 soils *	44.5 kN (10000 pounds)
Class 6 soils *	31.1 kN (7000 pounds)
Class 7 soils **	17.8 kN (4000 pounds)

* See Table for soil class descriptions

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.

Table B-3: Specifications for Mid-Strength 203 mm (8 inches) diameter Twin Helix

Length Overall:	2.7 m (9 feet) (including 7 foot rod)
Helix Diameter:	203 mm (8.0 inches)
Materials:	TBD
Holding Power:	
Class 3 soils *	12700 kg (28000 pounds)
Class 4 soils *	10900 kg (24000 pounds)
Class 5 soils *	9090 kg (20000 pounds)
Class 6 soils *	6800 kg (15000 pounds)
Class 7 soils *	5450 kg (12000 pounds)

* See Table 13 for soil class descriptions

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.

Products > Anchors - Utility > Manta Ray® Earth Anchor

MANTA RAY® EARTH ANCHOR

The Manta Ray Utility Anchor System is used by utilities worldwide. Manta Rays are driven into the ground using a jackhammer, not augured or torqued. No excavation is necessary. The anchors are driven with conventional hydraulic equipment that is readily available.

Description

Manta Ray Anchors are RUS approved, rugged and versatile driven plate anchors for all types of soil conditions. They can be installed in extremely tough soils such as caliche, decomposed rock, glacial till, and permafrost. Larger models are also available for swamp application. Fully portable installation equipment which can fit in the back of a standard pickup truck can be used to access difficult to reach anchor locations. They can also be installed using the line truck's hydraulic system. Every anchor is proof tested during standard installation procedures for a verified tension load measurement. Manta Ray anchors are compatible with standard power hub anchor rods and eyenuts for distribution guy anchors.

Links & PDFs

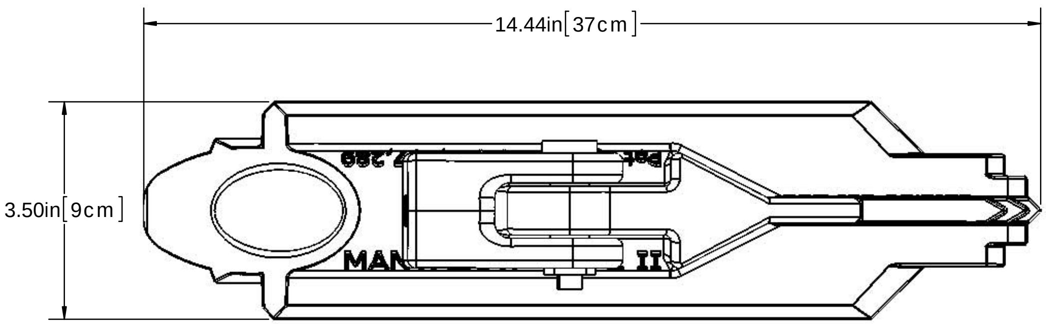
Manta Ray Anchors

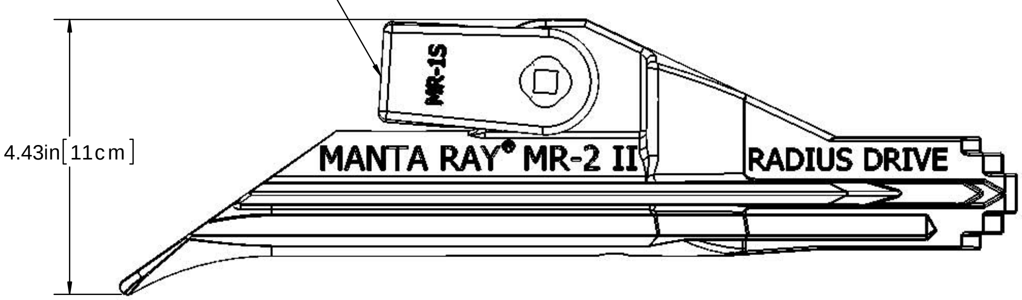
Catalog Number	Model	For PH Rod Size	Ultimate Load Rating (lbs)	Weight (lbs)
20036-UT-II	MR-1	D75 (3/4") or D100 (1")	23,000 or 36,000	13
20199-UT-II	MR-2	D75 (3/4") or D100 (1")	23,000 or 36,000	11
20210-UT-II	MR-3	D62 (5/8")	16,000	7
20229-UT-II	MR-SR	D75 (3/4") or D100 (1")	23,000 or 36,000	21

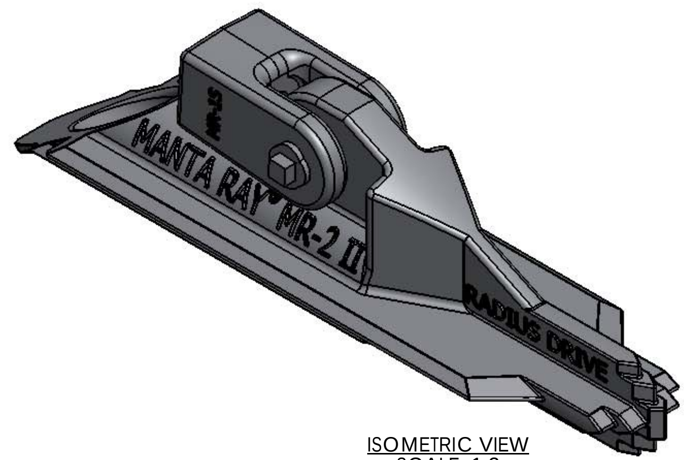
PAPER SIZE	CATALOG NUMBER
B	20199-UT-II

NOTES: UNLESS OTHERWISE SPECIFIED:

1) MECHANICAL ULTIMATE CAPACITY: 40,000 LBS [177.9kN]
2) MAXIMUM WORKING LOAD: UP TO 27,000 LBS [120.1 kN]
(THIS VALUE IS SOIL AND ANCHOR ROD DEPENDANT)
3) AVERAGE WEIGHT: 10.2 LBS [4.6 kg]
4) FINISH: HOT DIP GALVANIZED







ISOMETRIC VIEW
SCALE: 1:2

ODA

OUTSIDE DISTRIBUTION APPROVED: NON-PRODUCTION DRAWING

MACLEAN POWER SYSTEMS
www.macleanpower.com

DRAWING NUMBER:	20199-UT-II
SHEET NAME: SHEET1	1 OF 1
PRODUCT DESCRIPTION	MR-2-1"-UTILITY-II ANCHOR/SHACKLE ASSEMBLY
DRAWN BY: JFD	DATE: 03/06/13

MACLEAN POWER SYSTEMS

Product Information Bulletin

#068-0
02-28-13

MANTA RAY®
EARTH ANCHOR SYSTEMS

Manta Ray® anchor load ultimate tension capacity with 5/8” (16,000 lb-force), ¾” (23,000 lb-force) and 1” (36,000 lb-force) power hub anchor rods.

Manta Ray anchor ultimate load capacity with power hub anchor rods (lbs-force)					
Soil Description	Standard Penetrometer Blow Count (N)	MR-1 (3/4” or 1” rod)	MR-2 (3/4” or 1” rod)	MR-3 (5/8” rod)	MR-SR (3/4” or 1” rod)
Very dense/cemented sands; coarse gravel and cobbles	60-100+	36,000 (1)	36,000 (1)	16,000 (1)	NA
Dense fine compacted sands, very hard silts or clays	45-60	36,000 (1)	28,000 (2)	16,000 (1)	36,000 (1)
Dense clays, sands and gravels, hard silts and clays	35-40	36,000 (1)	22,000 (2)	16,000 (1)	36,000 (1)
Medium dense sandy gravel, stiff to hard silts and clays	24-40	20,000 (2)	18,000 (2)	14,000 (2)	34,000 (2)
Medium dense coarse sandy gravel, stiff to very still silts and clays	14-25	20,000 (2)	12,000 (2)	9,000 (2)	24,000 (2)
Loose to medium dense fine to coarse sand: firm to stiff clays and silts	7-14	15,000 (2)	10,000 (2)	8,000 (2)	18,000 (2)
Loose fine sand, alluvium, soft clays, fine saturated silty sand	4-8	12,000 (2)	8,000 (2)	5,000 (2)	14,000 (2)
Peat, organic silts: inundates silts fly ash	0-5	8,000 (2)	5,000 (2)	2,000 (2)	12,000 (2)

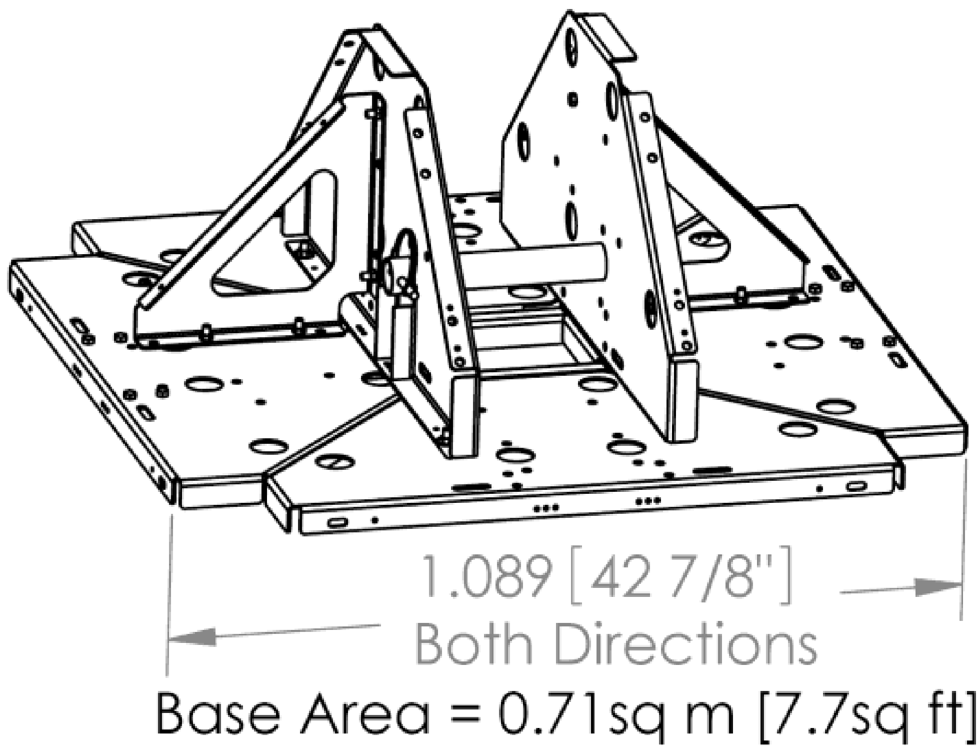
Notes: (1) Manta Ray anchor holding capacity limited by rod tension strength rating
(2) Manta Ray anchor holding capacity limited by soil capacity

Manta Ray® anchor load ultimate tension capacity with 5/8" (71.2 kn), ¾" (102.3 kn) and 1" (160.1 kn) power hub anchor rods.

Manta Ray anchor ultimate load capacity with power hub anchor rods (kn)					
Soil Description	Standard Penetrometer Blow Count (N)	MR-1 kn	MR-2 kn	MR-3 kn	MR-SR kn
Very dense/cemented sands; coarse gravel and cobbles	60-100+	160.1 (1)	160.1 (1)	71.2 (1)	NA
Dense fine compacted sands, very hard silts or clays	45-60	160.1 (1)	124.6 (2)	71.2 (1)	160.1 (1)
Dense clays, sands and gravels, hard silts and clays	35-40	160.1 (1))	97.9 (2)	71.2 (1)	160.1 (1)
Medium dense sandy gravel, stiff to hard silts and clays	24-40	89 (2)	80.1 (2)	62.3 (2)	151.2 (2)
Medium dense coarse sandy gravel, stiff to very still silts and clays	14-25	89 (2)	53.4 (2)	40.0 (2)	106.8 (2)
Loose to medium dense fine to coarse sand: firm to stiff clays and silts	7-14	66.7 (2)	44.5 (2)	35.6 (2)	80.1 (2)
Loose fine sand, alluvium, soft clays, fine saturated silty sand	4-8	53.4 (2)	35.6 (2)	22.2 (2)	62.3 (2)
Peat, organic silts: inundates silts fly ash	0-5	35.6 (2)	22.2 (2)	8.9 (2)	53.4 (2)

Notes: (1) Manta Ray anchor holding capacity limited by rod tension strength rating
(2) Manta Ray anchor holding capacity limited by soil capacity

Baseplate Geometry



APPENDIX D

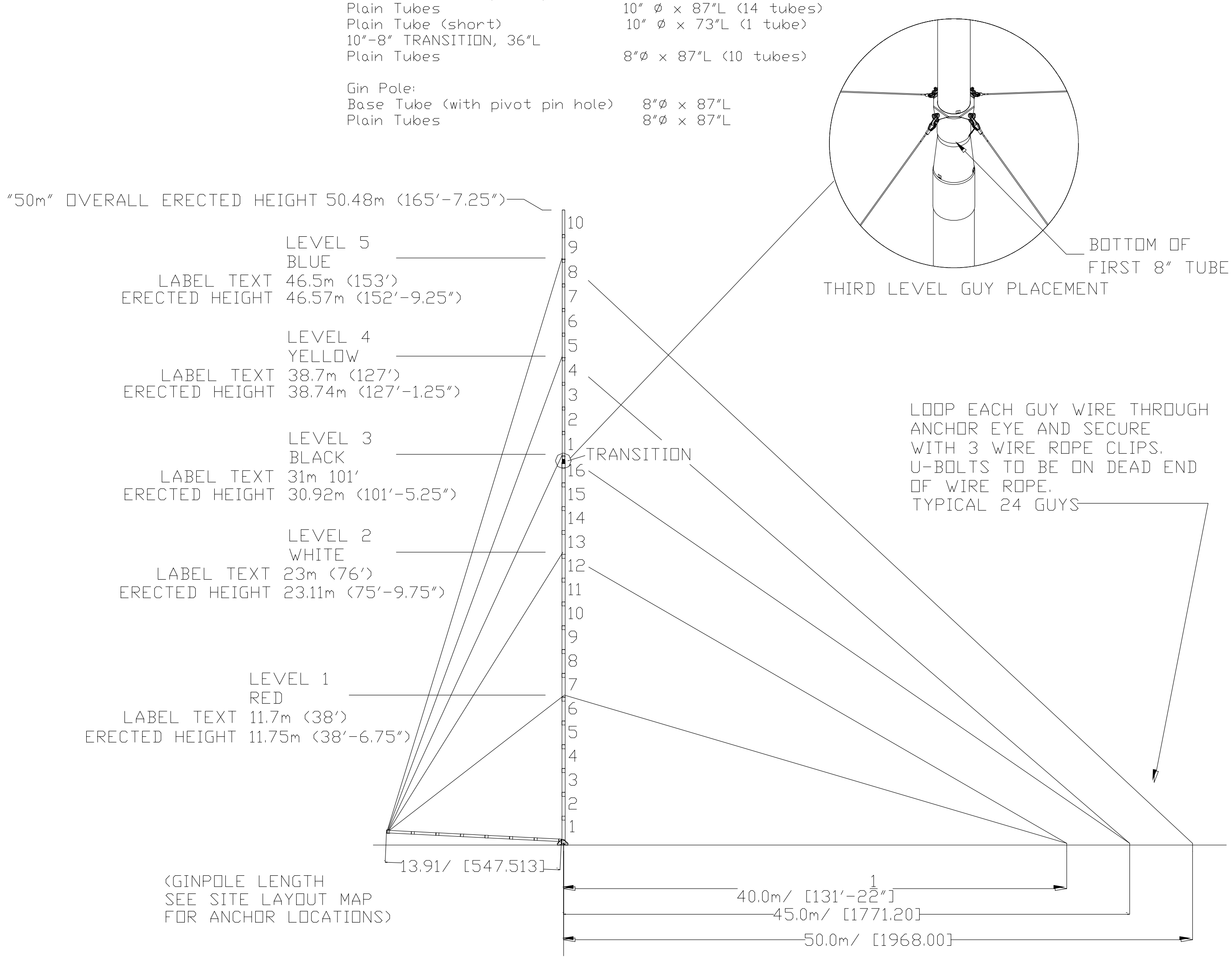
TOWER GROUNDING AND TOWER DETAILS

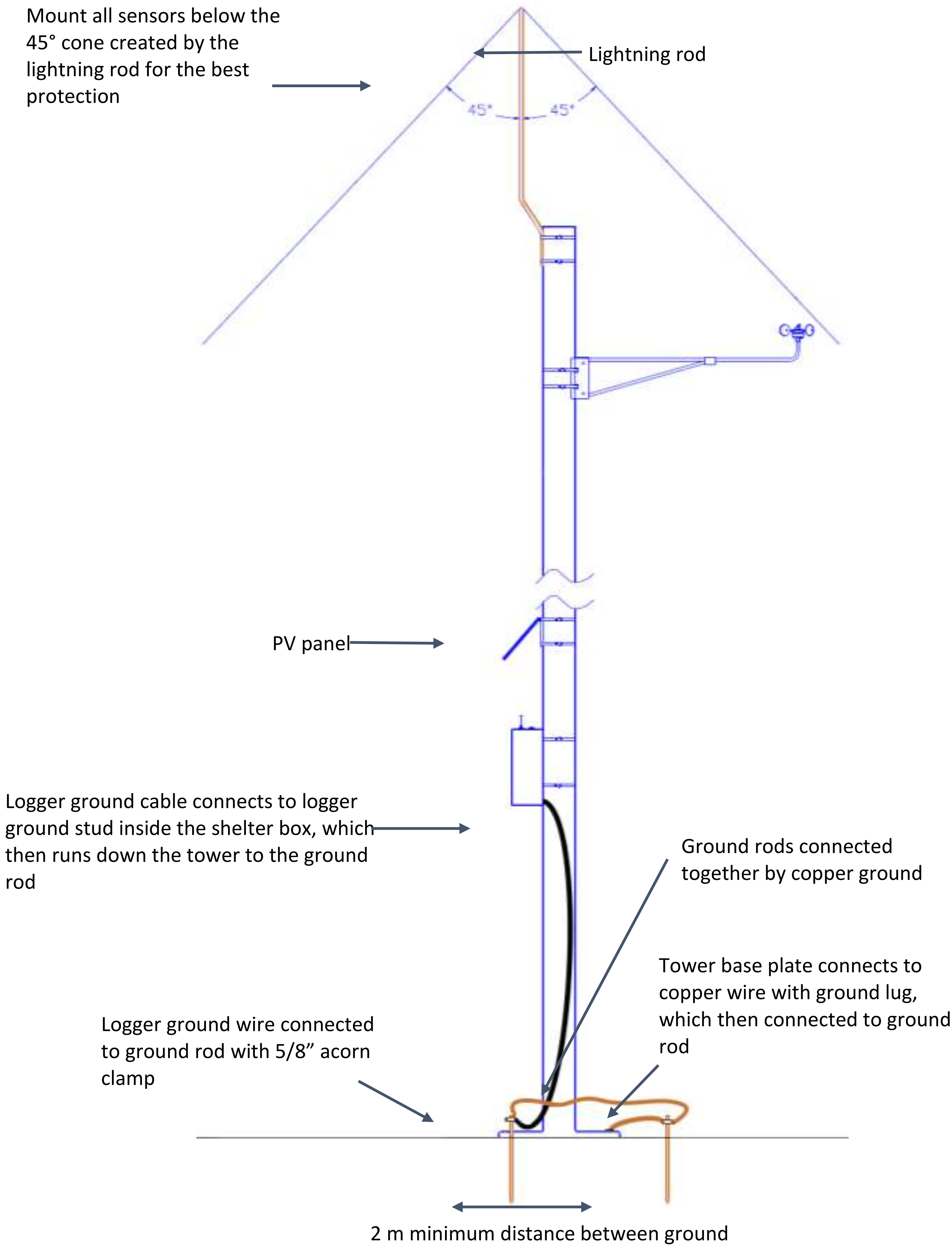
50m XHD with Standard Footprint

TUBE SPECS (in order of assembly):

Tower:
Base Tube (with pivot pin hole) 10" ø x 87"L (1 tube)
Plain Tubes 10" ø x 87"L (14 tubes)
Plain Tube (short) 10" ø x 73"L (1 tube)
10"-8" TRANSITION, 36"L
Plain Tubes 8"ø x 87"L (10 tubes)

Gin Pole:
Base Tube (with pivot pin hole) 8"ø x 87"L
Plain Tubes 8"ø x 87"L

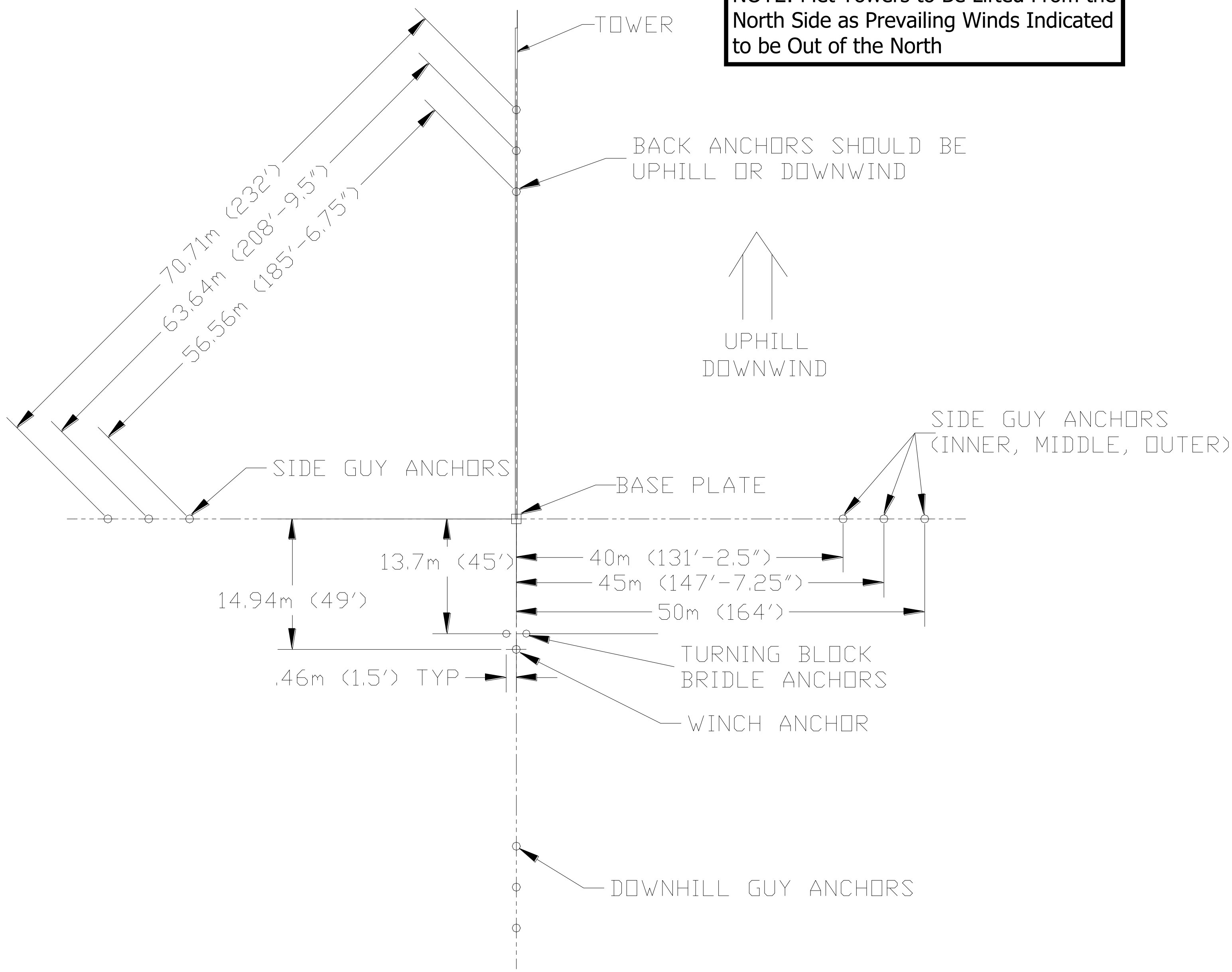



Mount all sensors below the 45° cone created by the lightning rod for the best protection
Lightning rod
45°
45°
PV panel
Logger ground cable connects to logger ground stud inside the shelter box, which then runs down the tower to the ground rod
Ground rods connected together by copper ground
Tower base plate connects to copper wire with ground lug, which then connected to ground rod
Logger ground wire connected to ground rod with 5/8" acorn clamp
2 m minimum distance between ground

50m XHD with
Standard Footprint

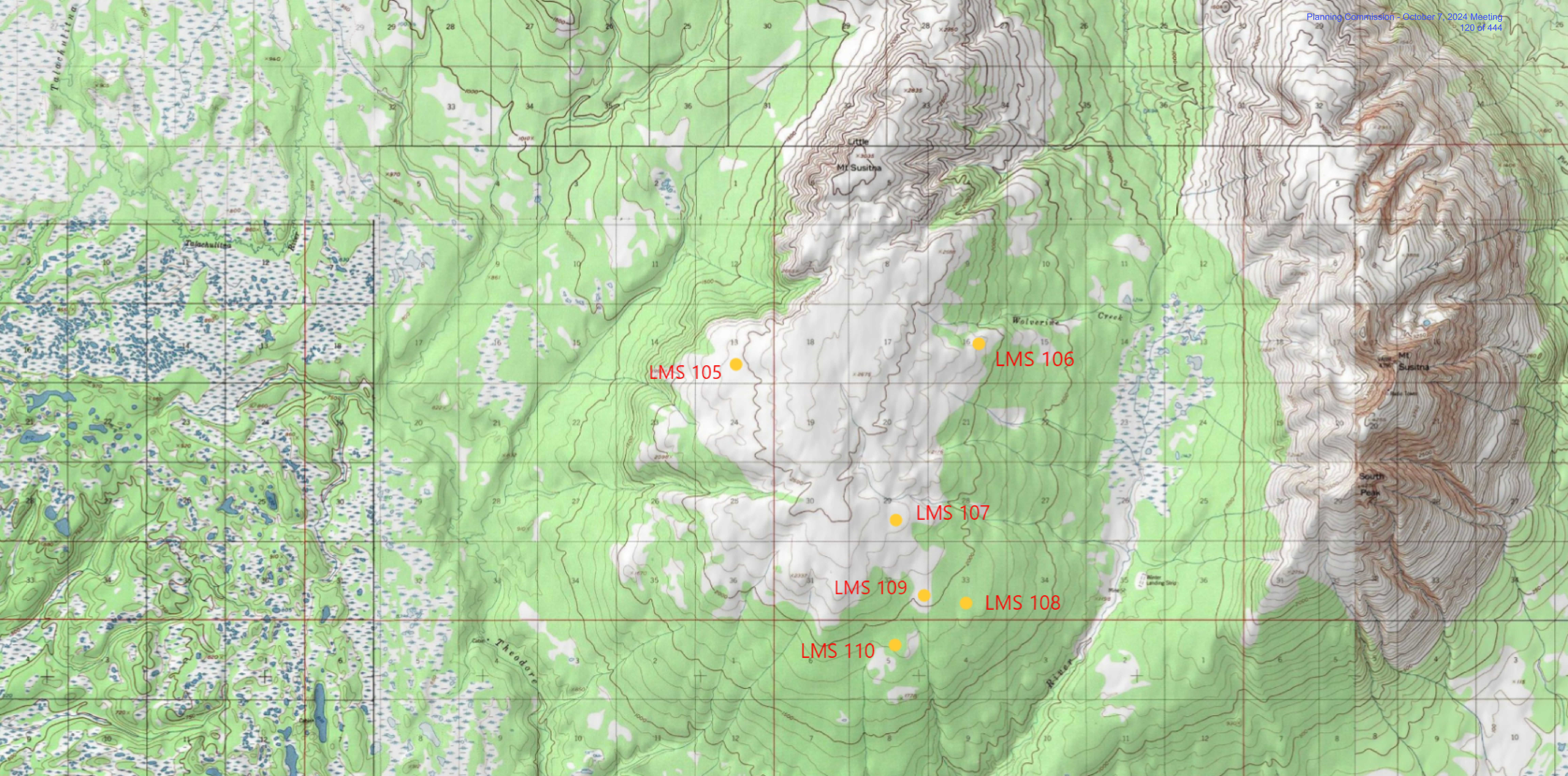
Site Layout

NOTE: Met Towers to Be Lifted From the North Side as Prevailing Winds Indicated to be Out of the North



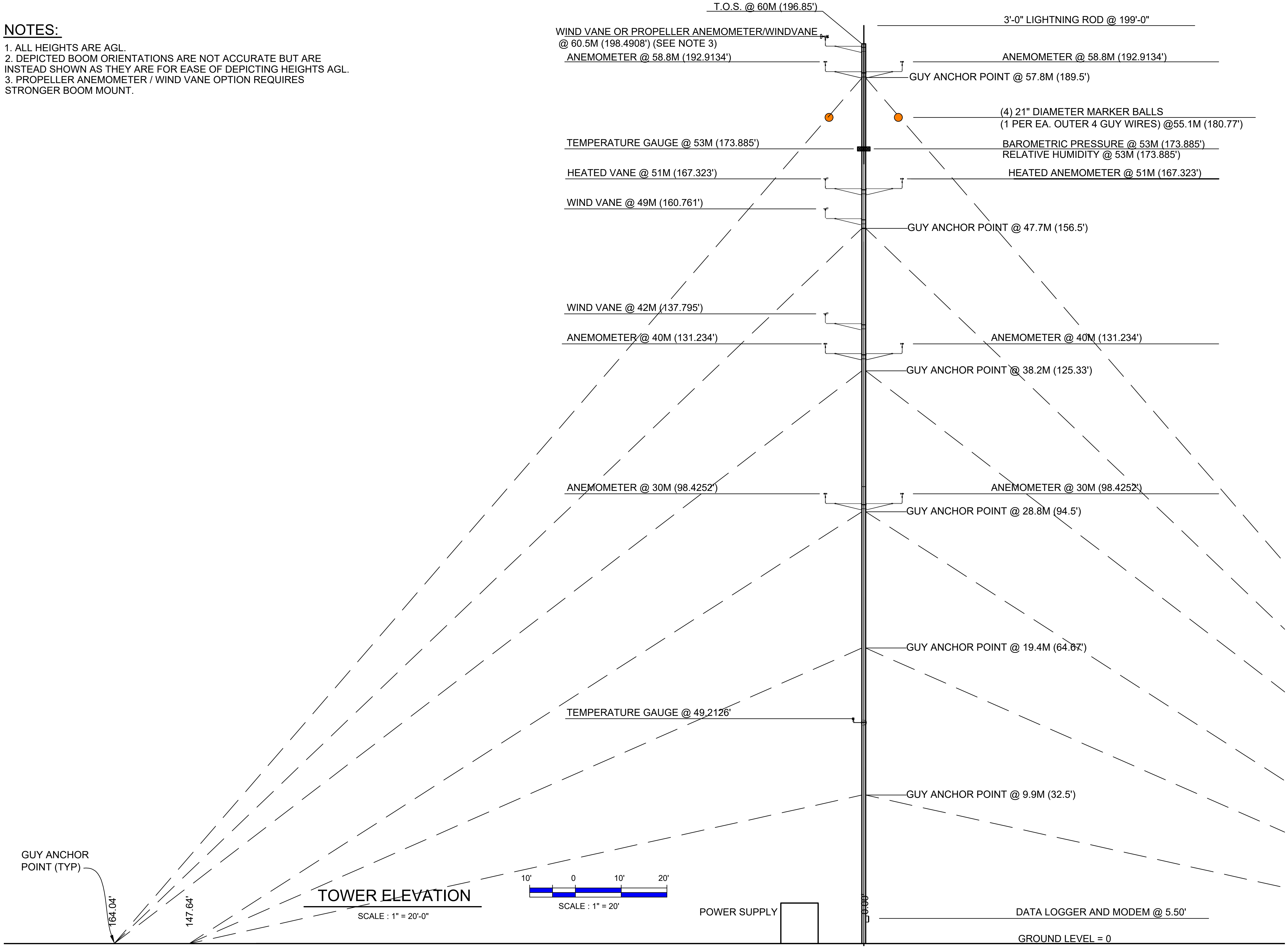
APPENDIX E

PROPOSED MET TOWER SITE LOCATION MAP


Little
Mt Susitna
Mt
Susitna
South
Peak
Wolverine
Creek
Theodore
River
Talachulitna
LMS 105
LMS 106
LMS 107
LMS 109
LMS 108
LMS 110

NOTES:

1. ALL HEIGHTS ARE AGL.
2. DEPICTED BOOM ORIENTATIONS ARE NOT ACCURATE BUT ARE INSTEAD SHOWN AS THEY ARE FOR EASE OF DEPICTING HEIGHTS AGL.
3. PROPELLER ANEMOMETER / WIND VANE OPTION REQUIRES STRONGER BOOM MOUNT.



TOWER ELEVATION

SCALE : 1" = 20'-0"

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
1		
0	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:

MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:

60M SUPER XHD NRG TALL TOWER

SHEET TITLE:

TOWER ELEVATION

SHEET NO.

1 OF 9

NOTES:

1. MET TOWERS WINCHED UPRIGHT APPROXIMATELY FROM THE NORTH SIDE.

GUYED TOWER NOTES

1) GUY WIRE INSTALLATION:
ALL GUY WIRES ARE TO BE INSTALLED PER MANUFACTURER'S GUIDELINES AND TENSIONED TO MANUFACTURER'S SPECIFIED LIMITS AND CONFIRMED BY THE USE OF A CALIBRATED TENSIONOMETER. THE TOWER MUST BE PLUMBED TO MANUFACTURER'S SPECIFICATIONS UTILIZING AN ENGINEER TRANSIT AND MUST NOT VARY MORE THAN ONE INCH PER 100 FT OF TOWER HEIGHT. FINAL TENSIONS ARE TO BE RECORDED IN TOWER ERECTION MANUAL AND SUBMITTED TO CONSTRUCTION MANAGER UPON COMPLETION.

2) GUY WIRES:
ALL CUT GUY WIRES WILL BE LASHED WITH A NON-FERROUS MATERIAL AND PAINTED WITH ZINC RICH COMPOUND UPON COMPLETION.

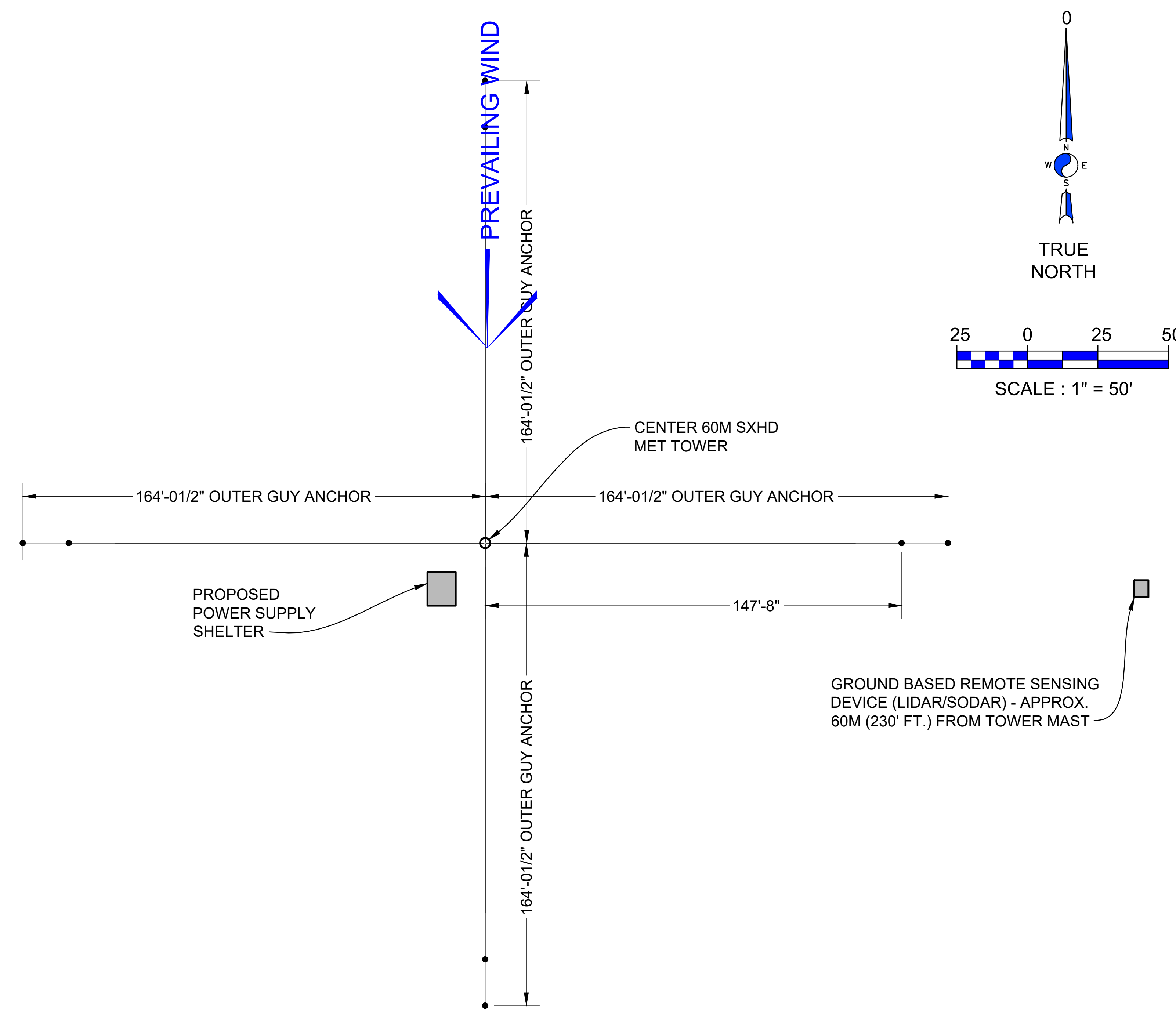
3) TURNBUCKLES:
ALL TURNBUCKLES ARE TO BE INSTALLED IN THE SAME ORIENTATION (WHEN BEHIND ANCHOR AND FACING TOWER, A CLOCKWISE TURN OF THE ADJUSTER WILL TIGHTEN THE TENSION AND A COUNTER-CLOCKWISE TURN OF THE ADJUSTER WILL LOOSEN TENSION). ALL ATTACHMENTS (BOLTS, PINS, CLEVISES) ARE TO BE INSTALLED IN THE SAME DIRECTION. DURING ERECTION, EACH GUY WIRE ADJUSTMENT WILL HAVE A TEMPORARY SAFETY INSTALLED. UPON COMPLETION, FOLLOWING FINAL PLUMB AND TENSION OF TOWER, ALL TURNBUCKLE ADJUSTERS WILL HAVE A SAFETY CABLE
ROUTED THROUGHOUT THEM AND SECURED TOGETHER WITH A WIRE ROPE CLIP, TO ENSURE NO MOVEMENT OF ADJUSTER.

4) PREFORM GRIPS:
UPON COMPLETION ALL GUY WIRES WILL HAVE AN ICE CLIP DEVICE INSTALLED AS DIRECTED AND SUPPLIED BY TOWER MANUFACTURER. ANY ABRASIONS ARE TO BE PAINTED WITH ZINC RICH PAINT.

5) GUY WIRE GROUNDS:
ALL GUY WIRES ARE TO BE GROUNDED IN UNISON UTILIZING #2 STRANDED WIRE AND MANUFACTURER SUPPLIED CONNECTORS AND COPPER SHEILD ON CABLE TO WIRE CONNECTIONS TO THE ANCHOR'S EARTHEN GROUND RING.

6) CONTRACTOR SHALL PROVIDE THE MINIMUM NUMBER OF GROUND RODS INDICATED, SEE GROUNDING PLAN FOR APPROXIMATE LOCATIONS.

7) GUY TOWER INSTALLATIONS MUST MEET OR EXCEED THE LATEST TIA/EIA-222-H STANDARDS.



60M SUPER XHD NRG TALL TOWER PLAN

SCALE : 1" = 50'-0"

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
⚠		
⚠	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

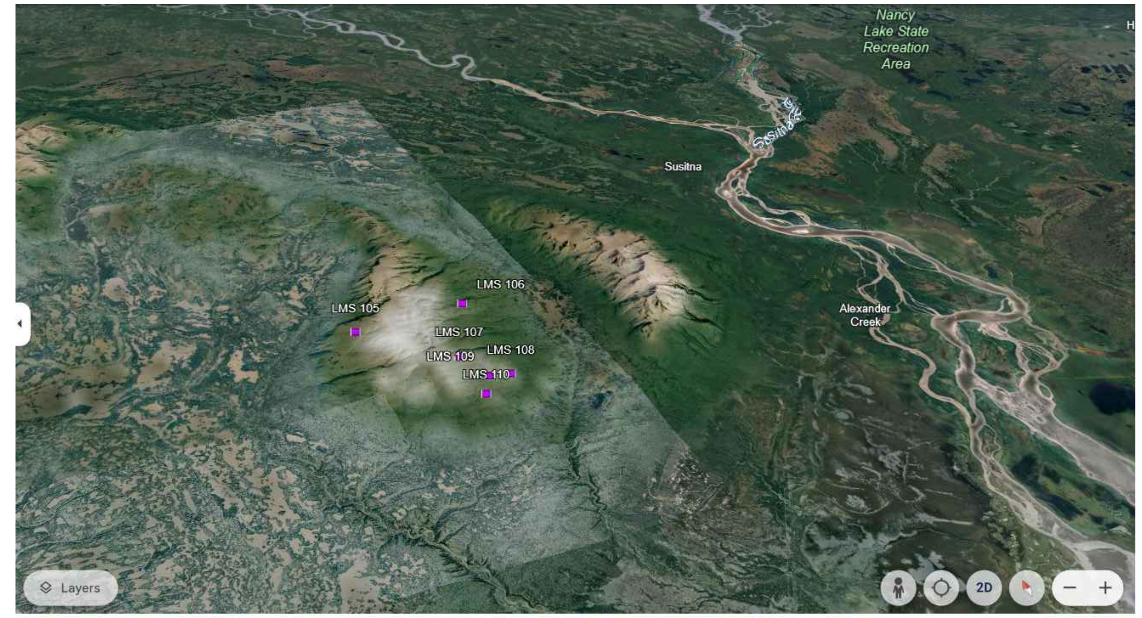
TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
TOWER PLAN

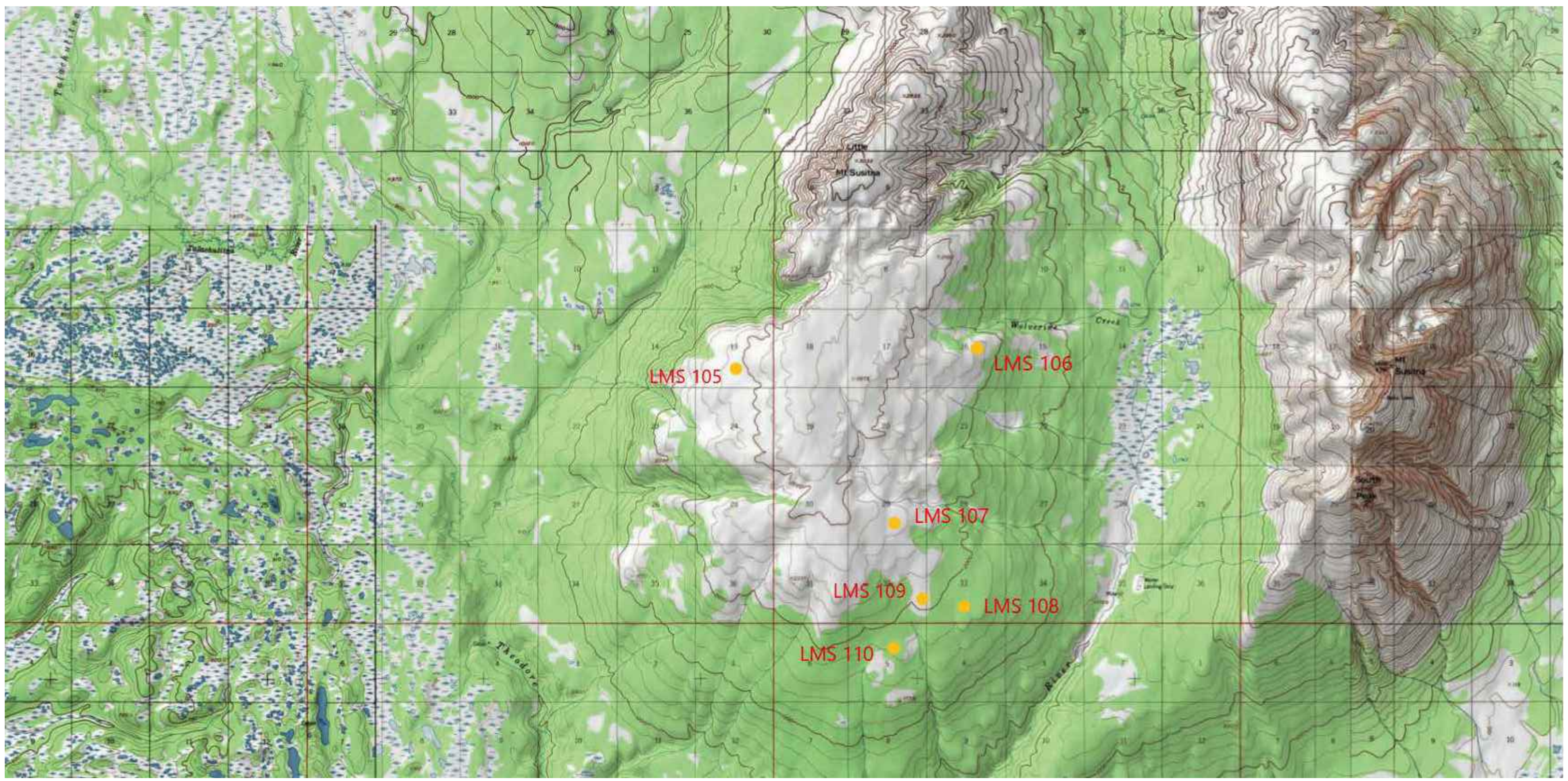
SHEET NO.
2 OF 9

20240430				
LMS met twrs to be permitted				
dataset	littleMountSusitna_toBePermittedMetTwrs_20240430_ja.shp			
	UTM WGS84 z5 meters		WGS84	
id	X	Y	LATITUDE	LONGITUDE
LMS 105	607144	6817133	61.47306128° N	150.98880926° W
LMS 106	612079	6817695	61.47670353° N	150.89590508° W
LMS 107	610490	6814070	61.44464000° N	150.92786700° W
LMS 108	611983	6812416	61.42937215° N	150.90087803° W
LMS 109	611119	6812558	61.43089025° N	150.91697790° W
LMS 110	610563	6811529	61.42181675° N	150.92800343° W

AK MET TOWER LATITUDE & LONGITUDE COORDINATE TABLE



LMS 105 THRU 110 GOOGLE MAPS LOCATIONS
SCALE : N.T.S.



LMS 105 THRU 110 LOCATIONS
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
⚠		
⚠	06.26.2024	I.F.C.

STATE OF ALASKA 49TH Aaron R. Boonstra Date 7/1/24 No. CE 198374 REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATIONS

SHEET NO.
3 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N010W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	438610.156, 837190.354	**NE:**	448157.576, 837035.014
SW:	438439.045, 827536.254	**SE:**	448013.17, 827380.568

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720902342723964	61 25 34.48445 N
E Longitude:	-2.6349935005514356	150 58 26.42385 W
N Latitude:	1.0736025151373458	61 30 46.41477 N
W Longitude:	-2.6381243219055466	151 09 12.20211 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

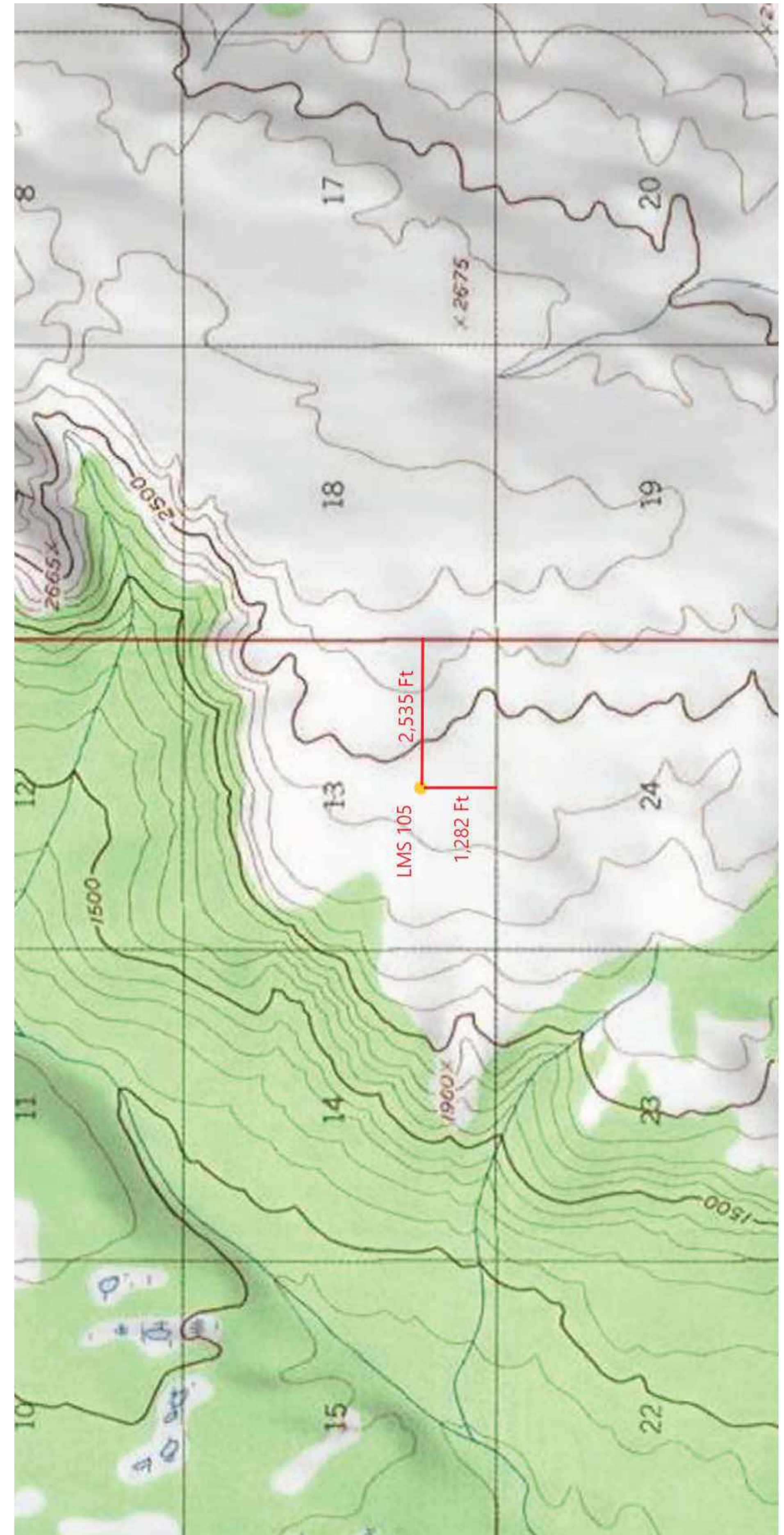
NW ITM Name:	TYONEK C-4	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-4	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:10 PM)

LMS 105 TOWNSHIP DATA



LMS 105 SETBACK DISTANCES TO SECTION LINES

SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA 49TH Aaron R. Boonstra Date 7/1/24 No. CE 198374 REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 105

SHEET NO.
4 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
W Longitude:	-2.6349934345081767	150 58 26.41023 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

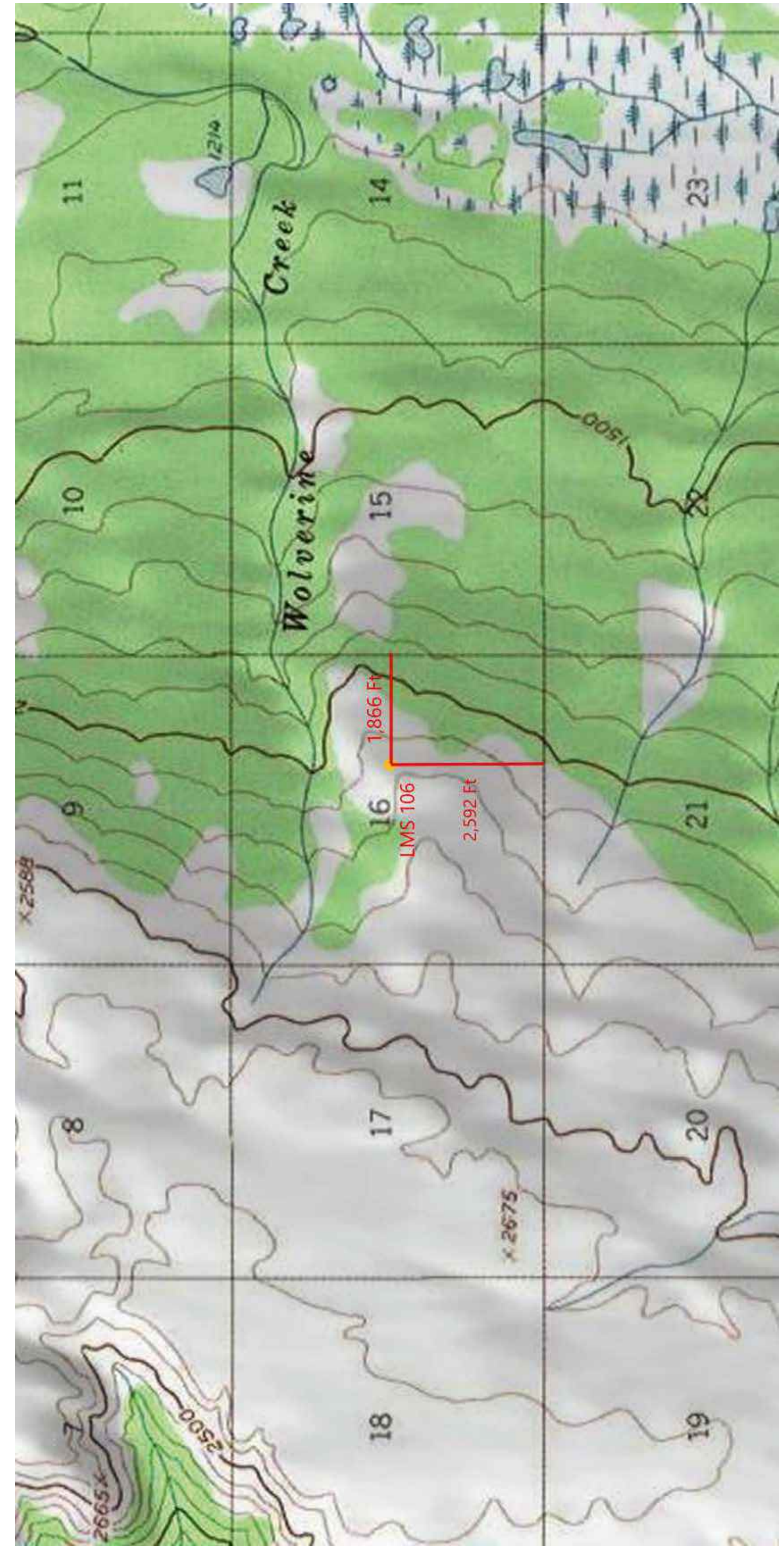
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:13 PM)

LMS 106 TOWNSHIP DATA



LMS 106 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 106

SHEET NO.
5 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
W Longitude:	-2.6349934345081767	150 58 26.41023 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

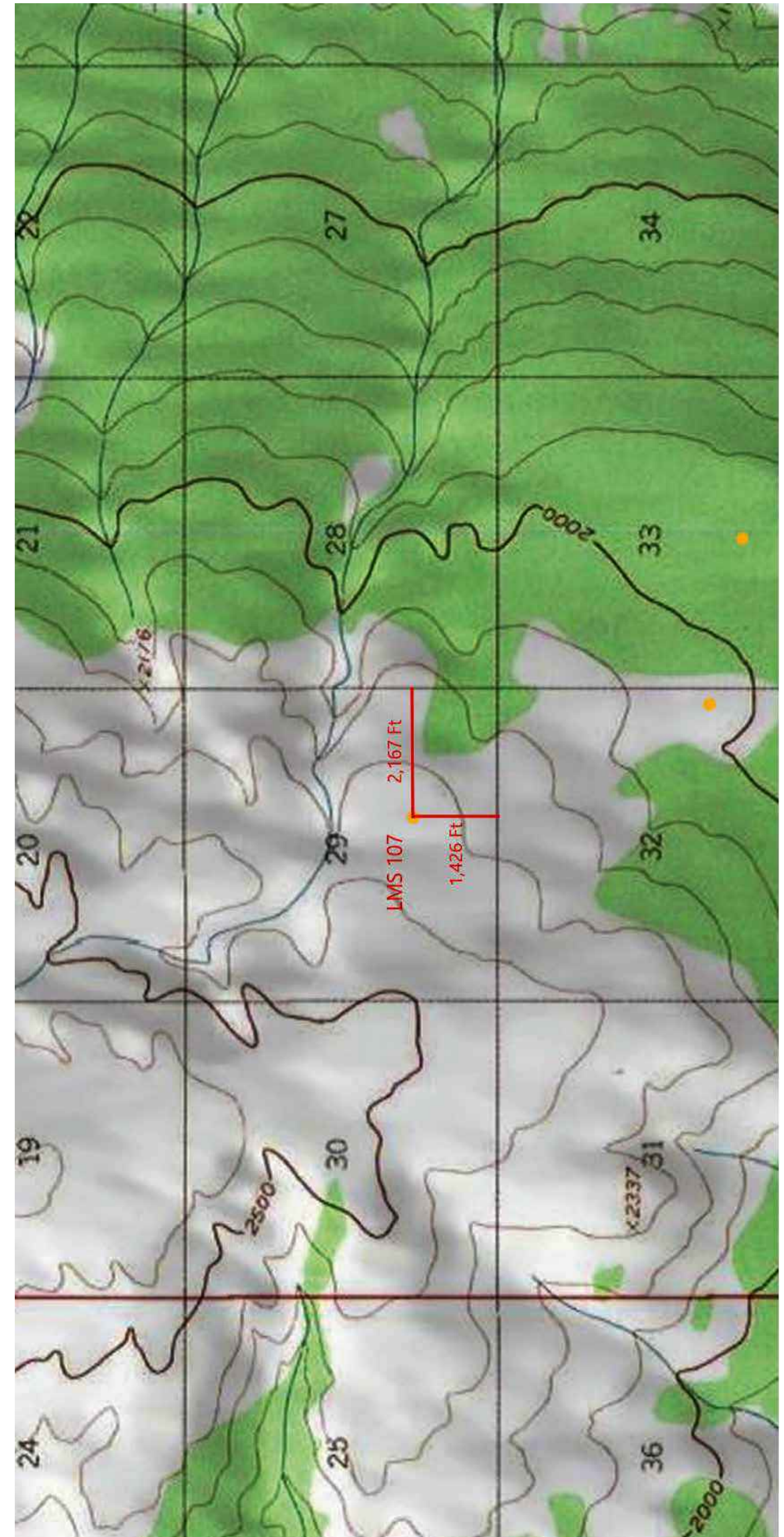
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 1:58 PM)

LMS 107 TOWNSHIP DATA



LMS 107 SETBACK DISTANCES TO SECTION LINES

SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA 49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 107

SHEET NO.
6 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S015N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448013.17, 827380.568	**NE:**	457587.577, 827251.266
SW:	447868.883, 817726.177	**SE:**	457469.991, 817596.635

Township Gracticule:

	Radians	DMS
S Latitude:	1.0705779481540059	61 20 22.55305 N
E Longitude:	-2.631862575612033	150 47 40.62423 W
N Latitude:	1.0720902342723964	61 25 34.48445 N
W Longitude:	-2.6349935005514356	150 58 26.42385 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

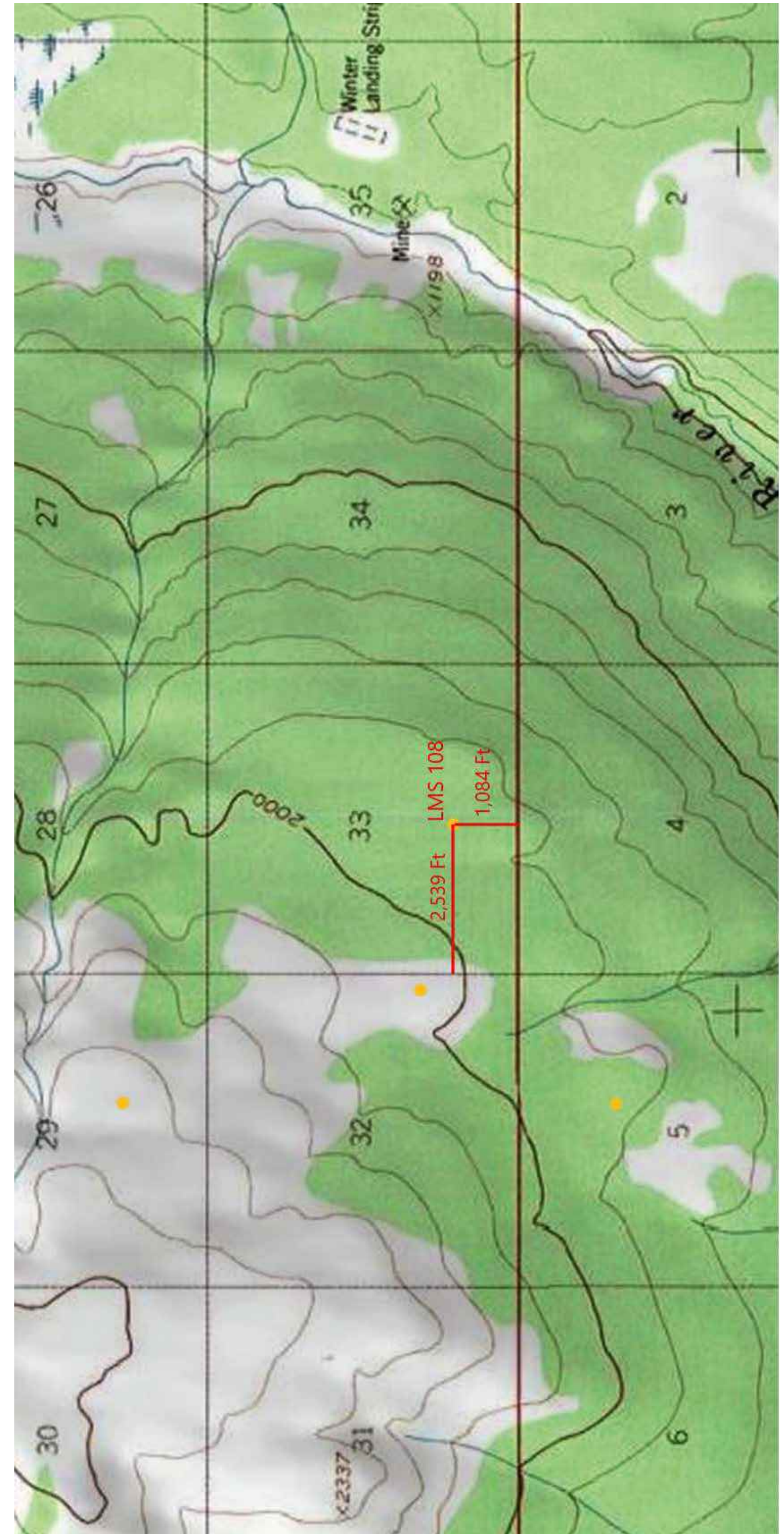
NW ITM Name:	TYONEK B-3	**NE ITM Name:**	TYONEK B-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:16 PM)

LMS 108 TOWNSHIP DATA



LMS 108 SETBACK DISTANCES TO SECTION LINES

SCALE : N.T.S.

longroad ENERGY

ALASKA RENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA 49TH Aaron R. Boonstra Date 7/1/24 No. CE 198374 REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 108

SHEET NO.
7 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S016N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448157.576, 837035.014	**NE:**	457705.264, 836905.964
SW:	448013.17, 827380.568	**SE:**	457587.577, 827251.266

Township Gracticule:

	Radians	DMS
S Latitude:	1.0720903097927932	61 25 34.50003 N
E Longitude:	-2.631862563063116	150 47 40.62164 W
N Latitude:	1.0736025881444686	61 30 46.42983 N
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BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

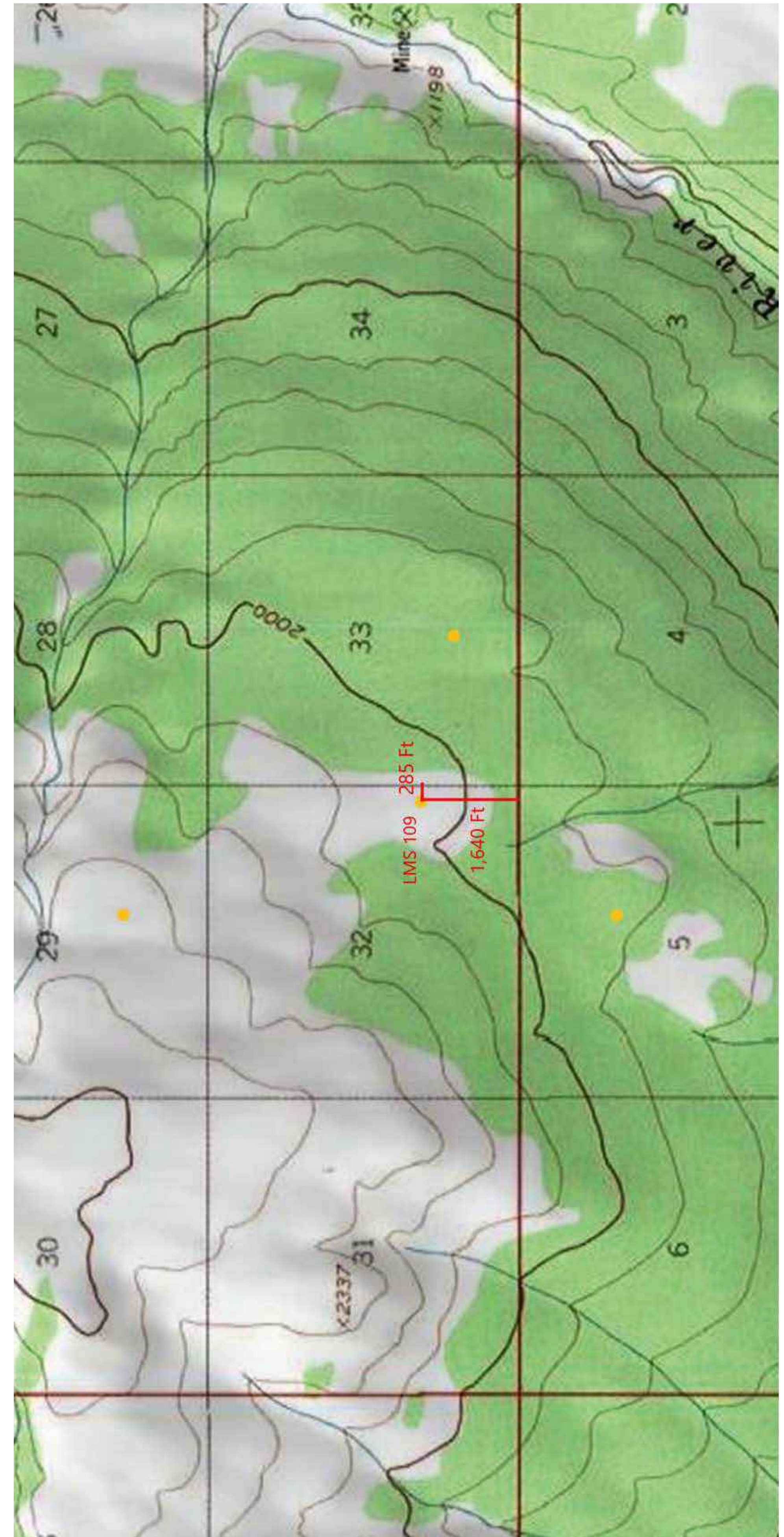
NW ITM Name:	TYONEK C-3	**NE ITM Name:**	TYONEK C-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:17 PM)

LMS 109 TOWNSHIP DATA



LMS 109 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
	06.26.2024	I.F.C.

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 109

SHEET NO.
8 OF 9

Township Information

Note: All generated information is based on the NAD83 datum.

Township: S015N009W

State Plane Zone: 4

Township Corners (State Plane Coordinates in Meters):

NW:	448013.17, 827380.568	**NE:**	457587.577, 827251.266
SW:	447868.883, 817726.177	**SE:**	457469.991, 817596.635

Township Gracticule:

	Radians	DMS
S Latitude:	1.0705779481540059	61 20 22.55305 N
E Longitude:	-2.631862575612033	150 47 40.62423 W
N Latitude:	1.0720902342723964	61 25 34.48445 N
W Longitude:	-2.6349935005514356	150 58 26.42385 W

BLM Protraction Diagram: S-13-03
Approved Date: 01/25/1963
Amended Date:

ADL Protraction Diagram: S-13-03
Approved Date: 12/29/1960
Amended Date:

USGS Quadrangles:

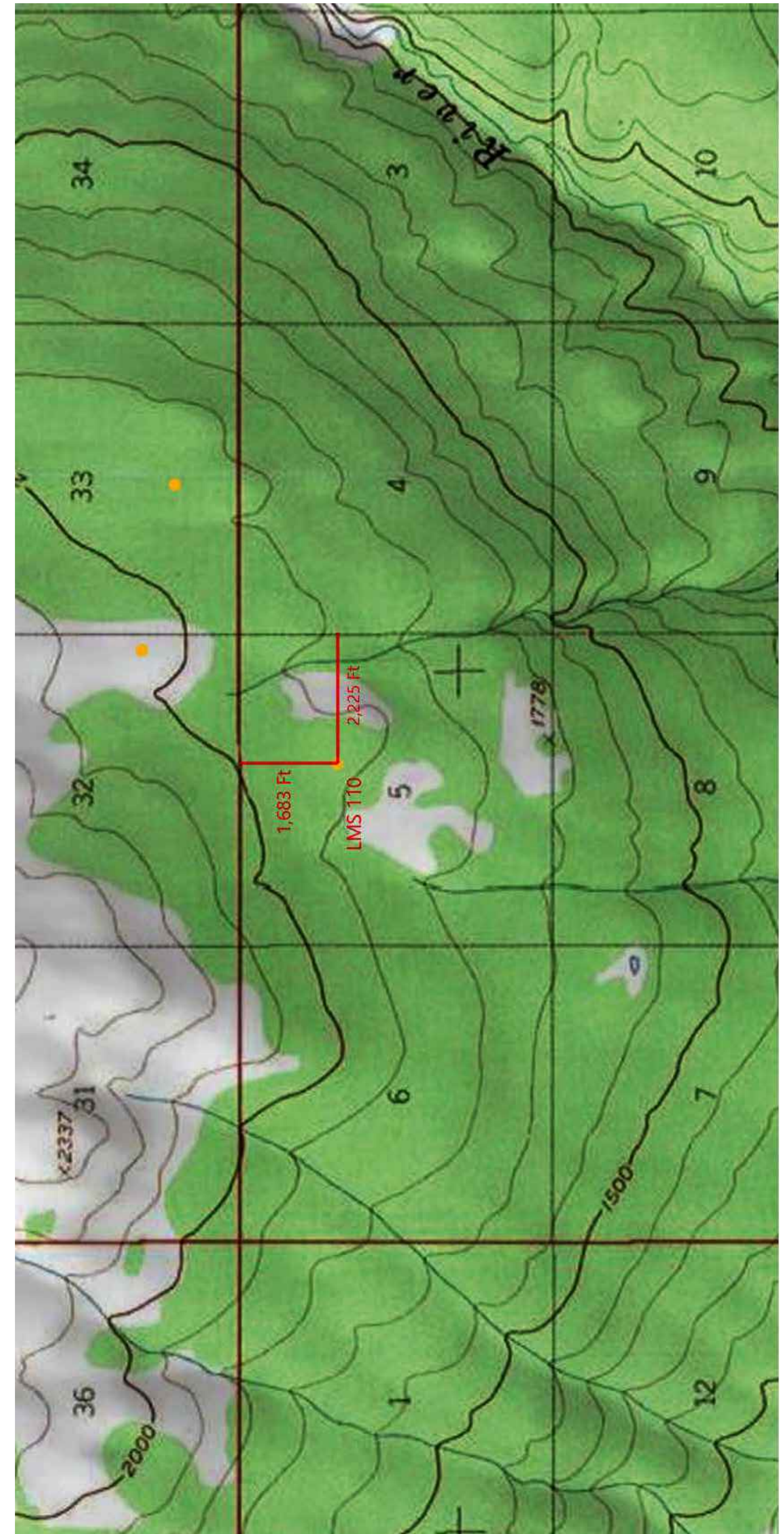
NW ITM Name:	TYONEK B-3	**NE ITM Name:**	TYONEK B-3
SW ITM Name:	TYONEK B-3	**SE ITM Name:**	TYONEK B-3

Recording Districts: ANCHORAGE RECORDING DISTRICT

Boroughs: Matanuska-Susitna Borough

Source: Alaska Department of Natural Resources, Support Services Division, Information Resource Management, GIS Programming Unit, Township Information Generator (Date Generated: June 26, 2024, 2:07 PM)

LMS 110 TOWNSHIP DATA



LMS 110 SETBACK DISTANCES TO SECTION LINES
SCALE : N.T.S.

longroad ENERGY

ALASKARENEWABLES

NewTower Engineering LLC

AHOLA ENGINEERING

A&E PROJECT #:	60M XHD ALASKA
DRAWN BY:	CB
CHECKED BY:	MA

REVISIONS

NO.	DATE	DESCRIPTION
0	06.26.2024	I.F.C.

STATE OF ALASKA 49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

SITE ADDRESS:
MATANUSKA-SUSITNA BOROUGH, AK

TOWER TYPE:
60M SUPER XHD NRG TALL TOWER

SHEET TITLE:
SITE LOCATION LMS 110

SHEET NO.
9 OF 9

NewTower Engineering LLC

Date: **July 01, 2024**

Jeff Armbruster
Longroad Energy
125 High Street
Boston, MA 02210
Phone: (857) 202-7475

Subject: **Matanuska Susitna Borough Met Tower Conditional Use Permit**

Applicant: ***Longroad Energy / Alaska Renewables***

Land Owner: ***State of Alaska***

Engineering Project No.: **Project Number:** 101-24-001

Tower Data: **(6) NRG Systems 60m Super XHD Tall Meteorological Towers**
Matanuska-Susitna Borough, AK

	UTM WGS84 z5 meters		WGS84	
id	X	Y	LATITUDE	LONGITUDE
LMS 105	607144	6817133	61.47306128° N	150.98880926° W
LMS 106	612079	6817695	61.47670353° N	150.89590508° W
LMS 107	610490	6814070	61.44464000° N	150.92786700° W
LMS 108	611983	6812416	61.42937215° N	150.90087803° W
LMS 109	611119	6812558	61.43089025° N	150.91697790° W
LMS 110	610563	6811529	61.42181675° N	150.92800343° W

Dear Mr. Armbruster,

Please find enclosed the following for the subject six (6) NRG 60m Super XHD Met Tower with Standard Footprint permit application:

1. A full tower structural analysis is provided (refer attached report and Appendix A output results) in accordance with the 2021 Alaska Building Code, 2021 International Building Code, ASCE 7-16 Code, and ANSI TIA 222-Rev H, based upon an ultimate 3-second gust wind speed of 121 mph (V_{ult}), Risk Category II, and Exposure Category C including seismic analysis.
2. Refer Appendix C and the Conclusions/Recommendations for recommended Manta Ray (MR-2) guy anchor, 8" double helix (or approved equal) details and minimum pull forces required (Table 4). No soils report is available for the site. As such, anchor pull tests will be required to meet the minimum resultant anchor loads as listed in Table 4 of this report.
3. Refer Appendix D for typical tower grounding and related tower installation details.

Structural analysis prepared by: Mikko P. Ahola, PE

Respectfully submitted by:

Aaron Boonstra, PE
Professional Engineer

STATE OF ALASKA
49TH
Aaron R. Boonstra
Date 7/1/24
No. CE 198374
REGISTERED PROFESSIONAL ENGINEER

TABLE OF CONTENTS

1) INTRODUCTION

The purpose of this report is to investigate the structural adequacy of proposed (6) 60m NRG Super XHD Tall guyed pole temporary meteorological towers to be located in the Matanuska-Susitna Borough, Alaska (refer Appendix D map locations). The met towers will support wind monitoring devices. The computer plots & output based on a 3D structural analysis using tnxTOWER (Version 8.2.2) is provided in Appendix A.

The 60m tall Super NRG guyed pole MET towers are designed and manufactured by NRG Systems and are a stronger version of the standard 60m XHD NRG met towers.

The finite element program "tnxTower" used in this analysis is developed by Tower Numerics in Lexington, MA. It is a specialized 3D structural analysis program widely used and accepted in the tower industry.

2) ANALYSIS CRITERIA

The analysis has been performed in accordance with the 2021 Alaska Building Code, 2021 International Building Code, and ANSI TIA-222-Rev H for the tower site locations in Alaska based upon an ultimate 3-second gust wind speed of 121 mph (V_{ult}). Exposure Category C, Risk Category II along with topographic category 2 and crest height of 1,500 feet were used in this analysis (typical for all 6 tower sites), including seismic analysis. Met towers are temporary structures (typically 1 to 3-year installation duration) and could be analyzed as Risk Category I structures and a lower 115 mph ultimate gust wind speed at the met tower site locations. Table 1 below shows the proposed MET tower loading.

Table 1 - Proposed 60m Tall Super XHD Met Tower Equipment Loading

Center Line Elevation (ft)	Number of Antennas	Antenna/Mount Manufacturer	Antenna/Mount Model	Number of Feed Lines	Feed Line Size (in)	Note
198.49 (60.5 m)	1	Young	Propellor Anemometer/ Wind Vane	1	0.14"ϕ cable	1
198.49 (60.5 m)	1	NRG Systems	NRG No. 4214 (95" Long Side Boom)	-	-	1
192.91 (58.8 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1
192.91 (58.8 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
180.77 (55.1 m)	4	NRG Systems	21" ϕ Orange Marker Balls (3.6m From Top Guy Ring)	-	-	1
173.89 (53.0 m)	1 1 1	Campbell Scientific	Barometric Pressure Gauge Relative Humidity Sensor Temperature Sensor	3	0.14"ϕ cables	1
167.323 (51.0 m)	2	NRG Systems	Heated Anemometer	2	0.14"ϕ cables	1
167.323 (51.0 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
160.76 (49.0 m)	1	NRG Systems	NRG 200P Wind Vane	1	0.14"ϕ cable	1
160.76 (49.0 m)	1	NRG Systems	NRG No. 4214 (95" Long Side Boom)	-	-	1
137.80 (42.0 m)	1	NRG Systems	NRG 200P Wind Vane	1	0.14"ϕ cable	1
137.80 (42.0 m)	1	NRG Systems	NRG No. 4214 (95" Long Side Boom)	-	-	1
131.23 (40.0 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1

Center Line Elevation (ft)	Number of Antennas	Antenna/Mount Manufacturer	Antenna/Mount Model	Number of Feed Lines	Feed Line Size (in)	Note
131.23 (40.0 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
98.43 (30.0 m)	2	NRG Systems	NRG #40C Anemometers	2	0.14"ϕ cables	1
98.43 (30.0 m)	2	NRG Systems	NRG No. 4214 (95" Long Side Booms)	-	-	1
49.21 (15.0 m)	1	Unknown	Temperature Sensor	1	0.14"ϕ cable	1
4.92 (1.5 m)	1	NRG Systems	Data Logger & Modem	-	-	1

Notes: 1. Proposed Equipment

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Remarks	Reference	Source
Met Tower Equipment Loading	Anemometers, Wind Vanes, Marker Balls	06/20/2024	Longroad Energy
Super 60m XHD Tall Tower Manual	Installation & Specifications Guide	12/14/2022	NRG Systems

3.1) Analysis Method

tnxTower (version 8.2.2), a commercially available analysis software package, was used to analyze the 60m Super XHD tall MET tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1. The pole steel is 45 ksi yield.
2. The MET tower is supported by 5/16" diameter Aircraft guy wiring with breaking strength of 9.8 kips with 0.255 kips (2.6%) initial tension.
3. The proposed MET tower is temporary (typically 1 to 3-year installation duration).
4. The met tower and anchors are to be installed by a professional contractor knowledge in met tower installation and will be installed following the instructions in the NRG 60m Super XHD Tower Installation Manual & Specifications & other manufacturer specifications.

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Section Capacity Table

Section No.	*Elevation ft*	*Component Type*	*Size*	*Critical Element*	*P lb*	*$øP_{allow}$ lb*	*% Capacity*	*Pass Fail*
L1	197.688 - 190.438	Pole	TP8.05x8x0.134	1	-99.47	134865.00	6.2	Pass
L2	190.438 - 184.021	Pole	TP8.05x7.7763x0.134	2	-7819.06	134427.00	18.5	Pass
		Guy A@189.321	NRG Guy 5/16 13MM	36	4661.95	5880.00	79.3	Pass
		Guy B@189.321	NRG Guy 5/16 13MM	35	5064.07	5880.00	86.1	Pass
		Guy C@189.321	NRG Guy 5/16 13MM	34	4663.94	5880.00	79.3	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$øP_{allow}$ lb	% Capacity	Pass Fail
		Guy D@189.321	NRG Guy 5/16 13MM	33	5064.44	5880.00	86.1	Pass
L3	184.021 - 177.604	Pole	TP8.05x7.7505x0.134	3	-8368.19	134376.00	33.2	Pass
L4	177.604 - 171.187	Pole	TP8.05x7.7476x0.134	4	-8414.02	131194.00	35.7	Pass
L5	171.187 - 164.771	Pole	TP8.05x7.7472x0.134	5	-8522.15	130395.00	33.9	Pass
L6	164.771 - 158.354	Pole	TP8.05x7.7472x0.134	6	-8628.17	130394.00	21.8	Pass
L7	158.354 - 151.937	Pole	TP8.05x7.7472x0.134	7	-15025.40	131984.00	27.9	Pass
		Guy A@156.121	NRG Guy 5/16 13MM	40	4057.42	5880.00	69.0	Pass
		Guy B@156.121	NRG Guy 5/16 13MM	39	4361.66	5880.00	74.2	Pass
		Guy C@156.121	NRG Guy 5/16 13MM	38	4055.13	5880.00	69.0	Pass
		Guy D@156.121	NRG Guy 5/16 13MM	37	4361.41	5880.00	74.2	Pass
L8	151.937 - 145.521	Pole	TP8.05x7.7472x0.134	8	-15091.00	130394.00	21.1	Pass
L9	145.521 - 139.104	Pole	TP8.05x7.7472x0.134	9	-15187.00	130394.00	14.2	Pass
L10	139.104 - 132.687	Pole	TP8.05x7.7472x0.134	10	-15523.80	134370.00	19.0	Pass
L11	132.687 - 126.271	Pole	TP8.05x7.7472x0.134	11	-15637.60	134370.00	32.3	Pass
L12	126.271 - 119.854	Pole	TP8.05x7.7472x0.134	12	-20106.70	131189.00	40.4	Pass
		Guy A@125.154	NRG Guy 5/16 13MM	44	2744.11	5880.00	46.7	Pass
		Guy B@125.154	NRG Guy 5/16 13MM	43	2937.87	5880.00	50.0	Pass
		Guy C@125.154	NRG Guy 5/16 13MM	42	2744.05	5880.00	46.7	Pass
		Guy D@125.154	NRG Guy 5/16 13MM	41	2937.74	5880.00	50.0	Pass
L13	119.854 - 113.437	Pole	TP8.05x7.7472x0.134	13	-20188.90	130394.00	33.6	Pass
L14	113.437 - 107.021	Pole	TP8.05x7.7472x0.134	14	-20288.10	130394.00	27.9	Pass
L15	107.021 - 100.604	Pole	TP8.05x7.7472x0.134	15	-20459.90	134370.00	26.6	Pass
L16	100.604 - 98.4375	Pole	TP10.04x7.7472x0.109	16	-20488.80	113431.00	31.8	Pass
L17	98.4375 - 93.3959	Pole	TP10.04x9.0259x0.134	17	-20614.50	165931.00	25.7	Pass
		Guy A@94.4376	NRG Guy 5/16 13MM	48	2205.98	5880.00	37.5	Pass
		Guy B@94.4376	NRG Guy 5/16 13MM	47	2302.03	5880.00	39.2	Pass
		Guy C@94.4376	NRG Guy 5/16 13MM	46	2206.74	5880.00	37.5	Pass
		Guy D@94.4376	NRG Guy 5/16 13MM	45	2302.06	5880.00	39.2	Pass
L18	93.3959 - 87.1876	Pole	TP10.04x9.5983x0.134	18	-23925.90	162443.00	25.6	Pass
L19	87.1876 - 80.9793	Pole	TP10.04x9.7085x0.134	19	-24052.80	164052.00	18.0	Pass
L20	80.9793 - 74.771	Pole	TP10.04x9.7244x0.134	20	-24103.50	167880.00	15.5	Pass
L21	74.771 - 68.5627	Pole	TP10.04x9.7267x0.134	21	-24231.90	167883.00	20.1	Pass
L22	68.5627 - 62.3544	Pole	TP10.04x9.727x0.134	22	-26459.20	167364.00	27.2	Pass
		Guy A@64.4294	NRG Guy 5/16 13MM	52	2022.88	5880.00	34.4	Pass
		Guy B@64.4294	NRG Guy 5/16 13MM	51	2024.51	5880.00	34.4	Pass
		Guy C@64.4294	NRG Guy 5/16 13MM	50	2022.78	5880.00	34.4	Pass
		Guy D@64.4294	NRG Guy 5/16 13MM	49	2024.53	5880.00	34.4	Pass
L23	62.3544 - 56.1461	Pole	TP10.04x9.727x0.134	23	-26513.80	164322.00	23.9	Pass
L24	56.1461 - 49.9378	Pole	TP10.04x9.727x0.134	24	-26950.00	167884.00	25.2	Pass
L25	49.9378 - 43.7295	Pole	TP10.04x9.727x0.134	25	-27057.30	166604.00	27.2	Pass
L26	43.7295 - 37.5212	Pole	TP10.04x9.727x0.134	26	-27130.60	164322.00	27.5	Pass
L27	37.5212 - 31.3129	Pole	TP10.04x9.727x0.134	27	-27257.70	164322.00	23.6	Pass
		Guy A@32.3546	NRG Guy 5/16 13MM	56	1735.48	5880.00	29.5	Pass
		Guy B@32.3546	NRG Guy 5/16 13MM	55	1719.95	5880.00	29.3	Pass
		Guy C@32.3546	NRG Guy 5/16 13MM	54	1733.35	5880.00	29.5	Pass

Section No.	*Elevation ft*	*Component Type*	*Size*	*Critical Element*	*P lb*	*$øP_{allow}$ lb*	*% Capacity*	*Pass Fail*
		Guy D@32.3546	NRG Guy 5/16 13MM	53	1719.94	5880.00	29.3	Pass
L28	31.3129 - 25.1046	Pole	TP10.04x9.727x0.134	28	-28489.50	167884.00	27.7	Pass
L29	25.1046 - 18.8963	Pole	TP10.04x9.727x0.134	29	-28617.80	167884.00	33.5	Pass
L30	18.8963 - 12.688	Pole	TP10.04x9.727x0.134	30	-28690.30	165843.00	35.3	Pass
L31	12.688 - 6.47966	Pole	TP10.04x9.727x0.134	31	-28789.60	164322.00	35.3	Pass
L32	6.47966 - 0	Pole	TP10.04x9.727x0.134	32	-28914.60	164295.00	30.6	Pass
							Summary	
						Pole (L12)	40.4	Pass
						Guy A (L2)	79.3	Pass
						Guy B (L2)	86.1	Pass
						Guy C (L2)	79.3	Pass
						Guy D (L2)	86.1	Pass
						RATING =	**86.1**	**Pass**

Table 4 – Guy Anchor Reactions

Anchor Radius	Factored Uplift Force (Vertical)	Factored Shear Force (Horizontal)	Factored Resultant Force
Inner Anchor (Radius = 147.67 ft)	2,280 lbs	5,507 lbs	5,960 lbs
Outer Anchor (Radius = 164.04 ft)	8,165 lbs	9,137 lbs	12,253 lbs

1. Anchor reactions are factored.

4.1) Conclusions & Recommendations

The proposed 60m Super XHD MET towers with standard footprint were analyzed with the proposed new wind monitoring devices and marker balls (Refer Table 1) per the 2021 International Building Code/ASCE 7-16 Code for the typical site conditions at the 6 tower site locations in Matanuska-Susitna Borough, AK based upon an ultimate 3-second gust wind speed of 121 mph (V_{ult}). Exposure Category C, Risk Category II along with topographic category 2 and crest height of 1,312 feet were used in this analysis. Seismic loading was also included in the analysis.

The analysis results show that:

1. The overall tower pole structure and guy wires are structurally adequate to support the proposed equipment. A maximum tower steel usage of 86.1% was computed (Refer Table 3).

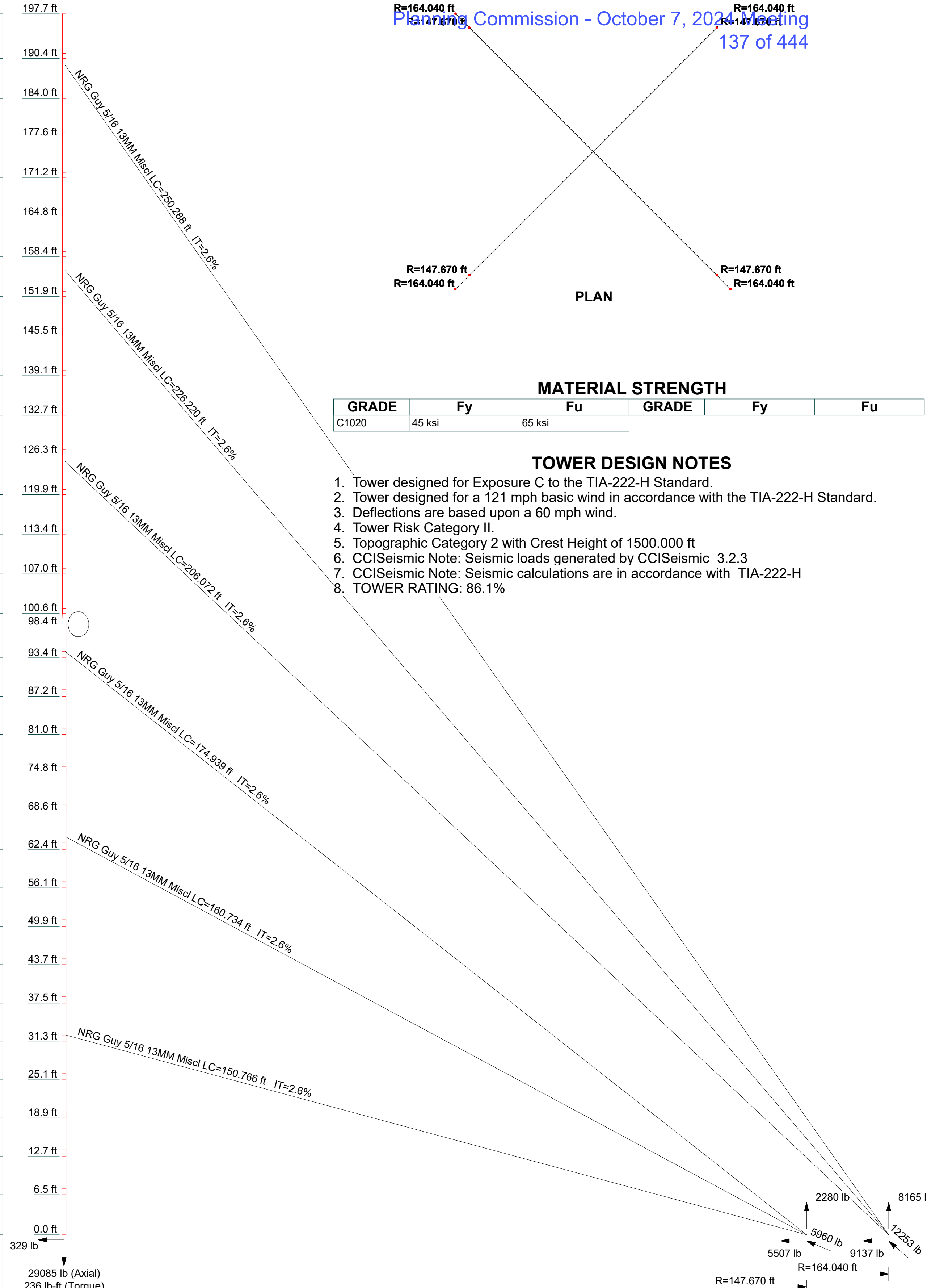
2. The maximum factored guy anchor resultant force computed was 12,253 lbs (Refer Table 4). The Manta Ray Earth Anchor (Model MR-2) has holding capacities up to 36,000 lbs (depending on soil type – Refer Appendix C earth anchor details & ultimate capacites) and would be adequate to secure the guy anchors in place under the wind loads shown in this analysis. However, no soils report was available to confirm the soil type at the proposed location of the towers. As such, a standard pull test will be required to ensure they meet the minimum factored resultant anchor loads in Table 4 above.

3. The maximum factored axial compression force at the base of the met tower is computed to be 29,085 lbs. Per the NRG tower specs, the 60m Super XHD steel base plate has a surface area of 19.5 ft^2. Thus, the maximum soil bearing stress is computed to be 1,492 psf and within the generally accepted 1,500 psf allowable soil bearing stress per the IBC code, even though the tower reactions are factored loads.

APPENDIX A

TNXTOWER OUTPUT

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (lb)
1	7.250	1	0.1340	0.833	8.0000	8.0500		84.4
2	7.250	1	0.1340	0.833	7.7763	8.0500		83.2
3	7.250	1	0.1340	0.833	7.7505	8.0500		83.1
4	7.250	1	0.1340	0.833	7.7476	8.0500		83.1
5	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
6	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
7	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
8	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
9	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
10	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
11	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
12	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
13	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
14	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
15	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
16	3.000	1	0.1090	1.042	7.7472	10.0400	C1020	31.6
17	6.083	1	0.1340	1.042	9.0257	10.0400		84.4
18	7.250	1	0.1340	1.042	9.5983	10.0400		103.6
19	7.250	1	0.1340	1.042	9.7085	10.0400		104.2
20	7.250	1	0.1340	1.042	9.7244	10.0400		104.3
21	7.250	1	0.1340	1.042	9.7266	10.0400		104.3
22	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
23	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
24	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
25	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
26	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
27	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
28	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
29	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
30	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
31	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
32	7.521	1	0.1340		9.7270	10.0400		108.2
								2930.9



MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
C1020	45 ksi	65 ksi			

TOWER DESIGN NOTES

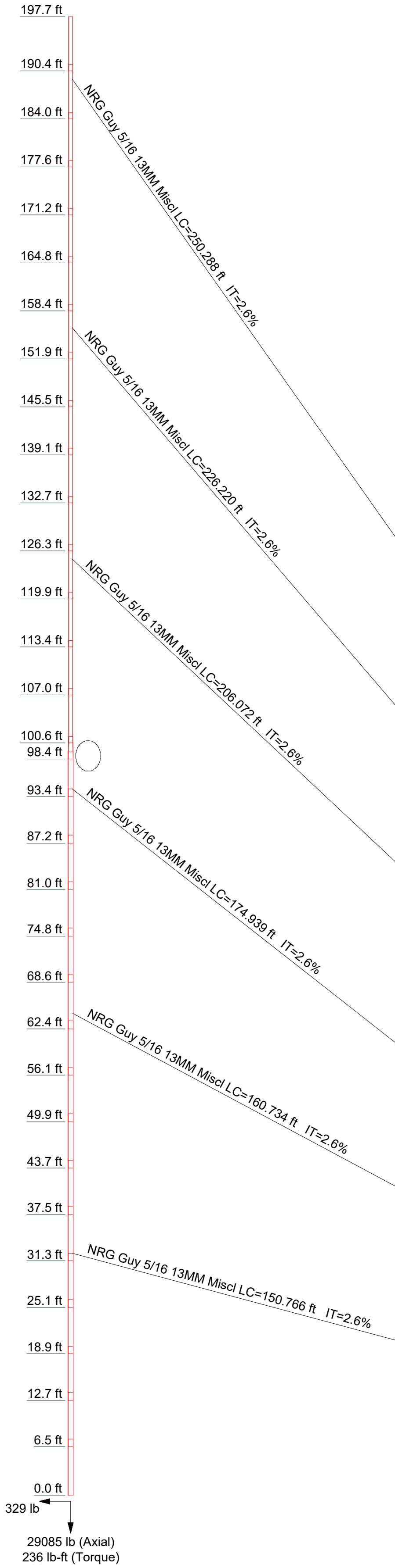
1. Tower designed for Exposure C to the TIA-222-H Standard.
2. Tower designed for a 121 mph basic wind in accordance with the TIA-222-H Standard.
3. Deflections are based upon a 60 mph wind.
4. Tower Risk Category II.
5. Topographic Category 2 with Crest Height of 1500.000 ft
6. CCISeismic Note: Seismic loads generated by CCISeismic 3.2.3
7. CCISeismic Note: Seismic calculations are in accordance with TIA-222-H
8. TOWER RATING: 86.1%

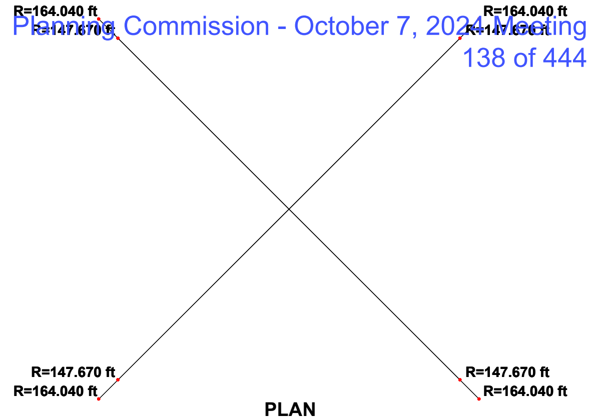
ALL REACTIONS ARE FACTORED

Ahola Engineering LLC
AHOLA ENGINEERING
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job:	***NRG 60m Super NRG Tall Tower***
Project:	***Matanuska-Susitna Borough, AK***
Client: Longroad Energy	Drawn by: Mikko Ahola, PE
App'd:	
Code: TIA-222-H	Date: 07/01/24
Scale: NTS	
Path:	Dwg No. E-1

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (lb)
1	7.250	1	0.1340	0.833	8.0000	8.0500	C1020	84.4
2	7.250	1	0.1340	0.833	7.7763	8.0500		83.2
3	7.250	1	0.1340	0.833	7.7505	8.0500		83.1
4	7.250	1	0.1340	0.833	7.7476	8.0500		83.1
5	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
6	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
7	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
8	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
9	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
10	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
11	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
12	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
13	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
14	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
15	7.250	1	0.1340	0.833	7.7472	8.0500		83.1
16	3.000	1	0.1090	1.042	7.7472	10.0400		31.6
17	6.083	1	0.1340	1.042	9.0257	10.0400		84.4
18	7.250	1	0.1340	1.042	9.5983	10.0400		103.6
19	7.250	1	0.1340	1.042	9.7085	10.0400		104.2
20	7.250	1	0.1340	1.042	9.7244	10.0400		104.3
21	7.250	1	0.1340	1.042	9.7266	10.0400		104.3
22	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
23	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
24	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
25	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
26	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
27	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
28	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
29	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
30	7.250	1	0.1340	1.042	9.7270	10.0400		104.3
31	7.250	1		1.042	9.7270	10.0400		104.3
32	7.521	1	0.1340		9.7270	10.0400		108.2
								2930.9





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION
Properllor Anemometer/Wind Vane	198.491
CCISeismic Properllor Anemometer/Wind Vane	198.491
95" Boom Mount	196.194
CCISeismic 95" Boom Mount	196.194
CCISeismic Tower Section 1 - 1	194.062
NRG #40C Anemometer	192.913
NRG #40C Anemometer	192.913
CCISeismic NRG #40C Anemometer	192.913
CCISeismic NRG #40C Anemometer	192.913
CCISeismic (12) miscl Cat5 From 0 to 196 (188ft to196ft)	192
95" Boom Mount	190.913
95" Boom Mount	190.913
CCISeismic 95" Boom Mount	190.913
CCISeismic 95" Boom Mount	190.913
CCISeismic Tower Section 2 - 1	187.646
CCISeismic (12) miscl Cat5 From 0 to 196 (178ft to188ft)	183
CCISeismic Tower Section 3 - 1	181.229
Aircraft Marker Balls (21" Dia - Orange)	180.77
Aircraft Marker Balls (21" Dia - Orange)	180.77
Aircraft Marker Balls (21" Dia - Orange)	180.77
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.77
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.77
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.77
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.77
Aircraft Marker Balls (21" Dia - Orange)	180.77
CCISeismic Tower Section 4 - 1	174.812
Temperature Probe w/ Shield	173.885
Barometric Pressure	173.885
CCISeismic Temperature Probe w/ Shield	173.885
CCISeismic Relative Humidty Sensor	173.885
CCISeismic Barometric Pressure	173.885
Relative Humidy Sensor	173.885
CCISeismic (12) miscl Cat5 From 0 to 196 (168ft to178ft)	173
CCISeismic Tower Section 5 - 1	168.396
NRG #40C Anemometer	167.323
CCISeismic NRG 200P Wind Vane	167.323
CCISeismic NRG #40C Anemometer	167.323
NRG 200P Wind Vane	167.323
95" Boom Mount	165.323
95" Boom Mount	165.323
CCISeismic 95" Boom Mount	165.323
CCISeismic 95" Boom Mount	165.323
CCISeismic (12) miscl Cat5 From 0 to 196 (158ft to168ft)	163
CCISeismic Tower Section 6 - 1	161.979
NRG 200P Wind Vane	160.761
CCISeismic NRG 200P Wind Vane	160.761
95" Boom Mount	158.761
CCISeismic 95" Boom Mount	158.761
CCISeismic Tower Section 7 - 1	155.562
CCISeismic (12) miscl Cat5 From 0 to 196 (148ft to158ft)	153
CCISeismic Tower Section 8 - 1	149.146
CCISeismic (12) miscl Cat5 From 0 to 196 (138ft to148ft)	143
CCISeismic Tower Section 9 - 1	142.729
NRG 200P Wind Vane	137.795
CCISeismic NRG 200P Wind Vane	137.795
CCISeismic Tower Section 10 - 1	136.312
95" Boom Mount	135.795
CCISeismic 95" Boom Mount	135.795
CCISeismic (12) miscl Cat5 From 0 to 196 (128ft to138ft)	133
NRG #40C Anemometer	131.234
NRG #40C Anemometer	131.234
CCISeismic NRG #40C Anemometer	131.234
CCISeismic NRG #40C Anemometer	131.234
CCISeismic Tower Section 11 - 1	129.896
95" Boom Mount	129.234
CCISeismic 95" Boom Mount	129.234
CCISeismic 95" Boom Mount	129.234
95" Boom Mount	129.234
CCISeismic Tower Section 12 - 1	123.479
CCISeismic (12) miscl Cat5 From 0 to 196 (118ft to128ft)	123
CCISeismic Tower Section 13 - 1	117.062
CCISeismic (12) miscl Cat5 From 0 to 196 (108ft to118ft)	113
CCISeismic Tower Section 14 - 1	110.646
CCISeismic Tower Section 15 - 1	104.229
CCISeismic (12) miscl Cat5 From 0 to 196 (98ft to108ft)	103
CCISeismic Tower Section 16 - 1	99.9375
NRG #40C Anemometer	98.425
NRG #40C Anemometer	98.425
CCISeismic NRG #40C Anemometer	98.425
CCISeismic NRG #40C Anemometer	98.425
CCISeismic Tower Section 17 - 1	96.4375
95" Boom Mount	96.425
CCISeismic 95" Boom Mount	96.425
CCISeismic 95" Boom Mount	96.425
95" Boom Mount	96.425
CCISeismic (12) miscl Cat5 From 0 to 196 (88ft to98ft)	93
CCISeismic Tower Section 18 - 1	90.8126
CCISeismic Tower Section 19 - 1	84.6043
CCISeismic (12) miscl Cat5 From 0 to 196 (78ft to88ft)	83
CCISeismic Tower Section 20 - 1	78.396
CCISeismic (12) miscl Cat5 From 0 to 196 (68ft to78ft)	73
CCISeismic Tower Section 21 - 1	72.1877
CCISeismic Tower Section 22 - 1	65.9794
CCISeismic (12) miscl Cat5 From 0 to 196 (58ft to68ft)	63
CCISeismic Tower Section 23 - 1	59.7711
CCISeismic Tower Section 24 - 1	53.5628
CCISeismic (12) miscl Cat5 From 0 to 196 (48ft to58ft)	53
CCISeismic Temperature Probe w/ Shield	49.2
Temperature Probe w/ Shield	49.2
CCISeismic Tower Section 25 - 1	47.3545
CCISeismic (12) miscl Cat5 From 0 to 196 (38ft to48ft)	43
CCISeismic Tower Section 26 - 1	41.1462
CCISeismic Tower Section 27 - 1	34.9379
CCISeismic (12) miscl Cat5 From 0 to 196 (28ft to38ft)	33
CCISeismic Tower Section 28 - 1	28.7296
CCISeismic (12) miscl Cat5 From 0 to 196 (18ft to28ft)	23

lb

AHOLA ENGINEERING
Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job: NRG 60m Super NRG Tall Tower	
Project: Matanuska-Susitna Borough, AK	
Client: Longroad Energy	Drawn by: Mikko Ahola, PE	App'd:
Code: TIA-222-H	Date: 07/01/24	Scale: NTS
Path:		Dwg No. E-1

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

- Tower base elevation above sea level: 2461.000 ft.
- Basic wind speed of 121 mph.
- Risk Category II.
- Exposure Category C.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 2.
- Crest Height: 1500.000 ft.
- Deflections calculated using a wind speed of 60 mph.
- CCISeismic Note: Seismic loads generated by CCISeismic 3.2.3.
- CCISeismic Note: Seismic calculations are in accordance with TIA-222-H.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Safety factor used in guy design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
Include Bolts In Member Capacity

Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
SR Members Have Cut Ends
SR Members Are Concentric

Distribute Leg Loads As Uniform
Assume Legs Pinned
Assume Rigid Index Plate
Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
√ Retension Guys To Initial Tension
Bypass Mast Stability Checks
√ Use Azimuth Dish Coefficients
Project Wind Area of Appurt.
Autocalc Torque Arm Areas

Add IBC .6D+W Combination
Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder
Ignore KL/ry For 60 Deg. Angle Legs

Use ASCE 10 X-Brace Ly Rules
Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
SR Leg Bolts Resist Compression
All Leg Panels Have Same Allowable
Offset Girt At Foundation
Consider Feed Line Torque
Include Angle Block Shear Check
Use TIA-222-H Bracing Resist. Exemption
4_ Use TIA-222-H Tension Splice Exemption

Poles

Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets
Pole Without Linear Attachments
Pole With Shroud Or No Appurtenances

Tapered Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Splice Length* *ft*	*Number of Sides*	*Top Diameter* *in*	*Bottom Diameter* *in*	*Wall Thickness* *in*	*Bend Radius* *in*	*Pole Grade*
L1	197.688-190.438	7.250	0.833	Round	8.0000	8.0500	0.1340		C1020 (45 ksi)
L2	190.438-184.021	7.250	0.833	Round	7.7763	8.0500	0.1340		C1020 (45 ksi)
L3	184.021-177.604	7.250	0.833	Round	7.7505	8.0500	0.1340		C1020 (45 ksi)

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 2 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L4	177.604-171.187	7.250	0.833	Round	7.7476	8.0500	0.1340		C1020 (45 ksi)
L5	171.187-164.771	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L6	164.771-158.354	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L7	158.354-151.937	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L8	151.937-145.521	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L9	145.521-139.104	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L10	139.104-132.687	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L11	132.687-126.271	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L12	126.271-119.854	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L13	119.854-113.437	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L14	113.437-107.021	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L15	107.021-100.604	7.250	0.833	Round	7.7472	8.0500	0.1340		C1020 (45 ksi)
L16	100.604-98.437	3.000	1.042	Round	7.7472	10.0400	0.1090		C1020 (45 ksi)
L17	98.437-93.396	6.083	1.042	Round	9.0259	10.0400	0.1340		C1020 (45 ksi)
L18	93.396-87.188	7.250	1.042	Round	9.5983	10.0400	0.1340		C1020 (45 ksi)
L19	87.188-80.979	7.250	1.042	Round	9.7085	10.0400	0.1340		C1020 (45 ksi)
L20	80.979-74.771	7.250	1.042	Round	9.7244	10.0400	0.1340		C1020 (45 ksi)
L21	74.771-68.563	7.250	1.042	Round	9.7266	10.0400	0.1340		C1020 (45 ksi)
L22	68.563-62.354	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L23	62.354-56.146	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L24	56.146-49.938	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L25	49.938-43.729	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L26	43.729-37.521	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L27	37.521-31.313	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L28	31.313-25.105	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L29	25.105-18.896	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L30	18.896-12.688	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L31	12.688-6.480	7.250	1.042	Round	9.7270	10.0400	0.1340		C1020 (45 ksi)
L32	6.480-0.000	7.521		Round	9.7270	10.0400	0.1340		C1020 (45 ksi)

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 3 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	8.0000	3.3114	25.6184	2.7815	4.0000	6.4046	51.2369	1.6547	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L2	7.8077	3.2172	23.4943	2.7024	3.8881	6.0426	46.9886	1.6076	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L3	7.7850	3.2064	23.2579	2.6933	3.8753	6.0016	46.5159	1.6022	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L4	7.7823	3.2051	23.2309	2.6922	3.8738	5.9969	46.4618	1.6016	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L5	7.7820	3.2050	23.2278	2.6921	3.8736	5.9964	46.4555	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L6	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4548	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L7	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L8	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L9	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L10	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L11	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L12	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L13	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L14	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L15	7.7820	3.2050	23.2274	2.6921	3.8736	5.9963	46.4547	1.6015	0.0000	0
	8.0500	3.3324	26.1100	2.7991	4.0250	6.4870	52.2200	1.6652	0.0000	0
L16	8.3841	2.6156	19.0786	2.7008	3.8736	4.9253	38.1572	1.3070	0.0000	0
	10.0400	3.4007	41.9293	3.5114	5.0200	8.3525	83.8586	1.6993	0.0000	0
L17	9.1995	3.7432	37.0034	3.1441	4.5129	8.1994	74.0068	1.8705	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L18	9.6618	3.9842	44.6193	3.3465	4.7992	9.2973	89.2386	1.9909	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L19	9.7562	4.0306	46.1959	3.3854	4.8543	9.5166	92.3918	2.0141	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L20	9.7697	4.0373	46.4255	3.3910	4.8622	9.5483	92.8509	2.0174	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L21	9.7717	4.0383	46.4585	3.3918	4.8633	9.5528	92.9170	2.0179	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L22	9.7720	4.0384	46.4633	3.3920	4.8635	9.5535	92.9265	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L23	9.7720	4.0384	46.4639	3.3920	4.8635	9.5536	92.9279	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L24	9.7720	4.0384	46.4640	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L25	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L26	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L27	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L28	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L29	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 4 of 71
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	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L30	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L31	9.7720	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0
L32	9.7704	4.0384	46.4641	3.3920	4.8635	9.5536	92.9281	2.0180	0.0000	0
	10.0400	4.1702	51.1610	3.5026	5.0200	10.1914	102.3220	2.0838	0.0000	0

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L1 197.688-190.438				1	1	1.03			
L2 190.438-184.021				1	1	1.03			
L3 184.021-177.604				1	1	1.03			
L4 177.604-171.187				1	1	1.03			
L5 171.187-164.771				1	1	1.03			
L6 164.771-158.354				1	1	1.03			
L7 158.354-151.937				1	1	1.03			
L8 151.937-145.521				1	1	1.03			
L9 145.521-139.104				1	1	1.03			
L10 139.104-132.687				1	1	1.03			
L11 132.687-126.271				1	1	1.03			
L12 126.271-119.854				1	1	1.03			
L13 119.854-113.437				1	1	1.03			
L14 113.437-107.021				1	1	1.03			
L15 107.021-100.604				1	1	1.03			
L16 100.604-98.437				1	1	1.03			

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 5 of 71
Ahola Engineering LLC, P.O. Box 989, Winter Park, CO 80482-0989, Phone: (719) 640-2408, FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L17 98.437-93.396				1	1	1.03			
L18 93.396-87.188				1	1	1.03			
L19 87.188-80.979				1	1	1.03			
L20 80.979-74.771				1	1	1.03			
L21 74.771-68.563				1	1	1.03			
L22 68.563-62.354				1	1	1.03			
L23 62.354-56.146				1	1	1.03			
L24 56.146-49.938				1	1	1.03			
L25 49.938-43.729				1	1	1.03			
L26 43.729-37.521				1	1	1.03			
L27 37.521-31.313				1	1	1.03			
L28 31.313-25.105				1	1	1.03			
L29 25.105-18.896				1	1	1.03			
L30 18.896-12.688				1	1	1.03			
L31 12.688-6.480				1	1	1.03			
L32 6.480-0.000				1	1	1.03			

Guy Data

Guy Elevation ft	Guy Grade	Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
189.321	Miscl	A NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	250.292	164.040	0.0000	0.000	100%
		B NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	250.292	164.040	0.0000	0.000	100%
		C NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	250.292	164.040	0.0000	0.000	100%
		D NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	250.292	164.040	0.0000	0.000	100%
156.121	Miscl	A NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	226.226	164.040	0.0000	0.000	100%
		B NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	226.226	164.040	0.0000	0.000	100%
		C NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	226.226	164.040	0.0000	0.000	100%
		D NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	226.226	164.040	0.0000	0.000	100%

125.154	Miscl	A	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	206.081	164.040	0.0000	0.000	100%
		B	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	206.081	164.040	0.0000	0.000	100%
		C	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	206.081	164.040	0.0000	0.000	100%
		D	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	206.081	164.040	0.0000	0.000	100%
94.4376	Miscl	A	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	174.932	147.670	0.0000	0.000	100%
		B	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	174.932	147.670	0.0000	0.000	100%
		C	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	174.932	147.670	0.0000	0.000	100%
		D	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	174.932	147.670	0.0000	0.000	100%
64.4294	Miscl	A	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	160.729	147.670	0.0000	0.000	100%
		B	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	160.729	147.670	0.0000	0.000	100%
		C	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	160.729	147.670	0.0000	0.000	100%
		D	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	160.729	147.670	0.0000	0.000	100%
32.3546	Miscl	A	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	150.764	147.670	0.0000	0.000	100%
		B	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	150.764	147.670	0.0000	0.000	100%
		C	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	150.764	147.670	0.0000	0.000	100%
		D	NRG Guy 5/16 13MM	254.80	2.6%	13000	0.173	150.764	147.670	0.0000	0.000	100%

Guy Data *(cont'd)*

Guy Elevation ft	*Mount Type*	*Torque-Arm Spread ft*	*Torque-Arm Leg Angle °*	*Torque-Arm Style*	*Torque-Arm Grade*	*Torque-Arm Type*	*Torque-Arm Size*
189.321	Corner						
156.121	Corner						
125.154	Corner						
94.4376	Corner						
64.4294	Corner						
32.3546	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	*Diagonal Grade*	*Diagonal Type*	*Upper Diagonal Size*	*Lower Diagonal Size*	*Is Strap.*	*Pull-Off Grade*	*Pull-Off Type*	*Pull-Off Size*
189.321	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
156.121	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
125.154	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
94.438	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
64.429	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	
32.355	A572-50 (50 ksi)	Solid Round				A572-50 (50 ksi)	Solid Round	

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
189.321	43.30	43.30	43.30	43.30	20.012 7.7 sec/pulse	20.012 7.7 sec/pulse	20.012 7.7 sec/pulse	20.012 7.7 sec/pulse
156.121	39.14	39.14	39.14	39.14	16.523 7.0 sec/pulse	16.523 7.0 sec/pulse	16.523 7.0 sec/pulse	16.523 7.0 sec/pulse
125.154	35.65	35.65	35.65	35.65	13.850 6.4 sec/pulse	13.850 6.4 sec/pulse	13.850 6.4 sec/pulse	13.850 6.4 sec/pulse
94.4376	30.26	30.26	30.26	30.26	10.078 5.5 sec/pulse	10.078 5.5 sec/pulse	10.078 5.5 sec/pulse	10.078 5.5 sec/pulse
64.4294	27.81	27.81	27.81	27.81	8.593 5.1 sec/pulse	8.593 5.1 sec/pulse	8.593 5.1 sec/pulse	8.593 5.1 sec/pulse
32.3546	26.08	26.08	26.08	26.08	7.642 4.8 sec/pulse	7.642 4.8 sec/pulse	7.642 4.8 sec/pulse	7.642 4.8 sec/pulse

Guy Data *(cont'd)*

			Torque Arm		Pull Off		Diagonal	
Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K_x	K_y	K_x	K_y	K_x	K_y
189.321	No	No			1	1	1	1
156.121	No	No			1	1	1	1
125.154	No	No			1	1	1	1
94.4376	No	No			1	1	1	1
64.4294	No	No			1	1	1	1
32.3546	No	No			1	1	1	1

Guy Data *(cont'd)*

	Torque-Arm				Pull Off				Diagonal			
Guy Elevation ft	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U
189.321	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
156.121	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1
125.154	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1
94.4376	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1
64.4294	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1
32.3546	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.0000 A325N	0	0.0000	1

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
189.321	A	94.660	80		
	B	94.660	80		
	C	94.660	80		
	D	94.660	80		
156.121	A	78.060	77		
	B	78.060	77		
	C	78.060	77		
	D	78.060	77		
125.154	A	62.577	74		
	B	62.577	74		
	C	62.577	74		
	D	62.577	74		
94.4376	A	47.219	70		
	B	47.219	70		
	C	47.219	70		
	D	47.219	70		
64.4294	A	32.215	65		
	B	32.215	65		
	C	32.215	65		
	D	32.215	65		
32.3546	A	16.177	57		
	B	16.177	57		
	C	16.177	57		
	D	16.177	57		

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
189.321	A	49.1488	287.73 255.00	-125.19	226.82	-125.19	-52.46	0.00	52.46
	B	49.1488	287.73 255.00	125.19	226.82	-125.19	-52.46	0.00	-52.46

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
	C	49.1488	287.73 255.00	125.19	226.82	125.19	52.46	0.00	-52.46
	D	49.1488	287.73 255.00	-125.19	226.82	125.19	52.46	0.00	52.46
			Sum:	0.00	907.28	0.00	0.00	0.00	0.00
156.121	A	43.6404	281.80 254.80	-136.99	204.64	-136.99	-47.48	0.00	47.48
	B	43.6404	281.80 254.80	136.99	204.64	-136.99	-47.48	0.00	-47.48
	C	43.6404	281.80 254.80	136.99	204.64	136.99	47.48	0.00	-47.48
	D	43.6404	281.80 254.80	-136.99	204.64	136.99	47.48	0.00	47.48
			Sum:	0.00	818.57	0.00	0.00	0.00	0.00
125.154	A	37.3968	275.71 254.06	-148.51	178.62	-148.51	-41.20	0.00	41.20
	B	37.3968	275.71 254.06	148.51	178.62	-148.51	-41.20	0.00	-41.20
	C	37.3968	275.71 254.06	148.51	178.62	148.51	41.20	0.00	-41.20
	D	37.3968	275.71 254.06	-148.51	178.62	148.51	41.20	0.00	41.20
			Sum:	0.00	714.48	0.00	0.00	0.00	0.00
94.4376	A	32.6722	271.13 254.80	-156.29	157.03	-156.29	-45.65	0.00	45.65
	B	32.6722	271.13 254.80	156.29	157.03	-156.29	-45.65	0.00	-45.65
	C	32.6722	271.13 254.80	156.29	157.03	156.29	45.65	0.00	-45.65
	D	32.6722	271.13 254.80	-156.29	157.03	156.29	45.65	0.00	45.65
			Sum:	0.00	628.13	0.00	0.00	0.00	0.00
64.4294	A	23.6311	265.94 254.80	-168.44	118.23	-168.44	-34.66	0.00	34.66
	B	23.6311	265.94 254.80	168.44	118.23	-168.44	-34.66	0.00	-34.66
	C	23.6311	265.94 254.80	168.44	118.23	168.44	34.66	0.00	-34.66
	D	23.6311	265.94 254.80	-168.44	118.23	168.44	34.66	0.00	34.66
			Sum:	0.00	472.92	0.00	0.00	0.00	0.00
32.3546	A	12.3921	260.40 254.80	-177.68	68.30	-177.68	-20.11	0.00	20.11
	B	12.3921	260.40 254.80	177.68	68.30	-177.68	-20.11	0.00	-20.11
	C	12.3921	260.40 254.80	177.68	68.30	177.68	20.11	0.00	-20.11
	D	12.3921	260.40 254.80	-177.68	68.30	177.68	20.11	0.00	20.11
			Sum:	0.00	273.20	0.00	0.00	0.00	0.00

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation *ft*	*Guy Location*	*Chord Angle* °	*Guy Tension Top Bottom* *lb*	F_x *lb*	F_y *lb*	F_z *lb*	M_x *lb-ft*	M_y *lb-ft*	M_z *lb-ft*
189.321	A	49.1488	287.73 255.00	-125.19	226.82	-125.19	-52.46	0.00	52.46
	B	49.1488	287.73 255.00	125.19	226.82	-125.19	-52.46	0.00	-52.46
	C	49.1488	287.73 255.00	125.19	226.82	125.19	52.46	0.00	-52.46
	D	49.1488	287.73 255.00	-125.19	226.82	125.19	52.46	0.00	52.46
			Sum:	0.00	907.28	0.00	0.00	0.00	0.00
156.121	A	43.6404	281.80 254.80	-136.99	204.64	-136.99	-47.48	0.00	47.48
	B	43.6404	281.80 254.80	136.99	204.64	-136.99	-47.48	0.00	-47.48
	C	43.6404	281.80 254.80	136.99	204.64	136.99	47.48	0.00	-47.48
	D	43.6404	281.80 254.80	-136.99	204.64	136.99	47.48	0.00	47.48
			Sum:	0.00	818.57	0.00	0.00	0.00	0.00
125.154	A	37.3968	275.71 254.06	-148.51	178.62	-148.51	-41.20	0.00	41.20
	B	37.3968	275.71 254.06	148.51	178.62	-148.51	-41.20	0.00	-41.20
	C	37.3968	275.71 254.06	148.51	178.62	148.51	41.20	0.00	-41.20
	D	37.3968	275.71 254.06	-148.51	178.62	148.51	41.20	0.00	41.20
			Sum:	0.00	714.48	0.00	0.00	0.00	0.00
94.4376	A	32.6722	271.13 254.80	-156.29	157.03	-156.29	-45.65	0.00	45.65
	B	32.6722	271.13 254.80	156.29	157.03	-156.29	-45.65	0.00	-45.65
	C	32.6722	271.13 254.80	156.29	157.03	156.29	45.65	0.00	-45.65
	D	32.6722	271.13 254.80	-156.29	157.03	156.29	45.65	0.00	45.65
			Sum:	0.00	628.13	0.00	0.00	0.00	0.00
64.4294	A	23.6311	265.94 254.80	-168.44	118.23	-168.44	-34.66	0.00	34.66
	B	23.6311	265.94 254.80	168.44	118.23	-168.44	-34.66	0.00	-34.66
	C	23.6311	265.94 254.80	168.44	118.23	168.44	34.66	0.00	-34.66
	D	23.6311	265.94 254.80	-168.44	118.23	168.44	34.66	0.00	34.66
			Sum:	0.00	472.92	0.00	0.00	0.00	0.00
32.3546	A	12.3921	260.40 254.80	-177.68	68.30	-177.68	-20.11	0.00	20.11
	B	12.3921	260.40 254.80	177.68	68.30	-177.68	-20.11	0.00	-20.11
	C	12.3921	260.40 254.80	177.68	68.30	177.68	20.11	0.00	-20.11
	D	12.3921	260.40 254.80	-177.68	68.30	177.68	20.11	0.00	20.11
			Sum:	0.00	273.20	0.00	0.00	0.00	0.00

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 11 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
Cat5	C	No	Yes	Inside Pole	196.000 - 0.000	12	No Ice	0.000	0.05

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L1	197.688-190.438	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.34
		D	0.000	0.000	0.000	0.000	0.00
L2	190.438-184.021	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L3	184.021-177.604	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L4	177.604-171.187	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L5	171.187-164.771	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L6	164.771-158.354	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L7	158.354-151.937	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L8	151.937-145.521	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L9	145.521-139.104	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L10	139.104-132.687	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L11	132.687-126.271	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
L12	126.271-119.854	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L13	119.854-113.437	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L14	113.437-107.021	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L15	107.021-100.604	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.85
		D	0.000	0.000	0.000	0.000	0.00
L16	100.604-98.437	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.30
		D	0.000	0.000	0.000	0.000	0.00
L17	98.437-93.396	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.02
		D	0.000	0.000	0.000	0.000	0.00
L18	93.396-87.188	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L19	87.188-80.979	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L20	80.979-74.771	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L21	74.771-68.563	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L22	68.563-62.354	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L23	62.354-56.146	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L24	56.146-49.938	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L25	49.938-43.729	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L26	43.729-37.521	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L27	37.521-31.313	A	0.000	0.000	0.000	0.000	0.00

Tower Section	*Tower Elevation* *ft*	*Face*	*A_R* *ft^2*	*A_F* *ft^2*	*C_AA_A In Face* *ft^2*	*C_AA_A Out Face* *ft^2*	*Weight* *lb*
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L28	31.313-25.105	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L29	25.105-18.896	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L30	18.896-12.688	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L31	12.688-6.480	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.72
		D	0.000	0.000	0.000	0.000	0.00
L32	6.480-0.000	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.89
		D	0.000	0.000	0.000	0.000	0.00

User Defined Loads - Seismic

Description	*Elevation* *ft*	*Offset From Centroid* *ft*	*Azimuth Angle* *°*	*E_v* *lb*	*E_{hx}* *lb*	*E_{hz}* *lb*	*E_h* *lb*
CCISeismic Tower Section 1 - 1	194.063	0.000	0.0000	21.78	0.00	0.00	102.45
CCISeismic Tower Section 2 - 1	187.646	0.000	0.0000	21.16	0.00	0.00	93.06
CCISeismic Tower Section 3 - 1	181.229	0.000	0.0000	21.09	0.00	0.00	86.51
CCISeismic Tower Section 4 - 1	174.812	0.000	0.0000	21.08	0.00	0.00	80.46
CCISeismic Tower Section 5 - 1	168.396	0.000	0.0000	21.08	0.00	0.00	74.66
CCISeismic Tower Section 6 - 1	161.979	0.000	0.0000	21.08	0.00	0.00	69.08
CCISeismic Tower Section 7 - 1	155.562	0.000	0.0000	21.08	0.00	0.00	63.71
CCISeismic Tower Section 8 - 1	149.146	0.000	0.0000	21.08	0.00	0.00	58.57
CCISeismic Tower Section 9 - 1	142.729	0.000	0.0000	21.08	0.00	0.00	53.64
CCISeismic Tower Section 10 - 1	136.312	0.000	0.0000	21.08	0.00	0.00	48.92
CCISeismic Tower Section 11 - 1	129.896	0.000	0.0000	21.08	0.00	0.00	44.42
CCISeismic Tower Section 12 - 1	123.479	0.000	0.0000	21.08	0.00	0.00	40.14
CCISeismic Tower Section 13 - 1	117.062	0.000	0.0000	21.08	0.00	0.00	36.08
CCISeismic Tower Section 14 - 1	110.646	0.000	0.0000	21.08	0.00	0.00	32.23
CCISeismic Tower Section 15 - 1	104.229	0.000	0.0000	21.08	0.00	0.00	28.60
CCISeismic Tower Section 16 - 1	99.937	0.000	0.0000	7.12	0.00	0.00	8.88
CCISeismic Tower Section 17 - 1	96.438	0.000	0.0000	20.66	0.00	0.00	24.00
CCISeismic Tower Section 18 - 1	90.813	0.000	0.0000	26.21	0.00	0.00	26.99
CCISeismic Tower Section 19 -	84.604	0.000	0.0000	26.51	0.00	0.00	23.70

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 14 of 71
Ahola Engineering LLC	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
P.O. Box 989, Winter Park, CO 80482-0989, Phone: (719) 640-2408, FAX:	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Description	Elevation ft	Offset From Centroid ft	Azimuth Angle °	E_v lb	E_{hx} lb	E_{hz} lb	E_h lb
1							
CCISeismic Tower Section 20 - 1	78.396	0.000	0.0000	26.56	0.00	0.00	20.38
CCISeismic Tower Section 21 - 1	72.188	0.000	0.0000	26.56	0.00	0.00	17.29
CCISeismic Tower Section 22 - 1	65.979	0.000	0.0000	26.57	0.00	0.00	14.44
CCISeismic Tower Section 23 - 1	59.771	0.000	0.0000	26.57	0.00	0.00	11.85
CCISeismic Tower Section 24 - 1	53.563	0.000	0.0000	26.57	0.00	0.00	9.52
CCISeismic Tower Section 25 - 1	47.354	0.000	0.0000	26.57	0.00	0.00	7.44
CCISeismic Tower Section 26 - 1	41.146	0.000	0.0000	26.57	0.00	0.00	5.62
CCISeismic Tower Section 27 - 1	34.938	0.000	0.0000	26.57	0.00	0.00	4.05
CCISeismic Tower Section 28 - 1	28.730	0.000	0.0000	26.57	0.00	0.00	2.74
CCISeismic Tower Section 29 - 1	22.521	0.000	0.0000	26.57	0.00	0.00	1.68
CCISeismic Tower Section 30 - 1	16.313	0.000	0.0000	26.57	0.00	0.00	0.88
CCISeismic Tower Section 31 - 1	10.105	0.000	0.0000	26.57	0.00	0.00	0.34
CCISeismic Tower Section 32 - 1	3.761	0.000	0.0000	27.56	0.00	0.00	0.05
CCISeismic Properllor Anemometer/Wind Vane	198.491	0.000	0.0000	0.57	0.00	0.00	2.80
CCISeismic 95" Boom Mount	196.194	0.000	0.0000	2.07	0.00	0.00	9.96
CCISeismic NRG #40C Anemometer	192.913	0.000	0.0000	0.05	0.00	0.00	0.24
CCISeismic 95" Boom Mount	190.913	0.000	0.0000	2.07	0.00	0.00	9.43
CCISeismic NRG #40C Anemometer	192.913	0.000	0.0000	0.05	0.00	0.00	0.24
CCISeismic 95" Boom Mount	190.913	0.000	0.0000	2.07	0.00	0.00	9.43
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.770	0.000	0.0000	3.88	0.00	0.00	15.85
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.770	0.000	0.0000	3.88	0.00	0.00	15.85
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.770	0.000	0.0000	3.88	0.00	0.00	15.85
CCISeismic Aircraft Marker Balls (21" Dia - Orange)	180.770	0.000	0.0000	3.88	0.00	0.00	15.85
CCISeismic NRG 200P Wind Vane	167.323	0.000	0.0000	0.06	0.00	0.00	0.23
CCISeismic 95" Boom Mount	165.323	0.000	0.0000	2.07	0.00	0.00	7.07
CCISeismic NRG #40C Anemometer	167.323	0.000	0.0000	0.05	0.00	0.00	0.18
CCISeismic 95" Boom Mount	165.323	0.000	0.0000	2.07	0.00	0.00	7.07
CCISeismic Temperature Probe w/ Shield	173.885	0.000	0.0000	1.29	0.00	0.00	4.89
CCISeismic Relative Humidty Sensor	173.885	0.000	0.0000	2.59	0.00	0.00	9.78
CCISeismic Barometric Pressure	173.885	0.000	0.0000	2.59	0.00	0.00	9.78
CCISeismic NRG 200P Wind Vane	160.761	0.000	0.0000	0.06	0.00	0.00	0.21
CCISeismic 95" Boom Mount	158.761	0.000	0.0000	2.07	0.00	0.00	6.52
CCISeismic NRG 200P Wind	137.795	0.000	0.0000	0.06	0.00	0.00	0.15

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Description	*Elevation* *ft*	*Offset From Centroid* *ft*	*Azimuth Angle* *°*	E_v *lb*	E_{hx} *lb*	E_{hz} *lb*	E_h *lb*
Vane							
CCISeismic 95" Boom Mount	135.795	0.000	0.0000	2.07	0.00	0.00	4.77
CCISeismic NRG #40C Anemometer	131.234	0.000	0.0000	0.05	0.00	0.00	0.11
CCISeismic 95" Boom Mount	129.234	0.000	0.0000	2.07	0.00	0.00	4.32
CCISeismic NRG #40C Anemometer	131.234	0.000	0.0000	0.05	0.00	0.00	0.11
CCISeismic 95" Boom Mount	129.234	0.000	0.0000	2.07	0.00	0.00	4.32
CCISeismic NRG #40C Anemometer	98.425	0.000	0.0000	0.05	0.00	0.00	0.06
CCISeismic 95" Boom Mount	96.425	0.000	0.0000	2.07	0.00	0.00	2.40
CCISeismic NRG #40C Anemometer	98.425	0.000	0.0000	0.05	0.00	0.00	0.06
CCISeismic 95" Boom Mount	96.425	0.000	0.0000	2.07	0.00	0.00	2.40
CCISeismic Temperature Probe w/ Shield	49.200	0.000	0.0000	1.29	0.00	0.00	0.39
CCISeismic Data Logger	5.000	0.000	0.0000	12.94	0.00	0.00	0.04
CCISeismic (12) miscl Cat5 From 0 to 196 (188ft to196ft)	192.000	0.000	0.0000	1.24	0.00	0.00	5.72
CCISeismic (12) miscl Cat5 From 0 to 196 (178ft to188ft)	183.000	0.000	0.0000	1.55	0.00	0.00	6.50
CCISeismic (12) miscl Cat5 From 0 to 196 (168ft to178ft)	173.000	0.000	0.0000	1.55	0.00	0.00	5.81
CCISeismic (12) miscl Cat5 From 0 to 196 (158ft to168ft)	163.000	0.000	0.0000	1.55	0.00	0.00	5.15
CCISeismic (12) miscl Cat5 From 0 to 196 (148ft to158ft)	153.000	0.000	0.0000	1.55	0.00	0.00	4.54
CCISeismic (12) miscl Cat5 From 0 to 196 (138ft to148ft)	143.000	0.000	0.0000	1.55	0.00	0.00	3.97
CCISeismic (12) miscl Cat5 From 0 to 196 (128ft to138ft)	133.000	0.000	0.0000	1.55	0.00	0.00	3.43
CCISeismic (12) miscl Cat5 From 0 to 196 (118ft to128ft)	123.000	0.000	0.0000	1.55	0.00	0.00	2.93
CCISeismic (12) miscl Cat5 From 0 to 196 (108ft to118ft)	113.000	0.000	0.0000	1.55	0.00	0.00	2.48
CCISeismic (12) miscl Cat5 From 0 to 196 (98ft to108ft)	103.000	0.000	0.0000	1.55	0.00	0.00	2.06
CCISeismic (12) miscl Cat5 From 0 to 196 (88ft to98ft)	93.000	0.000	0.0000	1.55	0.00	0.00	1.68
CCISeismic (12) miscl Cat5 From 0 to 196 (78ft to88ft)	83.000	0.000	0.0000	1.55	0.00	0.00	1.34
CCISeismic (12) miscl Cat5 From 0 to 196 (68ft to78ft)	73.000	0.000	0.0000	1.55	0.00	0.00	1.03
CCISeismic (12) miscl Cat5 From 0 to 196 (58ft to68ft)	63.000	0.000	0.0000	1.55	0.00	0.00	0.77
CCISeismic (12) miscl Cat5 From 0 to 196 (48ft to58ft)	53.000	0.000	0.0000	1.55	0.00	0.00	0.54
CCISeismic (12) miscl Cat5 From 0 to 196 (38ft to48ft)	43.000	0.000	0.0000	1.55	0.00	0.00	0.36
CCISeismic (12) miscl Cat5 From 0 to 196 (28ft to38ft)	33.000	0.000	0.0000	1.55	0.00	0.00	0.21
CCISeismic (12) miscl Cat5 From 0 to 196 (18ft to28ft)	23.000	0.000	0.0000	1.55	0.00	0.00	0.10
CCISeismic (12) miscl Cat5 From 0 to 196 (8ft to18ft)	13.000	0.000	0.0000	1.55	0.00	0.00	0.03
CCISeismic (12) miscl Cat5 From 0 to 196 (0ft to8ft)	4.000	0.000	0.0000	1.24	0.00	0.00	0.00

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* °	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *lb*
***									
Properllor Anemometer/Wind Vane	A	From Leg	7.920 0.000 0.000	0.0000	198.491	No Ice	0.350	0.350	2.20
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.0000	196.194	No Ice	0.250	1.000	8.00
***									
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.0000	192.913	No Ice	0.250	0.250	0.20
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	190.913	No Ice	0.250	1.000	8.00
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.0000	192.913	No Ice	0.250	0.250	0.20
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.0000	190.913	No Ice	0.250	1.000	8.00
***									
Aircraft Marker Balls (21" Dia - Orange)	A	From Leg	0.000 0.000 0.000	0.0000	180.770	No Ice	1.130	1.130	15.00
Aircraft Marker Balls (21" Dia - Orange)	B	From Leg	0.000 0.000 0.000	0.0000	180.770	No Ice	1.130	1.130	15.00
Aircraft Marker Balls (21" Dia - Orange)	C	From Leg	0.000 0.000 0.000	0.0000	180.770	No Ice	1.130	1.130	15.00
Aircraft Marker Balls (21" Dia - Orange)	D	From Leg	0.000 0.000 0.000	0.0000	180.770	No Ice	1.130	1.130	15.00
****									
NRG 200P Wind Vane	A	From Leg	7.920 0.000 0.000	0.0000	167.323	No Ice	0.250	0.250	0.25
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.0000	165.323	No Ice	0.250	1.000	8.00
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.0000	167.323	No Ice	0.250	0.250	0.20
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	165.323	No Ice	0.250	1.000	8.00
****									
Temperature Probe w/ Shield	A	From Leg	0.000 0.000 0.000	0.0000	173.885	No Ice	0.250	0.250	5.00
Relative Humidty Sensor	B	From Leg	0.000 0.000	0.0000	173.885	No Ice	0.450	0.450	10.00

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *lb*
			0.000						
Barometric Pressure	C	From Leg	0.000 0.000 0.000	0.0000	173.885	No Ice	0.500	0.500	10.00
****									
NRG 200P Wind Vane	C	From Leg	7.920 0.000 0.000	0.0000	160.761	No Ice	0.250	0.250	0.25
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	158.761	No Ice	0.250	1.000	8.00
****									
NRG 200P Wind Vane	C	From Leg	7.920 0.000 0.000	0.0000	137.795	No Ice	0.250	0.250	0.25
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	135.795	No Ice	0.250	1.000	8.00
****									
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.0000	131.234	No Ice	0.250	0.250	0.20
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	129.234	No Ice	0.250	1.000	8.00
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.0000	131.234	No Ice	0.250	0.250	0.20
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.0000	129.234	No Ice	0.250	1.000	8.00
***									
NRG #40C Anemometer	C	From Leg	7.920 0.000 0.000	0.0000	98.425	No Ice	0.250	0.250	0.20
95" Boom Mount	C	From Leg	0.000 0.000 0.000	0.0000	96.425	No Ice	0.250	1.000	8.00
NRG #40C Anemometer	A	From Leg	7.920 0.000 0.000	0.0000	98.425	No Ice	0.250	0.250	0.20
95" Boom Mount	A	From Leg	0.000 0.000 0.000	0.0000	96.425	No Ice	0.250	1.000	8.00
****									
Temperature Probe w/ Shield	C	From Leg	0.000 0.000 0.000	0.0000	49.200	No Ice	0.250	0.250	5.00
***									
Data Logger	C	From Leg	0.000 0.000 0.000	0.0000	5.000	No Ice	4.000	4.000	50.00

222-H Verification Constants

Constant	*Value*
K_d	0.95
Ice Thickness Importance Factor	1
Z_g	900
α	9.5
K_{zmin}	0.85
K_c	1
K_t	0.43
f	1.25
K_e	0.915

222-H Section Verification ArRr By Element

Section Elevation *ft*	*Elem. Num.*	*Size*	*C*	*C w/Ice*	*Face*	*e*	*e w/Ice*	*A_r* *ft^2*	*A_r w/Ice* *ft^2*	*A_rR_r* *ft^2*	*A_rR_r w/Ice* *ft^2*
L1 197.688-190.438	1	TP8.05x8x0.134	127.511	63.229		1	1	4.848	4.848	4.848	4.848
							Sum:	4.848	4.848	4.848	4.848
L2 190.438-184.021	2	TP8.05x7.7763x0.134	125.451	62.207		1	1	4.240	4.240	4.240	4.240
							Sum:	4.240	4.240	4.240	4.240
L3 184.021-177.604	3	TP8.05x7.7505x0.134	124.968	61.968		1	1	4.234	4.234	4.234	4.234
							Sum:	4.234	4.234	4.234	4.234
L4 177.604-171.187	4	TP8.05x7.7476x0.134	124.651	61.81		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L5 171.187-164.771	5	TP8.05x7.7472x0.134	124.338	61.655		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L6 164.771-158.354	6	TP8.05x7.7472x0.134	124.009	61.492		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L7 158.354-151.937	7	TP8.05x7.7472x0.134	123.662	61.32		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L8 151.937-145.521	8	TP8.05x7.7472x0.134	123.294	61.138		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L9 145.521-139.104	9	TP8.05x7.7472x0.134	122.904	60.944		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L10 139.104-132.687	10	TP8.05x7.7472x0.134	122.49	60.739		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 19 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
L11 132.687-126.271	11	TP8.05x7.7472x0.134	122.049	60.52		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L12 126.271-119.854	12	TP8.05x7.7472x0.134	121.579	60.287		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L13 119.854-113.437	13	TP8.05x7.7472x0.134	121.077	60.038		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L14 113.437-107.021	14	TP8.05x7.7472x0.134	120.539	59.771		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L15 107.021-100.604	15	TP8.05x7.7472x0.134	119.961	59.485		1	1	4.233	4.233	4.233	4.233
							Sum:	4.233	4.233	4.233	4.233
L16 100.604-98.437	16	TP10.04x7.7472x0.109	134.609	66.748		1	1	1.663	1.663	1.663	1.663
							Sum:	1.663	1.663	1.663	1.663
L17 98.437-93.396	17	TP10.04x9.0259x0.134	143.848	71.33		1	1	4.042	4.042	4.042	4.042
							Sum:	4.042	4.042	4.042	4.042
L18 93.396-87.188	18	TP10.04x9.5983x0.134	147.426	73.104		1	1	5.096	5.096	5.096	5.096
							Sum:	5.096	5.096	5.096	5.096
L19 87.188-80.979	19	TP10.04x9.7085x0.134	147.364	73.073		1	1	5.121	5.121	5.121	5.121
							Sum:	5.121	5.121	5.121	5.121
L20 80.979-74.771	20	TP10.04x9.7244x0.134	146.513	72.651		1	1	5.124	5.124	5.124	5.124
							Sum:	5.124	5.124	5.124	5.124
L21 74.771-68.563	21	TP10.04x9.7267x0.134	145.47	72.134		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L22 68.563-62.354	22	TP10.04x9.727x0.134	144.307	71.557		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L23 62.354-56.146	23	TP10.04x9.727x0.134	143.016	70.917		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L24 56.146-49.938	24	TP10.04x9.727x0.134	141.572	70.201		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L25 49.938-43.729	25	TP10.04x9.727x0.134	139.939	69.391		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L26 43.729-37.521	26	TP10.04x9.727x0.134	138.069	68.464		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L27 37.521-31.313	27	TP10.04x9.727x0.134	135.885	67.381		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L28 31.313-25.105	28	TP10.04x9.727x0.134	133.272	66.085		1	1	5.125	5.125	5.125	5.125
							Sum:	5.125	5.125	5.125	5.125
L29	29	TP10.04x9.727x0.13	130.027	64.476		1	1	5.125	5.125	5.125	5.125

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
25.105-18.896		4									
							Sum:	5.125	5.125	5.125	5.125
L30	30	TP10.04x9.727x0.13	125.757	62.359		1	1	5.125	5.125	5.125	5.125
18.896-12.688		4									
							Sum:	5.125	5.125	5.125	5.125
L31	31	TP10.04x9.727x0.13	125.365	62.165		1	1	5.125	5.125	5.125	5.125
12.688-6.480		4									
							Sum:	5.125	5.125	5.125	5.125
L32 6.480-0.000	32	TP10.04x9.727x0.13	125.564	62.263		1	1	5.349	5.349	5.349	5.349
		4									
							Sum:	5.349	5.349	5.349	5.349

222-H Section Verification Tables - No Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
L1 197.688-190.438	194.059		1.455	1.176	1.865		88		1	4.848
L2 190.438-184.021	187.213		1.444	1.169	1.871		88		1	4.240
L3 184.021-177.604	180.795		1.434	1.163	1.877		88		1	4.234
L4 177.604-171.187	174.378		1.423	1.156	1.882		87		1	4.233
L5 171.187-164.771	167.961		1.412	1.15	1.887		87		1	4.233
L6 164.771-158.354	161.544		1.4	1.144	1.893		86		1	4.233
L7 158.354-151.937	155.128		1.388	1.138	1.898		86		1	4.233
L8 151.937-145.521	148.711		1.376	1.132	1.904		85		1	4.233
L9 145.521-139.104	142.294		1.363	1.126	1.91		85		1	4.233
L10 139.104-132.687	135.878		1.35	1.12	1.915		84		1	4.233
L11 132.687-126.271	129.461		1.336	1.114	1.921		84		1	4.233
L12 126.271-119.854	123.044		1.322	1.108	1.927		83		1	4.233
L13 119.854-113.437	116.628		1.307	1.102	1.933		82		1	4.233
L14 113.437-107.021	110.211		1.292	1.096	1.938		82		1	4.233
L15 107.021-100.604	103.794		1.276	1.09	1.944		81		1	4.233
L16 100.604-98.437	99.488		1.264	1.086	1.948		80		1	1.663
L17 98.437-93.396	95.880		1.254	1.083	1.952		80		1	4.042
L18 93.396-87.188	90.272		1.239	1.078	1.957		79		1	5.096
L19 87.188-80.979	84.069		1.22	1.073	1.963		78		1	5.121
L20 80.979-74.771	77.861		1.201	1.067	1.968		77		1	5.124
L21 74.771-68.563	71.653		1.18	1.062	1.974		76		1	5.125
L22 68.563-62.354	65.445		1.158	1.056	1.98		75		1	5.125
L23 62.354-56.146	59.236		1.134	1.051	1.986		73		1	5.125
L24 56.146-49.938	53.028		1.107	1.045	1.992		72		1	5.125
L25 49.938-43.729	46.820		1.079	1.04	1.998		70		1	5.125
L26 43.729-37.521	40.611		1.047	1.034	2.004		68		1	5.125
L27 37.521-31.313	34.403		1.011	1.029	2.01		66		1	5.125
L28 31.313-25.105	28.195		0.97	1.024	2.016		64		1	5.125
L29 25.105-18.896	21.986		0.92	1.018	2.023		61		1	5.125
L30 18.896-12.688	15.778		0.858	1.013	2.029		57		1	5.125
L31 12.688-6.480	9.570		0.85	1.008	2.035		56		1	5.125
L32 6.480-0.000	3.225		0.85	1.003	2.042		57		1	5.349

222-H Section Verification Tables - Service

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
L1 197.688-190.438	194.059		1.455	1.176	1.865		19		1	4.848
L2 190.438-184.021	187.213		1.444	1.169	1.871		19		1	4.240
L3 184.021-177.604	180.795		1.434	1.163	1.877		19		1	4.234
L4 177.604-171.187	174.378		1.423	1.156	1.882		19		1	4.233
L5 171.187-164.771	167.961		1.412	1.15	1.887		19		1	4.233
L6 164.771-158.354	161.544		1.4	1.144	1.893		19		1	4.233
L7 158.354-151.937	155.128		1.388	1.138	1.898		19		1	4.233
L8 151.937-145.521	148.711		1.376	1.132	1.904		19		1	4.233
L9 145.521-139.104	142.294		1.363	1.126	1.91		19		1	4.233
L10 139.104-132.687	135.878		1.35	1.12	1.915		19		1	4.233
L11 132.687-126.271	129.461		1.336	1.114	1.921		18		1	4.233
L12 126.271-119.854	123.044		1.322	1.108	1.927		18		1	4.233
L13 119.854-113.437	116.628		1.307	1.102	1.933		18		1	4.233
L14 113.437-107.021	110.211		1.292	1.096	1.938		18		1	4.233
L15 107.021-100.604	103.794		1.276	1.09	1.944		18		1	4.233
L16 100.604-98.437	99.488		1.264	1.086	1.948		18		1	1.663
L17 98.437-93.396	95.880		1.254	1.083	1.952		18		1	4.042
L18 93.396-87.188	90.272		1.239	1.078	1.957		17		1	5.096
L19 87.188-80.979	84.069		1.22	1.073	1.963		17		1	5.121
L20 80.979-74.771	77.861		1.201	1.067	1.968		17		1	5.124
L21 74.771-68.563	71.653		1.18	1.062	1.974		17		1	5.125
L22 68.563-62.354	65.445		1.158	1.056	1.98		16		1	5.125
L23 62.354-56.146	59.236		1.134	1.051	1.986		16		1	5.125
L24 56.146-49.938	53.028		1.107	1.045	1.992		16		1	5.125
L25 49.938-43.729	46.820		1.079	1.04	1.998		15		1	5.125
L26 43.729-37.521	40.611		1.047	1.034	2.004		15		1	5.125
L27 37.521-31.313	34.403		1.011	1.029	2.01		15		1	5.125
L28 31.313-25.105	28.195		0.97	1.024	2.016		14		1	5.125
L29 25.105-18.896	21.986		0.92	1.018	2.023		13		1	5.125
L30 18.896-12.688	15.778		0.858	1.013	2.029		12		1	5.125
L31 12.688-6.480	9.570		0.85	1.008	2.035		12		1	5.125
L32 6.480-0.000	3.225		0.85	1.003	2.042		12		1	5.349

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 197.688-190.438	194.059	1.455	88	4.848	A	0.000	4.848	4.848	100.00	0.000	0.000
					B	0.000	4.848		100.00	0.000	0.000
					C	0.000	4.848		100.00	0.000	0.000
					D	0.000	4.848		100.00	0.000	0.000
L2 190.438-184.021	187.213	1.444	88	4.240	A	0.000	4.240	4.240	100.00	0.000	0.000
					B	0.000	4.240		100.00	0.000	0.000
					C	0.000	4.240		100.00	0.000	0.000
					D	0.000	4.240		100.00	0.000	0.000
L3 184.021-177.604	180.795	1.434	88	4.234	A	0.000	4.234	4.234	100.00	0.000	0.000
					B	0.000	4.234		100.00	0.000	0.000
					C	0.000	4.234		100.00	0.000	0.000
					D	0.000	4.234		100.00	0.000	0.000

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 22 of 71
Ahola Engineering LLC	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Section Elevation *ft*	*z* *ft*	K_Z	q_z *psf*	A_G ft^2	*Face*	A_F ft^2	A_R ft^2	A_{leg} ft^2	*Leg %*	C_AA_A *In Face* ft^2	C_AA_A *Out Face* ft^2
L4 177.604-171.187	174.378	1.423	87	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L5 171.187-164.771	167.961	1.412	87	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L6 164.771-158.354	161.544	1.4	86	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L7 158.354-151.937	155.128	1.388	86	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L8 151.937-145.521	148.711	1.376	85	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L9 145.521-139.104	142.294	1.363	85	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L10 139.104-132.687	135.878	1.35	84	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L11 132.687-126.271	129.461	1.336	84	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L12 126.271-119.854	123.044	1.322	83	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L13 119.854-113.437	116.628	1.307	82	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L14 113.437-107.021	110.211	1.292	82	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L15 107.021-100.604	103.794	1.276	81	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L16 100.604-98.437	99.488	1.264	80	1.663	A	0.000	1.663	1.663	100.00	0.000	0.000
					B	0.000	1.663		100.00	0.000	0.000
					C	0.000	1.663		100.00	0.000	0.000
					D	0.000	1.663		100.00	0.000	0.000
L17 98.437-93.396	95.880	1.254	80	4.042	A	0.000	4.042	4.042	100.00	0.000	0.000
					B	0.000	4.042		100.00	0.000	0.000
					C	0.000	4.042		100.00	0.000	0.000
					D	0.000	4.042		100.00	0.000	0.000
L18 93.396-87.188	90.272	1.239	79	5.096	A	0.000	5.096	5.096	100.00	0.000	0.000
					B	0.000	5.096		100.00	0.000	0.000
					C	0.000	5.096		100.00	0.000	0.000
					D	0.000	5.096		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L19 87.188-80.979	84.069	1.22	78	5.121	A	0.000	5.121	5.121	100.00	0.000	0.000
					B	0.000	5.121		100.00	0.000	0.000
					C	0.000	5.121		100.00	0.000	0.000
					D	0.000	5.121		100.00	0.000	0.000
L20 80.979-74.771	77.861	1.201	77	5.124	A	0.000	5.124	5.124	100.00	0.000	0.000
					B	0.000	5.124		100.00	0.000	0.000
					C	0.000	5.124		100.00	0.000	0.000
					D	0.000	5.124		100.00	0.000	0.000
L21 74.771-68.563	71.653	1.18	76	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L22 68.563-62.354	65.445	1.158	75	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L23 62.354-56.146	59.236	1.134	73	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L24 56.146-49.938	53.028	1.107	72	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L25 49.938-43.729	46.820	1.079	70	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L26 43.729-37.521	40.611	1.047	68	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L27 37.521-31.313	34.403	1.011	66	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L28 31.313-25.105	28.195	0.97	64	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L29 25.105-18.896	21.986	0.92	61	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L30 18.896-12.688	15.778	0.858	57	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L31 12.688-6.480	9.570	0.85	56	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L32 6.480-0.000	3.225	0.85	57	5.349	A	0.000	5.349	5.349	100.00	0.000	0.000
					B	0.000	5.349		100.00	0.000	0.000
					C	0.000	5.349		100.00	0.000	0.000
					D	0.000	5.349		100.00	0.000	0.000

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 24 of 71
	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Tower Pressure - Service

$G_H = 1.100$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 197.688-190.438	194.059	1.455	19	4.848	A	0.000	4.848	4.848	100.00	0.000	0.000
					B	0.000	4.848		100.00	0.000	0.000
					C	0.000	4.848		100.00	0.000	0.000
					D	0.000	4.848		100.00	0.000	0.000
L2 190.438-184.021	187.213	1.444	19	4.240	A	0.000	4.240	4.240	100.00	0.000	0.000
					B	0.000	4.240		100.00	0.000	0.000
					C	0.000	4.240		100.00	0.000	0.000
					D	0.000	4.240		100.00	0.000	0.000
L3 184.021-177.604	180.795	1.434	19	4.234	A	0.000	4.234	4.234	100.00	0.000	0.000
					B	0.000	4.234		100.00	0.000	0.000
					C	0.000	4.234		100.00	0.000	0.000
					D	0.000	4.234		100.00	0.000	0.000
L4 177.604-171.187	174.378	1.423	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L5 171.187-164.771	167.961	1.412	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L6 164.771-158.354	161.544	1.4	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L7 158.354-151.937	155.128	1.388	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L8 151.937-145.521	148.711	1.376	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L9 145.521-139.104	142.294	1.363	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L10 139.104-132.687	135.878	1.35	19	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L11 132.687-126.271	129.461	1.336	18	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L12 126.271-119.854	123.044	1.322	18	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L13 119.854-113.437	116.628	1.307	18	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000
					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L14 113.437-107.0	110.211	1.292	18	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
					B	0.000	4.233		100.00	0.000	0.000

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 25 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
21					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L15	103.794	1.276	18	4.233	A	0.000	4.233	4.233	100.00	0.000	0.000
107.021-100.6					B	0.000	4.233		100.00	0.000	0.000
04					C	0.000	4.233		100.00	0.000	0.000
					D	0.000	4.233		100.00	0.000	0.000
L16	99.488	1.264	18	1.663	A	0.000	1.663	1.663	100.00	0.000	0.000
100.604-98.43					B	0.000	1.663		100.00	0.000	0.000
7					C	0.000	1.663		100.00	0.000	0.000
					D	0.000	1.663		100.00	0.000	0.000
L17	95.880	1.254	18	4.042	A	0.000	4.042	4.042	100.00	0.000	0.000
98.437-93.396					B	0.000	4.042		100.00	0.000	0.000
					C	0.000	4.042		100.00	0.000	0.000
					D	0.000	4.042		100.00	0.000	0.000
L18	90.272	1.239	17	5.096	A	0.000	5.096	5.096	100.00	0.000	0.000
93.396-87.188					B	0.000	5.096		100.00	0.000	0.000
					C	0.000	5.096		100.00	0.000	0.000
					D	0.000	5.096		100.00	0.000	0.000
L19	84.069	1.22	17	5.121	A	0.000	5.121	5.121	100.00	0.000	0.000
87.188-80.979					B	0.000	5.121		100.00	0.000	0.000
					C	0.000	5.121		100.00	0.000	0.000
					D	0.000	5.121		100.00	0.000	0.000
L20	77.861	1.201	17	5.124	A	0.000	5.124	5.124	100.00	0.000	0.000
80.979-74.771					B	0.000	5.124		100.00	0.000	0.000
					C	0.000	5.124		100.00	0.000	0.000
					D	0.000	5.124		100.00	0.000	0.000
L21	71.653	1.18	17	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
74.771-68.563					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L22	65.445	1.158	16	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
68.563-62.354					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L23	59.236	1.134	16	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
62.354-56.146					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L24	53.028	1.107	16	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
56.146-49.938					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L25	46.820	1.079	15	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
49.938-43.729					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L26	40.611	1.047	15	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
43.729-37.521					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L27	34.403	1.011	15	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
37.521-31.313					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L28	28.195	0.97	14	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
31.313-25.105					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L29	21.986	0.92	13	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
25.105-18.896					B	0.000	5.125		100.00	0.000	0.000

Section Elevation *ft*	*z* *ft*	K_Z	q_z *psf*	A_G *ft²*	*Face*	A_F *ft²*	A_R *ft²*	A_{leg} *ft²*	*Leg %*	C_AA_A *In Face ft²*	C_AA_A *Out Face ft²*
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L30	15.778	0.858	12	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
18.896-12.688					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L31	9.570	0.85	12	5.125	A	0.000	5.125	5.125	100.00	0.000	0.000
12.688-6.480					B	0.000	5.125		100.00	0.000	0.000
					C	0.000	5.125		100.00	0.000	0.000
					D	0.000	5.125		100.00	0.000	0.000
L32	3.225	0.85	12	5.349	A	0.000	5.349	5.349	100.00	0.000	0.000
6.480-0.000					B	0.000	5.349		100.00	0.000	0.000
					C	0.000	5.349		100.00	0.000	0.000
					D	0.000	5.349		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *lb*	*Self Weight* *lb*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E *ft²*	*F* *lb*	*w* *plf*	*Ctrl. Face*
L1	3.34	84.41	A	1	0.6	88	1	1	4.848	282.93	39.02	D
197.688-190.4			B	1	0.6		1	1	4.848			
38			C	1	0.6		1	1	4.848			
			D	1	0.6		1	1	4.848			
L2	3.85	83.21	A	1	0.6	88	1	1	4.240	246.30	38.38	D
190.438-184.0			B	1	0.6		1	1	4.240			
21			C	1	0.6		1	1	4.240			
			D	1	0.6		1	1	4.240			
L3	3.85	83.08	A	1	0.6	88	1	1	4.234	244.85	38.16	D
184.021-177.6			B	1	0.6		1	1	4.234			
04			C	1	0.6		1	1	4.234			
			D	1	0.6		1	1	4.234			
L4	3.85	83.06	A	1	0.6	87	1	1	4.233	243.66	37.97	D
177.604-171.1			B	1	0.6		1	1	4.233			
87			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L5	3.85	83.06	A	1	0.6	87	1	1	4.233	242.44	37.78	D
171.187-164.7			B	1	0.6		1	1	4.233			
71			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L6	3.85	83.06	A	1	0.6	86	1	1	4.233	241.16	37.58	D
164.771-158.3			B	1	0.6		1	1	4.233			
54			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L7	3.85	83.06	A	1	0.6	86	1	1	4.233	239.82	37.37	D
158.354-151.9			B	1	0.6		1	1	4.233			
37			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L8	3.85	83.06	A	1	0.6	85	1	1	4.233	238.39	37.15	D
151.937-145.5			B	1	0.6		1	1	4.233			
21			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L9	3.85	83.06	A	1	0.6	85	1	1	4.233	236.89	36.92	D
145.521-139.1			B	1	0.6		1	1	4.233			
04			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L10	3.85	83.06	A	1	0.6	84	1	1	4.233	235.29	36.67	D
139.104-132.6			B	1	0.6		1	1	4.233			
87			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L11	3.85	83.06	A	1	0.6	84	1	1	4.233	233.60	36.41	D
132.687-126.2			B	1	0.6		1	1	4.233			
71			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L12	3.85	83.06	A	1	0.6	83	1	1	4.233	231.81	36.13	D
126.271-119.8			B	1	0.6		1	1	4.233			
54			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L13	3.85	83.06	A	1	0.6	82	1	1	4.233	229.89	35.83	D
119.854-113.4			B	1	0.6		1	1	4.233			
37			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L14	3.85	83.06	A	1	0.6	82	1	1	4.233	227.86	35.51	D
113.437-107.0			B	1	0.6		1	1	4.233			
21			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L15	3.85	83.06	A	1	0.6	81	1	1	4.233	225.68	35.17	D
107.021-100.6			B	1	0.6		1	1	4.233			
04			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L16	1.30	31.63	A	1	0.6	80	1	1	1.663	88.07	40.65	D
100.604-98.43			B	1	0.6		1	1	1.663			
7			C	1	0.6		1	1	1.663			
			D	1	0.6		1	1	1.663			
L17	3.02	84.36	A	1	0.6	80	1	1	4.042	212.71	42.19	D
98.437-93.396			B	1	0.6		1	1	4.042			
			C	1	0.6		1	1	4.042			
			D	1	0.6		1	1	4.042			
L18	3.72	103.60	A	1	0.6	79	1	1	5.096	265.54	42.77	D
93.396-87.188			B	1	0.6		1	1	5.096			
			C	1	0.6		1	1	5.096			
			D	1	0.6		1	1	5.096			
L19	3.72	104.19	A	1	0.6	78	1	1	5.121	263.62	42.46	D
87.188-80.979			B	1	0.6		1	1	5.121			
			C	1	0.6		1	1	5.121			
			D	1	0.6		1	1	5.121			
L20	3.72	104.28	A	1	0.6	77	1	1	5.124	260.35	41.94	D
80.979-74.771			B	1	0.6		1	1	5.124			
			C	1	0.6		1	1	5.124			
			D	1	0.6		1	1	5.124			
L21	3.72	104.29	A	1	0.6	76	1	1	5.125	256.62	41.34	D
74.771-68.563			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L22	3.72	104.29	A	1	0.6	75	1	1	5.125	252.53	40.68	D
68.563-62.354			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L23	3.72	104.29	A	1	0.6	73	1	1	5.125	248.03	39.95	D
62.354-56.146			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L24	3.72	104.29	A	1	0.6	72	1	1	5.125	243.05	39.15	D
56.146-49.938			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 28 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L25	3.72	104.29	A	1	0.6	70	1	1	5.125	237.47	38.25	D
49.938-43.729			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L26	3.72	104.29	A	1	0.6	68	1	1	5.125	231.17	37.24	D
43.729-37.521			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L27	3.72	104.29	A	1	0.6	66	1	1	5.125	223.91	36.07	D
37.521-31.313			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L28	3.72	104.29	A	1	0.6	64	1	1	5.125	215.38	34.69	D
31.313-25.105			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L29	3.72	104.29	A	1	0.6	61	1	1	5.125	205.02	33.02	D
25.105-18.896			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L30	3.72	104.29	A	1	0.6	57	1	1	5.125	191.78	30.89	D
18.896-12.688			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L31	3.72	104.29	A	1	0.6	56	1	1	5.125	190.59	30.70	D
12.688-6.480			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L32	3.89	108.19	A	1	0.6	57	1	1	5.349	199.53	30.79	D
6.480-0.000			B	1	0.6		1	1	5.349			
			C	1	0.6		1	1	5.349			
			D	1	0.6		1	1	5.349			
Sum Weight:	117.60	2930.86								7385.95		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1	3.34	84.41	A	1	0.6	88	1	1	4.848	282.93	39.02	D
197.688-190.4			B	1	0.6		1	1	4.848			
38			C	1	0.6		1	1	4.848			
			D	1	0.6		1	1	4.848			
L2	3.85	83.21	A	1	0.6	88	1	1	4.240	246.30	38.38	D
190.438-184.0			B	1	0.6		1	1	4.240			
21			C	1	0.6		1	1	4.240			
			D	1	0.6		1	1	4.240			
L3	3.85	83.08	A	1	0.6	88	1	1	4.234	244.85	38.16	D
184.021-177.6			B	1	0.6		1	1	4.234			
04			C	1	0.6		1	1	4.234			
			D	1	0.6		1	1	4.234			
L4	3.85	83.06	A	1	0.6	87	1	1	4.233	243.66	37.97	D
177.604-171.1			B	1	0.6		1	1	4.233			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
87			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L5	3.85	83.06	A	1	0.6	87	1	1	4.233	242.44	37.78	D
171.187-164.7			B	1	0.6		1	1	4.233			
71			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L6	3.85	83.06	A	1	0.6	86	1	1	4.233	241.16	37.58	D
164.771-158.3			B	1	0.6		1	1	4.233			
54			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L7	3.85	83.06	A	1	0.6	86	1	1	4.233	239.82	37.37	D
158.354-151.9			B	1	0.6		1	1	4.233			
37			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L8	3.85	83.06	A	1	0.6	85	1	1	4.233	238.39	37.15	D
151.937-145.5			B	1	0.6		1	1	4.233			
21			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L9	3.85	83.06	A	1	0.6	85	1	1	4.233	236.89	36.92	D
145.521-139.1			B	1	0.6		1	1	4.233			
04			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L10	3.85	83.06	A	1	0.6	84	1	1	4.233	235.29	36.67	D
139.104-132.6			B	1	0.6		1	1	4.233			
87			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L11	3.85	83.06	A	1	0.6	84	1	1	4.233	233.60	36.41	D
132.687-126.2			B	1	0.6		1	1	4.233			
71			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L12	3.85	83.06	A	1	0.6	83	1	1	4.233	231.81	36.13	D
126.271-119.8			B	1	0.6		1	1	4.233			
54			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L13	3.85	83.06	A	1	0.6	82	1	1	4.233	229.89	35.83	D
119.854-113.4			B	1	0.6		1	1	4.233			
37			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L14	3.85	83.06	A	1	0.6	82	1	1	4.233	227.86	35.51	D
113.437-107.0			B	1	0.6		1	1	4.233			
21			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L15	3.85	83.06	A	1	0.6	81	1	1	4.233	225.68	35.17	D
107.021-100.6			B	1	0.6		1	1	4.233			
04			C	1	0.6		1	1	4.233			
			D	1	0.6		1	1	4.233			
L16	1.30	31.63	A	1	0.6	80	1	1	1.663	88.07	40.65	D
100.604-98.43			B	1	0.6		1	1	1.663			
7			C	1	0.6		1	1	1.663			
			D	1	0.6		1	1	1.663			
L17	3.02	84.36	A	1	0.6	80	1	1	4.042	212.71	42.19	D
98.437-93.396			B	1	0.6		1	1	4.042			
			C	1	0.6		1	1	4.042			
			D	1	0.6		1	1	4.042			
L18	3.72	103.60	A	1	0.6	79	1	1	5.096	265.54	42.77	D
93.396-87.188			B	1	0.6		1	1	5.096			
			C	1	0.6		1	1	5.096			
			D	1	0.6		1	1	5.096			
L19	3.72	104.19	A	1	0.6	78	1	1	5.121	263.62	42.46	D
87.188-80.979			B	1	0.6		1	1	5.121			

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 30 of 71
Ahola Engineering LLC *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Section Elevation *ft*	*Add Weight* *lb*	*Self Weight* *lb*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	*Ctrl. Face*
			C	1	0.6		1	1	5.121			
			D	1	0.6		1	1	5.121			
L20	3.72	104.28	A	1	0.6	77	1	1	5.124	260.35	41.94	D
80.979-74.771			B	1	0.6		1	1	5.124			
			C	1	0.6		1	1	5.124			
			D	1	0.6		1	1	5.124			
L21	3.72	104.29	A	1	0.6	76	1	1	5.125	256.62	41.34	D
74.771-68.563			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L22	3.72	104.29	A	1	0.6	75	1	1	5.125	252.53	40.68	D
68.563-62.354			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L23	3.72	104.29	A	1	0.6	73	1	1	5.125	248.03	39.95	D
62.354-56.146			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L24	3.72	104.29	A	1	0.6	72	1	1	5.125	243.05	39.15	D
56.146-49.938			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L25	3.72	104.29	A	1	0.6	70	1	1	5.125	237.47	38.25	D
49.938-43.729			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L26	3.72	104.29	A	1	0.6	68	1	1	5.125	231.17	37.24	D
43.729-37.521			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L27	3.72	104.29	A	1	0.6	66	1	1	5.125	223.91	36.07	D
37.521-31.313			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L28	3.72	104.29	A	1	0.6	64	1	1	5.125	215.38	34.69	D
31.313-25.105			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L29	3.72	104.29	A	1	0.6	61	1	1	5.125	205.02	33.02	D
25.105-18.896			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L30	3.72	104.29	A	1	0.6	57	1	1	5.125	191.78	30.89	D
18.896-12.688			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L31	3.72	104.29	A	1	0.6	56	1	1	5.125	190.59	30.70	D
12.688-6.480			B	1	0.6		1	1	5.125			
			C	1	0.6		1	1	5.125			
			D	1	0.6		1	1	5.125			
L32	3.89	108.19	A	1	0.6	57	1	1	5.349	199.53	30.79	D
6.480-0.000			B	1	0.6		1	1	5.349			
			C	1	0.6		1	1	5.349			
			D	1	0.6		1	1	5.349			
Sum Weight:	117.60	2930.86								7385.95		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1	3.34	84.41	A	1	0.74	19	1	1	4.848	76.79	10.59	D
197.688-190.4			B	1	0.74		1	1	4.848			
38			C	1	0.74		1	1	4.848			
			D	1	0.74		1	1	4.848			
L2	3.85	83.21	A	1	0.751	19	1	1	4.240	67.81	10.57	D
190.438-184.0			B	1	0.751		1	1	4.240			
21			C	1	0.751		1	1	4.240			
			D	1	0.751		1	1	4.240			
L3	3.85	83.08	A	1	0.754	19	1	1	4.234	67.66	10.54	D
184.021-177.6			B	1	0.754		1	1	4.234			
04			C	1	0.754		1	1	4.234			
			D	1	0.754		1	1	4.234			
L4	3.85	83.06	A	1	0.755	19	1	1	4.233	67.50	10.52	D
177.604-171.1			B	1	0.755		1	1	4.233			
87			C	1	0.755		1	1	4.233			
			D	1	0.755		1	1	4.233			
L5	3.85	83.06	A	1	0.757	19	1	1	4.233	67.33	10.49	D
171.187-164.7			B	1	0.757		1	1	4.233			
71			C	1	0.757		1	1	4.233			
			D	1	0.757		1	1	4.233			
L6	3.85	83.06	A	1	0.759	19	1	1	4.233	67.15	10.47	D
164.771-158.3			B	1	0.759		1	1	4.233			
54			C	1	0.759		1	1	4.233			
			D	1	0.759		1	1	4.233			
L7	3.85	83.06	A	1	0.762	19	1	1	4.233	66.96	10.44	D
158.354-151.9			B	1	0.762		1	1	4.233			
37			C	1	0.762		1	1	4.233			
			D	1	0.762		1	1	4.233			
L8	3.85	83.06	A	1	0.764	19	1	1	4.233	66.76	10.40	D
151.937-145.5			B	1	0.764		1	1	4.233			
21			C	1	0.764		1	1	4.233			
			D	1	0.764		1	1	4.233			
L9	3.85	83.06	A	1	0.766	19	1	1	4.233	66.55	10.37	D
145.521-139.1			B	1	0.766		1	1	4.233			
04			C	1	0.766		1	1	4.233			
			D	1	0.766		1	1	4.233			
L10	3.85	83.06	A	1	0.769	19	1	1	4.233	66.33	10.34	D
139.104-132.6			B	1	0.769		1	1	4.233			
87			C	1	0.769		1	1	4.233			
			D	1	0.769		1	1	4.233			
L11	3.85	83.06	A	1	0.772	18	1	1	4.233	66.09	10.30	D
132.687-126.2			B	1	0.772		1	1	4.233			
71			C	1	0.772		1	1	4.233			
			D	1	0.772		1	1	4.233			
L12	3.85	83.06	A	1	0.775	18	1	1	4.233	65.84	10.26	D
126.271-119.8			B	1	0.775		1	1	4.233			
54			C	1	0.775		1	1	4.233			
			D	1	0.775		1	1	4.233			
L13	3.85	83.06	A	1	0.778	18	1	1	4.233	65.56	10.22	D
119.854-113.4			B	1	0.778		1	1	4.233			
37			C	1	0.778		1	1	4.233			
			D	1	0.778		1	1	4.233			
L14	3.85	83.06	A	1	0.781	18	1	1	4.233	65.27	10.17	D
113.437-107.0			B	1	0.781		1	1	4.233			
21			C	1	0.781		1	1	4.233			
			D	1	0.781		1	1	4.233			
L15	3.85	83.06	A	1	0.785	18	1	1	4.233	64.96	10.12	D

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 32 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
107.021-100.604			B	1	0.785		1	1	4.233			
			C	1	0.785		1	1	4.233			
			D	1	0.785		1	1	4.233			
L16 100.604-98.437	1.30	31.63	A	1	0.677	18	1	1	1.663	21.86	10.09	D
			B	1	0.677		1	1	1.663			
			C	1	0.677		1	1	1.663			
			D	1	0.677		1	1	1.663			
L17 98.437-93.396	3.02	84.36	A	1	0.65	18	1	1	4.042	50.71	10.06	D
			B	1	0.65		1	1	4.042			
			C	1	0.65		1	1	4.042			
			D	1	0.65		1	1	4.042			
L18 93.396-87.188	3.72	103.60	A	1	0.638	17	1	1	5.096	62.13	10.01	D
			B	1	0.638		1	1	5.096			
			C	1	0.638		1	1	5.096			
			D	1	0.638		1	1	5.096			
L19 87.188-80.979	3.72	104.19	A	1	0.639	17	1	1	5.121	61.76	9.95	D
			B	1	0.639		1	1	5.121			
			C	1	0.639		1	1	5.121			
			D	1	0.639		1	1	5.121			
L20 80.979-74.771	3.72	104.28	A	1	0.643	17	1	1	5.124	61.35	9.88	D
			B	1	0.643		1	1	5.124			
			C	1	0.643		1	1	5.124			
			D	1	0.643		1	1	5.124			
L21 74.771-68.563	3.72	104.29	A	1	0.647	17	1	1	5.125	60.91	9.81	D
			B	1	0.647		1	1	5.125			
			C	1	0.647		1	1	5.125			
			D	1	0.647		1	1	5.125			
L22 68.563-62.354	3.72	104.29	A	1	0.653	16	1	1	5.125	60.42	9.73	D
			B	1	0.653		1	1	5.125			
			C	1	0.653		1	1	5.125			
			D	1	0.653		1	1	5.125			
L23 62.354-56.146	3.72	104.29	A	1	0.658	16	1	1	5.125	59.88	9.65	D
			B	1	0.658		1	1	5.125			
			C	1	0.658		1	1	5.125			
			D	1	0.658		1	1	5.125			
L24 56.146-49.938	3.72	104.29	A	1	0.665	16	1	1	5.125	59.28	9.55	D
			B	1	0.665		1	1	5.125			
			C	1	0.665		1	1	5.125			
			D	1	0.665		1	1	5.125			
L25 49.938-43.729	3.72	104.29	A	1	0.673	15	1	1	5.125	58.59	9.44	D
			B	1	0.673		1	1	5.125			
			C	1	0.673		1	1	5.125			
			D	1	0.673		1	1	5.125			
L26 43.729-37.521	3.72	104.29	A	1	0.682	15	1	1	5.125	57.81	9.31	D
			B	1	0.682		1	1	5.125			
			C	1	0.682		1	1	5.125			
			D	1	0.682		1	1	5.125			
L27 37.521-31.313	3.72	104.29	A	1	0.693	15	1	1	5.125	56.90	9.16	D
			B	1	0.693		1	1	5.125			
			C	1	0.693		1	1	5.125			
			D	1	0.693		1	1	5.125			
L28 31.313-25.105	3.72	104.29	A	1	0.707	14	1	1	5.125	55.80	8.99	D
			B	1	0.707		1	1	5.125			
			C	1	0.707		1	1	5.125			
			D	1	0.707		1	1	5.125			
L29 25.105-18.896	3.72	104.29	A	1	0.724	13	1	1	5.125	54.44	8.77	D
			B	1	0.724		1	1	5.125			
			C	1	0.724		1	1	5.125			
			D	1	0.724		1	1	5.125			
L30	3.72	104.29	A	1	0.749	12	1	1	5.125	52.65	8.48	D

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 33 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
18.896-12.688			B	1	0.749		1	1	5.125			
			C	1	0.749		1	1	5.125			
			D	1	0.749		1	1	5.125			
L31	3.72	104.29	A	1	0.751	12	1	1	5.125	52.49	8.45	D
12.688-6.480			B	1	0.751		1	1	5.125			
			C	1	0.751		1	1	5.125			
			D	1	0.751		1	1	5.125			
L32	3.89	108.19	A	1	0.75	12	1	1	5.349	54.87	8.47	D
6.480-0.000			B	1	0.75		1	1	5.349			
			C	1	0.75		1	1	5.349			
			D	1	0.75		1	1	5.349			
Sum Weight:	117.60	2930.86								1950.43		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
L1	3.34	84.41	A	1	0.74	19	1	1	4.848	76.79	10.59	D
197.688-190.4			B	1	0.74		1	1	4.848			
38			C	1	0.74		1	1	4.848			
			D	1	0.74		1	1	4.848			
L2	3.85	83.21	A	1	0.751	19	1	1	4.240	67.81	10.57	D
190.438-184.0			B	1	0.751		1	1	4.240			
21			C	1	0.751		1	1	4.240			
			D	1	0.751		1	1	4.240			
L3	3.85	83.08	A	1	0.754	19	1	1	4.234	67.66	10.54	D
184.021-177.6			B	1	0.754		1	1	4.234			
04			C	1	0.754		1	1	4.234			
			D	1	0.754		1	1	4.234			
L4	3.85	83.06	A	1	0.755	19	1	1	4.233	67.50	10.52	D
177.604-171.1			B	1	0.755		1	1	4.233			
87			C	1	0.755		1	1	4.233			
			D	1	0.755		1	1	4.233			
L5	3.85	83.06	A	1	0.757	19	1	1	4.233	67.33	10.49	D
171.187-164.7			B	1	0.757		1	1	4.233			
71			C	1	0.757		1	1	4.233			
			D	1	0.757		1	1	4.233			
L6	3.85	83.06	A	1	0.759	19	1	1	4.233	67.15	10.47	D
164.771-158.3			B	1	0.759		1	1	4.233			
54			C	1	0.759		1	1	4.233			
			D	1	0.759		1	1	4.233			
L7	3.85	83.06	A	1	0.762	19	1	1	4.233	66.96	10.44	D
158.354-151.9			B	1	0.762		1	1	4.233			
37			C	1	0.762		1	1	4.233			
			D	1	0.762		1	1	4.233			
L8	3.85	83.06	A	1	0.764	19	1	1	4.233	66.76	10.40	D
151.937-145.5			B	1	0.764		1	1	4.233			
21			C	1	0.764		1	1	4.233			
			D	1	0.764		1	1	4.233			
L9	3.85	83.06	A	1	0.766	19	1	1	4.233	66.55	10.37	D
145.521-139.1			B	1	0.766		1	1	4.233			
04			C	1	0.766		1	1	4.233			

Section Elevation *ft*	*Add Weight* *lb*	*Self Weight* *lb*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	*Ctrl. Face*
			D	1	0.766		1	1	4.233			
L10	3.85	83.06	A	1	0.769	19	1	1	4.233	66.33	10.34	D
139.104-132.6			B	1	0.769		1	1	4.233			
87			C	1	0.769		1	1	4.233			
			D	1	0.769		1	1	4.233			
L11	3.85	83.06	A	1	0.772	18	1	1	4.233	66.09	10.30	D
132.687-126.2			B	1	0.772		1	1	4.233			
71			C	1	0.772		1	1	4.233			
			D	1	0.772		1	1	4.233			
L12	3.85	83.06	A	1	0.775	18	1	1	4.233	65.84	10.26	D
126.271-119.8			B	1	0.775		1	1	4.233			
54			C	1	0.775		1	1	4.233			
			D	1	0.775		1	1	4.233			
L13	3.85	83.06	A	1	0.778	18	1	1	4.233	65.56	10.22	D
119.854-113.4			B	1	0.778		1	1	4.233			
37			C	1	0.778		1	1	4.233			
			D	1	0.778		1	1	4.233			
L14	3.85	83.06	A	1	0.781	18	1	1	4.233	65.27	10.17	D
113.437-107.0			B	1	0.781		1	1	4.233			
21			C	1	0.781		1	1	4.233			
			D	1	0.781		1	1	4.233			
L15	3.85	83.06	A	1	0.785	18	1	1	4.233	64.96	10.12	D
107.021-100.6			B	1	0.785		1	1	4.233			
04			C	1	0.785		1	1	4.233			
			D	1	0.785		1	1	4.233			
L16	1.30	31.63	A	1	0.677	18	1	1	1.663	21.86	10.09	D
100.604-98.43			B	1	0.677		1	1	1.663			
7			C	1	0.677		1	1	1.663			
			D	1	0.677		1	1	1.663			
L17	3.02	84.36	A	1	0.65	18	1	1	4.042	50.71	10.06	D
98.437-93.396			B	1	0.65		1	1	4.042			
			C	1	0.65		1	1	4.042			
			D	1	0.65		1	1	4.042			
L18	3.72	103.60	A	1	0.638	17	1	1	5.096	62.13	10.01	D
93.396-87.188			B	1	0.638		1	1	5.096			
			C	1	0.638		1	1	5.096			
			D	1	0.638		1	1	5.096			
L19	3.72	104.19	A	1	0.639	17	1	1	5.121	61.76	9.95	D
87.188-80.979			B	1	0.639		1	1	5.121			
			C	1	0.639		1	1	5.121			
			D	1	0.639		1	1	5.121			
L20	3.72	104.28	A	1	0.643	17	1	1	5.124	61.35	9.88	D
80.979-74.771			B	1	0.643		1	1	5.124			
			C	1	0.643		1	1	5.124			
			D	1	0.643		1	1	5.124			
L21	3.72	104.29	A	1	0.647	17	1	1	5.125	60.91	9.81	D
74.771-68.563			B	1	0.647		1	1	5.125			
			C	1	0.647		1	1	5.125			
			D	1	0.647		1	1	5.125			
L22	3.72	104.29	A	1	0.653	16	1	1	5.125	60.42	9.73	D
68.563-62.354			B	1	0.653		1	1	5.125			
			C	1	0.653		1	1	5.125			
			D	1	0.653		1	1	5.125			
L23	3.72	104.29	A	1	0.658	16	1	1	5.125	59.88	9.65	D
62.354-56.146			B	1	0.658		1	1	5.125			
			C	1	0.658		1	1	5.125			
			D	1	0.658		1	1	5.125			
L24	3.72	104.29	A	1	0.665	16	1	1	5.125	59.28	9.55	D
56.146-49.938			B	1	0.665		1	1	5.125			
			C	1	0.665		1	1	5.125			

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 35 of 71
Ahola Engineering LLC *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Section Elevation *ft*	*Add Weight* *lb*	*Self Weight* *lb*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *lb*	*w* *plf*	*Ctrl. Face*
			D	1	0.665		1	1	5.125			
L25 49.938-43.729	3.72	104.29	A	1	0.673	15	1	1	5.125	58.59	9.44	D
			B	1	0.673		1	1	5.125			
			C	1	0.673		1	1	5.125			
			D	1	0.673		1	1	5.125			
L26 43.729-37.521	3.72	104.29	A	1	0.682	15	1	1	5.125	57.81	9.31	D
			B	1	0.682		1	1	5.125			
			C	1	0.682		1	1	5.125			
			D	1	0.682		1	1	5.125			
L27 37.521-31.313	3.72	104.29	A	1	0.693	15	1	1	5.125	56.90	9.16	D
			B	1	0.693		1	1	5.125			
			C	1	0.693		1	1	5.125			
			D	1	0.693		1	1	5.125			
L28 31.313-25.105	3.72	104.29	A	1	0.707	14	1	1	5.125	55.80	8.99	D
			B	1	0.707		1	1	5.125			
			C	1	0.707		1	1	5.125			
			D	1	0.707		1	1	5.125			
L29 25.105-18.896	3.72	104.29	A	1	0.724	13	1	1	5.125	54.44	8.77	D
			B	1	0.724		1	1	5.125			
			C	1	0.724		1	1	5.125			
			D	1	0.724		1	1	5.125			
L30 18.896-12.688	3.72	104.29	A	1	0.749	12	1	1	5.125	52.65	8.48	D
			B	1	0.749		1	1	5.125			
			C	1	0.749		1	1	5.125			
			D	1	0.749		1	1	5.125			
L31 12.688-6.480	3.72	104.29	A	1	0.751	12	1	1	5.125	52.49	8.45	D
			B	1	0.751		1	1	5.125			
			C	1	0.751		1	1	5.125			
			D	1	0.751		1	1	5.125			
L32 6.480-0.000	3.89	108.19	A	1	0.75	12	1	1	5.349	54.87	8.47	D
			B	1	0.75		1	1	5.349			
			C	1	0.75		1	1	5.349			
			D	1	0.75		1	1	5.349			
Sum Weight:	117.60	2930.86								1950.43		

Mast Vectors - No Ice

Section No.	*Section Elevation* *ft*	*Wind Azimuth* *°*	*Directionality*	*F* *lb*	V_x *lb*	V_z *lb*	OTM_x *lb-ft*	OTM_z *lb-ft*	*Torque* *lb-ft*
L1	197.688-190.438	0	Wind Normal	282.93	0.00	-282.93	-54905.19	0.00	0.00
		45	Wind 45	282.93	200.06	-200.06	-38823.83	-38823.83	0.00
		90	Wind Normal	282.93	282.93	0.00	0.00	-54905.19	0.00
		135	Wind 45	282.93	200.06	200.06	38823.83	-38823.83	0.00
		180	Wind Normal	282.93	0.00	282.93	54905.19	0.00	0.00
		225	Wind 45	282.93	-200.06	200.06	38823.83	38823.83	0.00
		270	Wind Normal	282.93	-282.93	0.00	0.00	54905.19	0.00
		315	Wind 45	282.93	-200.06	-200.06	-38823.83	38823.83	0.00
L2	190.438-184.021	0	Wind Normal	246.30	0.00	-246.30	-46110.43	0.00	0.00
		45	Wind 45	246.30	174.16	-174.16	-32605.00	-32605.00	0.00
		90	Wind Normal	246.30	246.30	0.00	0.00	-46110.43	0.00
		135	Wind 45	246.30	174.16	174.16	32605.00	-32605.00	0.00
		180	Wind Normal	246.30	0.00	246.30	46110.43	0.00	0.00
		225	Wind 45	246.30	-174.16	174.16	32605.00	32605.00	0.00

tnxTower

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job	Page
NRG 60m Super NRG Tall Tower	36 of 71
Project	**Date**
Matanuska-Susitna Borough, AK	09:27:06 07/01/24
Client	**Designed by**
Longroad Energy	Mikko Ahola, PE

Section No.	*Section Elevation ft*	*Wind Azimuth °*	*Directionality*	*F lb*	*V_x lb*	*V_z lb*	*OTM_x lb-ft*	*OTM_z lb-ft*	*Torque lb-ft*
		270	Wind Normal	246.30	-246.30	0.00	0.00	46110.43	0.00
		315	Wind 45	246.30	-174.16	-174.16	-32605.00	32605.00	0.00
L3	184.021-177.604	0	Wind Normal	244.85	0.00	-244.85	-44267.76	0.00	0.00
		45	Wind 45	244.85	173.14	-173.14	-31302.03	-31302.03	0.00
		90	Wind Normal	244.85	244.85	0.00	0.00	-44267.76	0.00
		135	Wind 45	244.85	173.14	173.14	31302.03	-31302.03	0.00
		180	Wind Normal	244.85	0.00	244.85	44267.76	0.00	0.00
		225	Wind 45	244.85	-173.14	173.14	31302.03	31302.03	0.00
		270	Wind Normal	244.85	-244.85	0.00	0.00	44267.76	0.00
		315	Wind 45	244.85	-173.14	-173.14	-31302.03	31302.03	0.00
L4	177.604-171.187	0	Wind Normal	243.66	0.00	-243.66	-42488.74	0.00	0.00
		45	Wind 45	243.66	172.29	-172.29	-30044.07	-30044.07	0.00
		90	Wind Normal	243.66	243.66	0.00	0.00	-42488.74	0.00
		135	Wind 45	243.66	172.29	172.29	30044.07	-30044.07	0.00
		180	Wind Normal	243.66	0.00	243.66	42488.74	0.00	0.00
		225	Wind 45	243.66	-172.29	172.29	30044.07	30044.07	0.00
		270	Wind Normal	243.66	-243.66	0.00	0.00	42488.74	0.00
		315	Wind 45	243.66	-172.29	-172.29	-30044.07	30044.07	0.00
L5	171.187-164.771	0	Wind Normal	242.44	0.00	-242.44	-40720.83	0.00	0.00
		45	Wind 45	242.44	171.43	-171.43	-28793.97	-28793.97	0.00
		90	Wind Normal	242.44	242.44	0.00	0.00	-40720.83	0.00
		135	Wind 45	242.44	171.43	171.43	28793.97	-28793.97	0.00
		180	Wind Normal	242.44	0.00	242.44	40720.83	0.00	0.00
		225	Wind 45	242.44	-171.43	171.43	28793.97	28793.97	0.00
		270	Wind Normal	242.44	-242.44	0.00	0.00	40720.83	0.00
		315	Wind 45	242.44	-171.43	-171.43	-28793.97	28793.97	0.00
L6	164.771-158.354	0	Wind Normal	241.16	0.00	-241.16	-38958.64	0.00	0.00
		45	Wind 45	241.16	170.53	-170.53	-27547.92	-27547.92	0.00
		90	Wind Normal	241.16	241.16	0.00	0.00	-38958.64	0.00
		135	Wind 45	241.16	170.53	170.53	27547.92	-27547.92	0.00
		180	Wind Normal	241.16	0.00	241.16	38958.64	0.00	0.00
		225	Wind 45	241.16	-170.53	170.53	27547.92	27547.92	0.00
		270	Wind Normal	241.16	-241.16	0.00	0.00	38958.64	0.00
		315	Wind 45	241.16	-170.53	-170.53	-27547.92	27547.92	0.00
L7	158.354-151.937	0	Wind Normal	239.82	0.00	-239.82	-37202.03	0.00	0.00
		45	Wind 45	239.82	169.58	-169.58	-26305.81	-26305.81	0.00
		90	Wind Normal	239.82	239.82	0.00	0.00	-37202.03	0.00
		135	Wind 45	239.82	169.58	169.58	26305.81	-26305.81	0.00
		180	Wind Normal	239.82	0.00	239.82	37202.03	0.00	0.00
		225	Wind 45	239.82	-169.58	169.58	26305.81	26305.81	0.00
		270	Wind Normal	239.82	-239.82	0.00	0.00	37202.03	0.00
		315	Wind 45	239.82	-169.58	-169.58	-26305.81	26305.81	0.00
L8	151.937-145.521	0	Wind Normal	238.39	0.00	-238.39	-35451.48	0.00	0.00
		45	Wind 45	238.39	168.57	-168.57	-25067.98	-25067.98	0.00
		90	Wind Normal	238.39	238.39	0.00	0.00	-35451.48	0.00
		135	Wind 45	238.39	168.57	168.57	25067.98	-25067.98	0.00
		180	Wind Normal	238.39	0.00	238.39	35451.48	0.00	0.00
		225	Wind 45	238.39	-168.57	168.57	25067.98	25067.98	0.00
		270	Wind Normal	238.39	-238.39	0.00	0.00	35451.48	0.00
		315	Wind 45	238.39	-168.57	-168.57	-25067.98	25067.98	0.00
L9	145.521-139.104	0	Wind Normal	236.89	0.00	-236.89	-33707.55	0.00	0.00
		45	Wind 45	236.89	167.50	-167.50	-23834.84	-23834.84	0.00
		90	Wind Normal	236.89	236.89	0.00	0.00	-33707.55	0.00
		135	Wind 45	236.89	167.50	167.50	23834.84	-23834.84	0.00
		180	Wind Normal	236.89	0.00	236.89	33707.55	0.00	0.00
		225	Wind 45	236.89	-167.50	167.50	23834.84	23834.84	0.00
		270	Wind Normal	236.89	-236.89	0.00	0.00	33707.55	0.00
		315	Wind 45	236.89	-167.50	-167.50	-23834.84	23834.84	0.00
L10	139.104-132.687	0	Wind Normal	235.29	0.00	-235.29	-31970.91	0.00	0.00
		45	Wind 45	235.29	166.38	-166.38	-22606.84	-22606.84	0.00
		90	Wind Normal	235.29	235.29	0.00	0.00	-31970.91	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
		135	Wind 45	235.29	166.38	166.38	22606.84	-22606.84	0.00
		180	Wind Normal	235.29	0.00	235.29	31970.91	0.00	0.00
		225	Wind 45	235.29	-166.38	166.38	22606.84	22606.84	0.00
		270	Wind Normal	235.29	-235.29	0.00	0.00	31970.91	0.00
		315	Wind 45	235.29	-166.38	-166.38	-22606.84	22606.84	0.00
L11	132.687-126.271	0	Wind Normal	233.60	0.00	-233.60	-30242.24	0.00	0.00
		45	Wind 45	233.60	165.18	-165.18	-21384.49	-21384.49	0.00
		90	Wind Normal	233.60	233.60	0.00	0.00	-30242.24	0.00
		135	Wind 45	233.60	165.18	165.18	21384.49	-21384.49	0.00
		180	Wind Normal	233.60	0.00	233.60	30242.24	0.00	0.00
		225	Wind 45	233.60	-165.18	165.18	21384.49	21384.49	0.00
		270	Wind Normal	233.60	-233.60	0.00	0.00	30242.24	0.00
		315	Wind 45	233.60	-165.18	-165.18	-21384.49	21384.49	0.00
L12	126.271-119.854	0	Wind Normal	231.81	0.00	-231.81	-28522.32	0.00	0.00
		45	Wind 45	231.81	163.91	-163.91	-20168.32	-20168.32	0.00
		90	Wind Normal	231.81	231.81	0.00	0.00	-28522.32	0.00
		135	Wind 45	231.81	163.91	163.91	20168.32	-20168.32	0.00
		180	Wind Normal	231.81	0.00	231.81	28522.32	0.00	0.00
		225	Wind 45	231.81	-163.91	163.91	20168.32	20168.32	0.00
		270	Wind Normal	231.81	-231.81	0.00	0.00	28522.32	0.00
		315	Wind 45	231.81	-163.91	-163.91	-20168.32	20168.32	0.00
L13	119.854-113.437	0	Wind Normal	229.89	0.00	-229.89	-26811.99	0.00	0.00
		45	Wind 45	229.89	162.56	-162.56	-18958.94	-18958.94	0.00
		90	Wind Normal	229.89	229.89	0.00	0.00	-26811.99	0.00
		135	Wind 45	229.89	162.56	162.56	18958.94	-18958.94	0.00
		180	Wind Normal	229.89	0.00	229.89	26811.99	0.00	0.00
		225	Wind 45	229.89	-162.56	162.56	18958.94	18958.94	0.00
		270	Wind Normal	229.89	-229.89	0.00	0.00	26811.99	0.00
		315	Wind 45	229.89	-162.56	-162.56	-18958.94	18958.94	0.00
L14	113.437-107.021	0	Wind Normal	227.86	0.00	-227.86	-25112.18	0.00	0.00
		45	Wind 45	227.86	161.12	-161.12	-17756.99	-17756.99	0.00
		90	Wind Normal	227.86	227.86	0.00	0.00	-25112.18	0.00
		135	Wind 45	227.86	161.12	161.12	17756.99	-17756.99	0.00
		180	Wind Normal	227.86	0.00	227.86	25112.18	0.00	0.00
		225	Wind 45	227.86	-161.12	161.12	17756.99	17756.99	0.00
		270	Wind Normal	227.86	-227.86	0.00	0.00	25112.18	0.00
		315	Wind 45	227.86	-161.12	-161.12	-17756.99	17756.99	0.00
L15	107.021-100.604	0	Wind Normal	225.68	0.00	-225.68	-23423.93	0.00	0.00
		45	Wind 45	225.68	159.58	-159.58	-16563.22	-16563.22	0.00
		90	Wind Normal	225.68	225.68	0.00	0.00	-23423.93	0.00
		135	Wind 45	225.68	159.58	159.58	16563.22	-16563.22	0.00
		180	Wind Normal	225.68	0.00	225.68	23423.93	0.00	0.00
		225	Wind 45	225.68	-159.58	159.58	16563.22	16563.22	0.00
		270	Wind Normal	225.68	-225.68	0.00	0.00	23423.93	0.00
		315	Wind 45	225.68	-159.58	-159.58	-16563.22	16563.22	0.00
L16	100.604-98.437	0	Wind Normal	88.07	0.00	-88.07	-8761.93	0.00	0.00
		45	Wind 45	88.07	62.27	-62.27	-6195.62	-6195.62	0.00
		90	Wind Normal	88.07	88.07	0.00	0.00	-8761.93	0.00
		135	Wind 45	88.07	62.27	62.27	6195.62	-6195.62	0.00
		180	Wind Normal	88.07	0.00	88.07	8761.93	0.00	0.00
		225	Wind 45	88.07	-62.27	62.27	6195.62	6195.62	0.00
		270	Wind Normal	88.07	-88.07	0.00	0.00	8761.93	0.00
		315	Wind 45	88.07	-62.27	-62.27	-6195.62	6195.62	0.00
L17	98.437-93.396	0	Wind Normal	212.71	0.00	-212.71	-20394.18	0.00	0.00
		45	Wind 45	212.71	150.41	-150.41	-14420.86	-14420.86	0.00
		90	Wind Normal	212.71	212.71	0.00	0.00	-20394.18	0.00
		135	Wind 45	212.71	150.41	150.41	14420.86	-14420.86	0.00
		180	Wind Normal	212.71	0.00	212.71	20394.18	0.00	0.00
		225	Wind 45	212.71	-150.41	150.41	14420.86	14420.86	0.00
		270	Wind Normal	212.71	-212.71	0.00	0.00	20394.18	0.00
		315	Wind 45	212.71	-150.41	-150.41	-14420.86	14420.86	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
L18	93.396-87.188	0	Wind Normal	265.54	0.00	-265.54	-23971.13	0.00	0.00
		45	Wind 45	265.54	187.77	-187.77	-16950.15	-16950.15	0.00
		90	Wind Normal	265.54	265.54	0.00	0.00	-23971.13	0.00
		135	Wind 45	265.54	187.77	187.77	16950.15	-16950.15	0.00
		180	Wind Normal	265.54	0.00	265.54	23971.13	0.00	0.00
		225	Wind 45	265.54	-187.77	187.77	16950.15	16950.15	0.00
		270	Wind Normal	265.54	-265.54	0.00	0.00	23971.13	0.00
		315	Wind 45	265.54	-187.77	-187.77	-16950.15	16950.15	0.00
L19	87.188-80.979	0	Wind Normal	263.62	0.00	-263.62	-22162.49	0.00	0.00
		45	Wind 45	263.62	186.41	-186.41	-15671.25	-15671.25	0.00
		90	Wind Normal	263.62	263.62	0.00	0.00	-22162.49	0.00
		135	Wind 45	263.62	186.41	186.41	15671.25	-15671.25	0.00
		180	Wind Normal	263.62	0.00	263.62	22162.49	0.00	0.00
		225	Wind 45	263.62	-186.41	186.41	15671.25	15671.25	0.00
		270	Wind Normal	263.62	-263.62	0.00	0.00	22162.49	0.00
		315	Wind 45	263.62	-186.41	-186.41	-15671.25	15671.25	0.00
L20	80.979-74.771	0	Wind Normal	260.35	0.00	-260.35	-20271.08	0.00	0.00
		45	Wind 45	260.35	184.10	-184.10	-14333.82	-14333.82	0.00
		90	Wind Normal	260.35	260.35	0.00	0.00	-20271.08	0.00
		135	Wind 45	260.35	184.10	184.10	14333.82	-14333.82	0.00
		180	Wind Normal	260.35	0.00	260.35	20271.08	0.00	0.00
		225	Wind 45	260.35	-184.10	184.10	14333.82	14333.82	0.00
		270	Wind Normal	260.35	-260.35	0.00	0.00	20271.08	0.00
		315	Wind 45	260.35	-184.10	-184.10	-14333.82	14333.82	0.00
L21	74.771-68.563	0	Wind Normal	256.62	0.00	-256.62	-18387.76	0.00	0.00
		45	Wind 45	256.62	181.46	-181.46	-13002.11	-13002.11	0.00
		90	Wind Normal	256.62	256.62	0.00	0.00	-18387.76	0.00
		135	Wind 45	256.62	181.46	181.46	13002.11	-13002.11	0.00
		180	Wind Normal	256.62	0.00	256.62	18387.76	0.00	0.00
		225	Wind 45	256.62	-181.46	181.46	13002.11	13002.11	0.00
		270	Wind Normal	256.62	-256.62	0.00	0.00	18387.76	0.00
		315	Wind 45	256.62	-181.46	-181.46	-13002.11	13002.11	0.00
L22	68.563-62.354	0	Wind Normal	252.53	0.00	-252.53	-16526.72	0.00	0.00
		45	Wind 45	252.53	178.57	-178.57	-11686.15	-11686.15	0.00
		90	Wind Normal	252.53	252.53	0.00	0.00	-16526.72	0.00
		135	Wind 45	252.53	178.57	178.57	11686.15	-11686.15	0.00
		180	Wind Normal	252.53	0.00	252.53	16526.72	0.00	0.00
		225	Wind 45	252.53	-178.57	178.57	11686.15	11686.15	0.00
		270	Wind Normal	252.53	-252.53	0.00	0.00	16526.72	0.00
		315	Wind 45	252.53	-178.57	-178.57	-11686.15	11686.15	0.00
L23	62.354-56.146	0	Wind Normal	248.03	0.00	-248.03	-14692.35	0.00	0.00
		45	Wind 45	248.03	175.38	-175.38	-10389.06	-10389.06	0.00
		90	Wind Normal	248.03	248.03	0.00	0.00	-14692.35	0.00
		135	Wind 45	248.03	175.38	175.38	10389.06	-10389.06	0.00
		180	Wind Normal	248.03	0.00	248.03	14692.35	0.00	0.00
		225	Wind 45	248.03	-175.38	175.38	10389.06	10389.06	0.00
		270	Wind Normal	248.03	-248.03	0.00	0.00	14692.35	0.00
		315	Wind 45	248.03	-175.38	-175.38	-10389.06	10389.06	0.00
L24	56.146-49.938	0	Wind Normal	243.05	0.00	-243.05	-12888.24	0.00	0.00
		45	Wind 45	243.05	171.86	-171.86	-9113.36	-9113.36	0.00
		90	Wind Normal	243.05	243.05	0.00	0.00	-12888.24	0.00
		135	Wind 45	243.05	171.86	171.86	9113.36	-9113.36	0.00
		180	Wind Normal	243.05	0.00	243.05	12888.24	0.00	0.00
		225	Wind 45	243.05	-171.86	171.86	9113.36	9113.36	0.00
		270	Wind Normal	243.05	-243.05	0.00	0.00	12888.24	0.00
		315	Wind 45	243.05	-171.86	-171.86	-9113.36	9113.36	0.00
L25	49.938-43.729	0	Wind Normal	237.47	0.00	-237.47	-11118.46	0.00	0.00
		45	Wind 45	237.47	167.92	-167.92	-7861.94	-7861.94	0.00
		90	Wind Normal	237.47	237.47	0.00	0.00	-11118.46	0.00
		135	Wind 45	237.47	167.92	167.92	7861.94	-7861.94	0.00
		180	Wind Normal	237.47	0.00	237.47	11118.46	0.00	0.00

tnxTower

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Job	Page
NRG 60m Super NRG Tall Tower	39 of 71
Project	**Date**
Matanuska-Susitna Borough, AK	09:27:06 07/01/24
Client	**Designed by**
Longroad Energy	Mikko Ahola, PE

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
		225	Wind 45	237.47	-167.92	167.92	7861.94	7861.94	0.00
		270	Wind Normal	237.47	-237.47	0.00	0.00	11118.46	0.00
		315	Wind 45	237.47	-167.92	-167.92	-7861.94	7861.94	0.00
L26	43.729-37.521	0	Wind Normal	231.17	0.00	-231.17	-9388.03	0.00	0.00
		45	Wind 45	231.17	163.46	-163.46	-6638.34	-6638.34	0.00
		90	Wind Normal	231.17	231.17	0.00	0.00	-9388.03	0.00
		135	Wind 45	231.17	163.46	163.46	6638.34	-6638.34	0.00
		180	Wind Normal	231.17	0.00	231.17	9388.03	0.00	0.00
		225	Wind 45	231.17	-163.46	163.46	6638.34	6638.34	0.00
		270	Wind Normal	231.17	-231.17	0.00	0.00	9388.03	0.00
		315	Wind 45	231.17	-163.46	-163.46	-6638.34	6638.34	0.00
L27	37.521-31.313	0	Wind Normal	223.91	0.00	-223.91	-7703.31	0.00	0.00
		45	Wind 45	223.91	158.33	-158.33	-5447.06	-5447.06	0.00
		90	Wind Normal	223.91	223.91	0.00	0.00	-7703.31	0.00
		135	Wind 45	223.91	158.33	158.33	5447.06	-5447.06	0.00
		180	Wind Normal	223.91	0.00	223.91	7703.31	0.00	0.00
		225	Wind 45	223.91	-158.33	158.33	5447.06	5447.06	0.00
		270	Wind Normal	223.91	-223.91	0.00	0.00	7703.31	0.00
		315	Wind 45	223.91	-158.33	-158.33	-5447.06	5447.06	0.00
L28	31.313-25.105	0	Wind Normal	215.38	0.00	-215.38	-6072.67	0.00	0.00
		45	Wind 45	215.38	152.30	-152.30	-4294.03	-4294.03	0.00
		90	Wind Normal	215.38	215.38	0.00	0.00	-6072.67	0.00
		135	Wind 45	215.38	152.30	152.30	4294.03	-4294.03	0.00
		180	Wind Normal	215.38	0.00	215.38	6072.67	0.00	0.00
		225	Wind 45	215.38	-152.30	152.30	4294.03	4294.03	0.00
		270	Wind Normal	215.38	-215.38	0.00	0.00	6072.67	0.00
		315	Wind 45	215.38	-152.30	-152.30	-4294.03	4294.03	0.00
L29	25.105-18.896	0	Wind Normal	205.02	0.00	-205.02	-4507.73	0.00	0.00
		45	Wind 45	205.02	144.97	-144.97	-3187.45	-3187.45	0.00
		90	Wind Normal	205.02	205.02	0.00	0.00	-4507.73	0.00
		135	Wind 45	205.02	144.97	144.97	3187.45	-3187.45	0.00
		180	Wind Normal	205.02	0.00	205.02	4507.73	0.00	0.00
		225	Wind 45	205.02	-144.97	144.97	3187.45	3187.45	0.00
		270	Wind Normal	205.02	-205.02	0.00	0.00	4507.73	0.00
		315	Wind 45	205.02	-144.97	-144.97	-3187.45	3187.45	0.00
L30	18.896-12.688	0	Wind Normal	191.78	0.00	-191.78	-3025.93	0.00	0.00
		45	Wind 45	191.78	135.61	-135.61	-2139.65	-2139.65	0.00
		90	Wind Normal	191.78	191.78	0.00	0.00	-3025.93	0.00
		135	Wind 45	191.78	135.61	135.61	2139.65	-2139.65	0.00
		180	Wind Normal	191.78	0.00	191.78	3025.93	0.00	0.00
		225	Wind 45	191.78	-135.61	135.61	2139.65	2139.65	0.00
		270	Wind Normal	191.78	-191.78	0.00	0.00	3025.93	0.00
		315	Wind 45	191.78	-135.61	-135.61	-2139.65	2139.65	0.00
L31	12.688-6.480	0	Wind Normal	190.59	0.00	-190.59	-1823.87	0.00	0.00
		45	Wind 45	190.59	134.76	-134.76	-1289.67	-1289.67	0.00
		90	Wind Normal	190.59	190.59	0.00	0.00	-1823.87	0.00
		135	Wind 45	190.59	134.76	134.76	1289.67	-1289.67	0.00
		180	Wind Normal	190.59	0.00	190.59	1823.87	0.00	0.00
		225	Wind 45	190.59	-134.76	134.76	1289.67	1289.67	0.00
		270	Wind Normal	190.59	-190.59	0.00	0.00	1823.87	0.00
		315	Wind 45	190.59	-134.76	-134.76	-1289.67	1289.67	0.00
L32	6.480-0.000	0	Wind Normal	199.53	0.00	-199.53	-643.52	0.00	0.00
		45	Wind 45	199.53	141.09	-141.09	-455.03	-455.03	0.00
		90	Wind Normal	199.53	199.53	0.00	0.00	-643.52	0.00
		135	Wind 45	199.53	141.09	141.09	455.03	-455.03	0.00
		180	Wind Normal	199.53	0.00	199.53	643.52	0.00	0.00
		225	Wind 45	199.53	-141.09	141.09	455.03	455.03	0.00
		270	Wind Normal	199.53	-199.53	0.00	0.00	643.52	0.00
		315	Wind 45	199.53	-141.09	-141.09	-455.03	455.03	0.00

Mast Totals - No Ice

Wind Azimuth °	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
0	0.00	-7385.95	-742235.59	0.00	0.00
45	5222.65	-5222.65	-524839.82	-524839.82	0.00
90	7385.95	0.00	0.00	-742235.59	0.00
135	5222.65	5222.65	524839.82	-524839.82	0.00
180	0.00	7385.95	742235.59	0.00	0.00
225	-5222.65	5222.65	524839.82	524839.82	0.00
270	-7385.95	0.00	0.00	742235.59	0.00
315	-5222.65	-5222.65	-524839.82	524839.82	0.00

Mast Vectors - Service

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
L1	197.688-190.438	0	Wind Normal	76.79	0.00	-76.79	-14901.16	0.00	0.00
		45	Wind 45	76.79	54.30	-54.30	-10536.71	-10536.71	0.00
		90	Wind Normal	76.79	76.79	0.00	0.00	-14901.16	0.00
		135	Wind 45	76.79	54.30	54.30	10536.71	-10536.71	0.00
		180	Wind Normal	76.79	0.00	76.79	14901.16	0.00	0.00
		225	Wind 45	76.79	-54.30	54.30	10536.71	10536.71	0.00
		270	Wind Normal	76.79	-76.79	0.00	0.00	14901.16	0.00
		315	Wind 45	76.79	-54.30	-54.30	-10536.71	10536.71	0.00
L2	190.438-184.021	0	Wind Normal	67.81	0.00	-67.81	-12694.54	0.00	0.00
		45	Wind 45	67.81	47.95	-47.95	-8976.39	-8976.39	0.00
		90	Wind Normal	67.81	67.81	0.00	0.00	-12694.54	0.00
		135	Wind 45	67.81	47.95	47.95	8976.39	-8976.39	0.00
		180	Wind Normal	67.81	0.00	67.81	12694.54	0.00	0.00
		225	Wind 45	67.81	-47.95	47.95	8976.39	8976.39	0.00
		270	Wind Normal	67.81	-67.81	0.00	0.00	12694.54	0.00
		315	Wind 45	67.81	-47.95	-47.95	-8976.39	8976.39	0.00
L3	184.021-177.604	0	Wind Normal	67.66	0.00	-67.66	-12232.01	0.00	0.00
		45	Wind 45	67.66	47.84	-47.84	-8649.34	-8649.34	0.00
		90	Wind Normal	67.66	67.66	0.00	0.00	-12232.01	0.00
		135	Wind 45	67.66	47.84	47.84	8649.34	-8649.34	0.00
		180	Wind Normal	67.66	0.00	67.66	12232.01	0.00	0.00
		225	Wind 45	67.66	-47.84	47.84	8649.34	8649.34	0.00
		270	Wind Normal	67.66	-67.66	0.00	0.00	12232.01	0.00
		315	Wind 45	67.66	-47.84	-47.84	-8649.34	8649.34	0.00
L4	177.604-171.187	0	Wind Normal	67.50	0.00	-67.50	-11770.09	0.00	0.00
		45	Wind 45	67.50	47.73	-47.73	-8322.71	-8322.71	0.00
		90	Wind Normal	67.50	67.50	0.00	0.00	-11770.09	0.00
		135	Wind 45	67.50	47.73	47.73	8322.71	-8322.71	0.00
		180	Wind Normal	67.50	0.00	67.50	11770.09	0.00	0.00
		225	Wind 45	67.50	-47.73	47.73	8322.71	8322.71	0.00
		270	Wind Normal	67.50	-67.50	0.00	0.00	11770.09	0.00
		315	Wind 45	67.50	-47.73	-47.73	-8322.71	8322.71	0.00
L5	171.187-164.771	0	Wind Normal	67.33	0.00	-67.33	-11308.74	0.00	0.00
		45	Wind 45	67.33	47.61	-47.61	-7996.48	-7996.48	0.00
		90	Wind Normal	67.33	67.33	0.00	0.00	-11308.74	0.00
		135	Wind 45	67.33	47.61	47.61	7996.48	-7996.48	0.00
		180	Wind Normal	67.33	0.00	67.33	11308.74	0.00	0.00

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 41 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
		225	Wind 45	67.33	-47.61	47.61	7996.48	7996.48	0.00
		270	Wind Normal	67.33	-67.33	0.00	0.00	11308.74	0.00
		315	Wind 45	67.33	-47.61	-47.61	-7996.48	7996.48	0.00
L6	164.771-158.354	0	Wind Normal	67.15	0.00	-67.15	-10848.00	0.00	0.00
		45	Wind 45	67.15	47.48	-47.48	-7670.70	-7670.70	0.00
		90	Wind Normal	67.15	67.15	0.00	0.00	-10848.00	0.00
		135	Wind 45	67.15	47.48	47.48	7670.70	-7670.70	0.00
		180	Wind Normal	67.15	0.00	67.15	10848.00	0.00	0.00
		225	Wind 45	67.15	-47.48	47.48	7670.70	7670.70	0.00
		270	Wind Normal	67.15	-67.15	0.00	0.00	10848.00	0.00
		315	Wind 45	67.15	-47.48	-47.48	-7670.70	7670.70	0.00
L7	158.354-151.937	0	Wind Normal	66.96	0.00	-66.96	-10387.96	0.00	0.00
		45	Wind 45	66.96	47.35	-47.35	-7345.39	-7345.39	0.00
		90	Wind Normal	66.96	66.96	0.00	0.00	-10387.96	0.00
		135	Wind 45	66.96	47.35	47.35	7345.39	-7345.39	0.00
		180	Wind Normal	66.96	0.00	66.96	10387.96	0.00	0.00
		225	Wind 45	66.96	-47.35	47.35	7345.39	7345.39	0.00
		270	Wind Normal	66.96	-66.96	0.00	0.00	10387.96	0.00
		315	Wind 45	66.96	-47.35	-47.35	-7345.39	7345.39	0.00
L8	151.937-145.521	0	Wind Normal	66.76	0.00	-66.76	-9928.66	0.00	0.00
		45	Wind 45	66.76	47.21	-47.21	-7020.63	-7020.63	0.00
		90	Wind Normal	66.76	66.76	0.00	0.00	-9928.66	0.00
		135	Wind 45	66.76	47.21	47.21	7020.63	-7020.63	0.00
		180	Wind Normal	66.76	0.00	66.76	9928.66	0.00	0.00
		225	Wind 45	66.76	-47.21	47.21	7020.63	7020.63	0.00
		270	Wind Normal	66.76	-66.76	0.00	0.00	9928.66	0.00
		315	Wind 45	66.76	-47.21	-47.21	-7020.63	7020.63	0.00
L9	145.521-139.104	0	Wind Normal	66.55	0.00	-66.55	-9470.21	0.00	0.00
		45	Wind 45	66.55	47.06	-47.06	-6696.45	-6696.45	0.00
		90	Wind Normal	66.55	66.55	0.00	0.00	-9470.21	0.00
		135	Wind 45	66.55	47.06	47.06	6696.45	-6696.45	0.00
		180	Wind Normal	66.55	0.00	66.55	9470.21	0.00	0.00
		225	Wind 45	66.55	-47.06	47.06	6696.45	6696.45	0.00
		270	Wind Normal	66.55	-66.55	0.00	0.00	9470.21	0.00
		315	Wind 45	66.55	-47.06	-47.06	-6696.45	6696.45	0.00
L10	139.104-132.687	0	Wind Normal	66.33	0.00	-66.33	-9012.67	0.00	0.00
		45	Wind 45	66.33	46.90	-46.90	-6372.92	-6372.92	0.00
		90	Wind Normal	66.33	66.33	0.00	0.00	-9012.67	0.00
		135	Wind 45	66.33	46.90	46.90	6372.92	-6372.92	0.00
		180	Wind Normal	66.33	0.00	66.33	9012.67	0.00	0.00
		225	Wind 45	66.33	-46.90	46.90	6372.92	6372.92	0.00
		270	Wind Normal	66.33	-66.33	0.00	0.00	9012.67	0.00
		315	Wind 45	66.33	-46.90	-46.90	-6372.92	6372.92	0.00
L11	132.687-126.271	0	Wind Normal	66.09	0.00	-66.09	-8556.15	0.00	0.00
		45	Wind 45	66.09	46.73	-46.73	-6050.11	-6050.11	0.00
		90	Wind Normal	66.09	66.09	0.00	0.00	-8556.15	0.00
		135	Wind 45	66.09	46.73	46.73	6050.11	-6050.11	0.00
		180	Wind Normal	66.09	0.00	66.09	8556.15	0.00	0.00
		225	Wind 45	66.09	-46.73	46.73	6050.11	6050.11	0.00
		270	Wind Normal	66.09	-66.09	0.00	0.00	8556.15	0.00
		315	Wind 45	66.09	-46.73	-46.73	-6050.11	6050.11	0.00
L12	126.271-119.854	0	Wind Normal	65.84	0.00	-65.84	-8100.75	0.00	0.00
		45	Wind 45	65.84	46.55	-46.55	-5728.10	-5728.10	0.00
		90	Wind Normal	65.84	65.84	0.00	0.00	-8100.75	0.00
		135	Wind 45	65.84	46.55	46.55	5728.10	-5728.10	0.00
		180	Wind Normal	65.84	0.00	65.84	8100.75	0.00	0.00
		225	Wind 45	65.84	-46.55	46.55	5728.10	5728.10	0.00
		270	Wind Normal	65.84	-65.84	0.00	0.00	8100.75	0.00
		315	Wind 45	65.84	-46.55	-46.55	-5728.10	5728.10	0.00
L13	119.854-113.437	0	Wind Normal	65.56	0.00	-65.56	-7646.58	0.00	0.00
		45	Wind 45	65.56	46.36	-46.36	-5406.95	-5406.95	0.00

tnxTower

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Section No.	*Section Elevation ft*	*Wind Azimuth °*	*Directionality*	*F lb*	*V_x lb*	*V_z lb*	*OTM_x lb-ft*	*OTM_z lb-ft*	*Torque lb-ft*
		90	Wind Normal	65.56	65.56	0.00	0.00	-7646.58	0.00
		135	Wind 45	65.56	46.36	46.36	5406.95	-5406.95	0.00
		180	Wind Normal	65.56	0.00	65.56	7646.58	0.00	0.00
		225	Wind 45	65.56	-46.36	46.36	5406.95	5406.95	0.00
		270	Wind Normal	65.56	-65.56	0.00	0.00	7646.58	0.00
		315	Wind 45	65.56	-46.36	-46.36	-5406.95	5406.95	0.00
L14	113.437-107.021	0	Wind Normal	65.27	0.00	-65.27	-7193.77	0.00	0.00
		45	Wind 45	65.27	46.15	-46.15	-5086.77	-5086.77	0.00
		90	Wind Normal	65.27	65.27	0.00	0.00	-7193.77	0.00
		135	Wind 45	65.27	46.15	46.15	5086.77	-5086.77	0.00
		180	Wind Normal	65.27	0.00	65.27	7193.77	0.00	0.00
		225	Wind 45	65.27	-46.15	46.15	5086.77	5086.77	0.00
		270	Wind Normal	65.27	-65.27	0.00	0.00	7193.77	0.00
		315	Wind 45	65.27	-46.15	-46.15	-5086.77	5086.77	0.00
L15	107.021-100.604	0	Wind Normal	64.96	0.00	-64.96	-6742.47	0.00	0.00
		45	Wind 45	64.96	45.93	-45.93	-4767.64	-4767.64	0.00
		90	Wind Normal	64.96	64.96	0.00	0.00	-6742.47	0.00
		135	Wind 45	64.96	45.93	45.93	4767.64	-4767.64	0.00
		180	Wind Normal	64.96	0.00	64.96	6742.47	0.00	0.00
		225	Wind 45	64.96	-45.93	45.93	4767.64	4767.64	0.00
		270	Wind Normal	64.96	-64.96	0.00	0.00	6742.47	0.00
		315	Wind 45	64.96	-45.93	-45.93	-4767.64	4767.64	0.00
L16	100.604-98.437	0	Wind Normal	21.86	0.00	-21.86	-2174.72	0.00	0.00
		45	Wind 45	21.86	15.46	-15.46	-1537.76	-1537.76	0.00
		90	Wind Normal	21.86	21.86	0.00	0.00	-2174.72	0.00
		135	Wind 45	21.86	15.46	15.46	1537.76	-1537.76	0.00
		180	Wind Normal	21.86	0.00	21.86	2174.72	0.00	0.00
		225	Wind 45	21.86	-15.46	15.46	1537.76	1537.76	0.00
		270	Wind Normal	21.86	-21.86	0.00	0.00	2174.72	0.00
		315	Wind 45	21.86	-15.46	-15.46	-1537.76	1537.76	0.00
L17	98.437-93.396	0	Wind Normal	50.71	0.00	-50.71	-4862.06	0.00	0.00
		45	Wind 45	50.71	35.86	-35.86	-3438.00	-3438.00	0.00
		90	Wind Normal	50.71	50.71	0.00	0.00	-4862.06	0.00
		135	Wind 45	50.71	35.86	35.86	3438.00	-3438.00	0.00
		180	Wind Normal	50.71	0.00	50.71	4862.06	0.00	0.00
		225	Wind 45	50.71	-35.86	35.86	3438.00	3438.00	0.00
		270	Wind Normal	50.71	-50.71	0.00	0.00	4862.06	0.00
		315	Wind 45	50.71	-35.86	-35.86	-3438.00	3438.00	0.00
L18	93.396-87.188	0	Wind Normal	62.13	0.00	-62.13	-5608.79	0.00	0.00
		45	Wind 45	62.13	43.93	-43.93	-3966.01	-3966.01	0.00
		90	Wind Normal	62.13	62.13	0.00	0.00	-5608.79	0.00
		135	Wind 45	62.13	43.93	43.93	3966.01	-3966.01	0.00
		180	Wind Normal	62.13	0.00	62.13	5608.79	0.00	0.00
		225	Wind 45	62.13	-43.93	43.93	3966.01	3966.01	0.00
		270	Wind Normal	62.13	-62.13	0.00	0.00	5608.79	0.00
		315	Wind 45	62.13	-43.93	-43.93	-3966.01	3966.01	0.00
L19	87.188-80.979	0	Wind Normal	61.76	0.00	-61.76	-5192.03	0.00	0.00
		45	Wind 45	61.76	43.67	-43.67	-3671.32	-3671.32	0.00
		90	Wind Normal	61.76	61.76	0.00	0.00	-5192.03	0.00
		135	Wind 45	61.76	43.67	43.67	3671.32	-3671.32	0.00
		180	Wind Normal	61.76	0.00	61.76	5192.03	0.00	0.00
		225	Wind 45	61.76	-43.67	43.67	3671.32	3671.32	0.00
		270	Wind Normal	61.76	-61.76	0.00	0.00	5192.03	0.00
		315	Wind 45	61.76	-43.67	-43.67	-3671.32	3671.32	0.00
L20	80.979-74.771	0	Wind Normal	61.35	0.00	-61.35	-4777.06	0.00	0.00
		45	Wind 45	61.35	43.38	-43.38	-3377.89	-3377.89	0.00
		90	Wind Normal	61.35	61.35	0.00	0.00	-4777.06	0.00
		135	Wind 45	61.35	43.38	43.38	3377.89	-3377.89	0.00
		180	Wind Normal	61.35	0.00	61.35	4777.06	0.00	0.00
		225	Wind 45	61.35	-43.38	43.38	3377.89	3377.89	0.00
		270	Wind Normal	61.35	-61.35	0.00	0.00	4777.06	0.00

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 43 of 71
	Project Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Ahola Engineering LLC
P.O. Box 989
Winter Park, CO 80482-0989
Phone: (719) 640-2408
FAX:

Section No.	*Section Elevation ft*	*Wind Azimuth °*	*Directionality*	*F lb*	V_x *lb*	V_z *lb*	OTM_x *lb-ft*	OTM_z *lb-ft*	*Torque lb-ft*
		315	Wind 45	61.35	-43.38	-43.38	-3377.89	3377.89	0.00
L21	74.771-68.563	0	Wind Normal	60.91	0.00	-60.91	-4364.37	0.00	0.00
		45	Wind 45	60.91	43.07	-43.07	-3086.08	-3086.08	0.00
		90	Wind Normal	60.91	60.91	0.00	0.00	-4364.37	0.00
		135	Wind 45	60.91	43.07	43.07	3086.08	-3086.08	0.00
		180	Wind Normal	60.91	0.00	60.91	4364.37	0.00	0.00
		225	Wind 45	60.91	-43.07	43.07	3086.08	3086.08	0.00
		270	Wind Normal	60.91	-60.91	0.00	0.00	4364.37	0.00
		315	Wind 45	60.91	-43.07	-43.07	-3086.08	3086.08	0.00
L22	68.563-62.354	0	Wind Normal	60.42	0.00	-60.42	-3954.28	0.00	0.00
		45	Wind 45	60.42	42.72	-42.72	-2796.10	-2796.10	0.00
		90	Wind Normal	60.42	60.42	0.00	0.00	-3954.28	0.00
		135	Wind 45	60.42	42.72	42.72	2796.10	-2796.10	0.00
		180	Wind Normal	60.42	0.00	60.42	3954.28	0.00	0.00
		225	Wind 45	60.42	-42.72	42.72	2796.10	2796.10	0.00
		270	Wind Normal	60.42	-60.42	0.00	0.00	3954.28	0.00
		315	Wind 45	60.42	-42.72	-42.72	-2796.10	2796.10	0.00
L23	62.354-56.146	0	Wind Normal	59.88	0.00	-59.88	-3547.13	0.00	0.00
		45	Wind 45	59.88	42.34	-42.34	-2508.20	-2508.20	0.00
		90	Wind Normal	59.88	59.88	0.00	0.00	-3547.13	0.00
		135	Wind 45	59.88	42.34	42.34	2508.20	-2508.20	0.00
		180	Wind Normal	59.88	0.00	59.88	3547.13	0.00	0.00
		225	Wind 45	59.88	-42.34	42.34	2508.20	2508.20	0.00
		270	Wind Normal	59.88	-59.88	0.00	0.00	3547.13	0.00
		315	Wind 45	59.88	-42.34	-42.34	-2508.20	2508.20	0.00
L24	56.146-49.938	0	Wind Normal	59.28	0.00	-59.28	-3143.30	0.00	0.00
		45	Wind 45	59.28	41.91	-41.91	-2222.65	-2222.65	0.00
		90	Wind Normal	59.28	59.28	0.00	0.00	-3143.30	0.00
		135	Wind 45	59.28	41.91	41.91	2222.65	-2222.65	0.00
		180	Wind Normal	59.28	0.00	59.28	3143.30	0.00	0.00
		225	Wind 45	59.28	-41.91	41.91	2222.65	2222.65	0.00
		270	Wind Normal	59.28	-59.28	0.00	0.00	3143.30	0.00
		315	Wind 45	59.28	-41.91	-41.91	-2222.65	2222.65	0.00
L25	49.938-43.729	0	Wind Normal	58.59	0.00	-58.59	-2743.30	0.00	0.00
		45	Wind 45	58.59	41.43	-41.43	-1939.81	-1939.81	0.00
		90	Wind Normal	58.59	58.59	0.00	0.00	-2743.30	0.00
		135	Wind 45	58.59	41.43	41.43	1939.81	-1939.81	0.00
		180	Wind Normal	58.59	0.00	58.59	2743.30	0.00	0.00
		225	Wind 45	58.59	-41.43	41.43	1939.81	1939.81	0.00
		270	Wind Normal	58.59	-58.59	0.00	0.00	2743.30	0.00
		315	Wind 45	58.59	-41.43	-41.43	-1939.81	1939.81	0.00
L26	43.729-37.521	0	Wind Normal	57.81	0.00	-57.81	-2347.73	0.00	0.00
		45	Wind 45	57.81	40.88	-40.88	-1660.10	-1660.10	0.00
		90	Wind Normal	57.81	57.81	0.00	0.00	-2347.73	0.00
		135	Wind 45	57.81	40.88	40.88	1660.10	-1660.10	0.00
		180	Wind Normal	57.81	0.00	57.81	2347.73	0.00	0.00
		225	Wind 45	57.81	-40.88	40.88	1660.10	1660.10	0.00
		270	Wind Normal	57.81	-57.81	0.00	0.00	2347.73	0.00
		315	Wind 45	57.81	-40.88	-40.88	-1660.10	1660.10	0.00
L27	37.521-31.313	0	Wind Normal	56.90	0.00	-56.90	-1957.38	0.00	0.00
		45	Wind 45	56.90	40.23	-40.23	-1384.07	-1384.07	0.00
		90	Wind Normal	56.90	56.90	0.00	0.00	-1957.38	0.00
		135	Wind 45	56.90	40.23	40.23	1384.07	-1384.07	0.00
		180	Wind Normal	56.90	0.00	56.90	1957.38	0.00	0.00
		225	Wind 45	56.90	-40.23	40.23	1384.07	1384.07	0.00
		270	Wind Normal	56.90	-56.90	0.00	0.00	1957.38	0.00
		315	Wind 45	56.90	-40.23	-40.23	-1384.07	1384.07	0.00
L28	31.313-25.105	0	Wind Normal	55.80	0.00	-55.80	-1573.30	0.00	0.00
		45	Wind 45	55.80	39.46	-39.46	-1112.49	-1112.49	0.00
		90	Wind Normal	55.80	55.80	0.00	0.00	-1573.30	0.00
		135	Wind 45	55.80	39.46	39.46	1112.49	-1112.49	0.00

Section No.	Section Elevation ft	Wind Azimuth °	Directionality	F lb	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
		180	Wind Normal	55.80	0.00	55.80	1573.30	0.00	0.00
		225	Wind 45	55.80	-39.46	39.46	1112.49	1112.49	0.00
		270	Wind Normal	55.80	-55.80	0.00	0.00	1573.30	0.00
		315	Wind 45	55.80	-39.46	-39.46	-1112.49	1112.49	0.00
L29	25.105-18.896	0	Wind Normal	54.44	0.00	-54.44	-1197.00	0.00	0.00
		45	Wind 45	54.44	38.50	-38.50	-846.41	-846.41	0.00
		90	Wind Normal	54.44	54.44	0.00	0.00	-1197.00	0.00
		135	Wind 45	54.44	38.50	38.50	846.41	-846.41	0.00
		180	Wind Normal	54.44	0.00	54.44	1197.00	0.00	0.00
		225	Wind 45	54.44	-38.50	38.50	846.41	846.41	0.00
		270	Wind Normal	54.44	-54.44	0.00	0.00	1197.00	0.00
		315	Wind 45	54.44	-38.50	-38.50	-846.41	846.41	0.00
L30	18.896-12.688	0	Wind Normal	52.65	0.00	-52.65	-830.80	0.00	0.00
		45	Wind 45	52.65	37.23	-37.23	-587.46	-587.46	0.00
		90	Wind Normal	52.65	52.65	0.00	0.00	-830.80	0.00
		135	Wind 45	52.65	37.23	37.23	587.46	-587.46	0.00
		180	Wind Normal	52.65	0.00	52.65	830.80	0.00	0.00
		225	Wind 45	52.65	-37.23	37.23	587.46	587.46	0.00
		270	Wind Normal	52.65	-52.65	0.00	0.00	830.80	0.00
		315	Wind 45	52.65	-37.23	-37.23	-587.46	587.46	0.00
L31	12.688-6.480	0	Wind Normal	52.49	0.00	-52.49	-502.33	0.00	0.00
		45	Wind 45	52.49	37.12	-37.12	-355.20	-355.20	0.00
		90	Wind Normal	52.49	52.49	0.00	0.00	-502.33	0.00
		135	Wind 45	52.49	37.12	37.12	355.20	-355.20	0.00
		180	Wind Normal	52.49	0.00	52.49	502.33	0.00	0.00
		225	Wind 45	52.49	-37.12	37.12	355.20	355.20	0.00
		270	Wind Normal	52.49	-52.49	0.00	0.00	502.33	0.00
		315	Wind 45	52.49	-37.12	-37.12	-355.20	355.20	0.00
L32	6.480-0.000	0	Wind Normal	54.87	0.00	-54.87	-176.97	0.00	0.00
		45	Wind 45	54.87	38.80	-38.80	-125.14	-125.14	0.00
		90	Wind Normal	54.87	54.87	0.00	0.00	-176.97	0.00
		135	Wind 45	54.87	38.80	38.80	125.14	-125.14	0.00
		180	Wind Normal	54.87	0.00	54.87	176.97	0.00	0.00
		225	Wind 45	54.87	-38.80	38.80	125.14	125.14	0.00
		270	Wind Normal	54.87	-54.87	0.00	0.00	176.97	0.00
		315	Wind 45	54.87	-38.80	-38.80	-125.14	125.14	0.00

Mast Totals - Service

Wind Azimuth °	V_x lb	V_z lb	OTM_x lb-ft	OTM_z lb-ft	Torque lb-ft
0	0.00	-1950.43	-199746.33	0.00	0.00
45	1379.16	-1379.16	-141241.98	-141241.98	0.00
90	1950.43	0.00	0.00	-199746.33	0.00
135	1379.16	1379.16	141241.98	-141241.98	0.00
180	0.00	1950.43	199746.33	0.00	0.00
225	-1379.16	1379.16	141241.98	141241.98	0.00
270	-1950.43	0.00	0.00	199746.33	0.00
315	-1379.16	-1379.16	-141241.98	141241.98	0.00

Force Totals (Does not include forces on guys)

Load Case	*Vertical Forces lb*	*Sum of Forces X lb*	*Sum of Forces Z lb*	*Sum of Torques lb-ft*
Leg Weight	2930.86			
Bracing Weight	0.00			
Total Member Self-Weight	2930.86			
Guy Weight	808.96			
Total Weight	4089.77			
Wind 0 deg - No Ice		0.00	-9115.23	181.00
Wind 45 deg - No Ice		6718.27	-6718.27	252.87
Wind 90 deg - No Ice		9115.23	0.00	160.82
Wind 135 deg - No Ice		6172.62	6172.62	-14.27
Wind 180 deg - No Ice		0.00	9115.23	-181.00
Wind 225 deg - No Ice		-6718.27	6718.27	-252.87
Wind 270 deg - No Ice		-9115.23	0.00	-160.82
Wind 315 deg - No Ice		-6172.62	-6172.62	14.27
Total Weight	4089.77			
Wind 0 deg - Service		0.00	-2330.88	39.82
Wind 45 deg - Service		1708.20	-1708.20	55.63
Wind 90 deg - Service		2330.88	0.00	35.38
Wind 135 deg - Service		1588.16	1588.16	-3.14
Wind 180 deg - Service		0.00	2330.88	-39.82
Wind 225 deg - Service		-1708.20	1708.20	-55.63
Wind 270 deg - Service		-2330.88	0.00	-35.38
Wind 315 deg - Service		-1588.16	-1588.16	3.14
Seismic Vertical	834.47			
Seismic Horizontal 0 deg		0.00	-1301.39	0.00
Seismic Horizontal 45 deg		920.22	-920.22	0.00
Seismic Horizontal 90 deg		1301.39	0.00	0.00
Seismic Horizontal 135 deg		920.22	920.22	0.00
Seismic Horizontal 180 deg		0.00	1301.39	0.00
Seismic Horizontal 225 deg		-920.22	920.22	0.00
Seismic Horizontal 270 deg		-1301.39	0.00	0.00
Seismic Horizontal 315 deg		-920.22	-920.22	0.00

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.0 Wind 45 deg - No Ice+1.0 Guy
4	1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy
5	1.2 Dead+1.0 Wind 135 deg - No Ice+1.0 Guy
6	1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy
7	1.2 Dead+1.0 Wind 225 deg - No Ice+1.0 Guy
8	1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy
9	1.2 Dead+1.0 Wind 315 deg - No Ice+1.0 Guy
10	Dead+Wind 0 deg - Service+Guy
11	Dead+Wind 45 deg - Service+Guy
12	Dead+Wind 90 deg - Service+Guy
13	Dead+Wind 135 deg - Service+Guy
14	Dead+Wind 180 deg - Service+Guy
15	Dead+Wind 225 deg - Service+Guy
16	Dead+Wind 270 deg - Service+Guy
17	Dead+Wind 315 deg - Service+Guy
18	1.2 Dead+1.0 Ev+1.0 Eh 0 deg+1.0 Guy

Comb. No.	Description
19	1.2 Dead+1.0 Ev+1.0 Eh 45 deg+1.0 Guy
20	1.2 Dead+1.0 Ev+1.0 Eh 90 deg+1.0 Guy
21	1.2 Dead+1.0 Ev+1.0 Eh 135 deg+1.0 Guy
22	1.2 Dead+1.0 Ev+1.0 Eh 180 deg+1.0 Guy
23	1.2 Dead+1.0 Ev+1.0 Eh 225 deg+1.0 Guy
24	1.2 Dead+1.0 Ev+1.0 Eh 270 deg+1.0 Guy
25	1.2 Dead+1.0 Ev+1.0 Eh 315 deg+1.0 Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L1	197.688 - 190.438	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	21	-131.47	-237.50	-237.49
			Max. Mx	8	-100.10	1451.23	14.85
			Max. My	2	-100.10	14.38	1451.23
			Max. Vy	8	-395.42	1451.23	14.85
			Max. Vx	2	-395.42	14.38	1451.23
			Max. Torque	3			314.51
L2	190.438 - 184.021	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-8201.56	14.35	-3159.65
			Max. Mx	4	-8200.16	3195.30	13.09
			Max. My	6	-8199.93	14.40	3194.77
			Max. Vy	4	-1104.66	-1347.39	15.02
			Max. Vx	6	-1104.56	13.60	-1347.48
			Max. Torque	7			-315.06
		Guy A	Bottom Tension	5	4632.83		
			Top Tension	5	4661.95		
			Top Cable Vert	5	3635.31		
			Top Cable Norm	5	2918.61		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-3335.80		
			Bot Cable Norm	5	3214.90		
			Bot Cable Tan	5	0.00		
		Guy B	Bottom Tension	7	5035.30		
			Top Tension	7	5064.07		
			Top Cable Vert	7	3934.82		
			Top Cable Norm	7	3187.79		
			Top Cable Tan	7	0.02		
			Bot Cable Vert	7	-3635.31		
			Bot Cable Norm	7	3484.08		
			Bot Cable Tan	7	0.02		
		Guy C	Bottom Tension	9	4634.82		
			Top Tension	9	4663.94		
			Top Cable Vert	9	3636.79		
			Top Cable Norm	9	2919.94		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-3337.28		
			Bot Cable Norm	9	3216.23		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	5035.67		
			Top Tension	3	5064.44		
			Top Cable Vert	3	3935.09		
			Top Cable Norm	3	3188.03		
			Top Cable Tan	3	0.02		
			Bot Cable Vert	3	-3635.58		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Bot Cable Norm	3	3484.32		
			Bot Cable Tan	3	0.02		
L3	184.021 - 177.604	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-8369.48	14.78	-7123.91
			Max. Mx	4	-8368.19	7158.87	11.46
			Max. My	6	-8367.96	14.83	7157.72
			Max. Vy	4	-885.00	3950.79	12.81
			Max. Vx	2	885.01	13.97	-3915.10
			Max. Torque	7			-315.12
L4	177.604 - 171.187	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-8494.40	8.92	-7061.42
			Max. Mx	4	-8436.62	7499.62	10.06
			Max. My	6	-8436.39	13.79	7498.16
			Max. Vy	4	248.32	7090.80	10.30
			Max. Vx	6	248.40	8.97	7094.72
			Max. Torque	7			-315.25
L5	171.187 - 164.771	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-8586.35	4.41	-4360.38
			Max. Mx	4	-8515.05	6862.50	9.50
			Max. My	6	-8514.83	7.85	6866.35
			Max. Vy	4	605.02	4385.80	6.20
			Max. Vx	6	605.13	4.45	4389.06
			Max. Torque	7			-307.52
L6	164.771 - 158.354	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-8693.25	-1.44	1180.66
			Max. Mx	4	-8621.20	3796.97	5.08
			Max. My	6	-8620.98	3.08	3800.12
			Max. Vy	4	1015.92	-1165.00	1.52
			Max. Vx	6	1016.07	-1.41	-1162.62
			Max. Torque	7			-307.56
L7	158.354 - 151.937	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-15228.45	-2290.45	-3.91
			Max. Mx	8	-8752.76	4607.27	-5.68
			Max. My	2	-8752.99	-9.41	4609.17
			Max. Vy	4	1180.76	-4601.44	-5.67
			Max. Vx	6	1180.92	-9.39	-4599.54
			Max. Torque	7			-86.28
		Guy A	Bottom Tension	5	4032.38		
			Top Tension	5	4057.42		
			Top Cable Vert	5	2893.99		
			Top Cable Norm	5	2843.85		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-2648.44		
			Bot Cable Norm	5	3040.70		
			Bot Cable Tan	5	0.00		
		Guy B	Bottom Tension	7	4336.77		
			Top Tension	7	4361.66		
			Top Cable Vert	7	3101.14		
			Top Cable Norm	7	3067.08		
			Top Cable Tan	7	0.02		
			Bot Cable Vert	7	-2855.58		
			Bot Cable Norm	7	3263.93		
			Bot Cable Tan	7	0.02		
		Guy C	Bottom Tension	9	4030.08		
			Top Tension	9	4055.13		
			Top Cable Vert	9	2892.43		

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 48 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project: Matanuska-Susitna Borough, AK	Date: 09:27:06 07/01/24
	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Top Cable Norm	9	2842.17		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-2646.87		
			Bot Cable Norm	9	3039.02		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	4336.52		
			Top Tension	3	4361.41		
			Top Cable Vert	3	3100.97		
			Top Cable Norm	3	3066.90		
			Top Cable Tan	3	0.01		
			Bot Cable Vert	3	-2855.41		
			Bot Cable Norm	3	3263.75		
			Bot Cable Tan	3	0.01		
L8	151.937 - 145.521	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-15323.80	-642.58	-1.97
			Max. Mx	8	-15250.47	2005.50	-3.09
			Max. My	2	-15250.56	-5.71	2007.35
			Max. Vy	8	337.83	2005.50	-3.09
			Max. Vx	2	337.86	-5.71	2007.35
			Max. Torque	7			-86.29
L9	145.521 - 139.104	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-15419.91	-450.70	-2.06
			Max. Mx	8	-15346.09	539.36	-0.83
			Max. My	2	-15346.18	-2.20	540.89
			Max. Vy	8	115.78	539.36	-0.83
			Max. Vx	2	115.84	-2.20	540.89
			Max. Torque	7			-86.29
L10	139.104 - 132.687	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-15523.75	-4.70	1956.54
			Max. Mx	4	-15523.75	-1960.89	-3.77
			Max. My	6	-15523.67	-4.70	-1960.38
			Max. Vy	4	390.10	-1960.89	-3.77
			Max. Vx	6	390.21	-4.70	-1960.38
			Max. Torque	3			-137.09
L11	132.687 - 126.271	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-15637.74	-11.36	5459.60
			Max. Mx	4	-15637.73	-5465.78	-9.85
			Max. My	6	-15637.64	-11.37	-5465.94
			Max. Vy	4	726.78	-5465.78	-9.85
			Max. Vx	6	726.90	-11.37	-5465.94
			Max. Torque	3			-137.08
L12	126.271 - 119.854	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20158.87	-4808.20	-8.91
			Max. Mx	4	-15676.57	-6911.49	-12.32
			Max. My	6	-15676.48	-14.15	-6911.86
			Max. Vy	4	770.40	-6911.49	-12.32
			Max. Vx	6	770.51	-14.15	-6911.86
			Max. Torque	3			-136.99
		Guy A	Bottom Tension	5	2723.21		
			Top Tension	5	2744.11		
			Top Cable Vert	5	1746.40		
			Top Cable Norm	5	2116.66		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-1557.01		
			Bot Cable Norm	5	2234.18		
			Bot Cable Tan	5	0.00		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
		Guy B	Bottom Tension	7	2917.03		
			Top Tension	7	2937.87		
			Top Cable Vert	7	1863.03		
			Top Cable Norm	7	2271.61		
			Top Cable Tan	7	0.02		
			Bot Cable Vert	7	-1673.64		
			Bot Cable Norm	7	2389.13		
			Bot Cable Tan	7	0.02		
		Guy C	Bottom Tension	9	2723.15		
			Top Tension	9	2744.05		
			Top Cable Vert	9	1746.36		
			Top Cable Norm	9	2116.61		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-1556.98		
			Bot Cable Norm	9	2234.13		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	2916.89		
			Top Tension	3	2937.74		
			Top Cable Vert	3	1862.95		
			Top Cable Norm	3	2271.50		
			Top Cable Tan	3	0.02		
			Bot Cable Vert	3	-1673.56		
			Bot Cable Norm	3	2389.03		
			Bot Cable Tan	3	0.02		
L13	119.854 - 113.437	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20257.55	-3223.85	-6.19
			Max. Mx	4	-20181.30	-4555.17	-7.03
			Max. My	6	-20181.28	-7.51	-4555.68
			Max. Vy	8	302.08	4548.07	-7.02
			Max. Vx	2	302.10	-7.52	4547.55
			Max. Torque	3			-132.69
L14	113.437 - 107.021	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20358.06	-2601.68	-5.51
			Max. Mx	4	-20280.40	-3085.90	-5.26
			Max. My	6	-20280.38	-5.22	-3086.55
			Max. Vy	4	-159.72	-3085.90	-5.26
			Max. Vx	6	-159.70	-5.22	-3086.55
			Max. Torque	3			-132.64
L15	107.021 - 100.604	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20459.89	-3020.71	-6.44
			Max. Mx	4	-20459.89	-3020.71	-6.44
			Max. My	6	-20459.87	-6.85	-3021.36
			Max. Vy	8	-149.61	3016.27	-6.44
			Max. Vx	2	-149.62	-6.84	3015.62
			Max. Torque	3			-132.62
L16	100.604 - 98.4375	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20496.05	-3355.03	-6.98
			Max. Mx	4	-20496.05	-3355.03	-6.98
			Max. My	6	-20496.03	-7.58	-3355.64
			Max. Vy	8	-204.93	3351.31	-6.97
			Max. Vx	2	-204.94	-7.57	3350.70
			Max. Torque	3			-132.60
L17	98.4375 - 93.3959	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-20614.57	-5181.54	-9.27
			Max. Mx	4	-20614.57	-5181.54	-9.27
			Max. My	6	-20614.55	-10.60	-5182.03

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 50 of 71
Ahola Engineering LLC	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	**Client** Longroad Energy	**Designed by** Mikko Ahola, PE

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
			Max. Vy	8	-527.15	5179.83	-9.26
			Max. Vx	2	-527.17	-10.59	5179.33
			Max. Torque	3			-132.60
		Guy A	Bottom Tension	5	2189.98		
			Top Tension	5	2205.98		
			Top Cable Vert	5	1248.73		
			Top Cable Norm	5	1818.52		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-1114.73		
			Bot Cable Norm	5	1885.05		
			Bot Cable Tan	5	0.00		
		Guy B	Bottom Tension	7	2286.05		
			Top Tension	7	2302.03		
			Top Cable Vert	7	1300.21		
			Top Cable Norm	7	1899.68		
			Top Cable Tan	7	0.01		
			Bot Cable Vert	7	-1166.22		
			Bot Cable Norm	7	1966.20		
			Bot Cable Tan	7	0.01		
		Guy C	Bottom Tension	9	2190.74		
			Top Tension	9	2206.74		
			Top Cable Vert	9	1249.13		
			Top Cable Norm	9	1819.16		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-1115.14		
			Bot Cable Norm	9	1885.69		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	2286.08		
			Top Tension	3	2302.06		
			Top Cable Vert	3	1300.23		
			Top Cable Norm	3	1899.71		
			Top Cable Tan	3	0.01		
			Bot Cable Vert	3	-1166.24		
			Bot Cable Norm	3	1966.23		
			Bot Cable Tan	3	0.01		
L18	93.3959 - 87.1876	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-24007.69	-7.19	1658.58
			Max. Mx	4	-23916.92	-4097.01	-9.71
			Max. My	6	-23916.88	-11.12	-4097.51
			Max. Vy	8	565.77	4095.10	-9.71
			Max. Vx	2	565.77	-11.10	4094.61
			Max. Torque	3			-129.50
L19	87.1876 - 80.9793	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-24135.76	-5.57	111.49
			Max. Mx	4	-24043.76	-1292.88	-7.41
			Max. My	6	-24043.73	-8.34	-1293.32
			Max. Vy	8	333.94	1290.64	-7.40
			Max. Vx	2	333.94	-8.33	1290.21
			Max. Torque	3			-129.50
L20	80.9793 - 74.771	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-24264.15	-5.11	176.16
			Max. Mx	3	-24103.52	-321.09	307.90
			Max. My	7	-24103.49	308.20	-321.12
			Max. Vy	8	-140.68	176.39	-4.61
			Max. Vx	2	-140.70	-5.11	176.16
			Max. Torque	3			-129.50
L21	74.771 - 68.5627	Pole	Max Tension	1	0.00	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Compression	2	-24392.76	-5.59	1825.39
			Max. Mx	4	-24392.48	-1827.53	-4.90
			Max. My	6	-24392.45	-5.59	-1827.62
			Max. Vy	8	-387.44	1825.48	-4.90
			Max. Vx	2	-387.46	-5.59	1825.39
			Max. Torque	3			-129.49
L22	68.5627 - 62.3544	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-26692.06	-5.92	3109.71
			Max. Mx	4	-24503.26	-4297.02	-5.65
			Max. My	6	-24503.23	-6.62	-4296.98
			Max. Vy	4	-829.57	-3946.51	-6.47
			Max. Vx	6	-829.58	-7.60	-3946.48
			Max. Torque	3			-129.49
		Guy A	Bottom Tension	5	2011.86		
			Top Tension	5	2022.88		
			Top Cable Vert	5	846.23		
			Top Cable Norm	5	1837.37		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-765.27		
			Bot Cable Norm	5	1860.63		
			Bot Cable Tan	5	0.00		
		Guy B	Bottom Tension	7	2013.49		
			Top Tension	7	2024.51		
			Top Cable Vert	7	846.88		
			Top Cable Norm	7	1838.87		
			Top Cable Tan	7	0.01		
			Bot Cable Vert	7	-765.91		
			Bot Cable Norm	7	1862.12		
			Bot Cable Tan	7	0.01		
		Guy C	Bottom Tension	9	2011.76		
			Top Tension	9	2022.78		
			Top Cable Vert	9	846.19		
			Top Cable Norm	9	1837.28		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-765.23		
			Bot Cable Norm	9	1860.54		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	2013.51		
			Top Tension	3	2024.53		
			Top Cable Vert	3	846.89		
			Top Cable Norm	3	1838.89		
			Top Cable Tan	3	0.01		
			Bot Cable Vert	3	-765.92		
			Bot Cable Norm	3	1862.15		
			Bot Cable Tan	3	0.01		
L23	62.3544 - 56.1461	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-26820.72	-2.38	-1091.17
			Max. Mx	4	-26728.08	-2307.11	-5.20
			Max. My	6	-26728.04	-6.12	-2307.08
			Max. Vy	4	-755.69	-2307.11	-5.20
			Max. Vx	6	-755.70	-6.12	-2307.08
			Max. Torque	3			-127.41
L24	56.1461 - 49.9378	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-26950.31	0.18	-3669.69
			Max. Mx	4	-26950.05	3670.86	0.30
			Max. My	6	-26950.01	0.18	3670.94
			Max. Vy	4	-507.49	1645.06	-2.04
			Max. Vx	6	-507.49	-2.49	1645.12

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Torque	3			-127.40
L25	49.9378 - 43.7295	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-27085.07	0.29	-4324.57
			Max. Mx	8	-27066.51	-4354.99	-0.01
			Max. My	2	-27066.55	0.02	-4354.90
			Max. Vy	4	-216.52	3926.67	0.34
			Max. Vx	6	-216.53	0.21	3926.75
			Max. Torque	3			-135.36
L26	43.7295 - 37.5212	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-27212.69	1.62	-3072.54
			Max. Mx	8	-27121.45	-4242.70	0.38
			Max. My	2	-27121.50	0.45	-4242.61
			Max. Vy	8	-343.96	-3072.63	1.46
			Max. Vx	2	-343.96	1.62	-3072.54
			Max. Torque	3			-135.35
L27	37.5212 - 31.3129	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-27339.91	2.51	-108.68
			Max. Mx	4	-27248.67	2687.57	1.67
			Max. My	6	-27248.63	1.85	2687.67
			Max. Vy	8	-599.91	-108.77	2.31
			Max. Vx	2	-599.91	2.51	-108.68
			Max. Torque	3			-135.35
		Guy A	Bottom Tension	5	1729.91		
			Top Tension	5	1735.48		
			Top Cable Vert	5	390.39		
			Top Cable Norm	5	1691.00		
			Top Cable Tan	5	0.00		
			Bot Cable Vert	5	-351.02		
			Bot Cable Norm	5	1693.92		
			Bot Cable Tan	5	0.00		
		Guy B	Bottom Tension	7	1714.38		
			Top Tension	7	1719.95		
			Top Cable Vert	7	387.07		
			Top Cable Norm	7	1675.83		
			Top Cable Tan	7	0.01		
			Bot Cable Vert	7	-347.71		
			Bot Cable Norm	7	1678.74		
			Bot Cable Tan	7	0.01		
		Guy C	Bottom Tension	9	1727.78		
			Top Tension	9	1733.35		
			Top Cable Vert	9	389.93		
			Top Cable Norm	9	1688.92		
			Top Cable Tan	9	0.00		
			Bot Cable Vert	9	-350.57		
			Bot Cable Norm	9	1691.84		
			Bot Cable Tan	9	0.00		
		Guy D	Bottom Tension	3	1714.37		
			Top Tension	3	1719.94		
			Top Cable Vert	3	387.07		
			Top Cable Norm	3	1675.82		
			Top Cable Tan	3	0.01		
			Bot Cable Vert	3	-347.71		
			Bot Cable Norm	3	1678.74		
			Bot Cable Tan	3	0.01		
L28	31.3129 - 25.1046	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-28489.52	4319.33	8.96
			Max. Mx	4	-28489.52	4319.33	8.96

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. My	6	-28489.47	9.41	4319.42
			Max. Vy	4	-733.30	1069.65	3.64
			Max. Vx	6	-733.30	3.91	1069.74
			Max. Torque	3			-134.35
L29	25.1046 - 18.8963	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-28617.87	6604.89	14.18
			Max. Mx	4	-28617.87	6604.89	14.18
			Max. My	6	-28617.82	14.75	6604.97
			Max. Vy	4	-462.59	4832.34	10.05
			Max. Vx	6	-462.59	10.55	4832.42
			Max. Torque	3			-134.35
L30	18.8963 - 12.688	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-28744.75	6972.00	17.74
			Max. Mx	4	-28708.47	7069.42	16.90
			Max. My	6	-28708.43	17.51	7069.48
			Max. Vy	4	-155.38	6801.83	15.04
			Max. Vx	6	-155.37	15.63	6801.90
			Max. Torque	3			-134.34
L31	12.688 - 6.47966	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-28869.77	5432.83	19.41
			Max. Mx	4	-28780.74	6845.07	18.29
			Max. My	6	-28780.70	18.88	6845.12
			Max. Vy	8	-391.23	-5399.70	19.40
			Max. Vx	2	-391.22	19.92	-5399.66
			Max. Torque	3			-134.33
L32	6.47966 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-29070.89	-0.14	3.54
			Max. Mx	4	-28905.43	4996.21	19.60
			Max. My	6	-28905.39	20.12	4996.24
			Max. Vy	8	-945.02	0.14	3.53
			Max. Vx	2	-945.02	3.92	0.14
			Max. Torque	3			-235.92

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Mast	Max. Vert	4	29085.07	-261.30	0.59
	Max. H_x	8	29084.94	262.71	0.59
	Max. H_z	2	29084.98	0.57	262.71
	Max. M_x	1	0.00	0.43	0.43
	Max. M_z	1	0.00	0.43	0.43
	Max. Torsion	7	233.98	228.58	-227.38
	Min. Vert	1	7096.49	0.43	0.43
	Min. H_x	4	29085.07	-261.30	0.59
	Min. H_z	6	29085.03	0.57	-261.30
	Min. M_x	1	0.00	0.43	0.43
	Min. M_z	1	0.00	0.43	0.43
	Min. Torsion	3	-235.97	-227.38	228.58
Guy D @ 164.04 ft Elev 0 ft Azimuth 225 deg	Max. Vert	23	-268.05	-246.69	246.69

tnxTower	Job NRG 60m Super NRG Tall Tower	Page 54 of 71
Ahola Engineering LLC P.O. Box 989 Winter Park, CO 80482-0989 Phone: (719) 640-2408 FAX:	Project Matanuska-Susitna Borough, AK	Date 09:27:06 07/01/24
	Client Longroad Energy	Designed by Mikko Ahola, PE

Location	*Condition*	*Gov. Load Comb.*	*Vertical lb*	*Horizontal, X lb*	*Horizontal, Z lb*
	Max. H_x	15	-368.87	-205.15	205.15
	Max. H_z	3	-8164.55	-6460.91	6460.90
	Min. Vert	3	-8164.55	-6460.91	6460.90
	Min. H_x	3	-8164.55	-6460.91	6460.90
	Min. H_z	15	-368.87	-205.15	205.15
Guy C @ 164.04 ft Elev 0 ft Azimuth 135 deg	Max. Vert	21	-268.05	246.68	246.68
	Max. H_x	9	-7541.13	6002.89	6002.90
	Max. H_z	9	-7541.13	6002.89	6002.90
	Min. Vert	9	-7541.13	6002.89	6002.90
	Min. H_x	13	-384.05	215.94	215.94
	Min. H_z	13	-384.05	215.94	215.94
Guy B @ 164.04 ft Elev 0 ft Azimuth 45 deg	Max. Vert	19	-268.05	246.69	-246.69
	Max. H_x	7	-8164.53	6460.93	-6460.95
	Max. H_z	11	-368.87	205.15	-205.15
	Min. Vert	7	-8164.53	6460.93	-6460.95
	Min. H_x	11	-368.87	205.15	-205.15
	Min. H_z	7	-8164.53	6460.93	-6460.95
Guy A @ 164.04 ft Elev 0 ft Azimuth -45 deg	Max. Vert	25	-268.06	-246.70	-246.70
	Max. H_x	17	-384.03	-215.94	-215.94
	Max. H_z	17	-384.03	-215.94	-215.94
	Min. Vert	5	-7541.25	-6003.18	-6003.18
	Min. H_x	5	-7541.25	-6003.18	-6003.18
	Min. H_z	5	-7541.25	-6003.18	-6003.18
Guy D @ 147.67 ft Elev 0 ft Azimuth 225 deg	Max. Vert	15	-55.31	-167.12	167.12
	Max. H_x	15	-55.31	-167.12	167.12
	Max. H_z	2	-2155.65	-3544.93	3982.76
	Min. Vert	3	-2279.87	-3894.14	3894.11
	Min. H_x	4	-2155.42	-3982.69	3544.82
	Min. H_z	15	-55.31	-167.12	167.12
Guy C @ 147.67 ft Elev 0 ft Azimuth 135 deg	Max. Vert	13	-55.93	167.69	167.69
	Max. H_x	8	-2155.39	3982.20	3544.34
	Max. H_z	2	-2155.37	3544.33	3982.20
	Min. Vert	9	-2230.94	3845.29	3845.29
	Min. H_x	13	-55.93	167.69	167.69
	Min. H_z	13	-55.93	167.69	167.69
Guy B @ 147.67 ft Elev 0 ft Azimuth 45 deg	Max. Vert	11	-55.31	167.12	-167.12
	Max. H_x	8	-2155.61	3982.73	-3544.90
	Max. H_z	11	-55.31	167.12	-167.12
	Min. Vert	7	-2279.84	3894.07	-3894.10
	Min. H_x	11	-55.31	167.12	-167.12
	Min. H_z	6	-2155.38	3544.79	-3982.66
Guy A @ 147.67 ft	Max. Vert	17	-55.97	-167.82	-167.82

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Elev 0 ft Azimuth -45 deg					
	Max. H_x	17	-55.97	-167.82	-167.82
	Max. H_z	17	-55.97	-167.82	-167.82
	Min. Vert	5	-2231.02	-3846.38	-3846.37
	Min. H_x	4	-2155.65	-3983.22	-3545.38
	Min. H_z	6	-2155.66	-3545.38	-3983.22

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	7096.49	-0.43	-0.43	0.00	0.00	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy	29084.98	-0.57	-262.71	0.00	0.00	167.48
1.2 Dead+1.0 Wind 45 deg - No Ice+1.0 Guy	28842.28	227.38	-228.58	0.00	0.00	235.97
1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy	29085.07	261.30	-0.59	0.00	0.00	150.88
1.2 Dead+1.0 Wind 135 deg - No Ice+1.0 Guy	28222.83	231.11	231.10	0.00	0.00	-12.60
1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy	29085.03	-0.57	261.30	0.00	0.00	-167.48
1.2 Dead+1.0 Wind 225 deg - No Ice+1.0 Guy	28842.23	-228.58	227.38	0.00	0.00	-233.98
1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy	29084.94	-262.71	-0.59	0.00	0.00	-150.88
1.2 Dead+1.0 Wind 315 deg - No Ice+1.0 Guy	28222.69	-232.48	-232.49	0.00	0.00	11.05
Dead+Wind 0 deg - Service+Guy	11597.92	-0.48	-151.35	0.00	0.00	38.77
Dead+Wind 45 deg - Service+Guy	11390.49	113.01	-113.95	0.00	0.00	54.26
Dead+Wind 90 deg - Service+Guy	11597.98	150.39	-0.48	0.00	0.00	34.60
Dead+Wind 135 deg - Service+Guy	11263.72	113.64	113.64	0.00	0.00	-2.97
Dead+Wind 180 deg - Service+Guy	11597.96	-0.48	150.39	0.00	0.00	-38.77
Dead+Wind 225 deg - Service+Guy	11390.47	-113.95	113.01	0.00	0.00	-54.23
Dead+Wind 270 deg - Service+Guy	11597.89	-151.35	-0.48	0.00	0.00	-34.60
Dead+Wind 315 deg - Service+Guy	11263.60	-114.61	-114.61	0.00	0.00	2.94
1.2 Dead+1.0 Ev+1.0 Eh 0 deg+1.0 Guy	9368.40	-0.53	5.97	0.00	0.00	-0.04
1.2 Dead+1.0 Ev+1.0 Eh 45 deg+1.0 Guy	9235.14	-5.33	4.21	0.00	0.00	-0.05
1.2 Dead+1.0 Ev+1.0 Eh 90 deg+1.0 Guy	9368.27	-7.25	-0.56	0.00	0.00	-0.04
1.2 Dead+1.0 Ev+1.0 Eh 135 deg+1.0 Guy	9235.05	-5.33	-5.33	0.00	0.00	-0.00
1.2 Dead+1.0 Ev+1.0 Eh 180 deg+1.0 Guy	9368.22	-0.56	-7.24	0.00	0.00	0.04
1.2 Dead+1.0 Ev+1.0 Eh 225	9235.08	4.21	-5.33	0.00	0.00	0.06

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
deg+1.0 Guy						
1.2 Dead+1.0 Ev+1.0 Eh 270 deg+1.0 Guy	9368.35	5.97	-0.53	0.00	0.00	0.03
1.2 Dead+1.0 Ev+1.0 Eh 315 deg+1.0 Guy	9235.18	4.10	4.10	0.00	0.00	-0.01

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	% Error
1	0.00	-4089.76	0.00	-0.00	4089.76	-0.00	0.000%
2	0.00	-4745.92	-15694.24	-0.01	4745.92	15694.20	0.000%
3	11796.40	-4745.92	-11796.40	-11796.45	4745.92	11796.44	0.000%
4	15694.24	-4745.92	0.00	-15694.20	4745.92	-0.01	0.000%
5	11250.74	-4745.92	11250.74	-11250.85	4745.93	-11250.85	0.001%
6	0.00	-4745.92	15694.24	-0.01	4745.92	-15694.20	0.000%
7	-11796.40	-4745.92	11796.40	11796.44	4745.92	-11796.45	0.000%
8	-15694.24	-4745.92	0.00	15694.20	4745.92	-0.01	0.000%
9	-11250.74	-4745.92	-11250.74	11250.85	4745.93	11250.85	0.001%
10	0.00	-4089.76	-3778.27	-0.00	4089.76	3778.26	0.000%
11	2825.40	-4089.76	-2825.40	-2825.40	4089.76	2825.40	0.000%
12	3778.27	-4089.76	0.00	-3778.26	4089.76	-0.00	0.000%
13	2705.36	-4089.76	2705.36	-2705.36	4089.76	-2705.36	0.000%
14	0.00	-4089.76	3778.27	-0.00	4089.76	-3778.26	0.000%
15	-2825.40	-4089.76	2825.40	2825.40	4089.76	-2825.40	0.000%
16	-3778.27	-4089.76	0.00	3778.26	4089.76	-0.00	0.000%
17	-2705.36	-4089.76	-2705.36	2705.36	4089.76	2705.36	0.000%
18	0.00	-5580.39	-1301.39	0.00	5580.41	1301.37	0.000%
19	920.22	-5580.39	-920.22	-920.22	5580.39	920.22	0.000%
20	1301.39	-5580.39	0.00	-1301.39	5580.39	0.00	0.000%
21	920.22	-5580.39	920.22	-920.22	5580.39	-920.22	0.000%
22	0.00	-5580.39	1301.39	0.00	5580.39	-1301.39	0.000%
23	-920.22	-5580.39	920.22	920.22	5580.39	-920.22	0.000%
24	-1301.39	-5580.39	0.00	1301.37	5580.41	0.00	0.000%
25	-920.22	-5580.39	-920.22	920.21	5580.41	920.21	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00004509
2	Yes	9	0.00005938	0.00007161
3	Yes	9	0.00000001	0.00004907
4	Yes	9	0.00005958	0.00005915
5	Yes	8	0.00005417	0.00002458
6	Yes	9	0.00005959	0.00007185
7	Yes	9	0.00000001	0.00004836
8	Yes	9	0.00005940	0.00005898
9	Yes	8	0.00005386	0.00002358
10	Yes	5	0.00000001	0.00008192
11	Yes	5	0.00000001	0.00008096
12	Yes	5	0.00000001	0.00006783

13	Yes	5	0.00000001	0.00001553
14	Yes	5	0.00000001	0.00008260
15	Yes	5	0.00000001	0.00008081
16	Yes	5	0.00000001	0.00006734
17	Yes	5	0.00000001	0.00001516
18	Yes	5	0.00000001	0.00001922
19	Yes	5	0.00000001	0.00001680
20	Yes	5	0.00000001	0.00001538
21	Yes	5	0.00000001	0.00001677
22	Yes	5	0.00000001	0.00001537
23	Yes	5	0.00000001	0.00001679
24	Yes	5	0.00000001	0.00001921
25	Yes	5	0.00000001	0.00002037

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* *°*	*Twist* *°*
L1	197.688 - 190.438	8.492	10	0.1986	0.0062
L2	191.271 - 184.021	8.272	10	0.1883	0.0050
L3	184.854 - 177.604	8.071	10	0.1841	0.0095
L4	178.437 - 171.187	7.815	12	0.2699	0.0155
L5	172.021 - 164.771	7.422	12	0.3829	0.0215
L6	165.604 - 158.354	6.889	14	0.4741	0.0273
L7	159.187 - 151.937	6.277	14	0.4965	0.0322
L8	152.771 - 145.521	5.695	14	0.4398	0.0338
L9	146.354 - 139.104	5.163	14	0.4233	0.0353
L10	139.937 - 132.687	4.634	14	0.4303	0.0368
L11	133.521 - 126.271	4.095	14	0.4296	0.0356
L12	127.104 - 119.854	3.582	14	0.3811	0.0329
L13	120.687 - 113.437	3.165	14	0.2876	0.0303
L14	114.271 - 107.021	2.832	16	0.2319	0.0276
L15	107.854 - 100.604	2.540	16	0.2066	0.0250
L16	101.437 - 98.4375	2.280	16	0.1752	0.0223
L17	99.4792 - 93.3959	2.210	16	0.1633	0.0217
L18	94.4376 - 87.1876	2.053	16	0.1290	0.0205
L19	88.2293 - 80.9793	1.908	10	0.0964	0.0192
L20	82.021 - 74.771	1.792	10	0.0828	0.0180
L21	75.8127 - 68.5627	1.689	10	0.0753	0.0167
L22	69.6044 - 62.3544	1.598	12	0.0613	0.0155
L23	63.3961 - 56.1461	1.536	12	0.0494	0.0142
L24	57.1878 - 49.9378	1.508	12	0.0488	0.0129
L25	50.9795 - 43.7295	1.479	12	0.0311	0.0117
L26	44.7712 - 37.5212	1.431	13	0.0570	0.0104
L27	38.5629 - 31.3129	1.383	13	0.0821	0.0090
L28	32.3546 - 25.1046	1.293	13	0.0933	0.0077
L29	26.1463 - 18.8963	1.172	13	0.1115	0.0064
L30	19.938 - 12.688	1.000	13	0.1603	0.0051
L31	13.7297 - 6.47966	0.757	13	0.2162	0.0037
L32	7.52136 - 0	0.445	13	0.2653	0.0024

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
198.491	Properllor Anemometer/Wind Vane	10	8.492	0.1986	0.0062	16566
196.194	95" Boom Mount	10	8.439	0.1971	0.0051	16566
194.063	CCISeismic Tower Section 1 - 1	10	8.365	0.1944	0.0050	16566
192.913	NRG #40C Anemometer	10	8.326	0.1923	0.0050	16566
192.000	CCISeismic (12) miscl Cat5 From 0 to 196 (188ft to196ft)	10	8.295	0.1902	0.0050	16503
190.913	95" Boom Mount	10	8.260	0.1872	0.0052	18889
189.321	Guy	10	8.211	0.1822	0.0062	41635
187.646	CCISeismic Tower Section 2 - 1	10	8.160	0.1785	0.0072	21784
183.000	CCISeismic (12) miscl Cat5 From 0 to 196 (178ft to188ft)	10	8.007	0.2003	0.0114	5206
181.229	CCISeismic Tower Section 3 - 1	12	7.939	0.2237	0.0130	4109
180.770	Aircraft Marker Balls (21" Dia - Orange)	12	7.920	0.2308	0.0134	3917
174.812	CCISeismic Tower Section 4 - 1	12	7.612	0.3343	0.0189	3208
173.885	Temperature Probe w/ Shield	12	7.552	0.3507	0.0197	3263
173.000	CCISeismic (12) miscl Cat5 From 0 to 196 (168ft to178ft)	12	7.492	0.3661	0.0206	3337
168.396	CCISeismic Tower Section 5 - 1	14	7.136	0.4399	0.0248	4073
167.323	NRG 200P Wind Vane	14	7.043	0.4543	0.0258	4453
165.323	95" Boom Mount	14	6.863	0.4769	0.0276	5894
163.000	CCISeismic (12) miscl Cat5 From 0 to 196 (158ft to168ft)	14	6.644	0.4945	0.0296	13021
161.979	CCISeismic Tower Section 6 - 1	14	6.545	0.4987	0.0304	27857
160.761	NRG 200P Wind Vane	14	6.428	0.5003	0.0313	40824
158.761	95" Boom Mount	14	6.236	0.4942	0.0324	11900
156.121	Guy	14	5.991	0.4718	0.0332	8251
155.562	CCISeismic Tower Section 7 - 1	14	5.940	0.4661	0.0333	8059
153.000	CCISeismic (12) miscl Cat5 From 0 to 196 (148ft to158ft)	14	5.714	0.4415	0.0337	8452
149.146	CCISeismic Tower Section 8 - 1	14	5.391	0.4244	0.0345	18739
143.000	CCISeismic (12) miscl Cat5 From 0 to 196 (138ft to148ft)	14	4.888	0.4262	0.0363	42328
142.729	CCISeismic Tower Section 9 - 1	14	4.866	0.4265	0.0364	41588
137.795	NRG 200P Wind Vane	14	4.454	0.4328	0.0367	100368
136.312	CCISeismic Tower Section 10 - 1	14	4.330	0.4334	0.0365	52595
135.795	95" Boom Mount	14	4.286	0.4333	0.0363	39145
133.000	CCISeismic (12) miscl Cat5 From 0 to 196 (128ft to138ft)	14	4.052	0.4279	0.0354	13115
131.234	NRG #40C Anemometer	14	3.905	0.4194	0.0347	8084
129.896	CCISeismic Tower Section 11 - 1	14	3.797	0.4100	0.0341	6155
129.234	95" Boom Mount	14	3.744	0.4043	0.0339	5543
125.154	Guy	14	3.444	0.3537	0.0321	4232
123.479	CCISeismic Tower Section 12 - 1	14	3.333	0.3279	0.0314	4318
123.000	CCISeismic (12) miscl Cat5 From 0 to 196 (118ft to128ft)	14	3.303	0.3206	0.0312	4380
117.062	CCISeismic Tower Section 13 - 1	16	2.970	0.2513	0.0288	6411
113.000	CCISeismic (12) miscl Cat5 From 0 to 196 (108ft to118ft)	16	2.772	0.2243	0.0271	8621
110.646	CCISeismic Tower Section 14 - 1	16	2.663	0.2164	0.0261	8897
104.229	CCISeismic Tower Section 15 - 1	16	2.388	0.1903	0.0234	6797
103.000	CCISeismic (12) miscl Cat5 From 0 to 196 (98ft to108ft)	16	2.339	0.1839	0.0229	6483
99.937	CCISeismic Tower Section 16 - 1	16	2.226	0.1662	0.0218	6404
98.425	NRG #40C Anemometer	16	2.175	0.1564	0.0214	6459
96.438	CCISeismic Tower Section 17 - 1	16	2.111	0.1426	0.0209	6442
96.425	95" Boom Mount	16	2.111	0.1425	0.0209	6442
94.438	Guy	16	2.053	0.1290	0.0205	6573
93.000	CCISeismic (12) miscl Cat5 From 0 to 196 (88ft to98ft)	16	2.015	0.1199	0.0202	7000
90.813	CCISeismic Tower Section 18 - 1	16	1.963	0.1077	0.0198	8438

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
84.604	CCISeismic Tower Section 19 - 1	10	1.838	0.0869	0.0185	18127
83.000	CCISeismic (12) miscl Cat5 From 0 to 196 (78ft to88ft)	10	1.809	0.0842	0.0182	22365
78.396	CCISeismic Tower Section 20 - 1	10	1.730	0.0784	0.0172	36944
73.000	CCISeismic (12) miscl Cat5 From 0 to 196 (68ft to78ft)	12	1.645	0.0710	0.0161	25311
72.188	CCISeismic Tower Section 21 - 1	12	1.634	0.0693	0.0160	22406
65.979	CCISeismic Tower Section 22 - 1	12	1.558	0.0432	0.0147	12505
64.429	Guy	12	1.544	0.0466	0.0144	12326
63.000	CCISeismic (12) miscl Cat5 From 0 to 196 (58ft to68ft)	12	1.534	0.0503	0.0141	13394
59.771	CCISeismic Tower Section 23 - 1	12	1.518	0.0531	0.0135	29006
53.563	CCISeismic Tower Section 24 - 1	12	1.493	0.0336	0.0122	12763
53.000	CCISeismic (12) miscl Cat5 From 0 to 196 (48ft to58ft)	12	1.491	0.0309	0.0121	12069
49.200	Temperature Probe w/ Shield	12	1.467	0.0378	0.0113	9480
47.354	CCISeismic Tower Section 25 - 1	12	1.451	0.0455	0.0109	8953
43.000	CCISeismic (12) miscl Cat5 From 0 to 196 (38ft to48ft)	13	1.423	0.0651	0.0100	8900
41.146	CCISeismic Tower Section 26 - 1	13	1.409	0.0730	0.0096	9392
34.938	CCISeismic Tower Section 27 - 1	13	1.335	0.0895	0.0083	14566
33.000	CCISeismic (12) miscl Cat5 From 0 to 196 (28ft to38ft)	13	1.304	0.0923	0.0079	16231
32.355	Guy	13	1.293	0.0933	0.0077	16160
28.730	CCISeismic Tower Section 28 - 1	13	1.227	0.1013	0.0069	11417
23.000	CCISeismic (12) miscl Cat5 From 0 to 196 (18ft to28ft)	13	1.093	0.1354	0.0057	7282
22.521	CCISeismic Tower Section 29 - 1	13	1.079	0.1394	0.0056	7135
16.313	CCISeismic Tower Section 30 - 1	13	0.867	0.1883	0.0043	6430
13.000	CCISeismic (12) miscl Cat5 From 0 to 196 (8ft to18ft)	13	0.724	0.2264	0.0036	6675
10.105	CCISeismic Tower Section 31 - 1	13	0.583	0.2643	0.0030	7264
5.000	Data Logger	13	0.301	0.2113	0.0017	12006
4.000	CCISeismic (12) miscl Cat5 From 0 to 196 (0ft to8ft)	13	0.242	0.1770	0.0014	12006
3.761	CCISeismic Tower Section 32 - 1	13	0.228	0.1679	0.0013	12006

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	197.688 - 190.438	40.223	2	0.8838	0.0341
L2	191.271 - 184.021	39.073	2	0.8416	0.0196
L3	184.854 - 177.604	37.995	2	0.8391	0.0328
L4	178.437 - 171.187	36.646	4	1.2375	0.0600
L5	172.021 - 164.771	34.663	6	1.7471	0.0871
L6	165.604 - 158.354	32.041	6	2.1526	0.1137
L7	159.187 - 151.937	29.038	6	2.2664	0.1360
L8	152.771 - 145.521	26.125	6	2.0587	0.1433
L9	146.354 - 139.104	23.429	6	1.9685	0.1506
L10	139.937 - 132.687	20.803	6	1.9402	0.1580
L11	133.521 - 126.271	18.233	6	1.8671	0.1526
L12	127.104 - 119.854	15.859	6	1.6189	0.1408
L13	120.687 - 113.437	13.951	8	1.2195	0.1292
L14	114.271 - 107.021	12.498	8	0.9488	0.1177

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	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L15	107.854 - 100.604	11.353	8	0.7654	0.1062
L16	101.437 - 98.4375	10.458	2	0.6120	0.0947
L17	99.4792 - 93.3959	10.236	2	0.5684	0.0921
L18	94.4376 - 87.1876	9.753	2	0.4573	0.0871
L19	88.2293 - 80.9793	9.319	2	0.3647	0.0816
L20	82.021 - 74.771	8.965	2	0.3424	0.0762
L21	75.8127 - 68.5627	8.621	2	0.3364	0.0708
L22	69.6044 - 62.3544	8.291	2	0.2936	0.0655
L23	63.3961 - 56.1461	8.044	4	0.1712	0.0601
L24	57.1878 - 49.9378	7.906	4	0.1223	0.0548
L25	50.9795 - 43.7295	7.727	4	0.1913	0.0496
L26	44.7712 - 37.5212	7.396	4	0.3308	0.0440
L27	38.5629 - 31.3129	6.886	4	0.4575	0.0384
L28	32.3546 - 25.1046	6.251	6	0.5115	0.0328
L29	26.1463 - 18.8963	5.547	6	0.5969	0.0272
L30	19.938 - 12.688	4.664	6	0.7858	0.0216
L31	13.7297 - 6.47966	3.504	6	1.0172	0.0160
L32	7.52136 - 0	2.049	6	1.2267	0.0105

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
198.491	Properllor Anemometer/Wind Vane	2	40.223	0.8838	0.0341	4048
196.194	95" Boom Mount	2	39.949	0.8776	0.0299	4048
194.063	CCISeismic Tower Section 1 - 1	2	39.562	0.8663	0.0239	4048
192.913	NRG #40C Anemometer	2	39.357	0.8579	0.0216	4048
192.000	CCISeismic (12) miscl Cat5 From 0 to 196 (188ft to196ft)	2	39.198	0.8495	0.0216	4059
190.913	95" Boom Mount	2	39.012	0.8372	0.0216	4743
189.321	Guy	2	38.748	0.8174	0.0216	12095
187.646	CCISeismic Tower Section 2 - 1	2	38.472	0.8042	0.0231	4719
183.000	CCISeismic (12) miscl Cat5 From 0 to 196 (178ft to188ft)	2	37.652	0.9178	0.0415	1180
181.229	CCISeismic Tower Section 3 - 1	4	37.294	1.0268	0.0490	936
180.770	Aircraft Marker Balls (21" Dia - Orange)	4	37.195	1.0590	0.0508	893
174.812	CCISeismic Tower Section 4 - 1	4	35.610	1.5288	0.0752	720
173.885	Temperature Probe w/ Shield	4	35.310	1.6026	0.0791	731
173.000	CCISeismic (12) miscl Cat5 From 0 to 196 (168ft to178ft)	4	35.010	1.6720	0.0829	745
168.396	CCISeismic Tower Section 5 - 1	6	33.249	2.0005	0.1022	919
167.323	NRG 200P Wind Vane	6	32.796	2.0645	0.1066	1006
165.323	95" Boom Mount	6	31.914	2.1651	0.1148	1315
163.000	CCISeismic (12) miscl Cat5 From 0 to 196 (158ft to168ft)	6	30.841	2.2446	0.1241	2619
161.979	CCISeismic Tower Section 6 - 1	6	30.359	2.2647	0.1278	5000
160.761	NRG 200P Wind Vane	6	29.782	2.2757	0.1318	15983
158.761	95" Boom Mount	6	28.838	2.2590	0.1369	2948
156.121	Guy	6	27.618	2.1798	0.1406	1909
155.562	CCISeismic Tower Section 7 - 1	6	27.365	2.1588	0.1412	1845
153.000	CCISeismic (12) miscl Cat5 From 0 to 196 (148ft to158ft)	6	26.225	2.0657	0.1431	1820
149.146	CCISeismic Tower Section 8 - 1	6	24.584	1.9889	0.1469	3013
143.000	CCISeismic (12) miscl Cat5 From 0 to 196 (138ft to148ft)	6	22.052	1.9536	0.1554	13565

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	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
142.729	CCISeismic Tower Section 9 - 1	6	21.941	1.9525	0.1557	13488
137.795	NRG 200P Wind Vane	6	19.935	1.9270	0.1576	6373
136.312	CCISeismic Tower Section 10 - 1	6	19.339	1.9130	0.1564	4756
135.795	95" Boom Mount	6	19.133	1.9066	0.1558	4281
133.000	CCISeismic (12) miscl Cat5 From 0 to 196 (128ft to138ft)	6	18.029	1.8548	0.1518	2384
131.234	NRG #40C Anemometer	6	17.349	1.8033	0.1487	1676
129.896	CCISeismic Tower Section 11 - 1	6	16.848	1.7537	0.1462	1346
129.234	95" Boom Mount	6	16.606	1.7256	0.1449	1233
125.154	Guy	6	15.224	1.5008	0.1372	973
123.479	CCISeismic Tower Section 12 - 1	8	14.718	1.3920	0.1342	987
123.000	CCISeismic (12) miscl Cat5 From 0 to 196 (118ft to128ft)	8	14.580	1.3609	0.1333	997
117.062	CCISeismic Tower Section 13 - 1	8	13.084	1.0489	0.1227	1343
113.000	CCISeismic (12) miscl Cat5 From 0 to 196 (108ft to118ft)	8	12.250	0.9080	0.1155	1744
110.646	CCISeismic Tower Section 14 - 1	8	11.819	0.8365	0.1113	1902
104.229	CCISeismic Tower Section 15 - 1	2	10.816	0.6774	0.0994	1952
103.000	CCISeismic (12) miscl Cat5 From 0 to 196 (98ft to108ft)	2	10.652	0.6481	0.0973	1967
99.937	CCISeismic Tower Section 16 - 1	2	10.286	0.5786	0.0926	2177
98.425	NRG #40C Anemometer	2	10.124	0.5446	0.0908	2291
96.438	CCISeismic Tower Section 17 - 1	2	9.929	0.4999	0.0889	2374
96.425	95" Boom Mount	2	9.928	0.4996	0.0888	2374
94.438	Guy	2	9.753	0.4573	0.0871	2500
93.000	CCISeismic (12) miscl Cat5 From 0 to 196 (88ft to98ft)	2	9.639	0.4298	0.0858	2770
90.813	CCISeismic Tower Section 18 - 1	2	9.484	0.3944	0.0839	3675
84.604	CCISeismic Tower Section 19 - 1	2	9.108	0.3460	0.0784	16023
83.000	CCISeismic (12) miscl Cat5 From 0 to 196 (78ft to88ft)	2	9.019	0.3433	0.0771	27611
78.396	CCISeismic Tower Section 20 - 1	2	8.764	0.3399	0.0731	51607
73.000	CCISeismic (12) miscl Cat5 From 0 to 196 (68ft to78ft)	2	8.466	0.3270	0.0684	8446
72.188	CCISeismic Tower Section 21 - 1	2	8.422	0.3219	0.0677	6970
65.979	CCISeismic Tower Section 22 - 1	4	8.132	0.2229	0.0623	3182
64.429	Guy	4	8.076	0.1905	0.0610	3095
63.000	CCISeismic (12) miscl Cat5 From 0 to 196 (58ft to68ft)	4	8.033	0.1646	0.0598	3344
59.771	CCISeismic Tower Section 23 - 1	4	7.959	0.1284	0.0570	7414
53.563	CCISeismic Tower Section 24 - 1	4	7.815	0.1460	0.0518	3903
53.000	CCISeismic (12) miscl Cat5 From 0 to 196 (48ft to58ft)	4	7.798	0.1540	0.0513	3636
49.200	Temperature Probe w/ Shield	4	7.650	0.2286	0.0480	2728
47.354	CCISeismic Tower Section 25 - 1	4	7.556	0.2701	0.0463	2571
43.000	CCISeismic (12) miscl Cat5 From 0 to 196 (38ft to48ft)	4	7.268	0.3721	0.0424	2651
41.146	CCISeismic Tower Section 26 - 1	4	7.119	0.4124	0.0407	2908
34.938	CCISeismic Tower Section 27 - 1	6	6.524	0.4935	0.0351	6435
33.000	CCISeismic (12) miscl Cat5 From 0 to 196 (28ft to38ft)	6	6.320	0.5069	0.0334	8129
32.355	Guy	6	6.251	0.5115	0.0328	7982
28.730	CCISeismic Tower Section 28 - 1	6	5.853	0.5486	0.0295	3869
23.000	CCISeismic (12) miscl Cat5 From 0 to 196 (18ft to28ft)	6	5.130	0.6875	0.0244	1915
22.521	CCISeismic Tower Section 29 - 1	6	5.061	0.7030	0.0240	1858
16.313	CCISeismic Tower Section 30 - 1	6	4.023	0.8984	0.0183	1553
13.000	CCISeismic (12) miscl Cat5 From 0 to 196 (8ft to18ft)	6	3.348	1.0618	0.0154	1581
10.105	CCISeismic Tower Section 31 - 1	6	2.688	1.2276	0.0130	1702
5.000	Data Logger	6	1.385	0.9747	0.0074	2789

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FAX:

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
4.000	CCISeismic (12) miscl Cat5 From 0 to 196 (0ft to8ft)	6	1.114	0.8161	0.0060	2789
3.761	CCISeismic Tower Section 32 - 1	6	1.048	0.7743	0.0056	2789

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T_u lb	Allowable ϕT_n lb	Required S.F.	Actual S.F.
L2	189.321 (A) (36)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4661.95	5880.00	1.000	1.261 ✔
	189.321 (B) (35)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	5064.07	5880.00	1.000	1.161 ✔
	189.321 (C) (34)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4663.94	5880.00	1.000	1.261 ✔
	189.321 (D) (33)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	5064.44	5880.00	1.000	1.161 ✔
L7	156.121 (A) (40)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4057.42	5880.00	1.000	1.449 ✔
	156.121 (B) (39)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4361.66	5880.00	1.000	1.348 ✔
	156.121 (C) (38)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4055.13	5880.00	1.000	1.450 ✔
	156.121 (D) (37)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	4361.41	5880.00	1.000	1.348 ✔
L12	125.154 (A) (44)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2744.11	5880.00	1.000	2.143 ✔
	125.154 (B) (43)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2937.87	5880.00	1.000	2.001 ✔
	125.154 (C) (42)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2744.05	5880.00	1.000	2.143 ✔
	125.154 (D) (41)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2937.74	5880.00	1.000	2.002 ✔
L17	94.438 (A) (48)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2205.98	5880.00	1.000	2.665 ✔
	94.438 (B) (47)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2302.03	5880.00	1.000	2.554 ✔
	94.438 (C) (46)	NRG Guy 5/16 13MM Miscl	254.80	9800.00	2206.74	5880.00	1.000	2.665 ✔
	94.438 (D) (45)	NRG Guy 5/16 13MM	254.80	9800.00	2302.06	5880.00	1.000	2.554 ✔

Section No.	*Elevation* *ft*	*Size*	*Initial Tension* *lb*	*Breaking Load* *lb*	*Actual* T_u *lb*	*Allowable* ϕT_n *lb*	*Required S.F.*	*Actual S.F.*
L22	64.429 (A) (52)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	2022.88	5880.00	1.000	2.907 ✔
	64.429 (B) (51)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	2024.51	5880.00	1.000	2.904 ✔
	64.429 (C) (50)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	2022.78	5880.00	1.000	2.907 ✔
	64.429 (D) (49)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	2024.53	5880.00	1.000	2.904 ✔
L27	32.355 (A) (56)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	1735.48	5880.00	1.000	3.388 ✔
	32.355 (B) (55)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	1719.95	5880.00	1.000	3.419 ✔
	32.355 (C) (54)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	1733.35	5880.00	1.000	3.392 ✔
	32.355 (D) (53)	Miscl NRG Guy 5/16 13MM	254.80	9800.00	1719.94	5880.00	1.000	3.419 ✔
		Miscl						

Compression Checks

Pole Design Data

Section No.	*Elevation* *ft*	*Size*	*L* *ft*	L_u *ft*	*Kl/r*	*A* in^2	P_u *lb*	ϕP_n *lb*	*Ratio* $\frac{P_u}{\phi P_n}$
L1	197.688 - 190.438 (1)	TP8.05x8x0.134	7.250	0.000	0.0	3.3300	-99.47	134865.00	0.001
L2	190.438 - 184.021 (2)	TP8.05x7.7763x0.134	7.250	0.000	0.0	3.3192	-7819.06	134427.00	0.058
L3	184.021 - 177.604 (3)	TP8.05x7.7505x0.134	7.250	0.000	0.0	3.3179	-8368.19	134376.00	0.062
L4	177.604 - 171.187 (4)	TP8.05x7.7476x0.134	7.250	0.000	0.0	3.2394	-8414.02	131194.00	0.064
L5	171.187 - 164.771 (5)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-8522.15	130395.00	0.065
L6	164.771 - 158.354 (6)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-8628.17	130394.00	0.066
L7	158.354 - 151.937 (7)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2589	-15025.40	131984.00	0.114
L8	151.937 - 145.521 (8)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-15091.00	130394.00	0.116
L9	145.521 - 139.104 (9)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-15187.00	130394.00	0.116
L10	139.104 - 132.687 (10)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.3178	-15523.80	134370.00	0.116

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
L11	132.687 - 126.271 (11)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.3178	-15637.60	134370.00	0.116
L12	126.271 - 119.854 (12)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2392	-20106.70	131189.00	0.153
L13	119.854 - 113.437 (13)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-20188.90	130394.00	0.155
L14	113.437 - 107.021 (14)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.2196	-20288.10	130394.00	0.156
L15	107.021 - 100.604 (15)	TP8.05x7.7472x0.134	7.250	0.000	0.0	3.3178	-20459.90	134370.00	0.152
L16	100.604 - 98.4375 (16)	TP10.04x7.7472x0.109	3.000	0.000	0.0	2.8337	-20488.80	113431.00	0.181
L17	98.4375 - 93.3959 (17)	TP10.04x9.0259x0.134	6.083	0.000	0.0	4.0971	-20614.50	165931.00	0.124
L18	93.3959 - 87.1876 (18)	TP10.04x9.5983x0.134	7.250	0.000	0.0	4.0110	-23925.90	162443.00	0.147
L19	87.1876 - 80.9793 (19)	TP10.04x9.7085x0.134	7.250	0.000	0.0	4.0507	-24052.80	164052.00	0.147
L20	80.9793 - 74.771 (20)	TP10.04x9.7244x0.134	7.250	0.000	0.0	4.1511	-24103.50	167880.00	0.144
L21	74.771 - 68.5627 (21)	TP10.04x9.7267x0.134	7.250	0.000	0.0	4.1512	-24231.90	167883.00	0.144
L22	68.5627 - 62.3544 (22)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.1325	-26459.20	167364.00	0.158
L23	62.3544 - 56.1461 (23)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.0573	-26513.80	164322.00	0.161
L24	56.1461 - 49.9378 (24)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.1512	-26950.00	167884.00	0.161
L25	49.9378 - 43.7295 (25)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.1137	-27057.30	166604.00	0.162
L26	43.7295 - 37.5212 (26)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.0573	-27130.60	164322.00	0.165
L27	37.5212 - 31.3129 (27)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.0573	-27257.70	164322.00	0.166
L28	31.3129 - 25.1046 (28)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.1512	-28489.50	167884.00	0.170
L29	25.1046 - 18.8963 (29)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.1512	-28617.80	167884.00	0.170
L30	18.8963 - 12.688 (30)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.0949	-28690.30	165843.00	0.173
L31	12.688 - 6.47966 (31)	TP10.04x9.727x0.134	7.250	0.000	0.0	4.0573	-28789.60	164322.00	0.175
L32	6.47966 - 0 (32)	TP10.04x9.727x0.134	7.521	0.000	0.0	4.0567	-28914.60	164295.00	0.176

Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	197.688 - 190.438 (1)	TP8.05x8x0.134	1613.54	26719.42	0.060	0.00	26719.42	0.000
L2	190.438 - 184.021 (2)	TP8.05x7.7763x0.134	3349.26	26560.00	0.126	0.00	26560.00	0.000
L3	184.021 - 177.604 (3)	TP8.05x7.7505x0.134	7158.88	26541.75	0.270	0.00	26541.75	0.000

tnxTower	**Job** NRG 60m Super NRG Tall Tower	**Page** 65 of 71
Ahola Engineering LLC *P.O. Box 989* *Winter Park, CO 80482-0989* *Phone: (719) 640-2408* *FAX:*	**Project** Matanuska-Susitna Borough, AK	**Date** 09:27:06 07/01/24
	Client Longroad Energy	**Designed by** Mikko Ahola, PE

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L4	177.604 - 171.187 (4)	TP8.05x7.7476x0.134	7425.23	25399.50	0.292	0.00	25399.50	0.000
L5	171.187 - 164.771 (5)	TP8.05x7.7472x0.134	6866.35	25116.50	0.273	0.00	25116.50	0.000
L6	164.771 - 158.354 (6)	TP8.05x7.7472x0.134	3800.12	25116.25	0.151	0.00	25116.25	0.000
L7	158.354 - 151.937 (7)	TP8.05x7.7472x0.134	4246.15	25680.83	0.165	0.00	25680.83	0.000
L8	151.937 - 145.521 (8)	TP8.05x7.7472x0.134	2398.98	25116.25	0.096	0.00	25116.25	0.000
L9	145.521 - 139.104 (9)	TP8.05x7.7472x0.134	642.61	25116.25	0.026	0.00	25116.25	0.000
L10	139.104 - 132.687 (10)	TP8.05x7.7472x0.134	1960.89	26539.33	0.074	0.00	26539.33	0.000
L11	132.687 - 126.271 (11)	TP8.05x7.7472x0.134	5465.96	26539.33	0.206	0.00	26539.33	0.000
L12	126.271 - 119.854 (12)	TP8.05x7.7472x0.134	6369.46	25397.75	0.251	0.00	25397.75	0.000
L13	119.854 - 113.437 (13)	TP8.05x7.7472x0.134	4555.69	25116.25	0.181	0.00	25116.25	0.000
L14	113.437 - 107.021 (14)	TP8.05x7.7472x0.134	3086.56	25116.25	0.123	0.00	25116.25	0.000
L15	107.021 - 100.604 (15)	TP8.05x7.7472x0.134	3021.37	26539.33	0.114	0.00	26539.33	0.000
L16	100.604 - 98.4375 (16)	TP10.04x7.7472x0.109	3150.65	22918.42	0.137	0.00	22918.42	0.000
L17	98.4375 - 93.3959 (17)	TP10.04x9.0259x0.134	5182.04	39206.83	0.132	0.00	39206.83	0.000
L18	93.3959 - 87.1876 (18)	TP10.04x9.5983x0.134	4097.53	37687.50	0.109	0.00	37687.50	0.000
L19	87.1876 - 80.9793 (19)	TP10.04x9.7085x0.134	1293.34	38384.75	0.034	0.00	38384.75	0.000
L20	80.9793 - 74.771 (20)	TP10.04x9.7244x0.134	445.09	40175.08	0.011	0.00	40175.08	0.000
L21	74.771 - 68.5627 (21)	TP10.04x9.7267x0.134	2271.76	40177.58	0.057	0.00	40177.58	0.000
L22	68.5627 - 62.3544 (22)	TP10.04x9.727x0.134	4522.28	39839.92	0.114	0.00	39839.92	0.000
L23	62.3544 - 56.1461 (23)	TP10.04x9.727x0.134	2963.18	38502.33	0.077	0.00	38502.33	0.000
L24	56.1461 - 49.9378 (24)	TP10.04x9.727x0.134	3670.94	40178.00	0.091	0.00	40178.00	0.000
L25	49.9378 - 43.7295 (25)	TP10.04x9.727x0.134	4331.52	39503.50	0.110	0.00	39503.50	0.000
L26	43.7295 - 37.5212 (26)	TP10.04x9.727x0.134	4242.61	38502.42	0.110	0.00	38502.42	0.000
L27	37.5212 - 31.3129 (27)	TP10.04x9.727x0.134	2687.67	38502.42	0.070	0.00	38502.42	0.000
L28	31.3129 - 25.1046 (28)	TP10.04x9.727x0.134	4319.43	40178.00	0.108	0.00	40178.00	0.000
L29	25.1046 - 18.8963 (29)	TP10.04x9.727x0.134	6604.98	40178.00	0.164	0.00	40178.00	0.000
L30	18.8963 - 12.688 (30)	TP10.04x9.727x0.134	7035.27	39168.42	0.180	0.00	39168.42	0.000
L31	12.688 - 6.47966 (31)	TP10.04x9.727x0.134	6845.15	38502.42	0.178	0.00	38502.42	0.000
L32	6.47966 - 0 (32)	TP10.04x9.727x0.134	4996.28	38490.33	0.130	0.00	38490.33	0.000

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 66 of 71
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P.O. Box 989, Winter Park, CO 80482-0989, Phone: (719) 640-2408, FAX:	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	197.688 - 190.438 (1)	TP8.05x8x0.134	431.91	40459.60	0.011	314.51	28137.83	0.011
L2	190.438 - 184.021 (2)	TP8.05x7.7763x0.134	934.98	40112.40	0.023	0.73	27955.17	0.000
L3	184.021 - 177.604 (3)	TP8.05x7.7505x0.134	232.40	40077.00	0.006	213.42	27934.25	0.008
L4	177.604 - 171.187 (4)	TP8.05x7.7476x0.134	81.00	39358.20	0.002	213.45	26626.75	0.008
L5	171.187 - 164.771 (5)	TP8.05x7.7472x0.134	341.61	39356.90	0.009	199.07	26303.33	0.008
L6	164.771 - 158.354 (6)	TP8.05x7.7472x0.134	810.41	39356.80	0.021	199.16	26303.08	0.008
L7	158.354 - 151.937 (7)	TP8.05x7.7472x0.134	505.60	39595.30	0.013	84.83	26948.58	0.003
L8	151.937 - 145.521 (8)	TP8.05x7.7472x0.134	380.76	39118.20	0.010	84.85	26303.08	0.003
L9	145.521 - 139.104 (9)	TP8.05x7.7472x0.134	162.83	39118.20	0.004	84.86	26303.08	0.003
L10	139.104 - 132.687 (10)	TP8.05x7.7472x0.134	390.10	40310.90	0.010	80.03	27931.50	0.003
L11	132.687 - 126.271 (11)	TP8.05x7.7472x0.134	726.91	40310.90	0.018	97.94	27931.50	0.004
L12	126.271 - 119.854 (12)	TP8.05x7.7472x0.134	391.87	39595.30	0.010	94.72	26624.83	0.004
L13	119.854 - 113.437 (13)	TP8.05x7.7472x0.134	301.96	39356.70	0.008	94.64	26303.08	0.004
L14	113.437 - 107.021 (14)	TP8.05x7.7472x0.134	159.70	39356.70	0.004	94.60	26303.08	0.004
L15	107.021 - 100.604 (15)	TP8.05x7.7472x0.134	149.24	40072.40	0.004	94.57	27931.50	0.003
L16	100.604 - 98.4375 (16)	TP10.04x7.7472x0.109	204.53	34429.10	0.006	94.56	23928.67	0.004
L17	98.4375 - 93.3959 (17)	TP10.04x9.0259x0.134	526.71	48642.40	0.011	94.55	42593.67	0.002
L18	93.3959 - 87.1876 (18)	TP10.04x9.5983x0.134	565.72	48733.00	0.012	92.32	40822.17	0.002
L19	87.1876 - 80.9793 (19)	TP10.04x9.7085x0.134	333.93	49215.70	0.007	92.31	41634.75	0.002
L20	80.9793 - 74.771 (20)	TP10.04x9.7244x0.134	171.86	50435.50	0.003	127.52	43724.17	0.003
L21	74.771 - 68.5627 (21)	TP10.04x9.7267x0.134	413.95	50437.20	0.008	127.51	43727.08	0.003
L22	68.5627 - 62.3544 (22)	TP10.04x9.727x0.134	790.13	50209.20	0.016	127.41	43332.75	0.003
L23	62.3544 - 56.1461 (23)	TP10.04x9.727x0.134	718.79	49296.70	0.015	127.41	41771.83	0.003
L24	56.1461 - 49.9378 (24)	TP10.04x9.727x0.134	314.88	50209.30	0.006	90.77	43727.58	0.002
L25	49.9378 - 43.7295 (25)	TP10.04x9.727x0.134	42.48	49981.20	0.001	96.40	42939.92	0.002
L26	43.7295 - 37.5212 (26)	TP10.04x9.727x0.134	146.26	49296.70	0.003	96.39	41771.92	0.002
L27	37.5212 - 31.3129 (27)	TP10.04x9.727x0.134	432.60	49296.70	0.009	96.39	41771.92	0.002
L28	31.3129 - 25.1046 (28)	TP10.04x9.727x0.134	556.44	50209.30	0.011	95.64	43727.58	0.002

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
L29	25.1046 - 18.8963 (29)	TP10.04x9.727x0.134	255.62	50209.30	0.005	95.63	43727.58	0.002
L30	18.8963 - 12.688 (30)	TP10.04x9.727x0.134	102.18	49524.90	0.002	95.63	42548.83	0.002
L31	12.688 - 6.47966 (31)	TP10.04x9.727x0.134	186.37	49296.70	0.004	95.63	41771.92	0.002
L32	6.47966 - 0 (32)	TP10.04x9.727x0.134	481.30	49518.20	0.010	95.63	41757.83	0.002

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	197.688 - 190.438 (1)	0.001	0.060	0.000	0.011	0.011	0.062 ✓	1.000	✓
L2	190.438 - 184.021 (2)	0.058	0.126	0.000	0.023	0.000	0.185 ✓	1.000	✓
L3	184.021 - 177.604 (3)	0.062	0.270	0.000	0.006	0.008	0.332 ✓	1.000	✓
L4	177.604 - 171.187 (4)	0.064	0.292	0.000	0.002	0.008	0.357 ✓	1.000	✓
L5	171.187 - 164.771 (5)	0.065	0.273	0.000	0.009	0.008	0.339 ✓	1.000	✓
L6	164.771 - 158.354 (6)	0.066	0.151	0.000	0.021	0.008	0.218 ✓	1.000	✓
L7	158.354 - 151.937 (7)	0.114	0.165	0.000	0.013	0.003	0.279 ✓	1.000	✓
L8	151.937 - 145.521 (8)	0.116	0.096	0.000	0.010	0.003	0.211 ✓	1.000	✓
L9	145.521 - 139.104 (9)	0.116	0.026	0.000	0.004	0.003	0.142 ✓	1.000	✓
L10	139.104 - 132.687 (10)	0.116	0.074	0.000	0.010	0.003	0.190 ✓	1.000	✓
L11	132.687 - 126.271 (11)	0.116	0.206	0.000	0.018	0.004	0.323 ✓	1.000	✓
L12	126.271 - 119.854 (12)	0.153	0.251	0.000	0.010	0.004	0.404 ✓	1.000	✓
L13	119.854 - 113.437 (13)	0.155	0.181	0.000	0.008	0.004	0.336 ✓	1.000	✓
L14	113.437 - 107.021 (14)	0.156	0.123	0.000	0.004	0.004	0.279 ✓	1.000	✓
L15	107.021 - 100.604 (15)	0.152	0.114	0.000	0.004	0.003	0.266 ✓	1.000	✓
L16	100.604 - 98.4375 (16)	0.181	0.137	0.000	0.006	0.004	0.318 ✓	1.000	✓
L17	98.4375 - 93.3959 (17)	0.124	0.132	0.000	0.011	0.002	0.257 ✓	1.000	✓
L18	93.3959 - 87.1876 (18)	0.147	0.109	0.000	0.012	0.002	0.256	1.000	✓

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L19	87.1876 - 80.9793 (19)	0.147	0.034	0.000	0.007	0.002	0.180 ✔	1.000	✔
L20	80.9793 - 74.771 (20)	0.144	0.011	0.000	0.003	0.003	0.155 ✔	1.000	✔
L21	74.771 - 68.5627 (21)	0.144	0.057	0.000	0.008	0.003	0.201 ✔	1.000	✔
L22	68.5627 - 62.3544 (22)	0.158	0.114	0.000	0.016	0.003	0.272 ✔	1.000	✔
L23	62.3544 - 56.1461 (23)	0.161	0.077	0.000	0.015	0.003	0.239 ✔	1.000	✔
L24	56.1461 - 49.9378 (24)	0.161	0.091	0.000	0.006	0.002	0.252 ✔	1.000	✔
L25	49.9378 - 43.7295 (25)	0.162	0.110	0.000	0.001	0.002	0.272 ✔	1.000	✔
L26	43.7295 - 37.5212 (26)	0.165	0.110	0.000	0.003	0.002	0.275 ✔	1.000	✔
L27	37.5212 - 31.3129 (27)	0.166	0.070	0.000	0.009	0.002	0.236 ✔	1.000	✔
L28	31.3129 - 25.1046 (28)	0.170	0.108	0.000	0.011	0.002	0.277 ✔	1.000	✔
L29	25.1046 - 18.8963 (29)	0.170	0.164	0.000	0.005	0.002	0.335 ✔	1.000	✔
L30	18.8963 - 12.688 (30)	0.173	0.180	0.000	0.002	0.002	0.353 ✔	1.000	✔
L31	12.688 - 6.47966 (31)	0.175	0.178	0.000	0.004	0.002	0.353 ✔	1.000	✔
L32	6.47966 - 0 (32)	0.176	0.130	0.000	0.010	0.002	0.306 ✔	1.000	✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$\emptyset P_{allow}$ lb	% Capacity	Pass Fail
L1	197.688 - 190.438	Pole	TP8.05x8x0.134	1	-99.47	134865.00	6.2	Pass
L2	190.438 - 184.021	Pole	TP8.05x7.7763x0.134	2	-7819.06	134427.00	18.5	Pass
		Guy A@189.321	NRG Guy 5/16 13MM	36	4661.95	5880.00	79.3	Pass
		Guy B@189.321	NRG Guy 5/16 13MM	35	5064.07	5880.00	86.1	Pass
		Guy C@189.321	NRG Guy 5/16 13MM	34	4663.94	5880.00	79.3	Pass
		Guy D@189.321	NRG Guy 5/16 13MM	33	5064.44	5880.00	86.1	Pass
L3	184.021 - 177.604	Pole	TP8.05x7.7505x0.134	3	-8368.19	134376.00	33.2	Pass
L4	177.604 - 171.187	Pole	TP8.05x7.7476x0.134	4	-8414.02	131194.00	35.7	Pass
L5	171.187 - 164.771	Pole	TP8.05x7.7472x0.134	5	-8522.15	130395.00	33.9	Pass
L6	164.771 -	Pole	TP8.05x7.7472x0.134	6	-8628.17	130394.00	21.8	Pass

tnxTower	Job: NRG 60m Super NRG Tall Tower	Page: 69 of 71
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	Client: Longroad Energy	Designed by: Mikko Ahola, PE

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$øP_{allow}$ lb	% Capacity	Pass Fail
	158.354							
L7	158.354 - 151.937	Pole	TP8.05x7.7472x0.134	7	-15025.40	131984.00	27.9	Pass
		Guy A@156.121	NRG Guy 5/16 13MM	40	4057.42	5880.00	69.0	Pass
		Guy B@156.121	NRG Guy 5/16 13MM	39	4361.66	5880.00	74.2	Pass
		Guy C@156.121	NRG Guy 5/16 13MM	38	4055.13	5880.00	69.0	Pass
		Guy D@156.121	NRG Guy 5/16 13MM	37	4361.41	5880.00	74.2	Pass
L8	151.937 - 145.521	Pole	TP8.05x7.7472x0.134	8	-15091.00	130394.00	21.1	Pass
L9	145.521 - 139.104	Pole	TP8.05x7.7472x0.134	9	-15187.00	130394.00	14.2	Pass
L10	139.104 - 132.687	Pole	TP8.05x7.7472x0.134	10	-15523.80	134370.00	19.0	Pass
L11	132.687 - 126.271	Pole	TP8.05x7.7472x0.134	11	-15637.60	134370.00	32.3	Pass
L12	126.271 - 119.854	Pole	TP8.05x7.7472x0.134	12	-20106.70	131189.00	40.4	Pass
		Guy A@125.154	NRG Guy 5/16 13MM	44	2744.11	5880.00	46.7	Pass
		Guy B@125.154	NRG Guy 5/16 13MM	43	2937.87	5880.00	50.0	Pass
		Guy C@125.154	NRG Guy 5/16 13MM	42	2744.05	5880.00	46.7	Pass
		Guy D@125.154	NRG Guy 5/16 13MM	41	2937.74	5880.00	50.0	Pass
L13	119.854 - 113.437	Pole	TP8.05x7.7472x0.134	13	-20188.90	130394.00	33.6	Pass
L14	113.437 - 107.021	Pole	TP8.05x7.7472x0.134	14	-20288.10	130394.00	27.9	Pass
L15	107.021 - 100.604	Pole	TP8.05x7.7472x0.134	15	-20459.90	134370.00	26.6	Pass
L16	100.604 - 98.4375	Pole	TP10.04x7.7472x0.109	16	-20488.80	113431.00	31.8	Pass
L17	98.4375 - 93.3959	Pole	TP10.04x9.0259x0.134	17	-20614.50	165931.00	25.7	Pass
		Guy A@94.4376	NRG Guy 5/16 13MM	48	2205.98	5880.00	37.5	Pass
		Guy B@94.4376	NRG Guy 5/16 13MM	47	2302.03	5880.00	39.2	Pass
		Guy C@94.4376	NRG Guy 5/16 13MM	46	2206.74	5880.00	37.5	Pass
		Guy D@94.4376	NRG Guy 5/16 13MM	45	2302.06	5880.00	39.2	Pass
L18	93.3959 - 87.1876	Pole	TP10.04x9.5983x0.134	18	-23925.90	162443.00	25.6	Pass
L19	87.1876 - 80.9793	Pole	TP10.04x9.7085x0.134	19	-24052.80	164052.00	18.0	Pass
L20	80.9793 - 74.771	Pole	TP10.04x9.7244x0.134	20	-24103.50	167880.00	15.5	Pass
L21	74.771 - 68.5627	Pole	TP10.04x9.7267x0.134	21	-24231.90	167883.00	20.1	Pass
L22	68.5627 - 62.3544	Pole	TP10.04x9.727x0.134	22	-26459.20	167364.00	27.2	Pass
		Guy A@64.4294	NRG Guy 5/16 13MM	52	2022.88	5880.00	34.4	Pass
		Guy B@64.4294	NRG Guy 5/16 13MM	51	2024.51	5880.00	34.4	Pass
		Guy C@64.4294	NRG Guy 5/16 13MM	50	2022.78	5880.00	34.4	Pass
		Guy D@64.4294	NRG Guy 5/16 13MM	49	2024.53	5880.00	34.4	Pass
L23	62.3544 - 56.1461	Pole	TP10.04x9.727x0.134	23	-26513.80	164322.00	23.9	Pass
L24	56.1461 - 49.9378	Pole	TP10.04x9.727x0.134	24	-26950.00	167884.00	25.2	Pass
L25	49.9378 - 43.7295	Pole	TP10.04x9.727x0.134	25	-27057.30	166604.00	27.2	Pass
L26	43.7295 - 37.5212	Pole	TP10.04x9.727x0.134	26	-27130.60	164322.00	27.5	Pass
L27	37.5212 - 31.3129	Pole	TP10.04x9.727x0.134	27	-27257.70	164322.00	23.6	Pass
		Guy A@32.3546	NRG Guy 5/16 13MM	56	1735.48	5880.00	29.5	Pass
		Guy B@32.3546	NRG Guy 5/16 13MM	55	1719.95	5880.00	29.3	Pass
		Guy C@32.3546	NRG Guy 5/16 13MM	54	1733.35	5880.00	29.5	Pass
		Guy D@32.3546	NRG Guy 5/16 13MM	53	1719.94	5880.00	29.3	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L28	31.3129 - 25.1046	Pole	TP10.04x9.727x0.134	28	-28489.50	167884.00	27.7	Pass
L29	25.1046 - 18.8963	Pole	TP10.04x9.727x0.134	29	-28617.80	167884.00	33.5	Pass
L30	18.8963 - 12.688	Pole	TP10.04x9.727x0.134	30	-28690.30	165843.00	35.3	Pass
L31	12.688 - 6.47966	Pole	TP10.04x9.727x0.134	31	-28789.60	164322.00	35.3	Pass
L32	6.47966 - 0	Pole	TP10.04x9.727x0.134	32	-28914.60	164295.00	30.6	Pass
							Summary	
						Pole (L12)	40.4	Pass
						Guy A (L2)	79.3	Pass
						Guy B (L2)	86.1	Pass
						Guy C (L2)	79.3	Pass
						Guy D (L2)	86.1	Pass
						RATING =	**86.1**	**Pass**

Element Map

Section No.	Section Elevation ft	Component Type	Element List
L1	197.688-190.438	Pole	1
L2	190.438-184.021	Pole	2
		Guy A	36
		Guy B	35
		Guy C	34
		Guy D	33
L3	184.021-177.604	Pole	3
L4	177.604-171.187	Pole	4
L5	171.187-164.771	Pole	5
L6	164.771-158.354	Pole	6
L7	158.354-151.937	Pole	7
		Guy A	40
		Guy B	39
		Guy C	38
		Guy D	37
L8	151.937-145.521	Pole	8
L9	145.521-139.104	Pole	9
L10	139.104-132.687	Pole	10
L11	132.687-126.271	Pole	11
L12	126.271-119.854	Pole	12
		Guy A	44
		Guy B	43
		Guy C	42
		Guy D	41
L13	119.854-113.43	Pole	13

Section No.	*Section Elevation ft*	*Component Type*	*Element List*
	7		
L14	113.437-107.021	Pole	14
L15	107.021-100.604	Pole	15
L16	100.604-98.437	Pole	16
L17	98.437-93.396	Pole	17
		Guy A	48
		Guy B	47
		Guy C	46
		Guy D	45
L18	93.396-87.188	Pole	18
L19	87.188-80.979	Pole	19
L20	80.979-74.771	Pole	20
L21	74.771-68.563	Pole	21
L22	68.563-62.354	Pole	22
		Guy A	52
		Guy B	51
		Guy C	50
		Guy D	49
L23	62.354-56.146	Pole	23
L24	56.146-49.938	Pole	24
L25	49.938-43.729	Pole	25
L26	43.729-37.521	Pole	26
L27	37.521-31.313	Pole	27
		Guy A	56
		Guy B	55
		Guy C	54
		Guy D	53
L28	31.313-25.105	Pole	28
L29	25.105-18.896	Pole	29
L30	18.896-12.688	Pole	30
L31	12.688-6.480	Pole	31
L32	6.480-0.000	Pole	32
			Total number of elements: 56

BU:	LMS 105 thru 110	Structure:	D
WO:	anuska Susitna Borough		
Order:	Longroad Energy	Rev:	H

Location

	Decimal Degrees		Deg	Min	Sec
Lat:	61.473061	+	61	28	23.02
Long:	-150.988808	-	150	59	19.71

Code and Site Parameters

Seismic Design Code:	TIA-222-H	
Site Soil:	D (Default)	Default
Risk Category:	II	

USGS Seismic Reference

S_S:	1.6180	g
S_1:	0.7570	g
T_L:	16	s

Seismic Design Category Determination

Importance Factor, I_e:	1	
Acceleration-based site coefficient, F_a:	1.2000	
Velocity-based site coefficient, F_v:	1.7000	
Design spectral response acceleration short period, S_{DS}:	1.2944	g
Design spectral response acceleration 1 s period, S_{D1}:	0.8579	g
Seismic Design Category Based on S_{DS}:	D	
Seismic Design Category Based on S_{D1}:	D	
Seismic Design Category Based on S_1:	E	
Controlling Seismic Design Category:	E	

CROWN CASTLE

BU:	LMS 105 thru 110	Structure:	D
WO:	atanuska Susitna Borough		
Order:	Longroad Energy	Rev:	H

Tower Details

Tower Type:	Tapered Monopole		
Height, h:	198	ft	
Effective Seismic Weight, W:	3.22	kips	
Amplification Factor, A_s:	1.0		2.7.8.1

Seismic Base Shear

Response Modification Factor, R:	1.5		
Discrete Appurtenance Weight in Top 1/3 of Structure, W_u:	0.14455	kips	
W_L:	3.078835518	kips	
E:	29000.0	ksi	
g:	386.088	in/s^2	
Average Moment of Inertia, I_{avg}:	36.87798227	in^4	
F_a:	0.051819005	hz	
Approximate Fundamental Period Monopole, T_a:	19.2979	s	2.7.7.1.3.3
Seismic Response Coefficient, C_s	0.8629		2.7.7.1.1
Seismic Response Coefficient Max 1, C_{smax}	N/A		2.7.7.1.1
Seismic Response Coefficient Max 2, C_{smax}	0.024573126		2.7.7.1.1
Seismic Response Coefficient Min 1, C_{smin}	0.0570		2.7.7.1.1
Seismic Response Coefficient Min 2, C_{smin}	0.4037		2.7.7.1.1
Controlling Seismic Response Coefficient, C_{sc}	0.4037		
Seismic Base Shear, V	1.301	kips	2.7.7.1.1

Vertical Distribution Factors

Period Related Exponent, k:	2.000	2.7.7.1.2
Sum of $w_i h_i^k$	40253.99	2.7.7.1.2

Tower Section Loads								
Section Number	Length	Top Height	Mid Height, h_x	Section Weight, w_x	$w_x h_x^k$	C_{vx}	F_{xh}	F_{xv}
1 - 1	7.25	197.69	194.06	0.0841	3168.84	0.0787	0.1024	0.0218
2 - 1	7.25	191.27	187.65	0.0817	2878.48	0.0715	0.0931	0.0212
3 - 1	7.25	184.85	181.23	0.0815	2675.94	0.0665	0.0865	0.0211
4 - 1	7.25	178.44	174.81	0.0814	2488.84	0.0618	0.0805	0.0211
5 - 1	7.25	172.02	168.40	0.0814	2309.38	0.0574	0.0747	0.0211
6 - 1	7.25	165.60	161.98	0.0814	2136.73	0.0531	0.0691	0.0211
7 - 1	7.25	159.19	155.56	0.0814	1970.79	0.0490	0.0637	0.0211
8 - 1	7.25	152.77	149.15	0.0814	1811.56	0.0450	0.0586	0.0211
9 - 1	7.25	146.35	142.73	0.0814	1659.04	0.0412	0.0536	0.0211
10 - 1	7.25	139.94	136.31	0.0814	1513.22	0.0376	0.0489	0.0211
11 - 1	7.25	133.52	129.90	0.0814	1374.11	0.0341	0.0444	0.0211
12 - 1	7.25	127.10	123.48	0.0814	1241.70	0.0308	0.0401	0.0211
13 - 1	7.25	120.69	117.06	0.0814	1116.00	0.0277	0.0361	0.0211
14 - 1	7.25	114.27	110.65	0.0814	997.01	0.0248	0.0322	0.0211
15 - 1	7.25	107.85	104.23	0.0814	884.73	0.0220	0.0286	0.0211
16 - 1	3.00	101.44	99.94	0.0275	274.67	0.0068	0.0089	0.0071
17 - 1	6.08	99.48	96.44	0.0798	742.25	0.0184	0.0240	0.0207
18 - 1	7.25	94.44	90.81	0.1012	834.92	0.0207	0.0270	0.0262
19 - 1	7.25	88.23	84.60	0.1024	733.10	0.0182	0.0237	0.0265
20 - 1	7.25	82.02	78.40	0.1026	630.50	0.0157	0.0204	0.0266
21 - 1	7.25	75.81	72.19	0.1026	534.72	0.0133	0.0173	0.0266
22 - 1	7.25	69.60	65.98	0.1026	446.72	0.0111	0.0144	0.0266
23 - 1	7.25	63.40	59.77	0.1026	366.61	0.0091	0.0119	0.0266
24 - 1	7.25	57.19	53.56	0.1026	294.41	0.0073	0.0095	0.0266
25 - 1	7.25	50.98	47.35	0.1026	230.11	0.0057	0.0074	0.0266
26 - 1	7.25	44.77	41.15	0.1026	173.73	0.0043	0.0056	0.0266
27 - 1	7.25	38.56	34.94	0.1026	125.26	0.0031	0.0040	0.0266
28 - 1	7.25	32.35	28.73	0.1026	84.70	0.0021	0.0027	0.0266
29 - 1	7.25	26.15	22.52	0.1026	52.05	0.0013	0.0017	0.0266
30 - 1	7.25	19.94	16.31	0.1026	27.31	0.0007	0.0009	0.0266
31 - 1	7.25	13.73	10.10	0.1026	10.48	0.0003	0.0003	0.0266
32 - 1	7.52	7.52	3.76	0.1065	1.51	0.0000	0.0000	0.0276
			Sum	2.8734	33789.42			

Discrete Loads						
Name	h_x	w_x	$w_x h_x^k$	C_{vx}	F_{xh}	F_{xv}
Properllor Anemometer/Wind Vane	198.49	0.0022	86.68	0.0022	0.0028	0.0006
95" Boom Mount	196.19	0.0080	307.94	0.0076	0.0100	0.0021
NRG #40C Anemometer	192.91	0.0002	7.44	0.0002	0.0002	0.0001
95" Boom Mount	190.91	0.0080	291.58	0.0072	0.0094	0.0021
NRG #40C Anemometer	192.91	0.0002	7.44	0.0002	0.0002	0.0001
95" Boom Mount	190.91	0.0080	291.58	0.0072	0.0094	0.0021
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
NRG 200P Wind Vane	167.32	0.0003	7.00	0.0002	0.0002	0.0001
95" Boom Mount	165.32	0.0080	218.65	0.0054	0.0071	0.0021
NRG #40C Anemometer	167.32	0.0002	5.60	0.0001	0.0002	0.0001
95" Boom Mount	165.32	0.0080	218.65	0.0054	0.0071	0.0021
Temperature Probe w/ Shield	173.89	0.0050	151.18	0.0038	0.0049	0.0013
Relative Humidty Sensor	173.89	0.0100	302.36	0.0075	0.0098	0.0026
Barometric Pressure	173.89	0.0100	302.36	0.0075	0.0098	0.0026
NRG 200P Wind Vane	160.76	0.0003	6.46	0.0002	0.0002	0.0001
95" Boom Mount	158.76	0.0080	201.64	0.0050	0.0065	0.0021
NRG 200P Wind Vane	137.80	0.0003	4.75	0.0001	0.0002	0.0001
95" Boom Mount	135.80	0.0080	147.52	0.0037	0.0048	0.0021
NRG #40C Anemometer	131.23	0.0002	3.44	0.0001	0.0001	0.0001
95" Boom Mount	129.23	0.0080	133.61	0.0033	0.0043	0.0021
NRG #40C Anemometer	131.23	0.0002	3.44	0.0001	0.0001	0.0001
95" Boom Mount	129.23	0.0080	133.61	0.0033	0.0043	0.0021
NRG #40C Anemometer	98.43	0.0002	1.94	0.0000	0.0001	0.0001
95" Boom Mount	96.43	0.0080	74.38	0.0018	0.0024	0.0021
NRG #40C Anemometer	98.43	0.0002	1.94	0.0000	0.0001	0.0001
95" Boom Mount	96.43	0.0080	74.38	0.0018	0.0024	0.0021
Temperature Probe w/ Shield	49.20	0.0050	12.10	0.0003	0.0004	0.0013
Data Logger	5.00	0.0500	1.25	0.0000	0.0000	0.0129
	Sum	0.2324	4959.61			

Linear Loads								
Name	Start Height	End Height	h_x	w_x	$w_xh_x^k$	C_{vx}	F_{xh}	F_{xv}
(12) miscl Cat5 From 0 to 196	188.00	196.00	192.00	0.0048	176.95	0.0044	0.0057	0.0012
(12) miscl Cat5 From 0 to 196	178.00	188.00	183.00	0.0060	200.93	0.0050	0.0065	0.0016
(12) miscl Cat5 From 0 to 196	168.00	178.00	173.00	0.0060	179.57	0.0045	0.0058	0.0016
(12) miscl Cat5 From 0 to 196	158.00	168.00	163.00	0.0060	159.41	0.0040	0.0052	0.0016
(12) miscl Cat5 From 0 to 196	148.00	158.00	153.00	0.0060	140.45	0.0035	0.0045	0.0016
(12) miscl Cat5 From 0 to 196	138.00	148.00	143.00	0.0060	122.69	0.0030	0.0040	0.0016
(12) miscl Cat5 From 0 to 196	128.00	138.00	133.00	0.0060	106.13	0.0026	0.0034	0.0016
(12) miscl Cat5 From 0 to 196	118.00	128.00	123.00	0.0060	90.77	0.0023	0.0029	0.0016
(12) miscl Cat5 From 0 to 196	108.00	118.00	113.00	0.0060	76.61	0.0019	0.0025	0.0016
(12) miscl Cat5 From 0 to 196	98.00	108.00	103.00	0.0060	63.65	0.0016	0.0021	0.0016
(12) miscl Cat5 From 0 to 196	88.00	98.00	93.00	0.0060	51.89	0.0013	0.0017	0.0016
(12) miscl Cat5 From 0 to 196	78.00	88.00	83.00	0.0060	41.33	0.0010	0.0013	0.0016
(12) miscl Cat5 From 0 to 196	68.00	78.00	73.00	0.0060	31.97	0.0008	0.0010	0.0016
(12) miscl Cat5 From 0 to 196	58.00	68.00	63.00	0.0060	23.81	0.0006	0.0008	0.0016
(12) miscl Cat5 From 0 to 196	48.00	58.00	53.00	0.0060	16.85	0.0004	0.0005	0.0016
(12) miscl Cat5 From 0 to 196	38.00	48.00	43.00	0.0060	11.09	0.0003	0.0004	0.0016
(12) miscl Cat5 From 0 to 196	28.00	38.00	33.00	0.0060	6.53	0.0002	0.0002	0.0016
(12) miscl Cat5 From 0 to 196	18.00	28.00	23.00	0.0060	3.17	0.0001	0.0001	0.0016
(12) miscl Cat5 From 0 to 196	8.00	18.00	13.00	0.0060	1.01	0.0000	0.0000	0.0016
(12) miscl Cat5 From 0 to 196	0.00	8.00	4.00	0.0048	0.08	0.0000	0.0000	0.0012
			Sum	0.1176	1504.96			

BU:	LMS 105 thru 110	Structure:	D
WO:	atanuska Susitna Borough		
Order:	Longroad Energy	Rev:	H

Tower Details

Tower Type:	Tapered Monopole		
Height, h:	198	ft	
Effective Seismic Weight, W:	3.22	kips	
Amplification Factor, A_s:	1.0		2.7.8.1

Seismic Base Shear

Response Modification Factor, R:	1.5		
Discrete Appurtenance Weight in Top 1/3 of Structure, W_u:	0.14455	kips	
W_L:	3.078835518	kips	
E:	29000.0	ksi	
g:	386.088	in/s^2	
Average Moment of Inertia, I_{avg}:	36.87798227	in^4	
F_a:	0.051819005	hz	
Approximate Fundamental Period Monopole, T_a:	19.2979	s	2.7.7.1.3.3
Seismic Response Coefficient, C_s	0.8629		2.7.7.1.1
Seismic Response Coefficient Max 1, C_{smax}	N/A		2.7.7.1.1
Seismic Response Coefficient Max 2, C_{smax}	0.024573126		2.7.7.1.1
Seismic Response Coefficient Min 1, C_{smin}	0.0570		2.7.7.1.1
Seismic Response Coefficient Min 2, C_{smin}	0.4037		2.7.7.1.1
Controlling Seismic Response Coefficient, C_{sc}	0.4037		
Seismic Base Shear, V	1.301	kips	2.7.7.1.1

Vertical Distribution Factors

Period Related Exponent, k:	2.000	2.7.7.1.2
Sum of $w_i h_i^k$	40253.99	2.7.7.1.2

Tower Section Loads								
Section Number	Length	Top Height	Mid Height, h_x	Section Weight, w_x	$w_x h_x^k$	C_{vx}	F_{xh}	F_{xv}
1 - 1	7.25	197.69	194.06	0.0841	3168.84	0.0787	0.1024	0.0218
2 - 1	7.25	191.27	187.65	0.0817	2878.48	0.0715	0.0931	0.0212
3 - 1	7.25	184.85	181.23	0.0815	2675.94	0.0665	0.0865	0.0211
4 - 1	7.25	178.44	174.81	0.0814	2488.84	0.0618	0.0805	0.0211
5 - 1	7.25	172.02	168.40	0.0814	2309.38	0.0574	0.0747	0.0211
6 - 1	7.25	165.60	161.98	0.0814	2136.73	0.0531	0.0691	0.0211
7 - 1	7.25	159.19	155.56	0.0814	1970.79	0.0490	0.0637	0.0211
8 - 1	7.25	152.77	149.15	0.0814	1811.56	0.0450	0.0586	0.0211
9 - 1	7.25	146.35	142.73	0.0814	1659.04	0.0412	0.0536	0.0211
10 - 1	7.25	139.94	136.31	0.0814	1513.22	0.0376	0.0489	0.0211
11 - 1	7.25	133.52	129.90	0.0814	1374.11	0.0341	0.0444	0.0211
12 - 1	7.25	127.10	123.48	0.0814	1241.70	0.0308	0.0401	0.0211
13 - 1	7.25	120.69	117.06	0.0814	1116.00	0.0277	0.0361	0.0211
14 - 1	7.25	114.27	110.65	0.0814	997.01	0.0248	0.0322	0.0211
15 - 1	7.25	107.85	104.23	0.0814	884.73	0.0220	0.0286	0.0211
16 - 1	3.00	101.44	99.94	0.0275	274.67	0.0068	0.0089	0.0071
17 - 1	6.08	99.48	96.44	0.0798	742.25	0.0184	0.0240	0.0207
18 - 1	7.25	94.44	90.81	0.1012	834.92	0.0207	0.0270	0.0262
19 - 1	7.25	88.23	84.60	0.1024	733.10	0.0182	0.0237	0.0265
20 - 1	7.25	82.02	78.40	0.1026	630.50	0.0157	0.0204	0.0266
21 - 1	7.25	75.81	72.19	0.1026	534.72	0.0133	0.0173	0.0266
22 - 1	7.25	69.60	65.98	0.1026	446.72	0.0111	0.0144	0.0266
23 - 1	7.25	63.40	59.77	0.1026	366.61	0.0091	0.0119	0.0266
24 - 1	7.25	57.19	53.56	0.1026	294.41	0.0073	0.0095	0.0266
25 - 1	7.25	50.98	47.35	0.1026	230.11	0.0057	0.0074	0.0266
26 - 1	7.25	44.77	41.15	0.1026	173.73	0.0043	0.0056	0.0266
27 - 1	7.25	38.56	34.94	0.1026	125.26	0.0031	0.0040	0.0266
28 - 1	7.25	32.35	28.73	0.1026	84.70	0.0021	0.0027	0.0266
29 - 1	7.25	26.15	22.52	0.1026	52.05	0.0013	0.0017	0.0266
30 - 1	7.25	19.94	16.31	0.1026	27.31	0.0007	0.0009	0.0266
31 - 1	7.25	13.73	10.10	0.1026	10.48	0.0003	0.0003	0.0266
32 - 1	7.52	7.52	3.76	0.1065	1.51	0.0000	0.0000	0.0276
			Sum	2.8734	33789.42			

Discrete Loads						
Name	h_x	w_x	$w_x h_x^k$	C_{vx}	F_{xh}	F_{xv}
Properllor Anemometer/Wind Vane	198.49	0.0022	86.68	0.0022	0.0028	0.0006
95" Boom Mount	196.19	0.0080	307.94	0.0076	0.0100	0.0021
NRG #40C Anemometer	192.91	0.0002	7.44	0.0002	0.0002	0.0001
95" Boom Mount	190.91	0.0080	291.58	0.0072	0.0094	0.0021
NRG #40C Anemometer	192.91	0.0002	7.44	0.0002	0.0002	0.0001
95" Boom Mount	190.91	0.0080	291.58	0.0072	0.0094	0.0021
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
Aircraft Marker Balls (21" Dia - Orange)	180.77	0.0150	490.17	0.0122	0.0158	0.0039
NRG 200P Wind Vane	167.32	0.0003	7.00	0.0002	0.0002	0.0001
95" Boom Mount	165.32	0.0080	218.65	0.0054	0.0071	0.0021
NRG #40C Anemometer	167.32	0.0002	5.60	0.0001	0.0002	0.0001
95" Boom Mount	165.32	0.0080	218.65	0.0054	0.0071	0.0021
Temperature Probe w/ Shield	173.89	0.0050	151.18	0.0038	0.0049	0.0013
Relative Humidty Sensor	173.89	0.0100	302.36	0.0075	0.0098	0.0026
Barometric Pressure	173.89	0.0100	302.36	0.0075	0.0098	0.0026
NRG 200P Wind Vane	160.76	0.0003	6.46	0.0002	0.0002	0.0001
95" Boom Mount	158.76	0.0080	201.64	0.0050	0.0065	0.0021
NRG 200P Wind Vane	137.80	0.0003	4.75	0.0001	0.0002	0.0001
95" Boom Mount	135.80	0.0080	147.52	0.0037	0.0048	0.0021
NRG #40C Anemometer	131.23	0.0002	3.44	0.0001	0.0001	0.0001
95" Boom Mount	129.23	0.0080	133.61	0.0033	0.0043	0.0021
NRG #40C Anemometer	131.23	0.0002	3.44	0.0001	0.0001	0.0001
95" Boom Mount	129.23	0.0080	133.61	0.0033	0.0043	0.0021
NRG #40C Anemometer	98.43	0.0002	1.94	0.0000	0.0001	0.0001
95" Boom Mount	96.43	0.0080	74.38	0.0018	0.0024	0.0021
NRG #40C Anemometer	98.43	0.0002	1.94	0.0000	0.0001	0.0001
95" Boom Mount	96.43	0.0080	74.38	0.0018	0.0024	0.0021
Temperature Probe w/ Shield	49.20	0.0050	12.10	0.0003	0.0004	0.0013
Data Logger	5.00	0.0500	1.25	0.0000	0.0000	0.0129
	Sum	0.2324	4959.61			

Linear Loads								
Name	**Start Height**	**End Height**	h_x	w_x	$w_x h_x^k$	C_{vx}	F_{xh}	F_{xv}
(12) miscl Cat5 From 0 to 196	188.00	196.00	192.00	0.0048	176.95	0.0044	0.0057	0.0012
(12) miscl Cat5 From 0 to 196	178.00	188.00	183.00	0.0060	200.93	0.0050	0.0065	0.0016
(12) miscl Cat5 From 0 to 196	168.00	178.00	173.00	0.0060	179.57	0.0045	0.0058	0.0016
(12) miscl Cat5 From 0 to 196	158.00	168.00	163.00	0.0060	159.41	0.0040	0.0052	0.0016
(12) miscl Cat5 From 0 to 196	148.00	158.00	153.00	0.0060	140.45	0.0035	0.0045	0.0016
(12) miscl Cat5 From 0 to 196	138.00	148.00	143.00	0.0060	122.69	0.0030	0.0040	0.0016
(12) miscl Cat5 From 0 to 196	128.00	138.00	133.00	0.0060	106.13	0.0026	0.0034	0.0016
(12) miscl Cat5 From 0 to 196	118.00	128.00	123.00	0.0060	90.77	0.0023	0.0029	0.0016
(12) miscl Cat5 From 0 to 196	108.00	118.00	113.00	0.0060	76.61	0.0019	0.0025	0.0016
(12) miscl Cat5 From 0 to 196	98.00	108.00	103.00	0.0060	63.65	0.0016	0.0021	0.0016
(12) miscl Cat5 From 0 to 196	88.00	98.00	93.00	0.0060	51.89	0.0013	0.0017	0.0016
(12) miscl Cat5 From 0 to 196	78.00	88.00	83.00	0.0060	41.33	0.0010	0.0013	0.0016
(12) miscl Cat5 From 0 to 196	68.00	78.00	73.00	0.0060	31.97	0.0008	0.0010	0.0016
(12) miscl Cat5 From 0 to 196	58.00	68.00	63.00	0.0060	23.81	0.0006	0.0008	0.0016
(12) miscl Cat5 From 0 to 196	48.00	58.00	53.00	0.0060	16.85	0.0004	0.0005	0.0016
(12) miscl Cat5 From 0 to 196	38.00	48.00	43.00	0.0060	11.09	0.0003	0.0004	0.0016
(12) miscl Cat5 From 0 to 196	28.00	38.00	33.00	0.0060	6.53	0.0002	0.0002	0.0016
(12) miscl Cat5 From 0 to 196	18.00	28.00	23.00	0.0060	3.17	0.0001	0.0001	0.0016
(12) miscl Cat5 From 0 to 196	8.00	18.00	13.00	0.0060	1.01	0.0000	0.0000	0.0016
(12) miscl Cat5 From 0 to 196	0.00	8.00	4.00	0.0048	0.08	0.0000	0.0000	0.0012
			Sum	0.1176	1504.96			

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Elevation: 0 ft (NAVD 88)
Latitude: 61.473061
Longitude: -150.988809

Wind

Results:

Wind Speed	121 Vmph
10-year MRI	86 Vmph
25-year MRI	94 Vmph
50-year MRI	99 Vmph
100-year MRI	105 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Wed May 29 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 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.618	S_{D1} :	N/A
S_1 :	0.757	T_L :	16
F_a :	1.2	PGA :	0.661
F_v :	N/A	PGA_M :	0.794
S_{MS} :	1.941	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.294	C_v :	1.424

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed May 29 2024

Date Source: [USGS Seismic Design Maps]

AMERICAN SOCIETY OF CIVIL ENGINEERS

Ice

Results:

Ice Thickness:	0.50 in.
Concurrent Temperature:	-15 F
Gust Speed	60 mph
Data Source:	Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8
Date Accessed:	Wed May 29 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 with concurrent 3-second gust speeds, for a 500-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

APPENDIX B

EQUIPMENT DETAILS

Search

Heavy Duty Wind Monitor-HD-Alpine

05108-45

The Heavy Duty Wind Monitor HD-Alpine combines the features of the HD unit along with the ice resistant coating of our popular Alpine Wind Monitor. Robust, reliable, durable . . . . all words to describe the latest addition of the YOUNG family of wind monitors developed to endure the most extreme environments.

0	WIND MONITOR-HD ALPINE 3M Cable	05108-45	$1,710.00

Qty	Product	Part No.	Price
0	WIND MONITOR-HD ALPINE 8M Cable	05108-45-8M	$1,730.00
0	WIND MONITOR-HD ALPINE 12M Cable	05108-45-12M	$1,756.00
0	SURGE PROTECTION ASSEMBLY 6 Channel	19120	$220.00
0	WIND SENSOR INTERFACE (for use with Model 05108) 0-5 VDC Outputs (recommended cable: 18446)	05608C	$526.00
0	WIND LINE DRIVER (for use with Model 05108) 4-20 mA Outputs (recommended cable: 18723)	05638C	$572.00
0	SENSOR CABLE, 5 CONDUCTOR SHIELDED 22 AWG, Per Ft.	18446	$1.24
0	SENSOR CABLE, 2 PAIR SHIELDED 22 AWG, Per Ft.	18723	$1.02
0	SENSOR CABLE, 6 CONDUCTOR SHIELDED 22 AWG, Per Ft.	18721	$1.50

Add to cart

Quantity discounts applied during checkout. Excludes sensor cables.

Categories: **All Wind Products**, **Mechanical Wind Sensors**

Description

Specifications

Brochures & Manuals

Replacement Parts

Range:	*Wind speed: 0-100 m/s (224 mph)* *Azimuth: 360° mechanical, 355° electrical (5° open)*
Accuracy:	*Wind speed: ± 0.3 m/s (0.6 mph) or 1% of reading* *Wind direction: ± 3 degrees*
Threshold: *	*Propeller: 1.0 m/s (2.2 mph)* *Vane: 1.0 m/s (2.2 mph)*
Dynamic Response: *	*Propeller distance constant (63% recovery) 2.7 m (8.9 ft)* *Vane delay distance (50% recovery) 1.3 m (4.3 ft)* *Damping ratio: 0.3* *Damped natural wavelength: 7.4 m (24.3 ft)* *Undamped natural wavelength: 7.2 m (23.6 ft)*
Signal Output:	*Wind speed: magnetically induced AC voltage, 3 pulses per revolution. 1800 rpm (90 Hz) = 15.0 m/s (33.6 mph)* *Azimuth: analog DC voltage from conductive plastic potentiometer – resistance 10K Ω , linearity 0.25%, life expectancy – 50 million revolutions*
Power Requirement:	*Potentiometer excitation: 15 VDC maximum*
Operating Temperature:	*-50 to 60°C*
Sensor Cable:	*A water tight pigtail cable is supplied for electrical connections. Available in standard lengths of 3, 8 and 12 meters.* *For longer cable lengths a user supplied junction box or connector may be used.*
Dimensions:	*Overall height: 37 cm (14.6 in)* *Overall length: 55 cm (21.7 in)* *Propeller: 18 cm (7 in) diameter* *Mounting: 34 mm (1.34 in) diameter (standard 1 inch pipe)*
Weight:	*1.0 kg (2.2 lbs)*
Shipping Weight:	*2.3 kg (5 lbs)*
Model 05608C	*Wind Sensor Interface* *Signal outputs: 0-5.00 VDC full scale* *Power requirement: 8-24 VDC (5 mA @ 12 VDC)* *Operating temperature: -50 to 60°C*
Model 05638C:	*Wind Line Driver* *Signal outputs: 4-20 mA full scale* *Power Requirement: 12-30 VDC (40 mA max.)* *Operating Temperature: -50 to 60°C*
*	*Nominal values, determined in accordance with ASTM standard procedures.*

SPECIFICATIONS

NRG #40C Anemometer

FEATURES

- The standard anemometer used in the wind energy industry
- Short distance constant
- Simple, durable design

The NRG #40C anemometer is the industry standard anemometer used worldwide. NRG #40 anemometers have recorded wind speeds of 96 m/s (214 mph). Their low moment of inertia and unique bearings permit very rapid response to gusts and lulls. Because of their output linearity, these sensors are ideal for use with various data retrieval systems. A four pole magnet induces a sine wave voltage into a coil producing an output signal with a frequency proportional to wind speed. The #40C is constructed of rugged Lexan cups molded in one piece for repeatable performance. A protective rubber terminal boot is included.

SPECIFICATIONS

Description	Sensor type	3-cup anemometer
	Applications	• wind resource assessment • meteorological studies • environmental monitoring
	Sensor range	1 m/s to 96 m/s (2.2 mph to 214 mph) (highest recorded)
	Instrument compatibility	all NRG loggers
Output signal	Signal type	low level AC sine wave, frequency linearly proportional to windspeed
	Transfer function	m/s = (Hz x 0.765) + 0.35 [miles per hour = (Hz x 1.711) + 0.78]
	Accuracy	within 0.1 m/s (0.2 mph) for the range 5 m/s to 25 m/s (11 mph to 55 mph)
	Calibration	each anemometer individually calibrated, calibration reports provided via electronic download
	Output signal range	0 Hz to 125 Hz (highest recorded)

Global leaders in wind assessment technology

NRG SYSTEMS

110 Riggs Road · Hinesburg · VT 05461 USA · TEL (802) 482-2255 · FAX (802) 482-2272 · EMAIL sales@nrgsystems.com

SPECIFICATIONS

Response characteristics	Threshold	0.78 m/s (1.75 miles per hour)
	Distance constant (63% recovery)	3.0 m (10 feet)
	Moment of inertia	68 x 10^{-6} S-ft^2
	Swept diameter of rotor	190 mm (7.5 inches)
Installation	Mounting	onto a 13 mm (0.5 inch) diameter mast with cotter pin and set screw
	Tools required	0.25 inch nut driver, petroleum jelly, electrical tape
Environmental	Operating temperature range	-55 °C to 60 °C (-67 °F to 140 °F)
	Operating humidity range	0 to 100% RH
Physical	Connections	4-40 brass hex nut/post terminals
	Weight	0.14 kg (0.3 pounds)
	Dimensions	• 3 cups of conical cross-section, 51 mm (2 inches) dia. • 81 mm (3.2 inches) overall assembly height
Materials	Cups	one piece injection-molded black polycarbonate
	Body	housing is black ABS plastic
	Shaft	beryllium copper, fully hardened
	Bearing	modified Teflon, self-lubricating
	Magnet	Indox 1, 25 mm (1 inch) diameter, 13 mm (0.5 inch) long, 4 poles
	Coil	single coil, bobbin wound, 4100 turns of #40 wire, shielded for ESD protection
	Boot	protective PVC sensor terminal boot included
	Terminals	brass

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200 SERIES WIND VANE

Wind Direction Sensor

NRG Systems
MEASURING THE WIND'S ENERGY

■ The 200 Series Wind Direction Vane is a professional quality sensor, originally designed for use in some of the world's largest wind power plants. Its unique qualities make it ideal for use in many other applications in environmental testing and meteorology. ■ Although moderately priced, these sensors offer a level of quality and reliability often found only at a very high premium. The thermoplastic and stainless steel components resist corrosion, and contribute to a high strength-to-weight ratio. ■ As with all NRG Systems products, the 200 Series Vane is elegantly engineered, employing a minimum number of parts while maximizing functional performance. ■ The vane is directly connected to a precision conductive plastic potentiometer located in the main body. An analog voltage output directly proportional to the wind direction is produced when a constant DC excitation voltage is applied to the potentiometer. Several different yaw vane configurations are available for wind turbine control. ■ Field proven, the #200 is the wind industry de facto standard.

NRG SYSTEMS

110 Commerce Street

Hinesburg, VT 05461 USA

(802) 482-2255

FAX (802) 482-2272

Email: sales@nrgsystems.com

200 SERIES WIND VANE
Wind Direction Sensor

APPLICATIONS
- Wind direction sensor for wind data loggers
- Yaw control on wind turbines
- Environmental monitoring instrumentation
- Meteorological studies

FEATURES
- Simple mechanical construction
- Long life, professional quality potentiometer
- No slip rings or brushes result in high reliability, low cost
- Corrosion-resistant materials
- Multiple mechanical and contact seals
- No setscrews to vibrate loose
- Very stable and smooth response to wind changes
- Fully balanced sensor vane

SPECIFICATIONS
MECHANICAL:
Range: Direction–360° mechanical, continuous rotation
Sensitivity: Approx. 1 m/s (2.2 mph)
Materials:
Direction vane and housing–black UV stabilized injection molded plastic
Balance weight–stainless steel
Terminals–three #4-40 solid brass studs with nuts
Potentiometer–stainless steel shaft in two shielded precision grade, stainless steel ball bearings, conductive plastic potentiometer element mounted in a machined aluminum housing
Hardware–all stainless steel construction
Dimensions:
Overall length–21cm (8.3")
Swept diameter–27cm (10.5")
Overall height–12cm (4.3")
Vane size–6cm high x 10cm long (2.3" x 3.8")
Main housing diameter–5cm (2")
Mounting–13mm (0.5") diameter mast with cotter pin and mast set screw
Weight: 0.1kg (0.25 lb)
Shipping Weight: 0.5kg (1 lb)
ELECTRICAL:
Range:
Direction– #200: 340° elecrical (20° open); #200P: 352° electrical (8° open)
Signal:
Analog DC voltage from conductive plastic potentiometer 1K(#200), 10K(#200P); linearity 1.0%, life expectancy of 50 million revolutions (2-6 years normal operation)
Power Requirements:
Regulated potentiometer excitation of 1 to 15 VDC

#200YZ YAW CONTROL WIND VANE
The #200YZ Vane is built with standard #200 Series vane and body with an opto-interrupter type switching system. This yaw control sensor has an open collector, sinking output. Switch points are +/- 10° right or left. Also will control wind turbine yaw at 90° out of the wind.

SPECIFICATIONS MAY CHANGE WITHOUT NOTICE.

ORDERING INFORMATION:

Wind Direction Vane–1K	Cat. No. 200
Precision Wind Direction Vane–10K	Cat. No. 200P

NRG Systems

MEASURING THE WIND'S ENERGY

110 Commerce Street
Hinesburg, VT 05461 USA
(802) 482-2255
FAX (802) 482-2272
Email: sales@nrgsystems.com

Barometric Pressure Sensors

090D
091

Barometric Pressure Sensors convert absolute atmospheric pressure into a linear, proportional voltage, which may be used in any meteorological program.

Features

- Compact size
- Weatherproof enclosure
- Remote output
- Permanent calibration
- Robust construction

These sensors are inherently stable devices that do not require periodic service or routine recalibration.

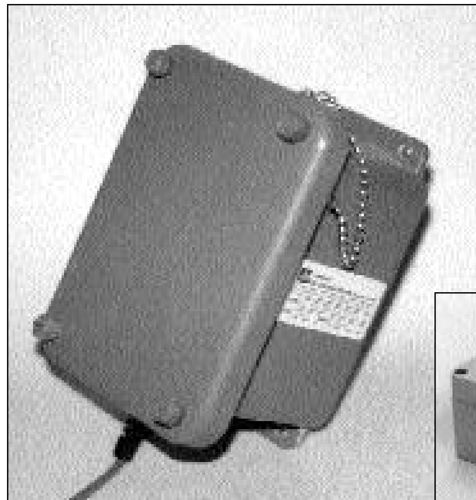
Operation

The enclosure houses a solid-state pressure transducer, with linearization and amplification electronics.

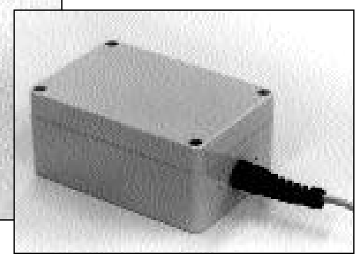
The Model 090D is housed in a heavy duty fiberglass enclosure, suitable for harsh and severe environments. A hose barb is provided to enable the connection of a 1/4" sampling tube to the outside environment.

The Model 091 is contained within a small polycarbonate enclosure, and may be mounted outside or inside a building or other enclosure. Small inlet holes allow the atmospheric pressure access to the sensing element.

The standard range of the 090D/ 091 is 26-32 in. Hg,* suitable for elevations sea level to 1500 ft. Other ranges are available.



090D



091

Specifications

Performance

Resolution:	Infinite
Temp. Operating Range:	-40°C to 65°C
Temp. Compensated Range:	-18°C to 65°C
Accuracy:	±0.04 in Hg (±1.35 mbar) or ±0.125% FS

Electrical Characteristics

Power Requirement:	11 mA @ 12 VDC, Typical
Sensor Output:	0-1 VDC, Standard
	0-5 VDC, Optional

Physical Characteristics

090D	Weight:	2 lbs, 5 oz (1.05 Kg)
	Dimensions:	5.5 x 5 x 7.5 in (14 x 12 x 19 cm)
091	Weight:	8.8 oz. (250 g)
	Dimensions:	2.1 x 3.2 x 5 in (5.4 x 8.3 x 13 cm)

Ordering Information

	Specify elevation
	Specify output voltage
Cable:	#1169-xx (xx = length in feet)
	Specify length in feet

Specifications subject to change without notice.
*Conversions: 1 in. Hg = 3.3864 kPa, 1 in. Hg = 33.864 mbar, 1 in. Hg = 25.4 mm/Hg

Met One Instruments, Inc.
Corporate Sales & Service: 1600 Washington Blvd., Grants Pass, OR 97526, Phone (541) 471-7111, Fax (541) 471-7116
Distribution & Service: 3206 Main Street, Suite 106, Rowlett, TX 75088, Phone (972) 412-4747, Fax (972) 412-4716
http://www.metone.com

107 and 108

Temperature Probes

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

The 107 and 108 are rugged, accurate probes that measure air, soil, and water temperature in a variety of applications. These probes consist of a thermistor encapsulated in an epoxy-filled aluminum housing. The housing protects the thermistor allowing the probes to be buried or submerged. The 107 measures from -35° to +50°C, the 108 from -5° to +95°C.

Please note that the 107 and 108 are not compatible with the CR200(X)-series dataloggers. However, a similar thermistor, the 109, has been developed specifically for our CR200(X)-series dataloggers.

Each 107 or 108 probe requires one single-ended channel for measurement.

Installation

Air Temperature

When exposed to sunlight, the 107 and 108 probes should be housed in a 41303-5A 6-plate Gill Radiation Shield. The 41303-5A's louvered construction allows air to pass freely through the shield thereby keeping the probe at or near ambient temperature. The shield's white color reflects solar radiation. The 41303-5A attaches to a crossarm, mast, or user-supplied pipe with a 1.0-in. to 2.1-in. outer diameter.

Above is a probe housed in the 41303-5A radiation shield. The U-bolt is placed in the holes on the side of the bracket to allow the 41303-5A to be attached to a mast or vertical pole.

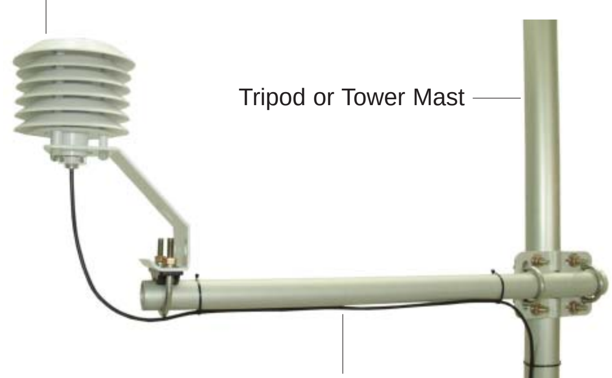
Water Temperature

The probes can be submerged to 50 feet (21 psi). Please note that neither the 107 nor 108 is weighted. Therefore, the installer should either add a weighting system or secure the probe to a fixed, submerged object, such as a piling.

Soil Temperature

The 107 and 108 are suitable for shallow burial only. Placement of the probe's cable inside a rugged conduit may be advisable for long cable runs—especially in locations subject to digging, mowing, traffic, use of power tools, or lightning strikes.

To attach the 41303-5A to a CM202, CM204, or CM206 crossarm, place the 41303-5A's U-bolt in the bottom holes. ▶



Recommended Cable Lengths for Air Temperature Measurements

2-m Height		Atop a tripod or tower via a 2-ft crossarm such as the CM202								
Mast/Leg	**CM202**	**CM6**	**CM106**	**CM10**	**CM110**	**CM115**	**CM120**	**UT10**	**UT20**	**UT30**
9 ft	11 ft	11 ft	14 ft	14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft

Note: *Add two feet to the cable length if mounting the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod.*

Ordering Information

Temperature Probes

107-L Temperature Probe (-35° to +50°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

108-L Temperature Probe (-5° to +95°C) with a user-specified cable length; enter the cable length (in feet) after the -L. Recommended cable length is shown above. Must choose a cable termination option (see below).

Cable Termination Options (choose one)

-PT Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.

-PW Cable terminates in connector for attachment to a prewired enclosure.

Solar Radiation Shield for Air Temperature Measurements

41303-5A 6-Plate Gill Radiation Shield that houses a 107 or 108 for air temperature measurements.

Specifications

Sensor: BetaTherm 100K6A1B Thermistor

Tolerance
- **107:** ±0.2°C over 0° to 50°C range
- **108:** ±0.2°C over 0° to 70°C range

Temperature Measurement Range
- **107:** -35° to +50°C
- **108:** -5° to +95°C

Steinhart-Hart Equation Error
- **(CRBasic loggers only):** ≤±0.01°C over measurement range

Polynomial Linearization Error (Edlog loggers only)
- **107:** Typically <±0.5°C over measurement range
- **108:** Typically <±0.5°C over -5° to +90°C range

Time Constant in Air: 30 to 60 seconds in a wind speed of 5 m sec^{-1}

Maximum Cable Length: 1000 ft (305 m)

Probe Length: 4.1 in. (10.4 cm)

Probe Diameter: 0.3 in. (0.762 cm)

Weight with 10-ft cable: 5 oz (136 g)

NRG Side Mount Boom, 2.4 m (95")

Made of galvanized steel, the 2.4 m (95”) side mount boom resists corrosion and is designed to securely mount NRG sensors away from NRG TallTowers to minimize tower shadowing effects.

FEATURES

- For use with NRG #40C or NRG #200P sensors
- Easy to assemble
- Robust, dual-beam support structure
- Mounting bracket tabs assure proper boom installation
- Self-aligning mounting bracket assures secure, 90-degree vertical orientation
- Meets or exceeds industry IEC 61400-12-1 recommendations for tower and boom offset distances
  - » *Horizontal mast offset:* 12.38D on 8” tube; 10D on 10” tube [1]
  - » *Vertical boom offset:* 20D above boom for an NRG #40C anemometer, exceeding IEC 61400-12-1 minimum recommendation of 15D [2]

Self-orienting mounting bracket   *Mounting bracket tab*

SPECIFICATIONS

Description	Boom type	Sensor mounting boom for standard NRG sensors on NRG TallTowers 8" or 10" diameter
	Applications	Wind resource assessment; for mounting NRG #40C anemometer or NRG #200P wind direction vane on NRG TallTowers
	Sensor compatibility	• NRG #40C anemometer • NRG #200P wind direction vane
	Tower compatibility	NRG TallTowers with 8" or 10" diameter tubing sections
Installation	Mounting	• Mounting bracket attaches to tower with three heavy-duty, stainless steel hose clamps • Sensor mounts to boom with set screw and cotter pin
	Tools required	• 5/16 inch hex driver or flat blade (-) screwdriver for hose clamps • Phillips head (+) screwdriver to mount sensor
	Recommended for installation	• Electric drill with 5/16 nut driver bit for tightening hose clamps • Sheet metal shears or similar for trimming hose clamps
Environmental	Lifespan	2 years +
Physical	Weight	3.6 kg (8 lbs)
	Boom diameter	15.875 mm (0.625 inch) dual beam support at mounting bracket location 19.05 mm (0.75 inch) at boom extension sleeve 12.7 mm (0.50 inch) at sensor mount location
	Offset distance	2.4 m (95 inches)
	Offset height	381 mm (15.0 inches)
Materials	Boom	15.8 mm (0.625 inch) galvanized steel tube
	Mounting bracket	Galvanized steel
Shipping	Shipping weight	3.8 kg (8.4 lbs) for one boom in one box

Note:

[1] *Horizontal offset value, D refers to diameter of the tube tower. Per IEC 61400-12-1 horizontal mast offset is defined as the boom distance from the center of a tubular mast divided by the mast diameter (R/d).*

[2] *Vertical offset value, D refers to the diameter of the mounting boom tube directly below the sensor. Per IEC 61400-12-1 vertical boom offset is defined as the distance from top of the mounting boom tube to the centerline of anemometer cup rotor.*

Global leader in wind measurement technology

110 Riggs Road · Hinesburg · VT 05461 USA · TEL (802) 482-2255 · FAX (802) 482-2272 · EMAIL sales@nrgsystems.com

RENEWABLE NRG SYSTEMS

Instructions

High Visibility Cable Balls

Introduction

These instructions will assist you in installing high visibility cable balls on TallTower guy wires. The items included are:

- 8 orange plastic cable ball ½ (part number 3814)
- 24 bolts, truss-head #10-32x5/8, stainless steel (part number 3842)
- 48 washers, stainless steel (part number 3843)
- 24 nuts, #10-32 stainless steel Nylock (part number 3844)
- 1/4" cable kit
    - 4 short wire rope cables ¼", 26 inches long (part number 1513) [*compatible with 3/16" or ¼" guy wires*]
    - 8 wire rope clips for ¼" cable (part number 1596)

The tools required are:
(1) #2 Phillips head (+) screwdriver
(1) 3/8 inch nut driver or socket
(1) 1/2 inch nut driver or socket

Installing the Cable Balls

Balls should be installed on each guy wire 3 m (10 feet) below the guy ring on the top set of guy wires. An additional set of balls can be installed lower on the same guy wires at least 3 m (10 feet) above highest point vegetation is likely to reach.

Place one half of a cable ball (part number 3814) in position with the TallTower guy wire cable running through the two grooves molded into the plastic to accept the cable.

Position the short wire rope cable next to the tower guy wire cable (marked with white tape in the photo below) in the grooves. Electrical tape may be used to hold this cable in place (as shown in photo 1).


PHOTO 1


PHOTO 2

Position the top half of the ball over the two cables (photo 2).

Install the bolts, washers and locknuts to secure the plastic pieces together (photo 3). Use a washer under the head of each bolt and another under each locknut. Tighten only enough to secure the plastic pieces together. Avoid over-tightening because this will crack the plastic.

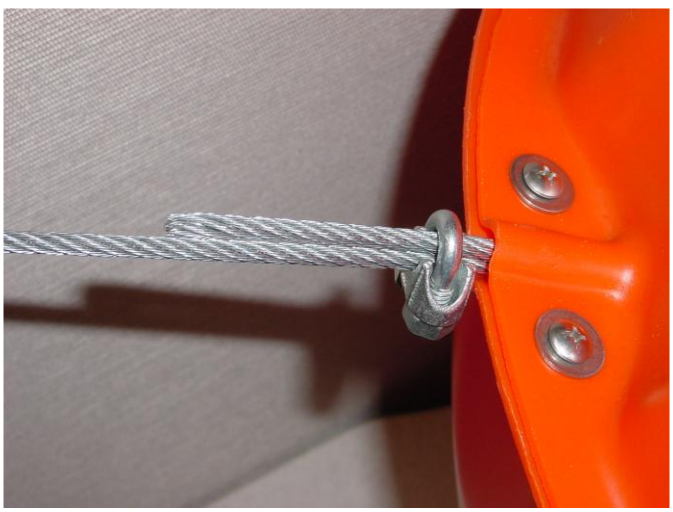


PHOTO 3

Place the u-bolt part of the wire rope clip over the 'dead' cable (the short wire rope cable). Place the saddle part of the wire rope clip over the 'live' cable (the TallTower guy wire cable) and tighten nuts. If you installed the wire rope clip correctly, the nuts will be on the same side as the TallTower guy wire cable (Photo 3). Pull the short cable tight and install another wire rope clip on the other side of the ball as described above.

CAUTION: Incorrect installation of the wire rope clip can severely weaken the cable and cause premature cable failure.

APPENDIX C

TYPICAL GUY ANCHORS AND TOWER BASE PLATE DETAIL

Appendix B: Anchoring Guidelines

B.1 DETERMINE SITE SOIL AND ANCHOR TYPE BEFORE YOU ORDER YOUR TOWER

Per ANSI/TIA-222-G, for design purposes, one can assume Class 6 soils. However, the Standard requires that soil parameters and assumptions be validated prior to installing the tower.

Before your tower is ordered, determine the soil type, preferably through soil sampling. Order the correct anchors based on the results of the soil sample.

The purpose of this section is to give you the information needed to provide suitable anchoring for your Super 60 m XHD TallTower. **Because anchor requirements are site specific, it is the responsibility of the customer to determine suitable anchors. If you are not sure what is required, seek professional guidance.**

Local utility companies can often provide useful information regarding anchoring used in the site area. Do not use rebar anchors, especially when the surface soils are loose or wet.

Table B-1: Soil Classes

Class	Common Soil Types	Geological Soil Classification
3	Dense clays, sands and gravel; hard silts and clays	Glacial till; weathered shales, schist, gneiss and siltstone
4	Medium dense sandy gravel; very stiff to hard silts and clays	Glacial till; hardpan; marls
5	Medium dense coarse sand and sandy gravels; stiff to very stiff silts and clays	Saprolites, residual soils
6	Loose to medium dense fine to coarse sand; firm to stiff clays and silts	Dense hydraulic fill; compacted fill; residual soils
7**	Loose fine sand; Alluvium; loess; soil-firm clays; varied clays; fill	Flood plain soils; lake clays; adobe; gumbo; fill

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.
Charts reproduced by permission, The A.B. Chance Company.

B.2 ANCHOR CHOICES AND OTHER CONSIDERATIONS

The choice of anchors must take into consideration soil type, maximum winds expected, icing or other weather that may affect the tower, and a safety factor suitable for the location and to meet any legal requirements. Considerations include but are not limited to: tornadoes, hurricanes or typhoons, locations where very high winds are expected, potential for flooding or periodic soaking of the soil, soil erosion, and icing events.

B.3 Screw-In Anchor Description

Screw-in anchors are the most commonly used anchors for normal clay soils without rocks. The 8 inch single helix anchors are installed by hand, using a cross bar to screw them into the earth like a corkscrew. The 8 inch twin helix anchors require machinery.

The Super 60 m XHD tower employs two (2), 8 inch diameter screw-in anchors and sixteen (12), 8 inch twin helix anchors.

Table B-2: Specifications for 203 mm (8 inches) diameter Screw-In Anchors

Length Overall:	**203 mm (8 inches) Anchor**
Helix diameter:	203 mm (8.0 inches)
Length Overall:	1.65 m (66 inches)
Rod diameter:	25 mm (1 inch)
Material:	Galvanized steel
Holding Power: (These anchors are not suitable for soils denser than class 5.)	
Class 5 soils *	44.5 kN (10000 pounds)
Class 6 soils *	31.1 kN (7000 pounds)
Class 7 soils **	17.8 kN (4000 pounds)

* See Table for soil class descriptions

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.

Table B-3: Specifications for Mid-Strength 203 mm (8 inches) diameter Twin Helix

Length Overall:	2.7 m (9 feet) (including 7 foot rod)
Helix Diameter:	203 mm (8.0 inches)
Materials:	TBD
Holding Power:	
Class 3 soils *	12700 kg (28000 pounds)
Class 4 soils *	10900 kg (24000 pounds)
Class 5 soils *	9090 kg (20000 pounds)
Class 6 soils *	6800 kg (15000 pounds)
Class 7 soils *	5450 kg (12000 pounds)

* See Table 13 for soil class descriptions

** In class 7 soils, it is advisable to place anchors deep enough to penetrate underlying class 5 or 6 soil.

MANTA RAY® EARTH ANCHOR

The Manta Ray Utility Anchor System is used by utilities worldwide. Manta Rays are driven into the ground using a jackhammer, not augured or torqued. No excavation is necessary. The anchors are driven with conventional hydraulic equipment that is readily available.

Description

Manta Ray Anchors are RUS approved, rugged and versatile driven plate anchors for all types of soil conditions. They can be installed in extremely tough soils such as caliche, decomposed rock, glacial till, and permafrost. Larger models are also available for swamp application. Fully portable installation equipment which can fit in the back of a standard pickup truck can be used to access difficult to reach anchor locations. They can also be installed using the line truck's hydraulic system. Every anchor is proof tested during standard installation procedures for a verified tension load measurement. Manta Ray anchors are compatible with standard power hub anchor rods and eyenuts for distribution guy anchors.

Links & PDFs

Manta Ray Anchors

Catalog Number	Model	For PH Rod Size	Ultimate Load Rating (lbs)	Weight (lbs)
20036-UT-II	MR-1	D75 (3/4") or D100 (1")	23,000 or 36,000	13
20199-UT-II	MR-2	D75 (3/4") or D100 (1")	23,000 or 36,000	11
20210-UT-II	MR-3	D62 (5/8")	16,000	7
20229-UT-II	MR-SR	D75 (3/4") or D100 (1")	23,000 or 36,000	21

PAPER SIZE	CATALOG NUMBER
B	20199-UT-II

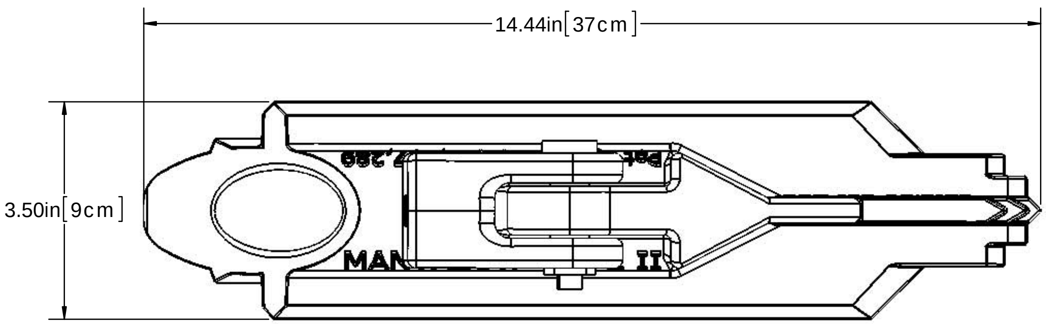
NOTES: UNLESS OTHERWISE SPECIFIED:

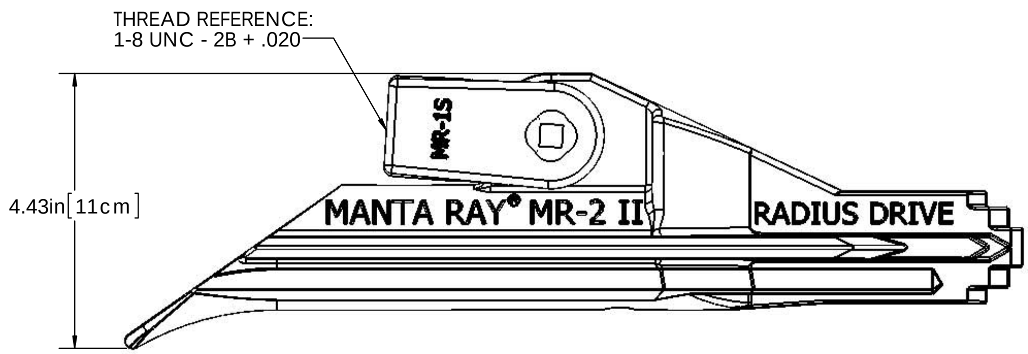
1) MECHANICAL ULTIMATE CAPACITY: 40,000 LBS [177.9kN]

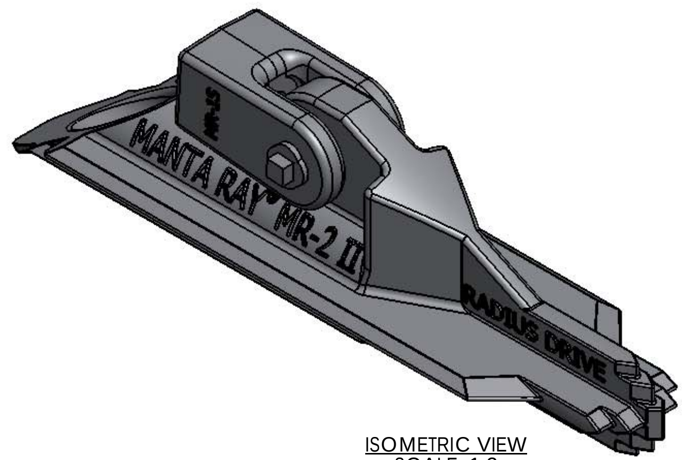
2) MAXIMUM WORKING LOAD: UP TO 27,000 LBS [120.1 kN]
(THIS VALUE IS SOIL AND ANCHOR ROD DEPENDANT)

3) AVERAGE WEIGHT: 10.2 LBS [4.6 kg]

4) FINISH: HOT DIP GALVANIZED







ISOMETRIC VIEW
SCALE: 1:2

ODA

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MACLEAN POWER SYSTEMS
www.macleanpower.com

DRAWING NUMBER:	20199-UT-II
SHEET NAME: SHEET1	1 OF 1
PRODUCT DESCRIPTION	MR-2-1"-UTILITY-II ANCHOR/SHACKLE ASSEMBLY
DRAWN BY: JFD	DATE: 03/06/13

Product Information Bulletin

#068-0
02-28-13

MANTA RAY®
EARTH ANCHOR SYSTEMS

Manta Ray® anchor load ultimate tension capacity with 5/8” (16,000 lb-force), ¾” (23,000 lb-force) and 1” (36,000 lb-force) power hub anchor rods.

Manta Ray anchor ultimate load capacity with power hub anchor rods (lbs-force)					
Soil Description	Standard Penetrometer Blow Count (N)	MR-1 (3/4” or 1” rod)	MR-2 (3/4” or 1” rod)	MR-3 (5/8” rod)	MR-SR (3/4” or 1” rod)
Very dense/cemented sands; coarse gravel and cobbles	60-100+	36,000 (1)	36,000 (1)	16,000 (1)	NA
Dense fine compacted sands, very hard silts or clays	45-60	36,000 (1)	28,000 (2)	16,000 (1)	36,000 (1)
Dense clays, sands and gravels, hard silts and clays	35-40	36,000 (1)	22,000 (2)	16,000 (1)	36,000 (1)
Medium dense sandy gravel, stiff to hard silts and clays	24-40	20,000 (2)	18,000 (2)	14,000 (2)	34,000 (2)
Medium dense coarse sandy gravel, stiff to very still silts and clays	14-25	20,000 (2)	12,000 (2)	9,000 (2)	24,000 (2)
Loose to medium dense fine to coarse sand: firm to stiff clays and silts	7-14	15,000 (2)	10,000 (2)	8,000 (2)	18,000 (2)
Loose fine sand, alluvium, soft clays, fine saturated silty sand	4-8	12,000 (2)	8,000 (2)	5,000 (2)	14,000 (2)
Peat, organic silts: inundates silts fly ash	0-5	8,000 (2)	5,000 (2)	2,000 (2)	12,000 (2)

Notes: (1) Manta Ray anchor holding capacity limited by rod tension strength rating
(2) Manta Ray anchor holding capacity limited by soil capacity

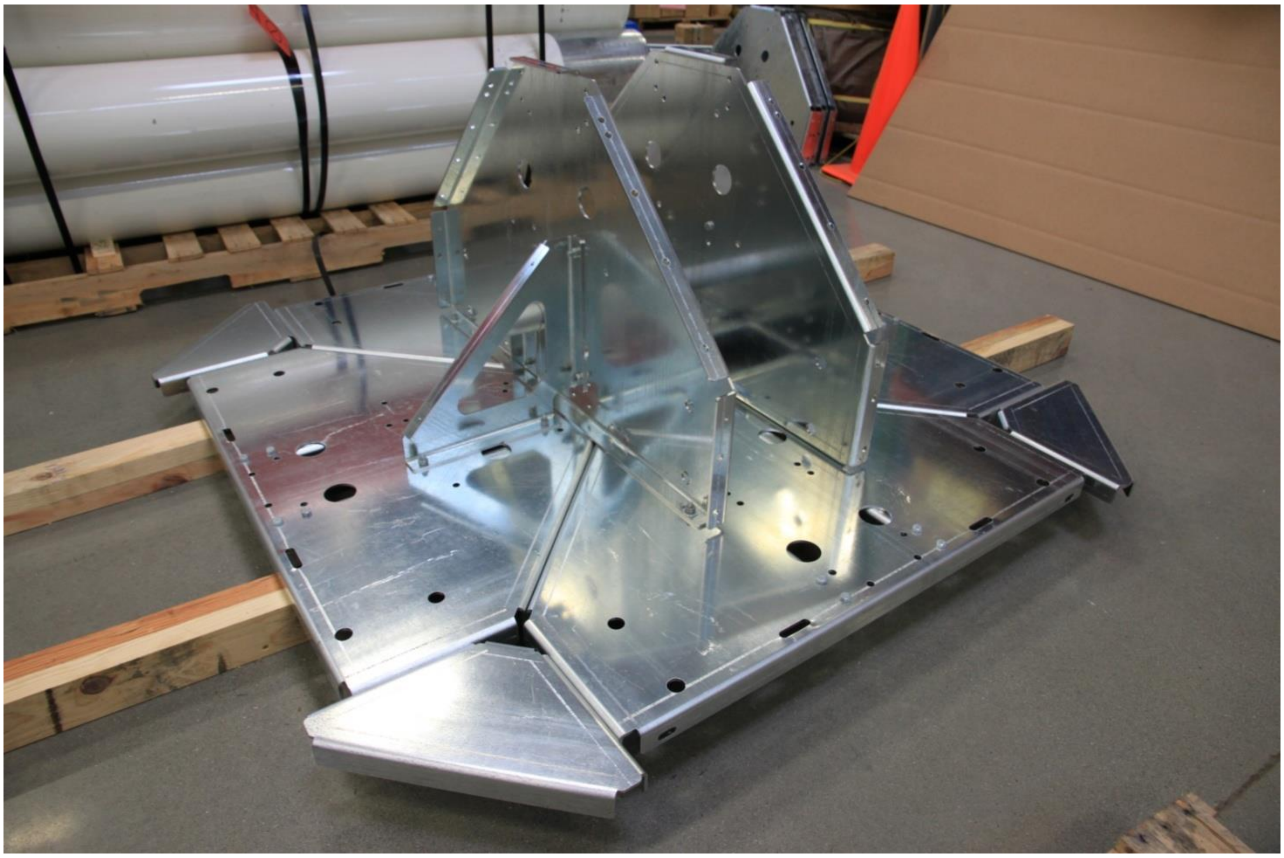
Manta Ray® anchor load ultimate tension capacity with 5/8” (71.2 kn), ¾” (102.3 kn) and 1” (160.1 kn) power hub anchor rods.

Manta Ray anchor ultimate load capacity with power hub anchor rods (kn)					
Soil Description	Standard Penetrometer Blow Count (N)	MR-1 kn	MR-2 kn	MR-3 kn	MR-SR kn
Very dense/cemented sands; coarse gravel and cobbles	60-100+	160.1 (1)	160.1 (1)	71.2 (1)	NA
Dense fine compacted sands, very hard silts or clays	45-60	160.1 (1)	124.6 (2)	71.2 (1)	160.1 (1)
Dense clays, sands and gravels, hard silts and clays	35-40	160.1 (1))	97.9 (2)	71.2 (1)	160.1 (1)
Medium dense sandy gravel, stiff to hard silts and clays	24-40	89 (2)	80.1 (2)	62.3 (2)	151.2 (2)
Medium dense coarse sandy gravel, stiff to very still silts and clays	14-25	89 (2)	53.4 (2)	40.0 (2)	106.8 (2)
Loose to medium dense fine to coarse sand: firm to stiff clays and silts	7-14	66.7 (2)	44.5 (2)	35.6 (2)	80.1 (2)
Loose fine sand, alluvium, soft clays, fine saturated silty sand	4-8	53.4 (2)	35.6 (2)	22.2 (2)	62.3 (2)
Peat, organic silts: inundates silts fly ash	0-5	35.6 (2)	22.2 (2)	8.9 (2)	53.4 (2)

Notes: (1) Manta Ray anchor holding capacity limited by rod tension strength rating
(2) Manta Ray anchor holding capacity limited by soil capacity

Appendix G: ANSI/TIA-222-G Foundation Considerations

Baseplate Geometry (with ground surface area of 19.5 ft^2)



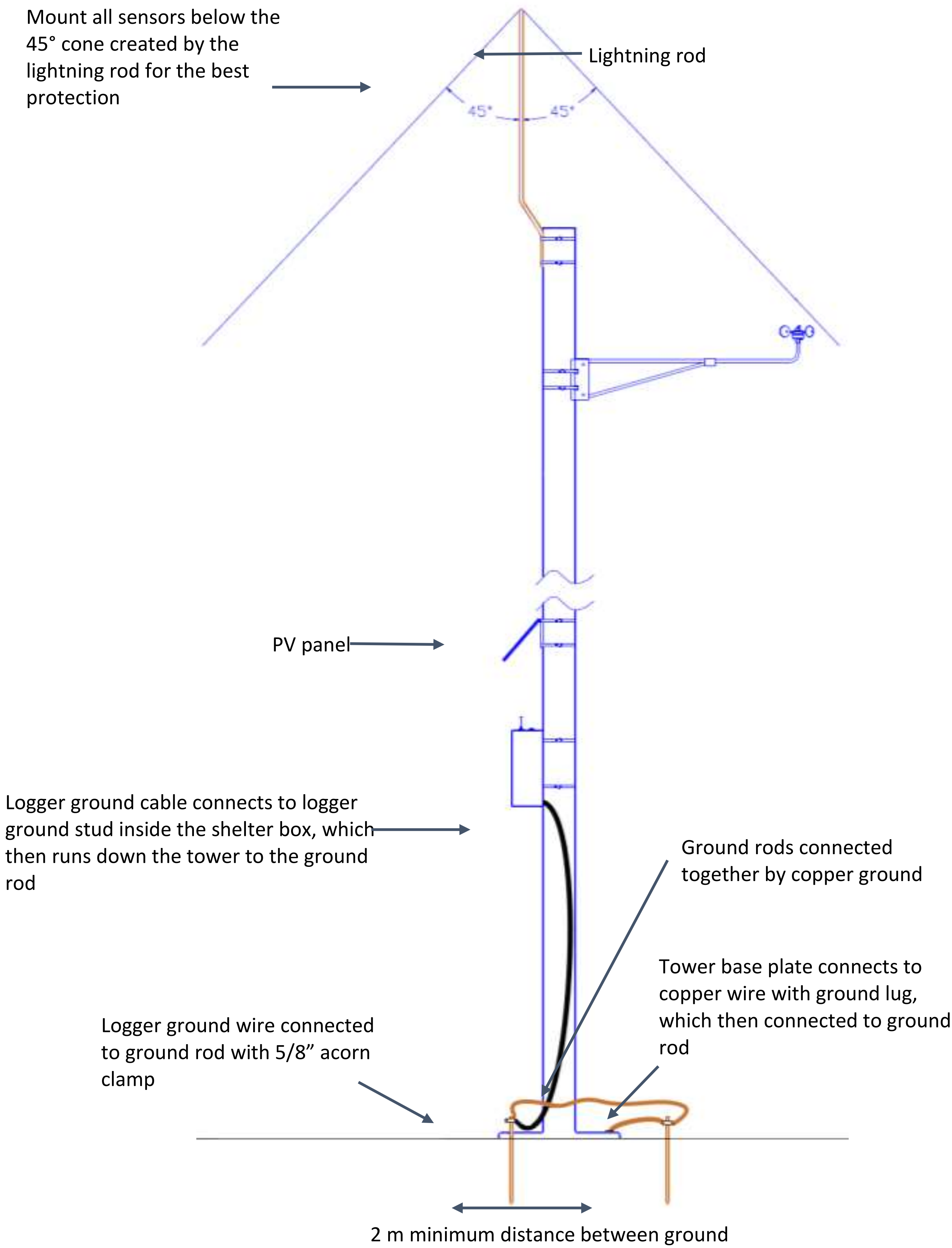
Picture H-1: Baseplate

Per
ANSI/TIA-222-G, for design purposes, one can assume Class 6 (Clay) soils. However, the Standard requires that soil parameters and assumptions be validated prior to installing the tower. Prior to tower installation, determine the soil type, preferably through soil sampling.

The baseplate cross-sectional area is 19.5 ft^2. The cross-sectional area was sized to ensure the factored resistance of Clay soil is greater than the reactions from the factored load combinations listed in section 2.3.2 of ANSI/TIA-222-G. The presumptive soil parameters per ANSI/TIA-222-G assume dry soil conditions. If your soil can develop a significant ice lens (due to poor soil drainage) during freezing, it may be necessary to provide a foundation to ensure adequate bearing strength. Foundation details must be approved for the specific application and site by a qualified professional.

APPENDIX D

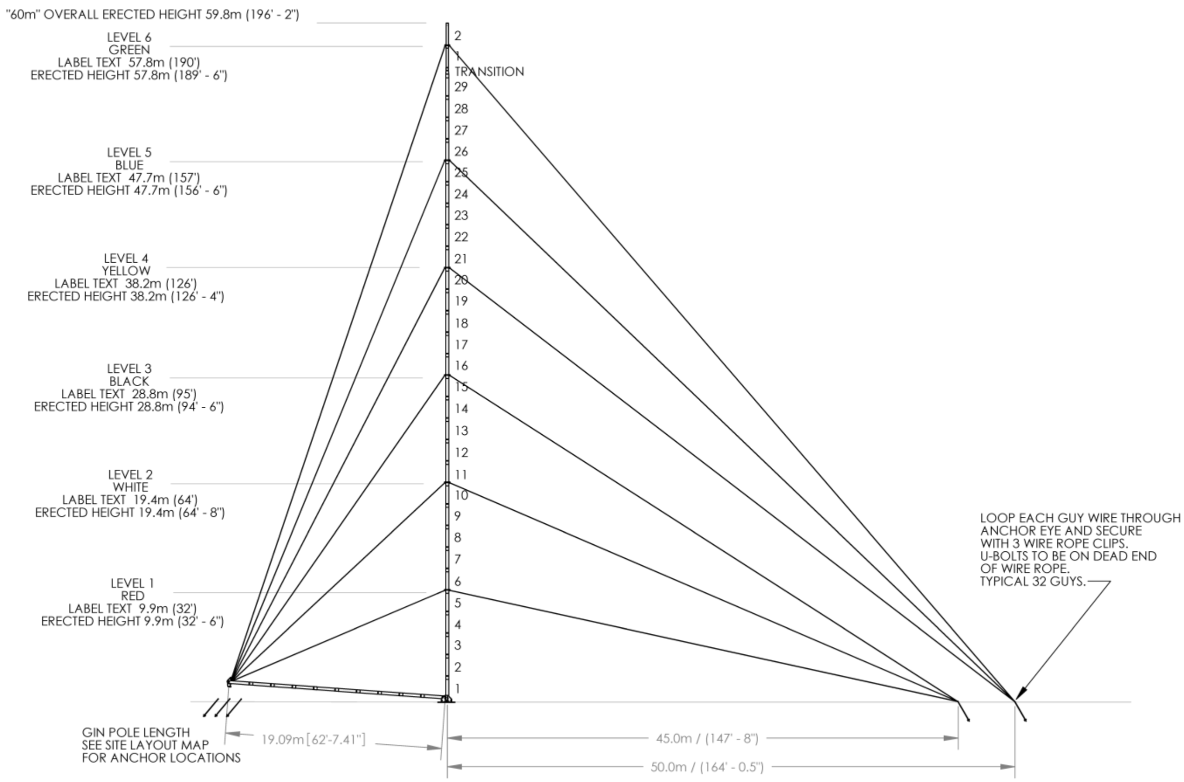
TOWER GROUNDING AND TOWER DETAILS


Mount all sensors below the 45° cone created by the lightning rod for the best protection
Lightning rod
45°
45°
PV panel
Logger ground cable connects to logger ground stud inside the shelter box, which then runs down the tower to the ground rod
Ground rods connected together by copper ground
Tower base plate connects to copper wire with ground lug, which then connected to ground rod
Logger ground wire connected to ground rod with 5/8” acorn clamp
2 m minimum distance between ground

Appendix A: Super 60 m XHD TallTower with Standard Footprint Tower Layout

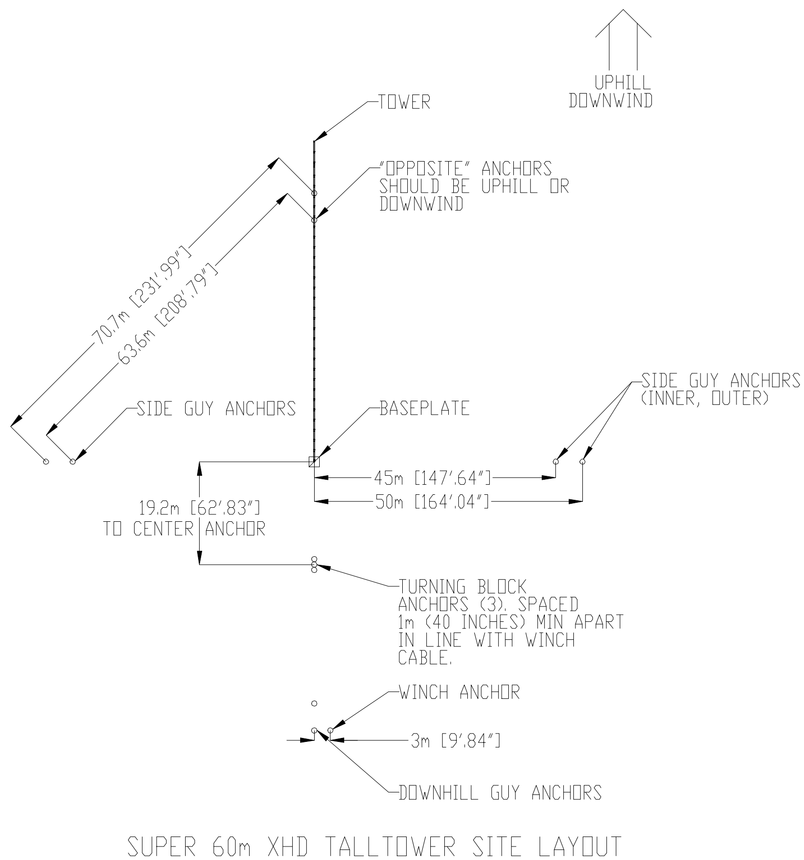
TUBE SPECS (in order of assmbly):

Tower:	
Base Tube (with pivot pin hole)	10" Ø x 87"L (1 tube)
Plain Tubes	10" Ø x 87"L (28 tubes)
10" - 8" Transition, 36"L	
Plain Tubes	8" Ø x 87"L (2 tubes)
Gin Pole:	
Base Tube (with pivot pin hole)	10" Ø x 87"L (1 tube)
Plain Tubes	10" Ø x 87"L (8 tubes)
Top Tube	10" Ø x 87"L (1 tube)



Picture A-1: Super 60 m XHD TallTower Layout

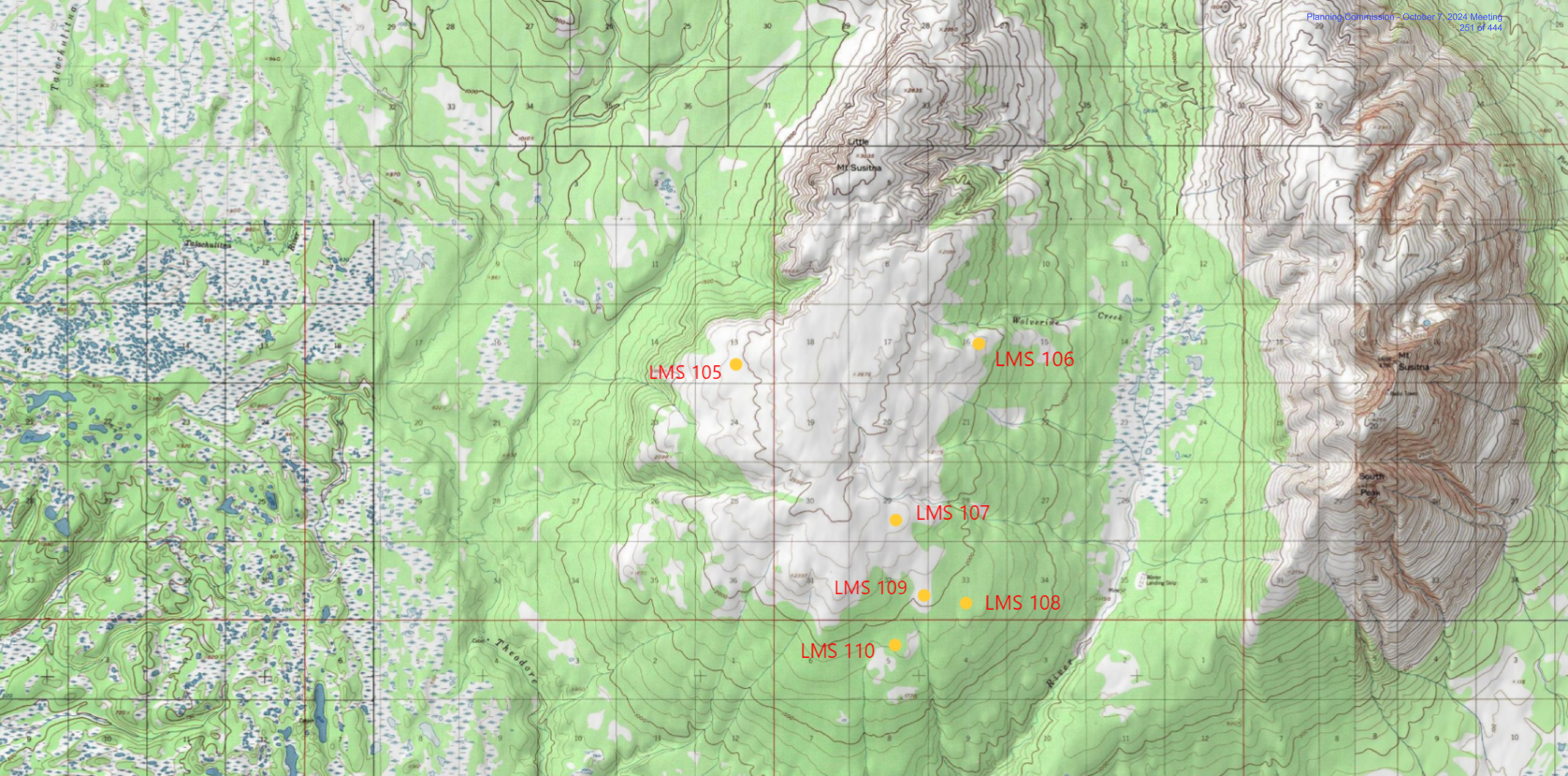
SITE LAYOUT



Picture A-2: Super 60m Site Layout

APPENDIX E

PROPOSED MET TOWER SITE LOCATION MAP


LMS 105
LMS 106
LMS 107
LMS 109
LMS 108
LMS 110
Little Mt Susitna
Mt Susitna
South Peak
Wolverine Creek
Theodore River
Talachulitna River

Federal Aviation Administration

The FAA is currently experiencing delays in processing off-airport aeronautical studies. These delays are currently resulting in an approximate 15 additional days in processing time. The FAA will continue to work aeronautical studies on a first come, first served basis. Please take this possible delay into consideration when determining when to submit your case. If your submitted aeronautical study requires priority and 60 days has elapsed since submission, please contact the OEG Specialist for your state with the rationale for your request and it will be reviewed for escalation. The issue causing these delays is actively being mitigated and is expected to be resolved around August.

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2018.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

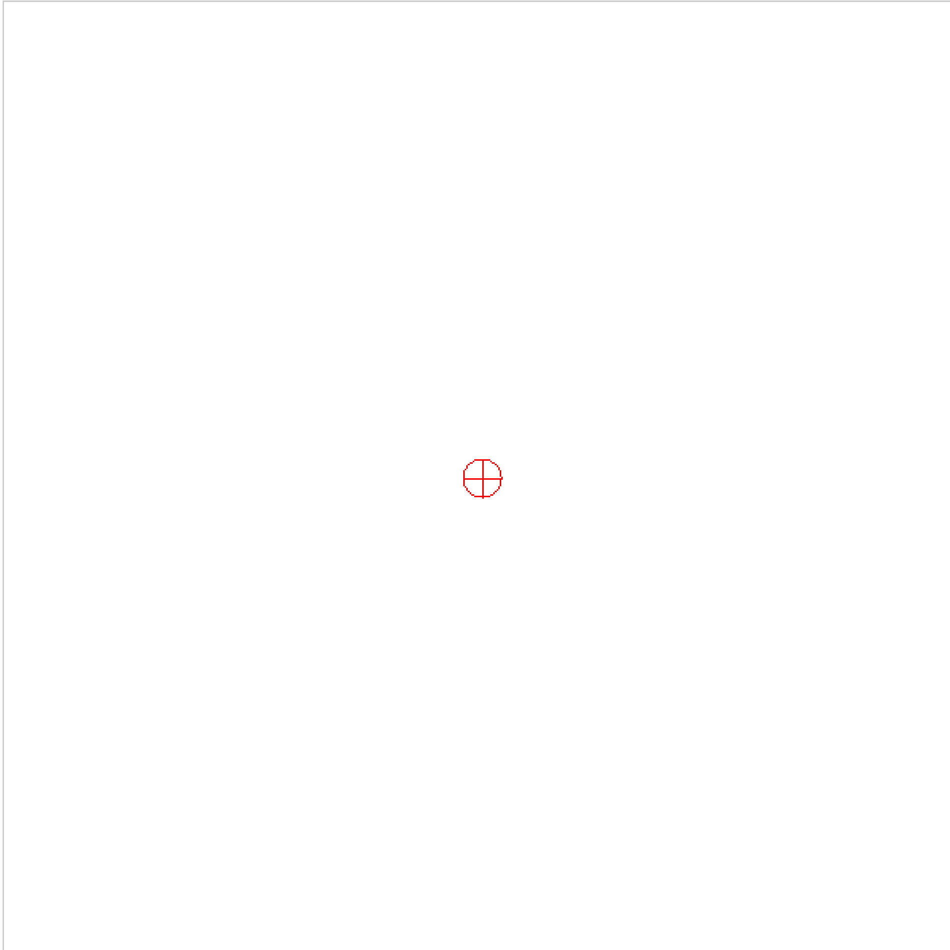
If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 28 M 23.02 S N
Longitude:	150 Deg 59 M 19.71 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	2466 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	(selected) No Yes

Results

You do not exceed Notice Criteria.



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- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
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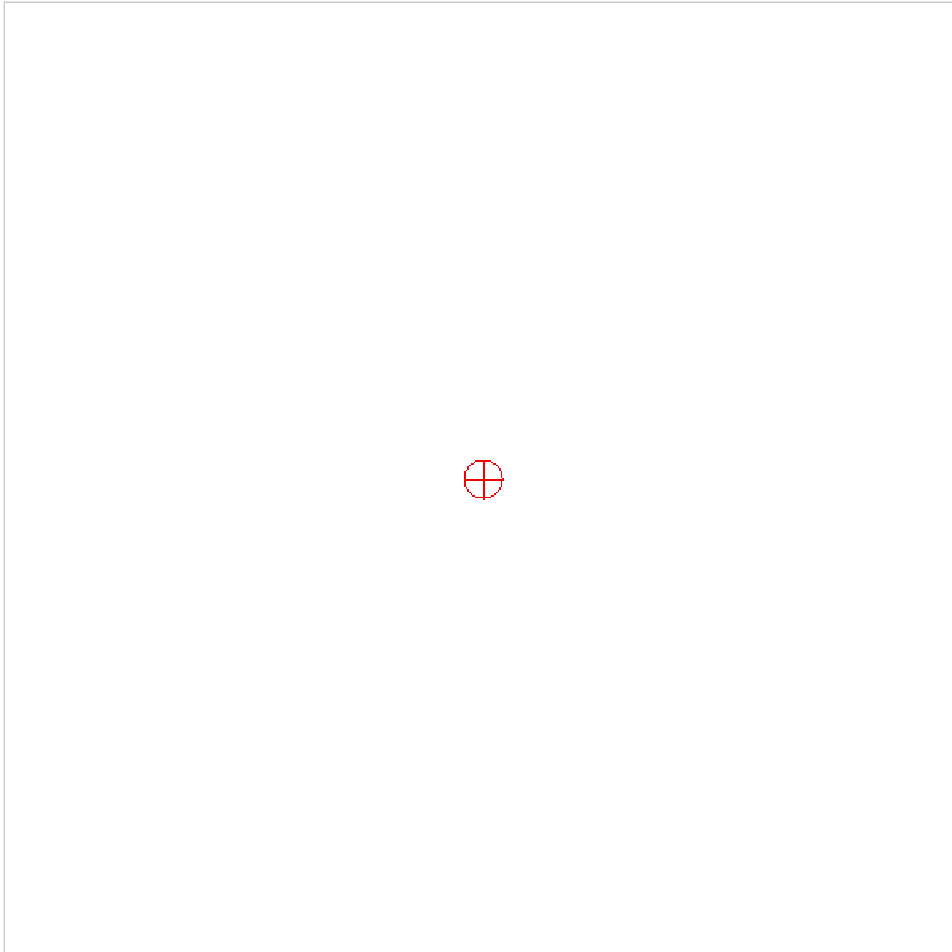
The tool below will assist in applying Part 77 Notice Criteria.

*** Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 28 M 36.13 S N
Longitude:	150 Deg 53 M 45.26 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	2200 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



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- your structure will be on an airport or heliport
- filing has been requested by the FAA

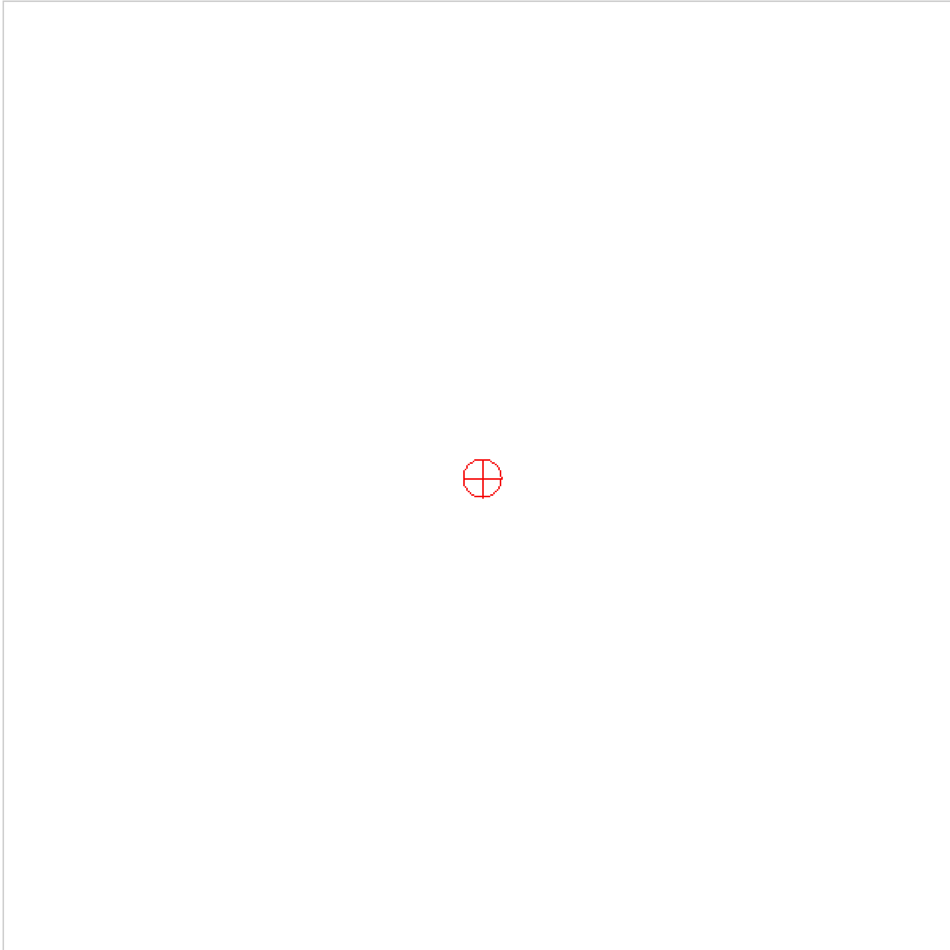
If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

*** Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 26 M 40.70 S N
Longitude:	150 Deg 55 M 40.32 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	2339 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

The FAA is currently experiencing delays in processing off-airport aeronautical studies. These delays are currently resulting in an approximate 15 additional days in processing time. The FAA will continue to work aeronautical studies on a first come, first served basis. Please take this possible delay into consideration when determining when to submit your case. If your submitted aeronautical study requires priority and 60 days has elapsed since submission, please contact the OEG Specialist for your state with the rationale for your request and it will be reviewed for escalation. The issue causing these delays is actively being mitigated and is expected to be resolved around August.

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2018.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

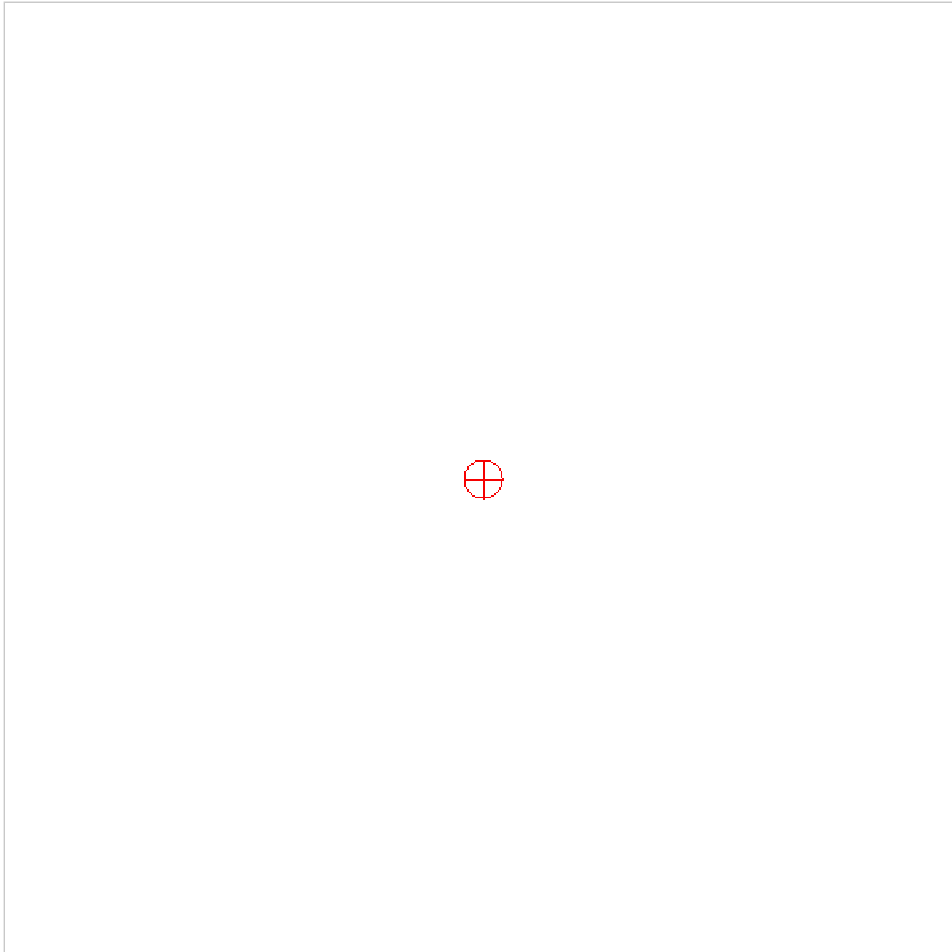
If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 25 M 45.74 S N
Longitude:	150 Deg 54 M 03.16 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	1934 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	◉ No ○ Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

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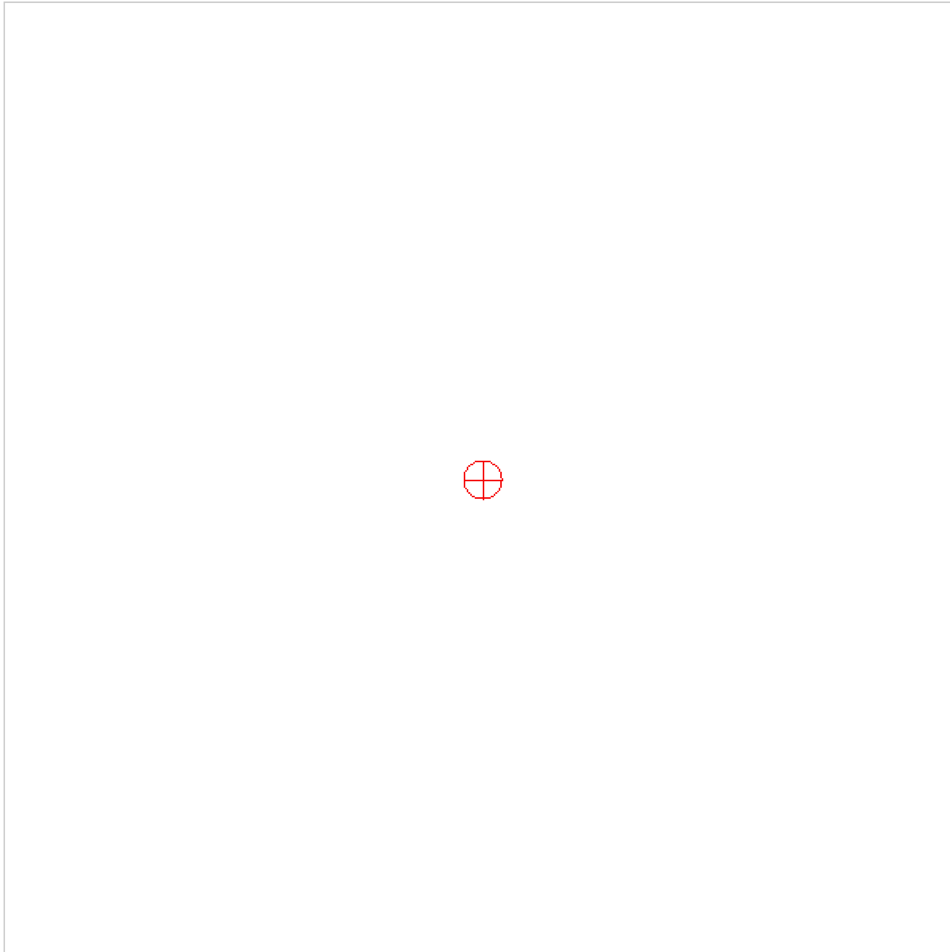
The tool below will assist in applying Part 77 Notice Criteria.

*** Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 25 M 51.20 S N
Longitude:	150 Deg 55 M 01.12 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	2037 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

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- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
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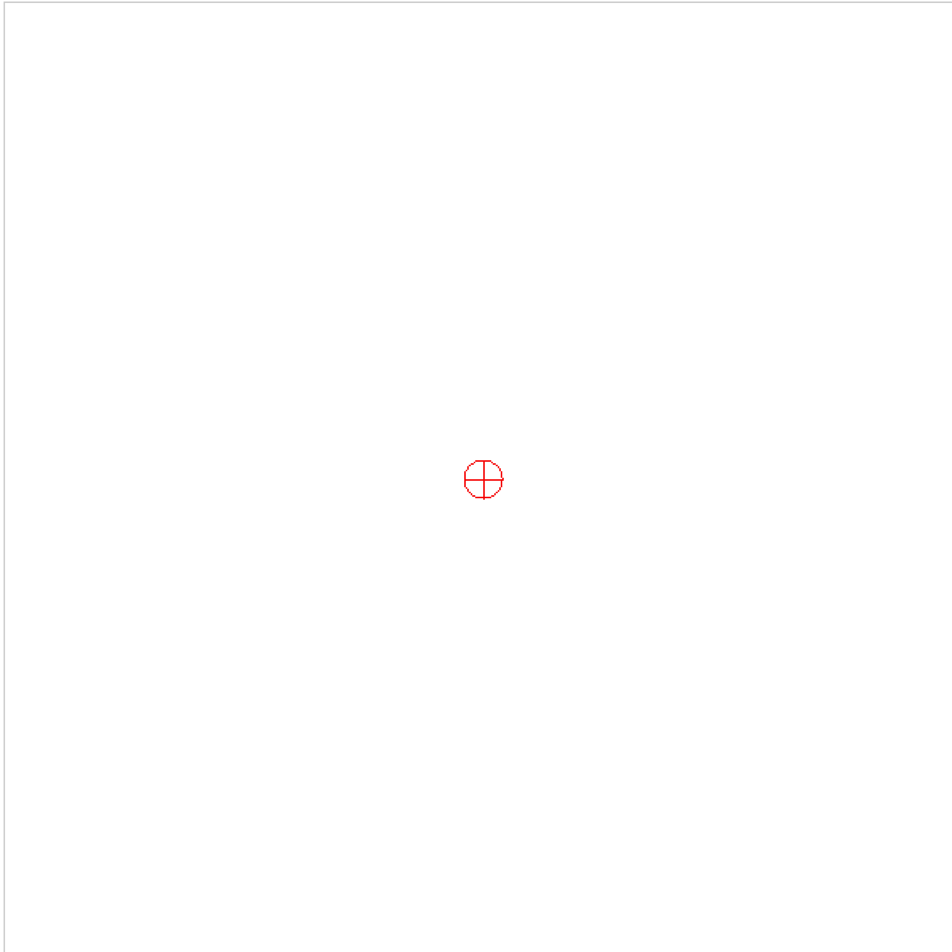
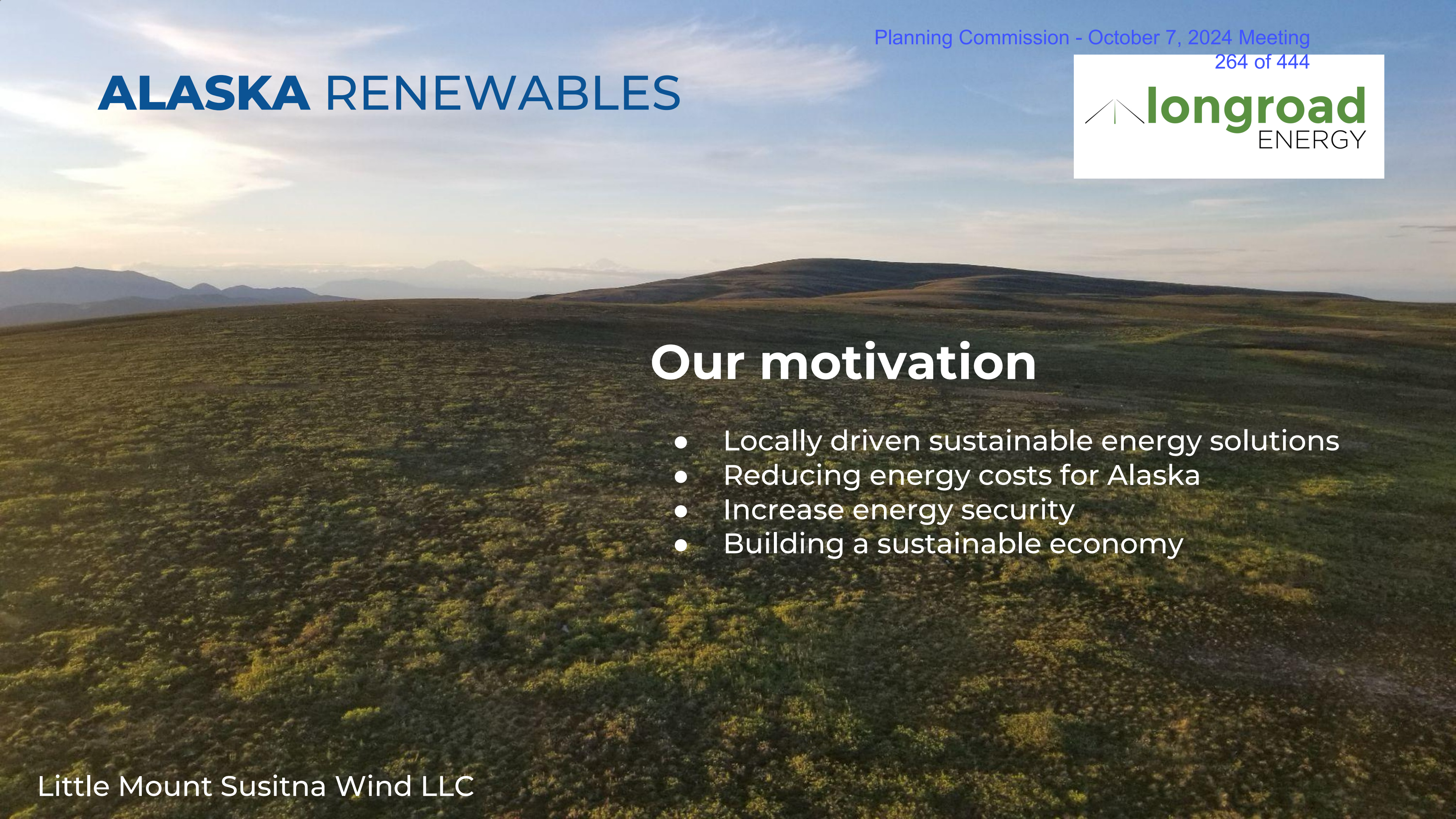
The tool below will assist in applying Part 77 Notice Criteria.

*** Structure Type:**	TOWER | Met Tower Please select structure type and complete location point information.
Latitude:	61 Deg 25 M 18.54 S N
Longitude:	150 Deg 55 M 40.81 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	1903 (nearest foot)
Structure Height :	199 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.





ALASKA RENEWABLES

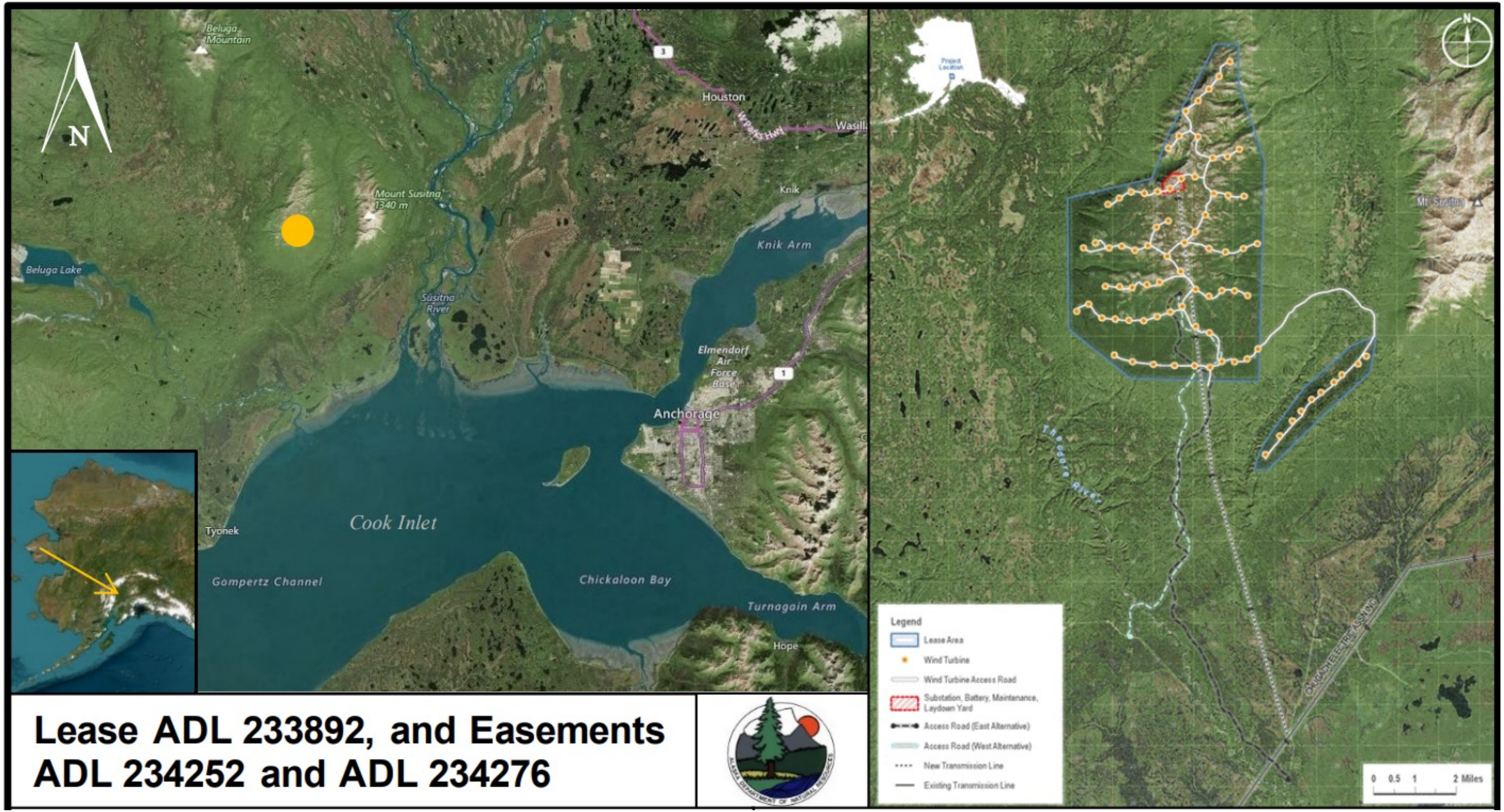
longroad ENERGY

Our motivation

- Locally driven sustainable energy solutions
- Reducing energy costs for Alaska
- Increase energy security
- Building a sustainable economy

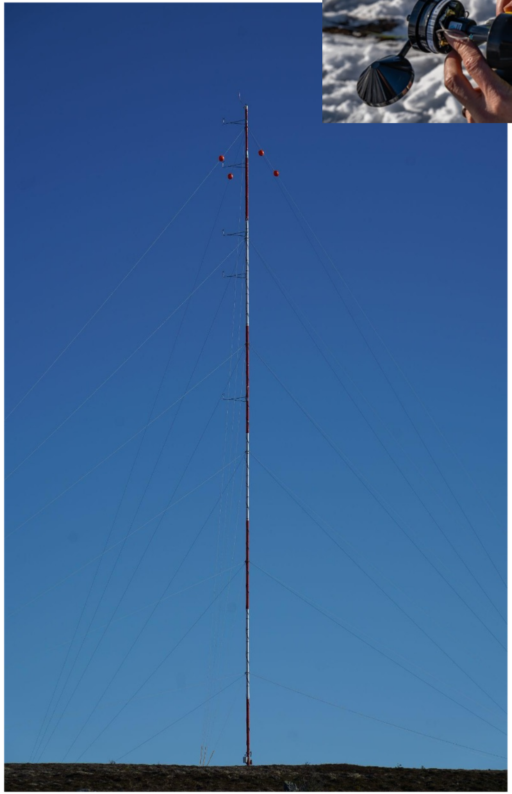
Little Mount Susitna Wind LLC

Little Mount Susitna Wind Project



Meteorological Towers

- Used to measure wind speed and direction for resource assessment
- Each tower is 50-60m (164-197 ft.) tall with 4 sets of guy wires
- Painted with FAA-compliant paint, and marked with guy guards and marker balls
- No lighting required
- Towers are engineered for harsh climates

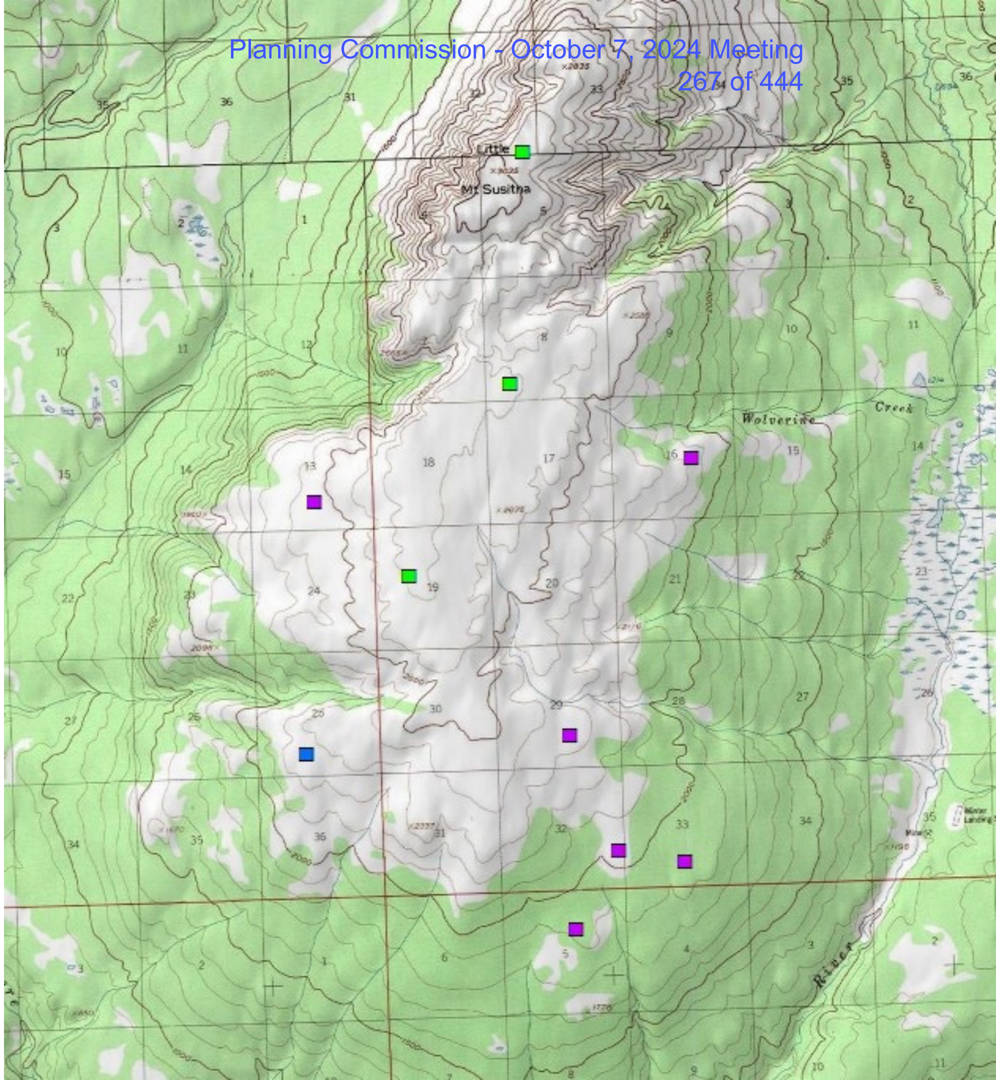


Meteorological Campaign

- Currently 3 meteorological towers installed on Little Mt. Susitna (Green Points)

- Permitting 6 additional tower locations (Purple Points) to collect additional wind data

- MSB Chapter 17.67 requires a permit for tall towers over 85 feet



Proposed Meteorological Tower Locations

Latitude/Longitude (WGS84)

61.473061N, 150.988809W

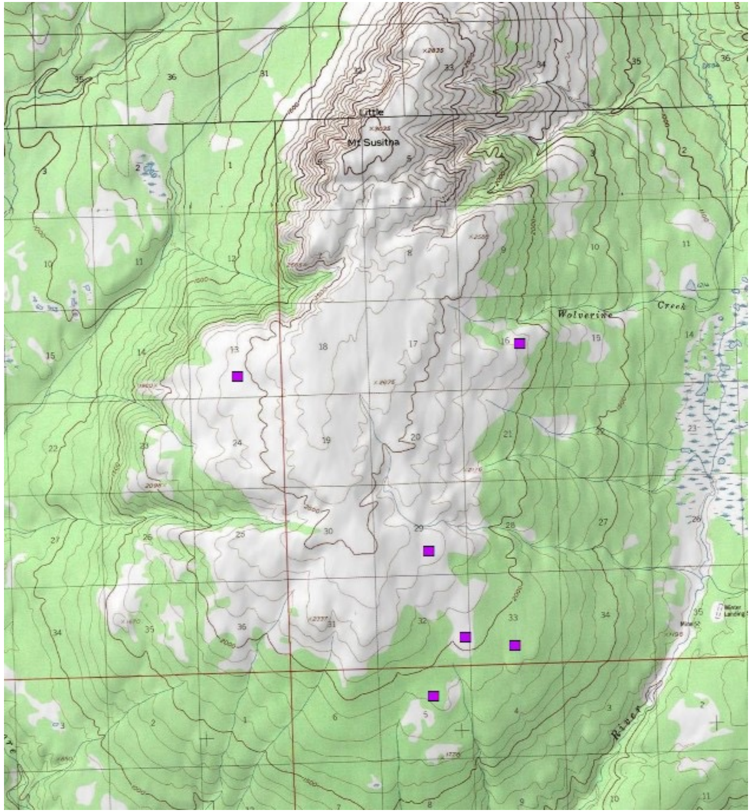
61.476704N, 150.895905W

61.444640N, 150.927867W

61.429372N, 150.900878W

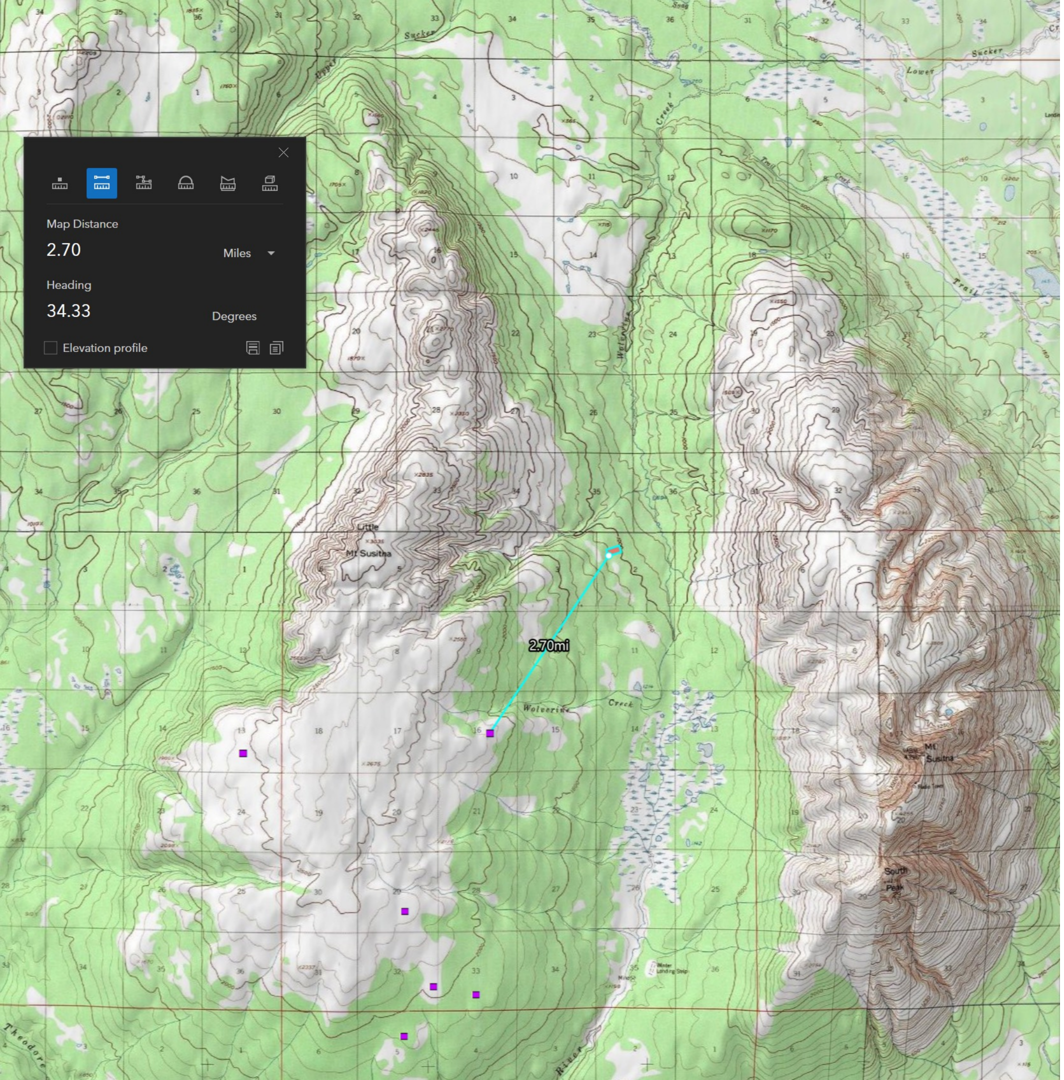
61.430890N, 150.916978W

61.421817N, 150.928003W



Visibility

Nearest Property

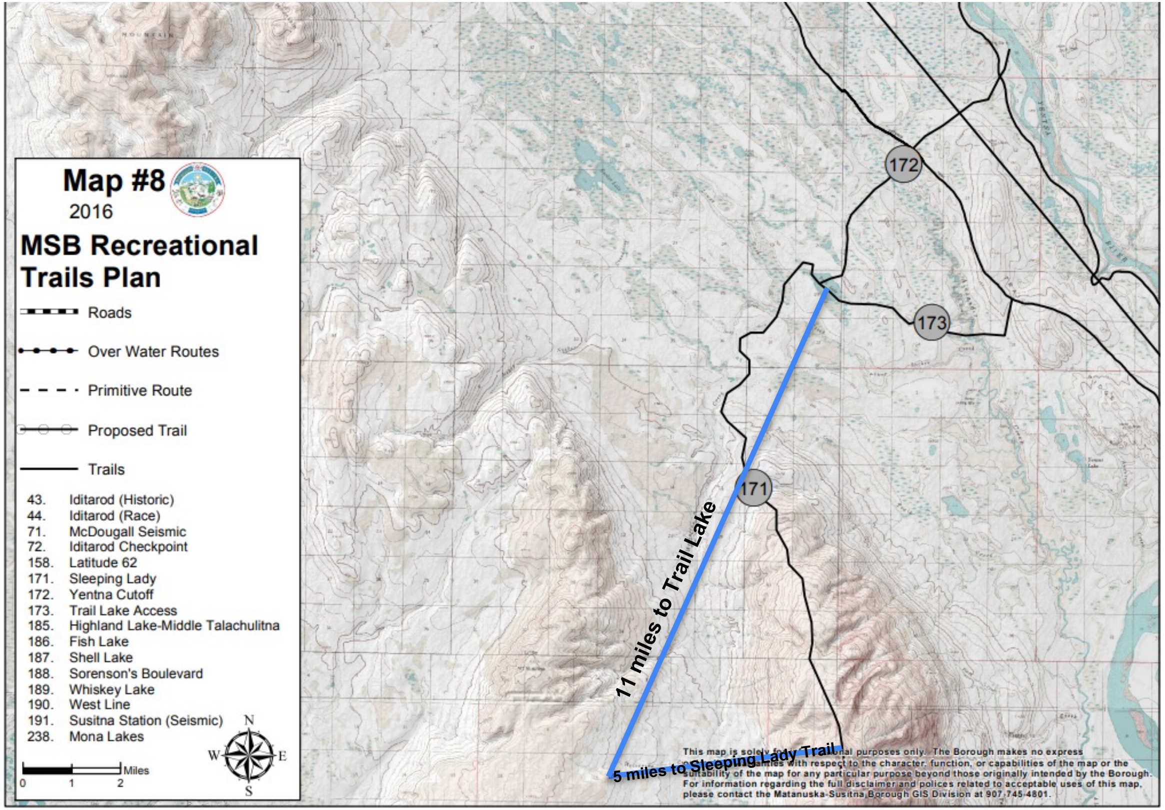


- The nearest private property is 2.7 miles away from the northeasternmost tower site
- Towers are not expected to be visible from this location
- One tower may be barely visible from Trail Lake, at a distance of over 11 miles

Nearest Recreation Site

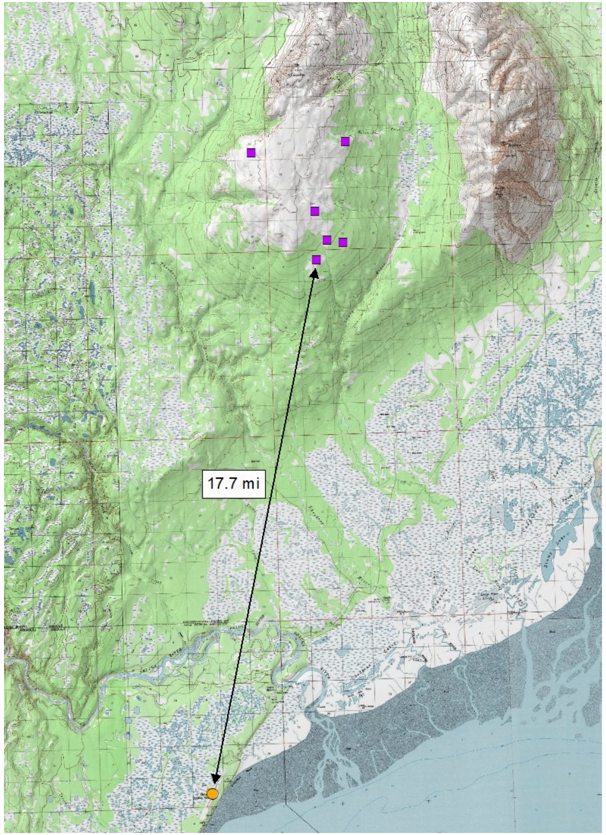
- 5 miles to the nearest trail (Sleeping Lady)

- 11 miles from the named lake (Trail Lake)



Nearest Airport

- 17.7 miles from the Beluga Airport
- Compliant with FAA criteria



Questions?

hello@alaskarenewables.com

Written Community Meeting Report
06/3/2024

1. **Written Meeting Summary**
2. **Notice Letter**
3. **Certificate of Mailings**
4. **Comments Received**
5. **Response to Written Comments**
6. **Meeting Roster**

Written Summary of Community Meeting

Hosts: Andrew McDonnell + Jeremy Vander Meer from Alaska Renewables,

representing Little Mount Susitna Wind LLC

Willow Community Center

6/3/2024, 5:30-6:45pm

Little Mount Susitna Wind LLC sent out 110 notices to the tax parcels identified by Rick Benedict, Current Planner at the Matanuska-Susitna Borough (see notice letter and certificate of mailings below). Additionally, as a courtesy, Little Mount Susitna Wind LLC notified Mike Williams, although he falls outside of the mandated contact area. Three people attended the meeting, and one person submitted a written comment. All attendees requested to receive updates via email.

Meeting Attendees:

1. Allen and Cindi Thomas: Owners of a remote cabin above Wolverine Creek, approximately 5.5 miles NNE of the northeastern-most proposed tower location. They also attended last year's meeting for the 2023 CUP. The Thomas' had seen the existing towers last fall when they were still on the ground but not yet erected. During the meeting, we shared photos and additional information about the existing towers, and reviewed plans for the new towers, including materials from the slide deck. We discussed the likely lack of visibility of the towers from their property, using line-of-sight analysis in ArcGIS Earth. They had no opposition to the project or towers but were interested in learning more and suggested the utility of installing an electric bear fence to protect equipment. They also invited project personnel to visit their cabin.

2. Taunnie Boothby: A Willow resident and MSB employee (Planner, focusing on floodplains and natural hazards). Little Mount Susitna Wind LLC provided her with a full walkthrough of the slide deck, answered questions, and discussed various topics, including the potential use of wind data to understand weather-related risks in the borough and the nature of wind energy. Taunnie inquired about the impact of wind turbines on birds, and we provided a verbal response based on current scientific data regarding birds and wind turbines.

Written Comment:

Mike Williams expressed concerns that the Little Mount Susitna Wind project is being rushed without sufficient study, particularly in terms of wind patterns and actual benefits. He worries the wind farm could interfere with low-level military training, which is becoming increasingly important as the U.S. military expands its Arctic presence. Williams also raised safety concerns due to the project's location in a busy airspace used by both military and private aircraft, especially during bad weather. His environmental concerns include the proximity to fault lines and volcanoes, potential impacts on wildlife such as moose and migratory birds, and possible disturbance to bat habitats. He feels the local population, including his family, would bear the negative consequences without benefiting from the project. Additionally, he questions why alternative sites haven't been explored. Williams is also concerned about the potential for property value declines and the destruction of culturally significant areas. He criticized the lack of sufficient local consultation and called for a more balanced, fact-based approach to the project.

Response to Written Comment:

Little Mount Susitna Wind LLC responded to Williams' concerns via email. They acknowledged his concerns and emphasized their commitment to understanding the local area and addressing potential issues. The developers clarified that the project is still in the data-gathering phase, with additional meteorological towers planned to further assess wind conditions. They assured Williams that military operations and private aviation routes have been considered in the planning process, with filings already submitted to the Department of Defense and the FAA to ensure aviation safety. The response also addressed concerns about seismic risks, wildlife impacts, and cultural heritage, noting that the company is working with relevant agencies to mitigate these risks. While recognizing local economic concerns, the developers are exploring ways to benefit nearby communities and remain open to further dialogue to ensure that all voices are heard. The letter concluded by reaffirming their commitment to transparency and collaboration as the project progresses.

Little Mount Susitna Wind LLC
MSB CUP for Tall Towers Community Meeting
6/3/2024 | 530pm-630pm

Sign in Sheet

	Name	Email	Address	Sign up for Newsletter?
1	Allen + Cindi Thomas	alaskallen@Hotmail.com	P.O. Box 693 willow, AK 99688	✓
2	TAWNIE Boothby	tlboothby@gmail.com	PO Box 962 willow, AK 99688	✓
3				
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20				

From:	Faith Tyson
To:	eagle@eaglesongalaska.com
Cc:	Rick Benedict
Subject:	Re: FW: Little Mount Susitna Wind Farm Public Comment
Date:	Monday, September 16, 2024 9:13:29 AM
Attachments:	20240912 - LMS - CUP #2 - Response to Mike Williams (1).pdf

[**EXTERNAL EMAIL** - CAUTION: Do not open unexpected attachments or links.]

Dear Mr. Williams,

Thank you for your written comment. Please find Little Mount Susitna Wind's response attached.

Best,

Faith Tyson (she/they)
Community Engagement and Accountability Manager
Alaska Renewables LLC
[c] +1-907-202-0507 [e] faith@alaskarenewables.com

Alaska Renewables LLC occupies the ancestral, traditional, and contemporary lands of Alaska Native people that have resided, occupied, and called this land home. I recognize the historic Indigenous individuals and communities who live here now and those who were forcibly removed from their homes. In offering this land acknowledgement, I affirm Indigenous sovereignty, history and experiences.

On Mon, Jun 3, 2024 at 10:01 AM Rick Benedict <Rick.Benedict@matsugov.us> wrote:

> Hello,
>
> Comments were received concerning the proposed Little Mount Susitna Wind project for tonight's community meeting.
>
> Respectfully,
>
> Rick Benedict – Current Planner
>
> Development Services Division
>
> Matanuska-Susitna Borough
>
> (907)861-8527 direct

From: Permit Center <Permit.Center@matsugov.us>
Sent: Monday, June 3, 2024 8:32 AM
To: Peggy Horton <Peggy.Horton@matsugov.us>; Rick Benedict <Rick.Benedict@matsugov.us>
Subject: FW: Little Mount Susitna Wind Farm Public Comment

Good morning. Is this for one of you, or someone else?

Thanks.

Brandon Tucker

Permit Technician

Matanuska-Susitna Borough Permit Center

350 E Dahlia Ave

Palmer AK 99645

P (907) 861-7871

F (907) 861-8158

From: eagle@eaglesongalaska.com <eagle@eaglesongalaska.com>
Sent: Sunday, June 2, 2024 10:34 AM
To: Permit Center <Permit.Center@matsugov.us>
Subject: Little Mount Susitna Wind Farm Public Comment

Please find attached comments for the community meeting to be held at the Willow Area Community Center, June 3, 2024.

The location and short notice of the Willow meeting make it impossible for my family to attend. We would hope that those remote stakeholders living in the vicinity of the wind farm project will have an opportunity to comment in a more direct manner in days to come. Might I suggest the Mat-Su Borough Development Services Division and Planning and Land Use Department offer an online meeting opportunity to take public comment.

Regards,

Michael W. Williams

EagleSong Peony Farm

200 W. 34th Ave. Ste 295

Anchorage, AK 99503

(907) 521-0034

eaglesongalaska.com

Instagram.com/eaglesongalaska

facebook.com/eaglesongalaska

www.tiktok.com/@alaskapeony

youtube.com/eaglesongalaska

September 12, 2024

Dear Mr. Williams,

Thank you for sharing your detailed concerns with Matanuska Susitna Borough regarding the proposed Little Mount Susitna Wind Project. I appreciate your deep connection to the land and the thoughtfulness with which you've approached this matter. As developers, we strive to consider the impact of our projects on the local community and environment, and your input is invaluable in this process.

Firstly, I want to address your concern that our company lacks sufficient knowledge of the Little Mt. Susitna area. While it is true that our company was founded in Fairbanks, we are committed to understanding the unique characteristics of the regions where we work. Our visit to your home and the subsequent conversations were part of our efforts to gather local insights and ensure that our plans are informed by those who know the area best.

The development of a wind farm is indeed a complex process and every step is being taken with careful consideration and thorough study. The meteorological towers installed last year are just the beginning of a comprehensive process to gather data over multiple seasons before any concrete conclusions are drawn. The additional meteorological towers that we seek to permit and install would build on that effort to expand our understanding of the weather conditions at additional locations across the project site.

We are aware of the regular low-level military operations west of the Susitna River involving the Army, Air Force, and Alaska National Guard, particularly around Mt. Susitna, Little Mt. Susitna, and Beluga Mountain. The proximity of these training areas to Joint Base Elmendorf-Richardson is crucial, and we have factored this into our planning process.

Additionally, we recognize Little Mount Susitna as a popular route for private pilots, especially during challenging weather conditions. Safety is paramount, and our wind farm design considers these flight patterns. We have completed the initial Department of Defense (DoD) screening and initiated a filing with the FAA, ensuring that all regulatory requirements for aviation safety are being adhered to. Little Mount Susitna Wind remains fully committed to the safety of all airspace users, including both military and civilian aircraft.

Regarding the project's proximity to the Castle Mountain Fault and Mt. Spur, these factors have been taken into account in our initial assessments and are an important part of our ongoing work. It is standard practice in the wind energy industry to conduct detailed meteorological, geotechnical and mechanical engineering studies in order to quantify the expected forces on the turbines and identify the appropriate design considerations for these conditions. The field and engineering studies we are currently conducting will provide the appropriate design basis to ensure project infrastructure is resilient to potential seismic events.

The potential impact on wildlife, including moose, ptarmigan, and migratory birds, is another area where we are proceeding with caution. We have engaged with the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) to develop appropriate wildlife impact assessments and mitigation strategies. This includes measures to minimize disruptions to migratory patterns and protect critical habitats.

It is important to note that the construction of any energy infrastructure involves a balance between the need for energy and the preservation of local ecosystems. We are committed to implementing best practices and mitigation measures to reduce the impact on wildlife and their habitats.

Your concern about the economic impact on the local community is reasonable. We recognize that large-scale projects can bring significant changes, and we are working to ensure that these changes are positive. While the primary beneficiaries of the power generated may be in the Anchorage area, we are exploring ways to provide direct benefits to the communities like yours that are nearest to the project site. Our visit to your home was a first step in developing an understanding of what those benefits might look like, and we will continue to consider your input on the matter.

We are also committed to ongoing dialogue with residents, including those who may not have been able to attend meetings in Willow. We are open to organizing additional meetings closer to the Little Mt. Susitna area to ensure that all voices are heard.

The presence of any artifacts and the cultural significance of the area is an issue we take very seriously. As part of the project permitting process, we have begun consultations with cultural and historical experts, agencies, and tribes, and initiated archaeological field work to identify any historically important sites within the project area. Through this work we are committed to design the project to in a way that avoids and minimizes impacts and complies will all relevant laws and regulations.

We understand that no project of this magnitude is without its challenges and concerns. Our aim is to ensure that the Little Mt. Susitna Wind Project is developed in a way that respects the environment, honors the local community, and contributes positively to Alaska’s renewable energy future. We are committed to transparency and collaboration as we move forward, and we welcome continued dialogue with you and other stakeholders.

Thank you again for your feedback. We look forward to working together to find the best possible outcomes for this project and the community.

Sincerely,

Faith Tyson

On behalf of Little Mount Susitna Wind LLC

Faith@alaskarenewables.com

Matanuska-Susitna Borough
Planning & Land Use Department
Development Services Division
350 East Dahlia Avenue
Palmer, Alaska 99645

FIRST CLASS MAIL

A community meeting will be conducted regarding the following new tall structure/cell tower:

Name of Company: Little Mount Susitna Wind LLC
Height of Tower: 60 meters
Tower Design: The meteorological towers are 60m tubular structures with multiple guy wires. The towers have FAA-compliant industrial paint, guy guards, and marker balls. Painting is with alternate bands of aviation orange and white paint. High visibility guy guards (yellow plastic sleeves) will be placed around the base of the guy wires. Four high visibility aviation orange marker balls will be placed on the top-level guy wires within approximately 10m of the top of the tower.
Lighting: N/A
Site Access: The site will be accessed by helicopter.
Proposed Service: The purpose of these installations is to allow for the quantitative assessment of the wind resources to enable the development of a future utility-scale wind energy generation project that would provide reliable, low-cost renewable energy to Southcentral Alaska.

A community meeting will be held on **June 3, 2024, from 5:30-6:30pm at the Willow Area Community Center, located at Mile 69 South Parks Highway, Willow Alaska.** Please come to the meeting to obtain more information and give feedback about this proposed project.

For additional information regarding the proposed tower please contact:

Faith Tyson
907-202-0507
3300 Arctic Blvd
Suite 201, PMB 1451
Anchorage, AK 99503

If you would like to submit comments, this form may be used for your convenience by filling in the information below and mailing it to the Matanuska-Susitna Borough, Development Services Division, 350 E. Dahlia Avenue, Palmer, AK 99745. You may e-mail to permitcenter@matsugov.us. Comments must be received by **June 3, 2024.**

Name: Michael W. Williams ***Address:*** 200 W. 34th Ave. Ste 295, Anchorage, AK 99503

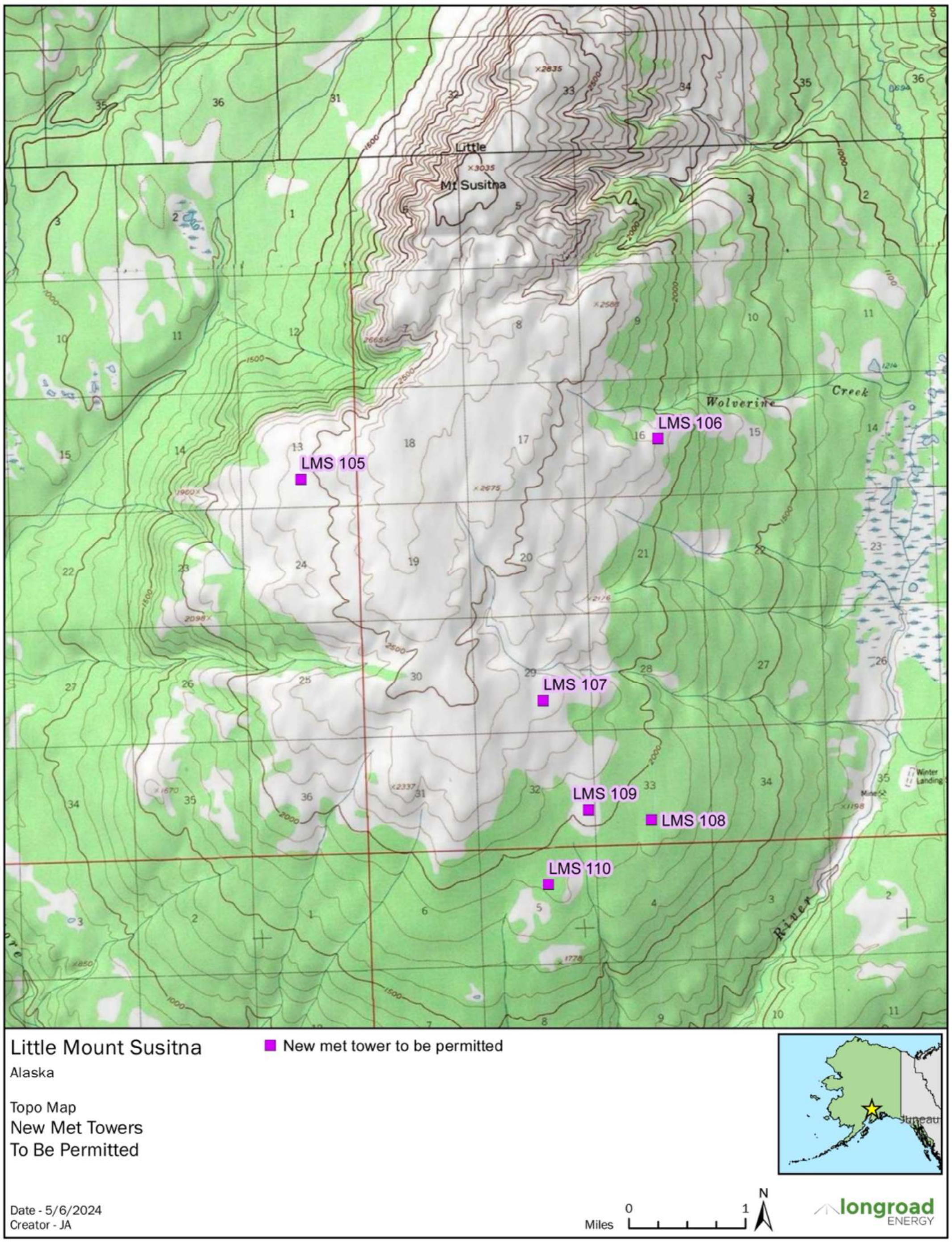
Location/Legal Description of your property: Tract D & E, ASL77-149, Trail Lake, AK (Alexander Creek Drainage)

Comments: See attached

Note: Vicinity Map Located on Reverse Side

Detailed topographic map of the meteorological tower sites proposed on Little Mt Susitna

Site Name	Lat/Lon (WGS84)	Elevation (ft)	MTRS
LMS_105	61.473061N, 150.988809W	2466	S016N010W13
LMS_106	61.476704N, 150.895905W	2200	S016N009W16
LMS_107	61.444640N, 150.927867W	2339	S016N009W29
LMS_108	61.429372N, 150.900878W	1934	S016N009W33
LMS_109	61.430890N, 150.916978W	2037	S016N009W32
LMS_110	61.421817N, 150.928003W	1903	S015N009W05



To: Mat-Su Borough, Planning and Land Use Department June 2, 2024

Subject: Little Mt. Susitna Wind Farm Project Comments

My family has lived at the northeast base of Little Mt. Susitna for the past 31 years. I look out the picture windows of my log cabin farm home and gaze upon Little Mt. Susitna every day. I think I can safely say there are few Alaskans alive today that have spent more time on and around that mountain than me. We built a successful peony farm after losing the prolific Alexander Creek drainage salmon runs to northern pike and closing our 15-year business as EagleSong Lodge.

I recently read an opinion piece written by New Energy Alaska. In that article it was stated that had the Little Mt. Susitna Wind Farm project been operational that up to 20% of the electric demand could have been met reducing natural gas demand during an extreme cold snap in the Anchorage area this past winter. This was a statement created by Alaska Renewable Inc., the developers of the proposed Little Mt. Susitna Wind Farm.

I am concerned with the apparent rush to develop the Little Mt. Susitna Wind Farm without looking at all sides of the picture. Claims like this project could have off-set a potential shortage in Cook Inlet natural gas this winter is a sound bite created to sway the public without any basis in fact and prey on public fear. How do I know? Alaska Renewable Inc. (wind farm developers) constructed 3 meteorological towers in October 2023 to study wind patterns. It is not possible to draw conclusions in such a short period of time. That is a statement made before the facts are even known.

The owners of Alaska Renewable Inc. flew out and visited me last August. We sat in my yard on the shores of Trail Lake and looked directly at Little Mt. Susitna while we discussed the project for more than 2 hours. From that conversation I noted several issues.

- First, this Fairbanks owned company appears to know very little about the area they picked to pursue their project. In their own words they revealed that their job was to get the project started and then, if successful, pass it on to an international company to finance, build, own, and operate. Alaska Renewable Inc. will hype the project with a goal of a big payday and a residual that should make their lives quite comfortable.
- The proposed wind farm project sets directly on top of the active Castle Mountain Fault and its juncture with the Beluga Fault. In the event of a significant seismic event when the rail belt could need reliable power the most it may not be available from this site. Keep in mind we had a 7.1 earthquake in November 2018 centered just 25 miles east of the proposed site. Why would one build such an important and expensive wind farm directly on top of a seismic fault line? At a minimum it will significantly increase costs to try and build to withstand significant earthquakes. "It's the only active fault that comes to the surface in southcentral Alaska," said geologist Peter Haeussler, a leading earthquake researcher with the U.S. Geological Survey in Anchorage. "I'd personally try to avoid living within six miles of this thing," Haeussler said. "You wouldn't want to put any critical facilities on top of it."(Associated Press, Dec 29, 2002)
- The proposed site is less than 35 miles from the active volcano Mt. Spur. It last erupted June 27, 1992 after being quiet for 39 years. It is considered one of the most active volcanoes in Alaska

and last rumbled awake in 2012. Does it make sense to locate a critical energy production facility so close?

- The Army, Air Force and Alaska National Guard conduct low level (nap of the earth) operations west of the Susitna River. Mt. Susitna, Little Mt. Susitna and Beluga Mountain experience almost weekly helicopter and fixed wing training activities. Helicopters conduct low level operations and landings all over Little Mt. Susitna and the proposed wind farm site. At a time when the U.S. military is increasing a significant arctic presence in Alaska it stands to lose a training area within minutes of Joint Base Elmendorf/Richardson. We even see significant presence of the massive twin rotor Chinook helicopters stationed in the Fairbanks area. Their presence was last noted on June 1st.
- The impact on wildlife will likely be significant. At this moment Alaska Department of Fish and Game (ADF&G) is imposing restrictions on moose hunting in game management unit 16B. ADF&G has eliminated the permit and youth hunts for the coming year. They have indicated they will narrowly approve a fall general and subsistence hunt for the region. ADF&G established a minimum population of 6000 moose for a sustained hunt. In January they counted under 6200 moose. The population continues to decline for a variety of reasons. This is the second crash of the moose population in 20 years. Little Mt. Susitna is significant summer habitat for moose. The wind farm is asking for over 19,000 acres (lease) to build up to 80 wind turbines. That essentially consumes Little Mt. Susitna and the critical habitat for moose survival.
- The impact on moose is not the only wildlife issue. There are significant flocks of ptarmigan that call Little Mt. Susitna home. The wind farm project will be located less than 3 miles from the Susitna Flats Game Refuge. The Susitna Flats State Game Refuge encompasses approximately 300,800 acres and supports spectacular spring and fall concentrations of migrating waterfowl and shorebirds. The massive wind turbines will be in the direct migratory flight path of Upper Cook Inlet. U.S. Fish and Wildlife Service in their comments expressed concerns about the impact of the wind turbines, flashing navigation lighting and miles of roads, transmission lines and wind turbine sites on migratory birds. USFWS called for development of appropriate bird (and bat) strike mitigation strategies to ensure compliance with the Migratory Bird Treaty Act. This includes bird diversion measures on the guy wires. The three current towers and the proposed towers do not have or address this issue.
- Little is known about bats in Alaska. EagleSong Farm is currently working with Alaska Dept of Fish and Game to install audio monitoring equipment and conduct census counts as it is thought our farm may support a bat nursery. No one knows where these bats currently winter over. It is very possible Mt. Susitna, Little Mt. Susitna and Beluga Mountain offers winter refuge to Alaska's tiny brown bats.
- Little Mt. Susitna sees significant private air traffic in addition to the military air traffic identified above. It is a popular area to fly and land for ski and wheel planes. Small planes often transit between the north and south side of Mt. Susitna during inclement weather conditions trying to get to/from the Anchorage area. The wind farm site is in direct line of pilots trying to navigate the weather that Mt. Susitna often generates. Various Alaska aviation organizations have already sent correspondence to their members warning of the 3 meteorological towers that currently stand there.
- The West Susitna region covers 14,150 square miles. It is larger than 9 U.S. states. In all this vastness according to a demographer from the Alaska Department of Labor and Workforce Development the population (fulltime) in the immediate vicinity of Little Mt. Susitna is approximately 70 people. We are a group so small that we are insignificant in the political world. The area is extremely poor…especially so after the invasion of northern pike and loss of

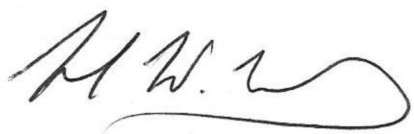
the once prolific salmon runs. We often don't even qualify as an afterthought, especially by developers and politicians. We are the ones that will experience the negative results of this project but appear to be of little concern to Alaska Renewables or our local and state governments. It appears this project will drive the immediate area further into poverty.

- Alaska Renewable Inc. highlights the fact that "Anchorage" will not see the wind turbines. That has become a key selling point to the Rail Belt audience. What about those west of the Susitna River? We don't even get the benefit of the power it will generate. When I pressed Alaska Renewable Inc. representatives to give me one positive outcome for our region, they admitted there were <u>none</u> they could think of. I guess this is a case of the sacrifice of a few for the betterment of the many. I estimate after 31 years of building our lives and business here we stand to lose over $200,000 in value by this project's development after a lifetime of work. Let's be honest, what Alaskan wants to live in the shadow of 80 wind turbines. It was a fight to get the wind turbines constructed on Fire Island and that was just off the end of Ted Stevens Anchorage Intl. Airport. That was an area teeming with development. People don't want to see them.
- Alaska Renewable Inc. indicated they had an alternate site to the south by the village of Tyonek. It doesn't appear they are doing any real evaluation of alternate sites. The average person doesn't understand the massive heavy industrial road system that will have to be built, the rivers it will span or the amount of gravel that will have to be mined to support the massive, specialized equipment that will be needed to move and construct the towers.
- Over the years we have discovered artifacts on Little Mt. Susitna that the University of Alaska estimate to be over 11,000 years old. It is believed Mt. Susitna, Little Mt. Susitna and Beluga Mountain was the only land overlooking the glaciers that covered the southern Susitna Valley at that time. What is likely to be destroyed if Little Mt. Susitna has its top ripped off?
- When it comes to wildfire and wildfire suppression the project proposes to brush the entire project area annually. That is a massive and expensive undertaking. It will impact wildlife, especially the flocks of ptarmigan that call that mountain home.
- The current project development plan submitted to Department of Natural Resources supporting Alaska Renewables land use request only identifies the Lewis and Theodore Rivers as potential impacted waterways. If the request for these new towers is approved a portion of them will potentially impact Wolverine, Sucker and Alexander Creeks on the northeast side of the mountain. These drainages have not been identified in the current development plan.
- I would like to direct the Mat-Su Borough Planning and Land Use Department to the Department of Natural Resources "Preliminary Decision" document dated 5/22/2024. In that document numerous issues have been identified by several state and federal agencies with this project. The meteorological towers already constructed and the new ones proposed are being constructed before any of these issues are addressed.
- We are not aware of any meeting previously held by the Mat-Su Borough Planning and Land Use Department for the three towers currently on Little Mt. Susitna. If there was no meeting, why? It appears the three existing towers were constructed prior to Mat-Su Borough approval.
- Finally, the community meeting being held in Willow ignores the fact that the majority of stakeholders that will be directly impacted by construction of the towers are being ignored. Most stakeholders in the vicinity of Little Mt. Susitna cannot make it to a meeting held 40 miles away in Willow.

My family is not anti-development but feel it must be a measured and fact-based approach. We are very much in favor of Alaska's move to renewable energy.

Let’s not lose sight of the fact that development of the West Susitna Access Road, Little Mt. Susitna Wind Farm, coal power plant, Donlin gas line, mining, drilling and other projects will require the destruction of the lower west Susitna Valley. A valley that to this point has been little touched by civilization. It will require us to destroy a region that is still in its natural state. Is it worth the price? Are the Alaskans that call this place home to be tossed aside? Once it happens there is no going back.

Does my family and I have a bias regarding these projects? Of course we do, this has been our home for over 31 years. I am approaching my 70th birthday and hope to retire someday, but that may not be possible if the wilderness that enticed us to come here is turned into an industrial park. Our hope is this wind farm, and the other projects are measured by their pros and cons and decisions are based on merit, but that rarely happens today does it. The Little Mt. Susitna Wind Farm project is not a benign project. Let’s make sure the benefit is worth the sacrifice.



Michael W. Williams
General Partner

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(907) 521-0034
eagle@eaglesongalaska.com

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Landowner
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1920 6th St #347
Santa Monica, CA 90405

Landowner
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Raymond, WA 98577-1500

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Reno, NV 89523

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Fullerton, CA 92832

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Landowner(s)
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Landowner(s)
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Matanuska-Susitna Borough
Planning & Land Use Department
Development Services Division
350 East Dahlia Avenue
Palmer, Alaska 99645

FIRST CLASS MAIL

A community meeting will be conducted regarding the following new tall structure/cell tower:

Name of Company: Little Mount Susitna Wind LLC
Height of Tower: 60 meters
Tower Design: The meteorological towers are 60m tubular structures with multiple guy wires. The towers have FAA-compliant industrial paint, guy guards, and marker balls. Painting is with alternate bands of aviation orange and white paint. High visibility guy guards (yellow plastic sleeves) will be placed around the base of the guy wires. Four high visibility aviation orange marker balls will be placed on the top-level guy wires within approximately 10m of the top of the tower.
Lighting: N/A
Site Access: The site will be accessed by helicopter.
Proposed Service: The purpose of these installations is to allow for the quantitative assessment of the wind resources to enable the development of a future utility-scale wind energy generation project that would provide reliable, low-cost renewable energy to Southcentral Alaska.

A community meeting will be held on **June 3, 2024, from 5:30-6:30pm at the Willow Area Community Center, located at Mile 69 South Parks Highway, Willow Alaska.** Please come to the meeting to obtain more information and give feedback about this proposed project.

For additional information regarding the proposed tower please contact:

Faith Tyson
907-202-0507
3300 Arctic Blvd
Suite 201, PMB 1451
Anchorage, AK 99503

If you would like to submit comments, this form may be used for your convenience by filling in the information below and mailing it to the Matanuska-Susitna Borough, Development Services Division, 350 E. Dahlia Avenue, Palmer, AK 99745. You may e-mail to permitcenter@matsugov.us. Comments must be received by **June 3, 2024.**

Name: ________________________________ ***Address:*** ____

Location/Legal Description of your property: ____

Comments: ____

____

____

____

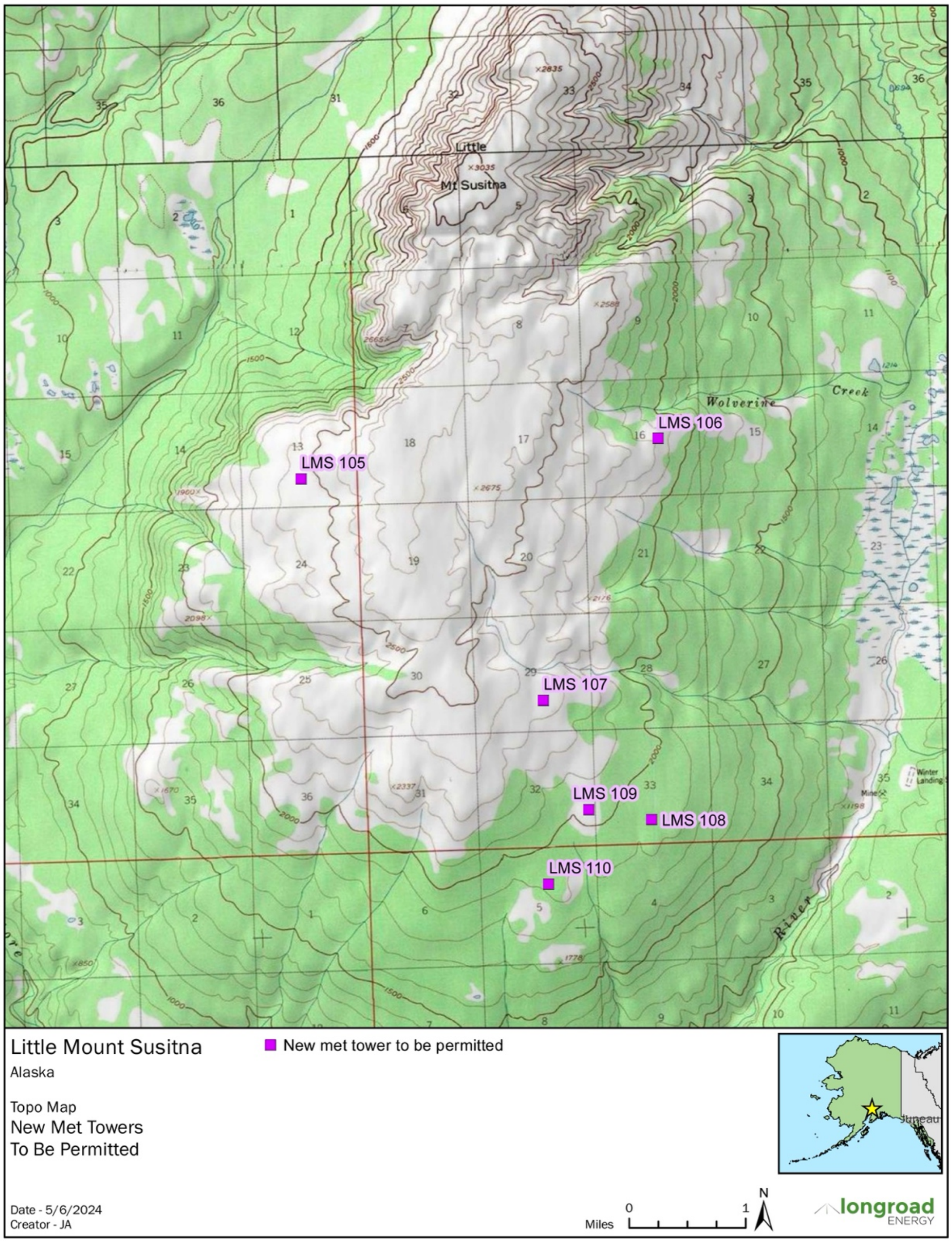
____

____

Note: Vicinity Map Located on Reverse Side

Detailed topographic map of the meteorological tower sites proposed on Little Mt Susitna

Site Name	Lat/Lon (WGS84)	Elevation (ft)	MTRS
LMS_105	61.473061N, 150.988809W	2466	S016N010W13
LMS_106	61.476704N, 150.895905W	2200	S016N009W16
LMS_107	61.444640N, 150.927867W	2339	S016N009W29
LMS_108	61.429372N, 150.900878W	1934	S016N009W33
LMS_109	61.430890N, 150.916978W	2037	S016N009W32
LMS_110	61.421817N, 150.928003W	1903	S015N009W05



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99530
MAY 16, 24
AMOUNT
$2.00
R2304M110467-

To:
Landowner(s)
1303 NW Hawk Creek Dr
Blue Springs, MO 64015

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To:

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Reno, NV 89523

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To:

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Po box 415
Girdwood, AK 99587

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Po box 875513

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To:

Landowner(s)
11202 W Granada Dr

Sun City, AZ 85373

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To:

Landowner(s)
11508 N Greenwood Ave, Unit B3
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To:

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7031 Clairmont Cir

Anchorage, AK 99507

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To:

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7302 Oakmont Dr

Santa Rosa, CA 95409

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To:
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To:

Landowner
402A W Palm Valley Blvd #153
Round Rock, TX 78664

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To:

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Raymond, WA 98577-1500

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To:

Landowner
17409 Four Corner Rd
Prairie Grove, AR 72753-9765

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To:

Landowner
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AMOUNT
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To:

Landowner
Po box 693
Willow, AK 99688

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AK
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To:

Landowner
Po box 661
Whittier, AK 99693

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From:

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Po box 93330
Anchorage, AK 99509

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To:

Landowner
11340 Elmore Rd
Anchorage, AK 99516

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AMOUNT
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To:

Landowner
130 Woodland Ave
Reno, NV 89523

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99530
MAY 16, 24
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$2.00
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To:

Landowner
13301 E Jensen Ave
Palmer, AK 99645

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To:

Landowner(s)
28323 Eagle River Rd

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Federal Way, WA 98023

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Willow, AK 99688

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To:

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20632 David Ave

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To: Landowner(s)
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Astoria, OR 97103

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Big Lake, AK 99652

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INTRODUCTION FOR PUBLIC HEARING

LEGISLATIVE

Resolution No. 24-29

Recommending Approval Of An Ordinance Amending MSB 17.73 To Clarify That Mobile Home Parks Are Not Permitted In The Matanuska-Susitna Borough

(Pages 404-417)

INTRODUCTION FOR PUBLIC HEARING

By: A. Strawn
Introduced: October 7, 2024
Public Hearing: October 21, 2024
Action:

MATANUSKA-SUSITNA BOROUGH
PLANNING COMMISSION RESOLUTION NO. 24-29

A RESOLUTION OF THE MATANUSKA-SUSITNA BOROUGH PLANNING COMMISSION RECOMMENDING APPROVAL OF AN ORDINANCE AMENDING MSB 17.73 TO CLARIFY THAT MOBILE HOME PARKS ARE NOT PERMITTED IN THE MATANUSKA-SUSITNA BOROUGH.

WHEREAS, Assembly Ordinance 24-053 repealed MSB 17.48 Mobile Home Parks in its entirety, thereby eliminating the permit process and public hearing requirements for proposed mobile home parks, but did not ban mobile home parks; and

WHEREAS, because of that repeal, mobile home parks constructed on foundations can now be built in Mat-Su without giving residents a chance to voice their concerns or provide input through a public hearing; and

WHEREAS, the intent of this ordinance is to prohibit the establishment of new mobile home parks in the Mat-Su unless and until the Assembly reinstates a permit process that includes a public hearing in front of the Planning Commission; and

WHEREAS, Alaska's cold temperatures pose a challenge for mobile homes which typically have less insulation than permanent housing structures. This can lead to higher heating costs, difficulty in maintaining a stable interior temperature, and vulnerability to freezing water lines; and

WHEREAS, mobile homes pose an increase risk to death in the event of a fire because they are typically constructed with highly flammable materials, are small and confined, and lack proper escape routes; and

WHEREAS, establishment of mobile home parks may lead to lower property values in surrounding areas.

NOW, THEREFORE, BE IT RESOLVED, that the Matanuska-Susitna Borough Planning Commission hereby recommends approval of Assembly Ordinance 24-096.

ADOPTED by the Matanuska-Susitna Borough Planning Commission this -- day of --, 2024.

C J KOAN, CHAIR

ATTEST

Lacie Olivieri
Planning Clerk

(SEAL)

YES:

NO:

MATANUSKA-SUSITNA BOROUGH INFORMATION MEMORANDUM **IM No. 24-097**

SUBJECT: AN ORDINANCE OF THE MATANUSKA-SUSITNA BOROUGH ASSEMBLY REPEALING MSB 17.48 MOBILE HOME PARK ORDINANCE IN ITS ENTIRETY.

AGENDA OF: May 7, 2024

ASSEMBLY ACTION: Amended and defeated with Assemblymembers Yundt, Fonov, and Bernier in support and Assemblymembers Hale, Nowers, and McKee opposed (tie vote) Passed with Mayor DeVries voting in support. 08/06/24 - BJH

AGENDA ACTION REQUESTED: Refer to Planning Commission for 90 days.

Route To	Signatures
Originator	4/17/2024 X Alex Strawn Signed by: Alex
Department Director	4/17/2024 X Alex Strawn Signed by: Alex
Finance Director	4/22/2024 X Cheyenne Heindel Signed by: Cheyenne Heindel
Borough Attorney	4/22/2024 X Nicholas Spiropoulos Signed by: Nicholas Spiropoulos
Borough Manager	4/22/2024 X Michael Brown Signed by: Michael Brown
Borough Clerk	4/25/2024 X Lonnie McKechnie Signed by: Lonnie McKechnie

ATTACHMENT(S): Ordinance Serial No. 24-053 (1 p.)
MSB Code 17.48 (6 pp)
Planning Commission Reso. 24-13 (2 pp)

SUMMARY STATEMENT: This ordinance is at the request of Assembly Member Yundt. The intent of this ordinance is to make developing a mobile home park impossible.

RECOMMENDATION OF ADMINISTRATION: Staff respectfully recommends approval of this ordinance.

CHAPTER 17.48: MOBILE HOME PARK ORDINANCE

Section

Article I. Eligibility

Article II. Procedures for Mobile Home Park Plan Approval

Article III. General Provisions

ARTICLE I. ELIGIBILITY

17.48.010 APPLICABILITY.

A mobile home park may be established in any area of the MSB except where prohibited by zoning ordinances, provided that the mobile home park meets the requirements of this chapter and is approved at a public hearing by the planning commission, except that mobile home parks within the corporate limits of the cities of Houston, Palmer and Wasilla are subject only to regulations in existence for those cities.

(Ord. 83-63, § 2 (part), 1983)

17.48.020 DEVELOPMENT PROHIBITION.

No person shall proceed with any construction work on the proposed property, including clearing, grading or excavation relating to improvements, until planning commission approval of the mobile home park plan has been obtained.

(Ord. 83-63, § 2 (part), 1983)

17.48.030 PROOF OF FINANCIAL ABILITY TO COMPLETE THE PROJECT.

Arrangement of guaranteed financing and construction of public recreational facilities and other amenities proposed within the mobile home park shall be required for approval of the mobile home park by the planning commission and prior to beginning of construction.

(Ord. 83-63, § 2 (part), 1983)

17.48.040 STANDARDS.

(A) A mobile home park shall have an area of not less than two acres nor more than ten acres. No mobile home, parking, office or service building shall be closer than 30 feet to a public use area or other property line.

(B) Individual mobile home sites shall have an area of not less than 6,000 square feet per single-wide mobile home and 6,500 square feet per double-wide mobile home, and the total number of mobile homes per gross acre will not exceed five.

(C) A minimum of a ten-foot-wide buffer, to a maximum of a 25-foot-wide buffer shall be provided along the property boundaries. Mobile home placement shall be set back ten feet from the internal edge of the buffer. The intent of the buffer is to provide a vegetated visual transition area between the mobile home park and adjacent properties.

(D) A minimum separation of 30 feet between mobile homes, including any attached entrance, lean-to, or other extension from mobile homes shall be maintained between mobile homes.

(E) A minimum of two parking spaces per mobile home will be provided.

(F) A fenced area for the storage of boats and other recreational vehicles may be required by the planning commission in mobile home parks with three or more spaces per acre.

(G) Sufficient open space is required for a common area for residents, such as playground areas for resident children.

(H) The location of the mobile home park shall be compatible with the surrounding land uses and density of existing development. Public facilities necessary to serve the mobile home park, including roads, utilities, water, waste disposal, recreation, schools and fire protection, shall be shown to be provided or available. No mobile home park shall be located where the combined acreage of all mobile home parks within a one-mile radius exceeds ten acres.

(Ord. 90-051, § 2 (part), 1990; Ord. 83-63, § 2 (part), 1983)

ARTICLE II. PROCEDURES FOR MOBILE HOME PARK PLAN APPROVAL

17.48.050 APPLICATION REQUIREMENTS.

(A) Prior to submitting a formal application to the planning commission, the applicant shall confer with the borough planning department on the review process for the application. An appropriate filing fee as established by the assembly shall accompany the formal application.

(B) An application for approval of a mobile home park shall be submitted to the planning department and shall include a site plan containing the following information:

(1) location and size of all mobile home spaces;

(2) landscaping and buffering areas;

(3) utility layouts, including sewer and water;

(4) parking for cars and recreational vehicles;

(5) locations and development and open space;

(6) vehicular circulation and traffic patterns;

(7) name of the mobile home park and the name and address of the developer;

(8) existing topography and soils information;

(9) scale, north arrow, date and general location map.

(C) The application shall include a legal description of the property identifying property dimensions and total area, and an affidavit stating that the applicant holds controlling interest in the property and describing the ownership interest of the applicant and all other persons having an interest in the property.

(D) The review process will include a review of the site plan, other application material required in MSB 17.48.020 and the following information:

(1) the character, design and attractiveness of the proposed mobile home park and its adequacy to encourage desirable living conditions, to provide separation and screening between uses where desirable, and to preserve the natural amenities of streams and wooded areas;

(2) the adequacy of open space and recreational areas, existing and proposed, to meet the needs of the development;

(3) traffic circulation into and through the mobile home park.

(E) The planning director shall review the application for completeness and accept or reject within ten days of receipt.

(Ord. 90-051, § 2 (part), 1990; Ord. 86-47, § 13, 1986; Ord. 83-79, § 2, 1983; Ord. 83-63, § 2 (part), 1983)

17.48.060 PLANNING COMMISSION REVIEW.

Within 30 days after the mobile home park application has been approved by the planning director, the director shall schedule a public hearing before the planning commission. Any conditions attached to the mobile home park plan, staff recommendations and technical agency review comments will be presented to the planning commission.

(Ord 83-63, § 2 (part), 1983)

17.48.080 TECHNICAL REVIEW AGENCIES.

After the mobile home park plan has received pre-application approval by the planning director, the applicant or the applicant’s representative shall be informed which agencies shall receive copies of the plan. The planning department shall submit the plan to the agencies to which planned unit developments are referred under MSB 17.36.

(Ord. 83-63, § 2 (part), 1983)

17.48.090 ACTION OF THE PLANNING COMMISSION.

The planning commission shall review the mobile home park plan and approve the application, give conditional approval, or deny the application. The planning commission shall render its decision and findings in writing; and if its decision is to deny the application, it shall indicate what the applicant might do to make the application acceptable. If given conditional approval, the applicant shall submit final plans meeting the conditions of the planning commission to the planning department within 30 days of such approval.

(Ord. 83-63, § 2 (part), 1983)

17.48.100 APPEAL PROCESS.

A decision of the planning commission is final unless an appeal is filed within 15 borough business days after the commission’s action. Appeals shall be conducted under the provisions of MSB 15.39 as a conditional use.

(Ord. 97-026, § 2, 1997; IM 96-013, page 1 (part), presented 3-19-96; Ord. 83-63, § 2 (part), 1983)

ARTICLE III. GENERAL PROVISIONS

17.48.110 DEFINITIONS.

(A) For the purpose of this chapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

(1) "Buffer" means a means of protection against negative impacts which provides a physical separation or barrier.

(2) "Mobile home" means a detached single-family dwelling designed for long-term human habitation and having complete living facilities; capable of being transported to a location of use on its own chassis and wheels; identified by a model number and serial number by its manufacturer, and designed primarily for placement on a nonpermanent foundation. Travel trailers are not considered as mobile homes.

(3) "Mobile home parks" means any parcel, tract or lot or portion thereof where space for two or more mobile homes or travel trailers is leased, rented or held for rent for occupancy, but not including automobile or trailer sales lots on which unoccupied mobile homes are parked for inspection and sale or camper parks in which travel trailers are permitted for temporary occupancy of less than 30 days.

(4) "Travel trailers" means a motor vehicle or portable vehicular structure capable of being towed on the highways by a motor vehicle designed or intended for casual or short-term human occupancy for travel, recreational or vacation uses, identified by a model number, serial number or vehicle registration number, equipped with limited water storage and other self-contained living facilities.

(Ord. 90-051, § 2 (part), 1990; Ord. 83-63, § 2 (part), 1983)

17.48.130 NONCONFORMING MOBILE HOME PARKS.

(A) Within the borough there may exist mobile home parks as of the date of adoption of the ordinance codified in this chapter, or amendments thereto which were lawful before the effective date of applicable regulations, but which would otherwise be prohibited, regulated or restricted under this chapter. Such existing nonconforming parks are permitted to continue subject to the provisions of this section, but shall not be expanded except in accordance with this chapter.

(B) Nothing in this chapter shall require the relocation or removal of mobile home parks existing or under construction at the time of adoption of the ordinance codified in this chapter if such use was lawful at the time of its construction. No mobile home park shall be constructed or operated except in accordance with these regulations, except to the extent it was in existence or under actual construction as of the effective date of the ordinance codified in this chapter or amendment thereto. "Actual construction" is defined as the substantial placement of construction materials and performance of labor for construction of facilities which cannot reasonably be used except in a manner which does not conform with these regulations.

(C) Mobile home parks under construction or in existence as of the date of the ordinance codified in this chapter shall apply for, and may obtain approval of, the mobile home park within 120 days of the effective date of the ordinance codified in this chapter. The planning director shall grant approval of the mobile home park if it complies with the requirements of this chapter, excepting only those facilities and improvements which were under construction or in existence prior to the effective date of the respective regulation. The mobile home park shall meet all other requirements of this chapter which are not in conflict with the pre-existing use or construction.

(D) No existing mobile home park shall be expanded in area or in number of dwelling units permitted unless the area of expansion meets the requirements of this chapter. No area of a mobile home park which is abandoned shall be used as a mobile home park unless it meets the requirements of this chapter. “Abandonment” is defined as a discontinuation of use of a mobile home park or a discrete portion or parcel thereof, or the failure to complete construction and begin use, for a continuous period of more than one year. If abandoned, the land shall not thereafter be used except in conformity with the requirements of this chapter.

(Ord. 83-78, § 3, 1983)

17.48.140 VIOLATIONS AND ENFORCEMENT.

Violations and enforcement of this chapter shall be consistent with the terms and provisions of MSB 17.56.

(Ord. 90-051, § 2 (part), 1990: Ord. 83-78, § 4, 1983)

17.48.150 APPEAL PROCEDURE.

Appeals from a decision of the planning director of a zoning enforcement action shall be filed and conducted in accordance with MSB 15.39.

(IM 96-013, page 1 (part), presented 3-19-96; Ord. 84-78, § 5, 1983)

By: A. Strawn
Introduced: June 3, 2024
Public Hearing: June 17, 2024
Action: APPROVED

MATANUSKA-SUSITNA BOROUGH
PLANNING COMMISSION RESOLUTION NO. 24-13

A RESOLUTION OF THE MATANUSKA-SUSITNA BOROUGH PLANNING COMMISSION RECOMMENDING FAILURE OF AN ORDINANCE REPEALING MSB 17.48 MOBILE HOME PARK ORDINANCE IN ITS ENTIRETY.

WHEREAS, the commission opposes the loss of public notice and ability for public hearing in front of the Planning Commission that is included with the mobile home park ordinance; and

WHEREAS, mobile home parks present unique risk to public safety based on the risk factors associated with fire entrapments and higher crime rates.

NOW, THEREFORE, BE IT RESOLVED, that the Matanuska-Susitna Borough Planning Commission hereby recommends failure of Assembly Ordinance 24-053.

BE IT FURTHER RESOLVED, that the commission recommends the Assembly direct staff to produce an ordinance that combines and streamlines MSB 17.73 and MSB 17.48, making mobile home parks a chapter within MSB 17.73 that requires a public hearing before the Planning Commission.

ADOPTED by the Matanuska-Susitna Borough Planning Commission this 17 day of JUNE 2024.

C J KOAN, CHAIR

ATTEST

CORINNE LINDFORS
Planning Clerk

(SEAL)

YES: ALLEN, KOAN, McCABE, GLENN, SHANE

NO: Ø

OR 24-053
IM 24-097

PUBLIC HEARING

LEGISLATIVE

Resolution No. 24-28

Recommending Adoption of the Fiscal Year (FY) 2026
Capital Improvement Program

(Pages 419-437)

CAPITAL IMPROVEMENT PROGRAM (CIP)

2025-2026 (FY 26)

Matanuska-Susitna Borough
Planning Division

https://cip.matsugov.us/

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Capital Improvement Program Overview

The Matanuska Susitna Borough (MSB) Capital Improvement Program (CIP) originated in 1965 as part of the MSB's capital budget. The CIP's purpose is to help the MSB plan and budget for community infrastructure improvements.

Throughout the past five decades, the CIP has taken many forms ranging from an itemized list of projects in the annual capital budget to a list of unfunded, community-supported transportation projects. In 2022, the CIP process and criteria were updated at the request of the Planning Commission and the Assembly to provide a better process for community members and MSB departments to nominate capital projects. While the new process will be further evaluated and refined, it is now functioning in its third cycle, providing a ranked list of priority projects for consideration in the upcoming budget cycle.

While each MSB Department submits operational capital budget nominations, the CIP program is designed to elevate projects with community support during the budget cycle. These projects contribute directly to the *Quality of Life* of residents and enhance the visitor experience. This year's nominations are mostly bike and pedestrian pathways, facility improvements and upgrades, trail and parking improvements, and trailhead amenity projects, but CIP projects can include libraries, transit facilities, and other infrastructure designed to make the Matanuska-Susitna Borough the *greatest community in Alaska to live, work, and play.*

Nominations

The online CIP application is active year-round through the CIP portal on the MSB website. Submissions received between August 1, 2023, and August 1, 2024, were eligible for this year's FY 26 CIP consideration. Nominations submitted after August 1st, 2024, will be evaluated during next year's CIP review.

Public Engagement

The Planning Division solicited nominations and community input throughout the year through:

- Public Facing Website https://cip.matsugov.us/
- Social Media Campaign - Facebook Posts and *Planner Platform* E-Newsletter
- Direct E-Mail Communication with All Community Councils
- Presentations at Community Councils, as requested

Qualifying Criteria

To qualify as a valid CIP project, nominations must be eligible for areawide funding and meet the requirements of MSB code.

All nominations are initially evaluated against the following criteria to ensure that the project fits the program.

- Must Fall Within Borough Powers (Generally Recreation)
- Cannot be Considered Routine Maintenance or Equipment Replacement
- Must Have a Minimum Cost of $20,000
- Must Have a Lifespan of Over Five Years
- Must Align with a MSB Assembly Adopted Plan

Scoring & Ranking

The scoring committee is comprised of MSB Department representatives from Public Works, Finance, Planning, Emergency Services, and Parks and Recreation Services.

All the nominations were presented to the CIP scoring committee for verification of validity. Then all valid projects were scored based on ten weighted criteria.

FY 26 CIP NOMINATIONS RANKED

23 valid projects were nominated by the community and by the MSB Parks & Outdoor Recreation Services. The projects are listed in order of score by the committee. Cost estimates are rough order of magnitude for planning purposes. **The top twelve (12) projects, totaling $2.7M are considered priority projects. If approved for funding, the twelve projects could be completed during the six-year CIP funding cycle if $500,000 per year were allocated to the FY26 CIP program.**

RANK	PROJECT	SUMMARY	ESTIMATE
01	Hollywood Road Pedestrian Pathway	Construct new pathway alongside Hollywood Road	$97,590K
02	Jordan Lake Park	The establishment of green space/town center	$52K
03	Kenlar Rd., Hawk Rd., and Parks Hwy Bike Lane	Designate safe walking/biking routes for pedestrian travel	$100K
04	Whigmi Road Restroom	Installation of restroom at popular trailhead	$100K
05	Jim Creek Campground Expansion	Expand camping area	$250K
06	Beaver Lake Road Pedestrian & Bike Path	To build a non-motorized pathway to serve local communities	$500k
07	GPRA Pioneer Loop Expansion & Bridge	Expansion of trail system and access	$75k
08	Government Peak Traverse	Link trails together between Skeetawk and Recreation area	$500k
09	Lion Head Trailhead Development	Develop trailhead including parking and restroom	$350K

FY 26 CIP NOMINATIONS RANKED

The remaining eleven (13-23) projects scored below the priority category yet are still valid for consideration. These projects demonstrate the ongoing need for recreational and community-focused infrastructure.

RANK	PROJECT	SUMMARY	ESTIMATE
10	Alcantra Ball Field Renovation	Renovate baseball/softball fields with new soil	$175K
11	Jim Creek Campground Electric & Water Upgrade	Campground utility upgrades	$400K
12	GPRA Chalet Improvements	Install sound baffles, flooring, & restrooms	$150K
13	Fish Creek Pedestrian Walkway	Construction of a safe walking route over Fish Creek	$500K
14	Port Mackenzie Community Park Outdoor Restroom	Install outdoor restroom	$75K
15	Settlers Bay New Aquisition Paving Trails and Restroom	Improvement of Coastal Park amenities & parking	$250K
16	Crevasse Moraine Dog Park	To establish a MSB dog park and improve waste management	$95K
17	Jim Creek Parking Lot Paving	Pave parking area to reduce maintenance costs	$400K

FY 26 CIP NOMINATIONS RANKED

The following projects scored below the priority category yet are still valid for consideration. These projects demonstrate the ongoing need for recreational and community-focused infrastructure.

RANK	PROJECT	SUMMARY	ESTIMATE
18	Sutton Library to Alpine Historical Playground Pathway	Construct a safe walking route between both	$85K
19	7th Summit Shooting Park	Develop two additional shooting fields	$314K
20	Brett Ice Arena Maintenance Area Expansion	Construct structure for additional work space & storage	$350K
21	Carpenter Lake Access	Expanding parking area	$200K
22	7th Summit Education Center	Provide space for seminars, restrooms & meeting space	$500K
23	Crevasse Moraine Parking Lot	Pave preexisting rock parking area	$150K

FY 26 CIP PRIORITY PROJECTS (TOP 12)

#1 Hollywood Road Pedestrian Pathway

This project would create a pedestrian and bicycle pathway adjacent to Hollywood Road to provide safe passage to the Big Lake Elementary School, Jordan Lake Park, and the strip mall from the neighboring communities.

#2 Jordan Lake Park

This project will repair and rehabilitate a former gravel pit on the parkland to create a central green space area that the Big Lake community could utilize for community events, to improve playgrounds and community garden space, and to promote the creation of a town center.

#3 Kenlar Road, Hawk Lane, and Parks Highway Bike Lane

This project would complete a bike lane and pedestrian loop returning to Big Lake Rd via Hawk Ln, and Kenlar Rd., with access to the Parks Highway as well. It would provide a safe and designated route for Jr. and Sr. Houston High School students.

FY 26 CIP PRIORITY PROJECTS (TOP 12)

#4 Whigmi Road Restroom

This project would install a concrete vaulted toilet at the popular Whigmi Road Trailhead. The trailhead provides access to the Talkeetna Lakes area where there's currently no restroom facilities.

#5 Jim Creek Campground Expansion

This project would expand the existing campground to nearly double its capacity. The current campground is often at capacity during summer months, and the Jim Creek facility is one of the most heavily used recreational amenities that the Borough manages.

#6 Beaver Lake Road Pedestrian & Bike Pathway

This project would construct a non-motorized paved pathway adjacent to the Beaver Lake Road, providing a safe cycling and pedestrian access along Beaver Lake Road to serve the Rocky Lake and Meadow Creek communities.

FY 26 CIP PRIORITY PROJECTS (TOP 12)

#7 GPRA Pioneer Loop Expansion & Bridge

The expansion would take advantage of the new lower parking area by expanding the current Pioneer loop trail system and extending it across the creek, and into the lower section of the recreation area with an access point.

#8 Government Peak Traverse

This project would construct 10-miles of new connector trails to improve public access between two non-motorized trails. The project would link the GPRA with the Skeetawk Ski Area and the 16-mile Downhill Mountain Bike Trail.

#9 Lion Head/Natsede'aayi Trailhead Development

The Lion Head Trail currently does not have an adequate trailhead or restroom, and portions of the trail trespass on private land. Borough's Land Management Division has made progress on securing easements/agreements. If formalized and improved, this trail and trailhead improvement can provide an additional recreational opportunity near the Chickaloon/Glacier View area.

FY 26 CIP PRIORITY PROJECTS (TOP 12)

#10 Alcantra Ball Field

The sports complex baseball and softball fields have protruding rocks, uneven surfaces, and inadequate topsoil. The project would renovate one field as part of a mulit-year program to improve the complex and return it back to a useable ballfield.

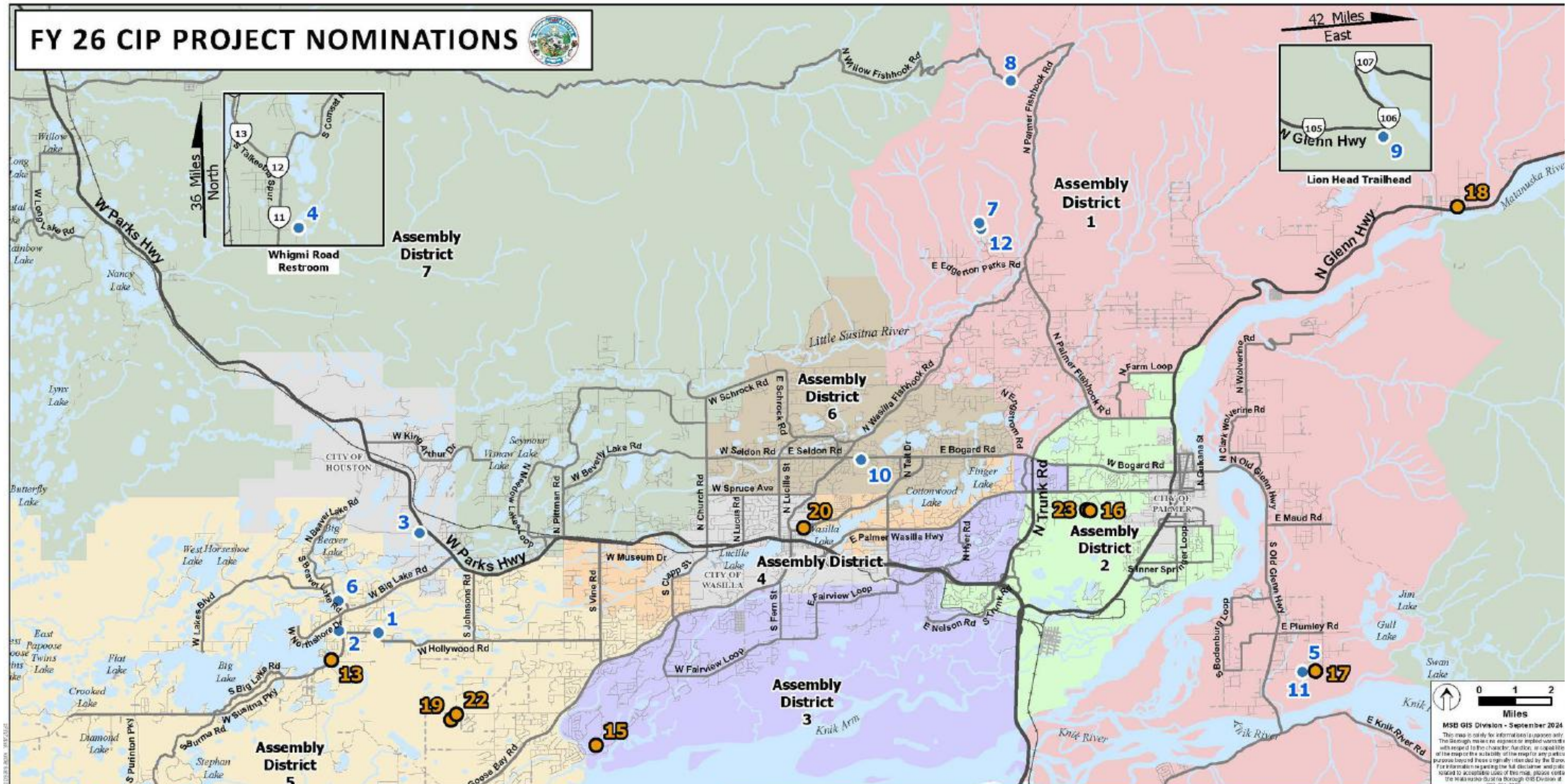
#11 Jim Creek Campground Electric and Water Upgrades

This project would upgrade the existing pull-through campground sites with electrical and water utilities.

#12 GPRA Chalet Improvements

This project would include the following improvements to the Great Room: the installation of sound baffles, a modern audio/visual system, and hard flooring in high-traffic areas. Special high-traffic carpeting in the Foyer and attached heating bathrooms on the north side of the building.

FY 26 CIP REPORT



Rank	Priority Projects	Estimated Cost
1	Hollywood Road Pedestrian Pathway	$97,590.00
2	Jordan Lake Park	$52,000.00
3	Kenlar/Hawk/Parks Highway Bike Lane	$100,000.00
4	Whigmi Road Restroom	$100,000.00
5	Jim Creek Campground Expansion	$250,000.00
6	Beaver Lake Road Pedestrian & Bike Path	$500,000.00
7	GPRA Pioneer Loop Expansion & Bridge	$75,000.00
8	Government Peak Traverse	$500,000.00
9	Lion Head Trailhead Construction	$350,000.00
10	Alcantra Ball Field Renovation	$175,000.00
11	Electric and Water Upgrades to Jim Creek Campground	$400,000.00
12	GPRA Chalet Sound Improvements	$25,000.00

Rank	Alternative Projects	Estimated Cos
13	Fish Creek Pedestrian Walkway	$500,000.00
14	Point Mackenzie Community Park Outdoor Restrooms	$75,000.00
15	Settler's Bay New Acquisition Paving, Trails and Restroom	$250,000.00
16	Crevasse Moraine Dog Park	$95,000.00
17	Jim Creek Parking Lot Paving	$400,000.00
18	Sutton Library to Alpine Historical Park Playground Pathway	$85,000.00
19	7th Summit Shooting Park	$314,750.00
20	Brett Ice Arena Maintenance Area Expansion	$350,000.00
21	Carpenter Lake access improvement	$200,000.00
22	7th Summit Shooting Park Education Center	$500,000.00
23	Crevasse Moraine Parking Lot Paving	$150,000.00

SCHEDULE & PROCESS

MSB Code 3.04.060 requires that the MSB Manager submit the Capital Improvement Program projects to the Planning Commission for review and comment prior to presentation to the MSB Assembly. The CIP list and the Manager's recommendations are formalized via Borough Assembly Resolution. Assembly approval of the CIP list does not guarantee funding.

Following approval, the project list will be available to the Manager and the Assembly for inclusion in the annual budget.

FY 2025 CIP timeline:

DATE	MILESTONE	STATUS
Aug 2024	Scoring and ranking	✔
Sept-Oct 2024	Planning Commission	●
Oct-Nov 2024	MSB Assembly	●
Nov 2024	Approved projects are available for inclusion in the annual capital budget	●

By: R.Fodge
Introduced: September 16, 2024
Public Hearing: October 7, 2024
Action:

MATANUSKA-SUSITNA BOROUGH
PLANNING COMMISSION RESOLUTION SERIAL NO. 24-28

A RESOLUTION OF THE MATANUSKA-SUSITNA BOROUGH PLANNING COMMISSION RECOMMENDING ADOPTION OF THE FISCAL YEAR (FY)2026 CAPITAL IMPROVEMENT PROGRAM.

WHEREAS, the Capital Improvement Program (CIP) is a program managed by the Borough's Planning Division designed to solicit, prioritize, and recommend community and Borough department nominations for public infrastructure projects on an annual basis; and

WHEREAS, the CIP provides the Assembly with a prioritized list of community-supported infrastructure projects for consideration during annual Borough budget deliberations; and

WHEREAS, the CIP provides the Assembly with a vetted list of community infrastructure and public facility projects to be included in the annual state and federal legislative priorities list; and

WHEREAS, the CIP is a budget planning tool used by governments to plan for annual investments necessary to build important public infrastructure over a six-year budget period; and

WHEREAS, in the 2023 Strategic Plan, the Assembly identified three Focus Areas: Economic Growth and Diversification, Delivering High Quality Services, and Managing Growth; and

WHEREAS, under the Managing Growth focus area, identifying and documenting needed public infrastructure and to support its development was called out as a strategy under Economic Growth and Diversification focus area, the CIP is a tool that assists with the implementation of the MSB 2023-2028 Strategic Plan focus area goals; and

WHEREAS, investment in community infrastructure is a function of the Matanuska-Susitna Borough government and supports residents' quality of life, recreation opportunities, tourism, and the economy; and

WHEREAS, the FY26 CIP valid nominations included twenty-three (23) projects; and

WHEREAS, the twelve (12) top-ranked projects being presented for FY26 CIP include:

1) Hollywood Road Pedestrian Pathway
2) Jordan Lake Park
3) Kenlar Road, Hawk Lane, and the Parks Highway Bike Lane
4) Whigmi Road Restroom
5) Jim Creek Campground Expansion

6) Beaver Lake Road Pedestrian and Bike Pathway

7) GPRA Pioneer Loop Expansion and Bridge

8) Government Peak Traverse

9) Lion Head Trail Construction

10) Alcantra Ball Field Renovation

11) Jim Creek Campground Electric and Water Upgrades

12) GPRA Chalet Improvements

These 12 projects, if approved, will make up the FY26 CIP project list; and

WHEREAS, MSB code 03.04.060 requires that the Borough Manager submit a Capital Improvement Program to the Planning Commission for review and comment annually.

NOW, THEREFORE, BE IT RESOLVED, that the Matanuska-Susitna Borough Planning Commission hereby recommends to the Assembly the adoption of the FY26 Capital Improvement Program project list.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the MSB Planning Commission hereby recommends that the MSB Assembly allocate or seek funding to support the construction or advancement of projects identified in the FY26 Capital Improvement Program.

ADOPTED by the Matanuska-Susitna Borough Planning Commission this 7 day of October, 2024.

____
C.J. KOAN, CHAIR

ATTEST:

____
LACIE OLIVIERI, Planning Clerk

(SEAL)

CORRESPONDENCE & INFORMATION

(Pages 439-440)

Matanuska-Susitna Borough
Public Works Department
350 E Dahlia Avenue
Palmer, AK 99645

PRSRT STD
US Postage
PAID
Anchorage, AK
Permit #537

2*1************5-DIGIT 99645
MBS PLANNING COMMISSION
350 E DAHLIA AVE
PALMER AK 99645-6411

CONSTRUCTION NOTICE

EDGERTON PARKS RD – MOUNTAIN TRAILS DR

UPGRADE & PATHWAY

More information on reverse side.

Construction area shown in yellow.

CONSTRUCTION NOTICE

EDGERTON PARKS RD – MOUNTAIN TRAILS DR UPGRADE & PATHWAY

Matanuska-Susitna Borough PROJECT NOTICE

What's Happening

This is to notify you of an upcoming construction project that may affect you or your property.

Work includes constructing a non-motorized pathway along the north side of Edgerton Parks Rd and the west side of Mountain Trails Dr from Palmer-Fishhook Rd to the Government Peak Recreation Area (GPRA) parking lot. Improvements to Edgerton Parks Rd are also included in the project.

This project is funded by the Transportation Infrastructure Program 2021 (TIP21), approved by voters in November 2021.

When

This project is considered Phase 1 and is anticipated to begin construction in fall 2024. Phase 2 will include pedestrian facilities across the Little Susitna River.

What to Expect

Access through the existing roads in the project area will remain open, but some delays may occur. We ask that you use extra caution while there are equipment and/or workers in the area.

Benefits

The purpose is to provide a safe location for people walking, running, and bicycling near the Government Peak Recreation Area.

Contact Information

Larry Donahue
Construction Superintendent
Neeser Construction Inc.
Ldonahue@neeserinc.com
907-244-3368

Forrester Cook
Construction Management
DOWL
fcook@dowl.com
907-978-0726

Andrew Strahler
Civil Construction Project Manager
Matanuska-Susitna Borough
andrew.strahler@matsugov.us
907-861-7710

COMMISSION BUSINESS

(Pages 442-443)

MATANUSKA-SUSITNA BOROUGH
Planning and Land Use Department
350 East Dahlia Avenue • Palmer, AK 99645
Phone (907) 861-7822
www.matsugov.us

MEMORANDUM

DATE: September 16, 2024

TO: Planning Commissioners

FROM: Alex Strawn, Planning and Land Use Director

SUBJECT: Tentative Future PC Items

Upcoming PC Actions

Quasi-Judicial

- Houdini's Herbs – Marijuana Retail Facility; 6298B01L002 (Staff: Peggy Horton)
- The Aardvark – Alcoholic Beverage Dispensary; 1454000L001 (Staff: Peggy Horton)
- Craft Cannabis Cabin – Marijuana Retail Facility; 1842B01L007 (Staff: Rick Benedict)
- Ficklin Gravel Products LLC – Earth Materials Extraction; 16N04W03A009 (Staff: Rick Benedict)
- Butte Land Co. – Earth Materials Extraction; 17N02E35A024 (Staff: Peggy Horton)
- New Horizons Telecom – Tall Structure; 17N03E30A012 (Staff: Rick Benedict)
- Central Gravel Products – Earth Materials Extraction; 18N01E27A002, D001, & D002 (Staff: Peggy Horton)
- Big Dipper – Earth Materials Extraction; 1341000T001 & 1341000T002 (Staff: Rick Benedict)
- Susitna Sungrown LLC – Standard Marijuana Cultivation Facility; 24N04W30A014 (Staff: Rick Benedict)
- Mass Excavation Inc. – Earth Materials Extraction; 17N01E18A005, A012, A013, & A014 (Staff: Peggy Horton)
- The Ark at Denali RV Campground – Denali SpUD; U04998000L024 (Staff: Peggy Horton)

Legislative

- Historic Preservation Plan (HPP) (Staff: Leda Borys)
- MSB Borough-Wide Comprehensive Plan (Staff: Alex Strawn)
- Corridor Studies (Staff: Julie Spackman)
- Public Transit Plan (Staff: Alex Strawn and Maija DiSalvo)

- Amending MSB 17.59 Standardize Definitions for Lake Management Regulations (Staff: Alex Strawn)
- Fuller Lake Management Plan (Staff: Maija DiSalvo)