



C Squared Systems, LLC
65 Dartmouth Drive
Auburn, NH 03032
Phone: (603) 644 2800
support@csquaredsystems.com

RF Report

Strafford East

15 Strafford Road
Strafford, NH 03884

November 29, 2022

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1. Overview

This RF Report has been prepared on behalf of Mariner Tower in support of its application to the Town of Strafford for the installation and operation of a wireless facility located at 15 Strafford Road in Strafford, NH. The proposed facility consists of a 160' lattice tower within a fenced compound, intended for use by wireless service providers to support their individual network deployment.

This report addresses the need for the proposed wireless facility and confirms that there are no other suitable existing structures that could address the coverage gaps of interest. The coverage analysis completed by C Squared Systems confirms: there is a significant gap in reliable service in Strafford, and that the proposed facility located at 15 Strafford Road will provide enhanced coverage in that service gap.

Included in this report is a brief summary of the high-level coverage analysis in and around Strafford, with maps showing the locations of surrounding wireless facilities and modeled Radio Frequency coverage of the existing and proposed Sites in conjunction with surrounding wireless facilities in the area.

2. Introduction

Mariner Tower serves the wireless operator community as a provider of key infrastructure that facilitates deployment of wireless communications networks. Their infrastructure assets are used as a resource by wireless service providers to collocate their own wireless facilities which both reduces the deployment time and expense in comparison to developing a new raw land facility, while also satisfying common municipal planning objectives of collocating on existing sites thereby minimizing the number of towers constructed throughout an area.

Mariner Tower's customers include major national and regional commercial service providers of wireless digital voice and data communications services. The networks deployed by these wireless providers are used by mobile devices for fast web browsing, media streaming, video conferencing, and other applications that require broadband connections. The mobile devices that benefit from these advanced networks include typical smartphones, tablets, laptops, and Wi-Fi hot-spots. Reliance on these wireless services for personal, business, and emergency use has continued to grow aggressively such that these services have evolved into indispensable parts of daily life.

As explained within this report, Mariner Tower has identified the need to develop a facility to provide coverage and capacity in the Strafford area to fill a significant gap in service.

To maintain a reliable and robust communications system for the individuals, businesses, public safety workers and others who use its network, wireless service providers deploy a network of cell sites (also called wireless communications facilities) throughout the areas in which they are licensed to provide service. These cell sites typically consist of antennas mounted on structures, such as buildings and towers, supported by radio and power equipment. The receivers and transmitters at each of these sites process signals within a limited geographic area known as a "cell."

Mobile subscriber handsets and wireless devices operate by transmitting and receiving low power radio frequency signals to and from these cell sites. Handset signals that reach the cell site are transferred through land lines (or other means of backhaul transport) and routed to their destinations by sophisticated electronic equipment. For these networks to function effectively, there must be adequate overlapping coverage between the "serving cell" and adjoining cells. This not only allows a user to access the network initially, but also allows for the transfer or "hand-off" of calls and data transmissions from one cell to another and prevents unintended disconnections or "dropped calls."

The antennas for these networks must be located high enough above ground level to allow transmission (a.k.a. propagation) of the radio frequency signals above trees, buildings, and other natural or man-made structures that may obstruct or diminish the signals. Areas without adequate radio frequency coverage have substandard service, characterized by dropped and blocked calls, slow data connections, or no wireless service at all, and are commonly referred to as coverage gaps.

The size of the area potentially served by each cell site depends on several factors including the number of antennas used, the height at which the antennas are deployed, the topography of the surrounding land, vegetative cover, and natural or man-made obstructions in the area. The actual service area at any given time also depends on the number of customers who are on a given network in range of that cell site. As customers move throughout the service area, the transmission from the phone or other device is automatically transferred to a nearby facility with the best reception, without interruption in service, provided that there is overlapping coverage between the cells.

Each cell site must be primarily designed to strike a balance between the overall geographic coverage area it will serve, and the site's capacity to support the usage within the coverage footprint. In rural areas, cell sites are generally designed to have broader coverage footprints because the potential traffic is sparser and distributed over a larger area. In more densely populated suburban and urban environments, the capacity to handle calls and data transmissions is of increasing concern, and cell sites must limit their coverage footprint to an area where the offered network traffic can be supported by the radio equipment and resources. Due to the aggressive historical and projected growth of mobile usage, particularly for mobile data (By 2023, North America will have 345 million Internet users (92 percent of regional population), up from 328 million (90 percent of regional population) in 2018.¹), instances arise where the usage demand can no longer be supported by the site(s) serving an area, and new facilities must be integrated to provide capacity relief to the overloaded sites.

We have concluded that the proposed Tower Site at 15 Strafford Road will allow tenant operators an opportunity to fill a significant gap in coverage and to provide significant coverage improvement to the residents, businesses, visitors, and traffic corridors within Strafford that are currently located within deficient service areas.

¹ "Cisco Visual Networking Index: Forecast and Trends, 2018-2023", March 9, 2020, Cisco Systems, Inc. <https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html?dtid=ossdc000283>

3. The Proposed Facility

As depicted in the site plans² submitted with the application, Mariner Tower's proposal consists principally of the following elements:

- 1) A 160' Lattice Tower within a 75' x 75' fenced compound for tenant telecommunication equipment; and
- 2) Utility meter/interconnect rack within the proposed compound.

4. Coverage Objectives

As mentioned above, a new facility is necessary to expand the coverage in the Strafford area from the surrounding facilities in the neighboring towns used currently by the service providers to deploy their networks. These surrounding facilities are not limited to sites owned or operated by Mariner Tower. Due in large part to the distances between the surrounding sites, the intervening topography, and volume of user traffic in the area, these surrounding facilities alone do not provide adequate service to portions of Strafford. Specifically, much of Strafford is without reliable service, and gaps in coverage exist along substantial portions of the town's roadways and adjacent properties, as listed below.

- State Hwy 202A;
- 2nd Crown Point Rd;
- New Bow Lake Rd;
- State Hwy 126;
- Johnsonboro Rd;
- The surrounding roads, neighborhoods, and business/retail areas in the proximity of the proposed site.

By developing the proposed wireless communications facility at 15 Strafford Road, wireless carriers would have additional infrastructure from which to provide significantly improved network coverage, quality, and reliability for their subscribers located in these areas of Strafford.

² Existing Conditions Plan prepared by Hudson Design Group, dated 11/29/2022 (Rev. 0).

5. Pertinent Site Data

Table 1 below details the site-specific information for the sites used to generate the coverage plots and perform the analysis provided herein. These sites are based upon information provided by Mariner Tower.

Site Name	Address	City/State	Location		Antenna Height (ft AGL)	Structure Type	Status
			Latitude	Longitude			
Barnstead	Hartshorn Road	Barnstead	43.3294	-71.2831	190	Lattice Tower	Existing
Northwood	Olde Canterbury Road	Northwood	43.2242	-71.2400	140	Lattice Tower	Existing
Northwood Turnpike	Bean Road	Northwood	43.1944	-71.1442	122	Monopole	Existing
Barrington	Jacob's Way	Barrington	43.2092	-71.0906	120	Monopole	Existing
Farmington	623 Ten Rod Road	Farmington	43.3564	-71.0722	560	Guyed	Existing
Strafford North	581 Barn Door Gap Road	Strafford	43.3141	-71.1395	155	Lattice Tower	Planned
Pittsfield	Catamount Mtn. 72 Governor's Rd	Pittsfield	43.2753	-71.2953	152	Guyed	Existing
Rochester	Dry Hill Road	Rochester	43.3114	-71.2100	196	Lattice Tower	Existing
Northwood Ridge	Neally Lane, Northwood Ridge	Northwood	43.1944	-71.1692	160	Monopole	Existing
Strafford East	15 Strafford Road	Strafford	43.2714	-71.1185	155	Lattice Tower	Proposed

Table 1: Site Information Used in Coverage Analysis³

³ Some sites listed in this table are outside the attached plot views but are included for completeness of information.

6. Coverage Analysis and Propagation Plots

The signal propagation plots provided in this report show coverage for the 700 and 1900 MHz frequency range and were produced using deciBel Planner™, a Windows-based RF propagation computer modeling program and network planning tool. The software considers the topographical features of an area, land cover, antenna models, antenna heights, RF transmitting power and receiver thresholds to predict coverage and other related RF parameters used in site design and network expansion.

Because of the superior propagation characteristics of 700 MHz relative to 1900 MHz, the 700 MHz coverage areas will encompass a larger geographic region compared to 1900 MHz. Presenting both frequency bands shows a typical best-case (700 MHz) and worse-case (1900 MHz) scenario. Commercial wireless service providers deploy their services over multiple frequency bands to support capacity demands and provide a variety of different services and must balance the coverage and capacity needs against the available FCC licensed spectrum resources they hold in a given region.

The coverage plots included as attachments are based on RSRP signal strengths of -85/-95/-105 dBm and above. All other areas (depicted in white) fall within coverage areas likely characterized by poor voice quality, low data throughput, and the substantial likelihood of unreliable service even when located in an outdoor environment. While each service provider designs their network based upon their own internal proprietary link budget, the -95 dBm threshold referenced on the coverage plots can be considered a reasonable RSRP threshold targeted by many operators for their LTE requirements in suburban areas such as Strafford.

Attachments A – F are discussed below:

Attachment A titled “*Strafford East - Existing 700 MHz LTE Coverage*” shows the 700 MHz coverage provided around Strafford from the surrounding existing sites listed in Table 1. and demonstrates that there are currently significant gaps in 700 MHz LTE coverage effecting service throughout much of Strafford. The coverage shown is where the signal strengths are: > -85 dBm (generally robust service and performance), > -95 dBm (generally adequate level of service) and > -105 dBm for marginal coverage. The proposed wireless facility at 15 Strafford Road would provide an infrastructure opportunity for the wireless operators serving the area to improve their service.

Attachment B titled “*Strafford East - Existing 700 MHz LTE Coverage with Proposed Site*” shows how this proposed site would fill in the existing coverage gaps and improve the 700 MHz LTE network within the targeted areas. As evident when compared against Attachment A, the proposed facility provides adequate coverage improvement to:

- o ~ 5.3 miles of State Hwy 202A;
- o ~ 3.8 miles of 2nd Crown Point Rd;
- o ~ 2.5 miles of New Bow Lake Rd;
- o ~ 2.1 miles of State Hwy 126,
- o ~ 1.7 miles of Johnsonboro Rd,

Attachment C titled “*Strafford East - Existing 1900 MHz LTE Coverage*” shows the coverage provided to areas of Strafford from the surrounding sites listed in Table 1. and similar to Attachment A, demonstrates that there are also currently significant gaps in 1900 MHz LTE coverage in Strafford, except to a greater extent than at 700 MHz.

The coverage levels presented on the 1900 MHz LTE coverage plots are consistent with those presented earlier for the 700 MHz coverage plots.

Attachment D titled “*Strafford East - Existing 1900 MHz LTE Coverage with Proposed Site*” shows how this proposed site would fill in the existing coverage gaps and improve 1900 MHz LTE network within the targeted areas. As shown by the additional areas of coverage in comparison with Attachment C, the proposed facility will provide coverage to:

- o ~ 2.6 miles of State Hwy 202A;
- o ~ 1.5 miles of State Route 126;
- o ~ 1.5 miles of Johnsonboro Rd,

Attachment E titled “*Strafford East Area Terrain Map*” details the topographical features around the Existing Site and Relo Site. These terrain features play a key role in dictating both the unique coverage areas served from a given location, and the coverage gaps within the network. This map is included to provide a visual representation of the terrain variations that must be considered when determining the appropriate location and design of a proposed wireless facility. The blue, green and yellow shades correspond to lower elevations, whereas the orange, red, grey and white shades indicate higher elevations.

Attachment F titled: “*Strafford East Neighbor Sites & Radial Distances*” provides an overview of the network of sites in the area, with distances shown from the proposed site to the surrounding sites in the area.

7. Summary

Mariner Tower has identified an area of deficient coverage affecting a significant portion of Strafford, NH, including key traffic corridors through the roadways and residential areas of town. The proposed facility will provide infrastructure from which wireless service providers could fill in coverage to significant portions of Strafford, including along State Hwy 202A, 2nd Crown Point Rd, Johnsonboro Rd, State Hwy 126, New Bow Lake Rd, and the surrounding neighborhoods that are currently within a coverage gap.

As discussed in this report and depicted in the attached plots, the proposed Mariner Tower site will provide the public need for service in this area, by providing an appropriate coverage footprint for the Strafford community along with effective connectivity to the rest of existing network.

Without the installation of the proposed Site, multiple wireless operators will be unable to maintain their existing communication services in this area of Strafford; therefore, Mariner Tower respectfully requests that the Town of Strafford act favorably upon the proposed facility.

8. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate.



Sohail Usmani

RF Engineer

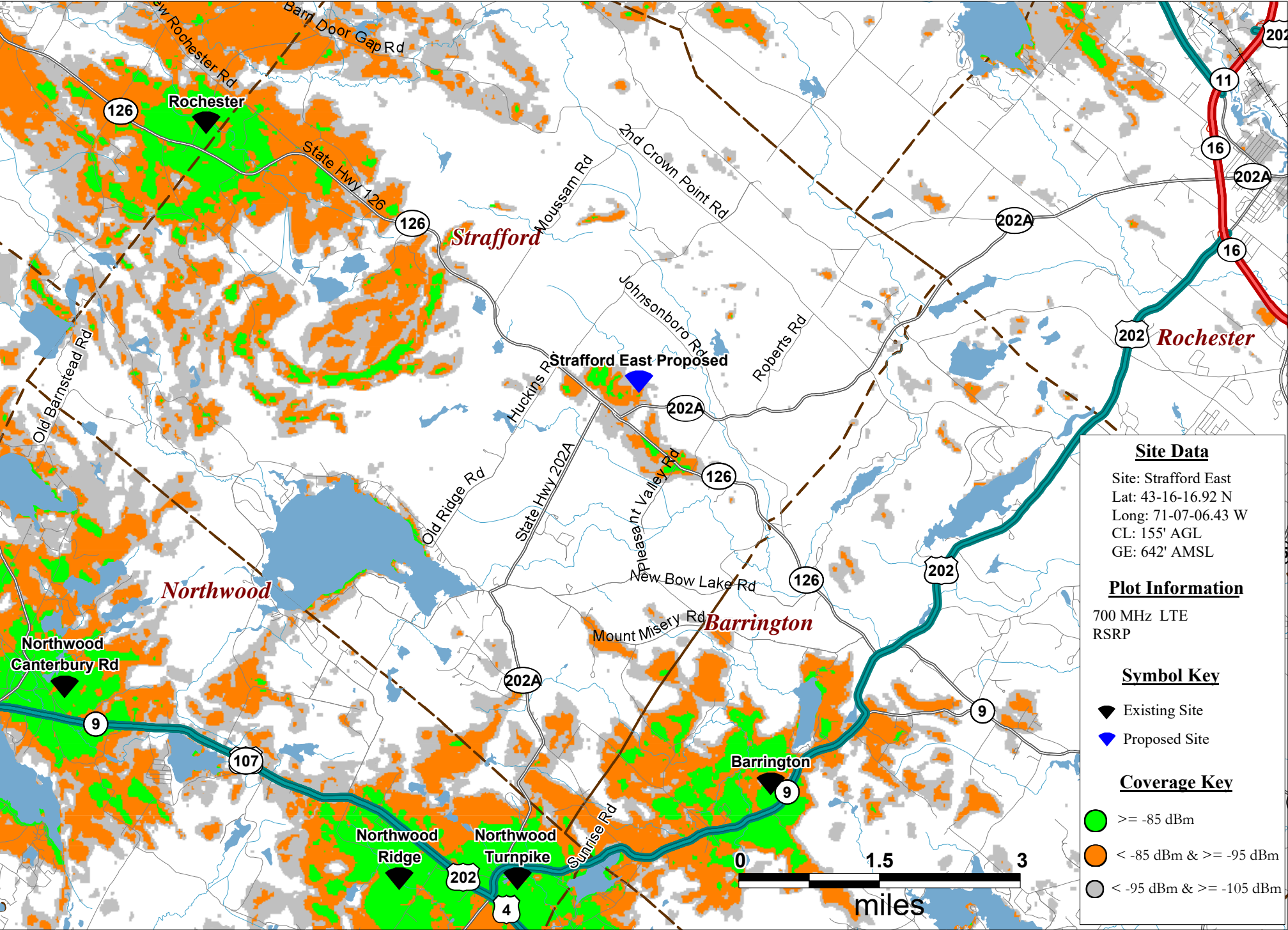
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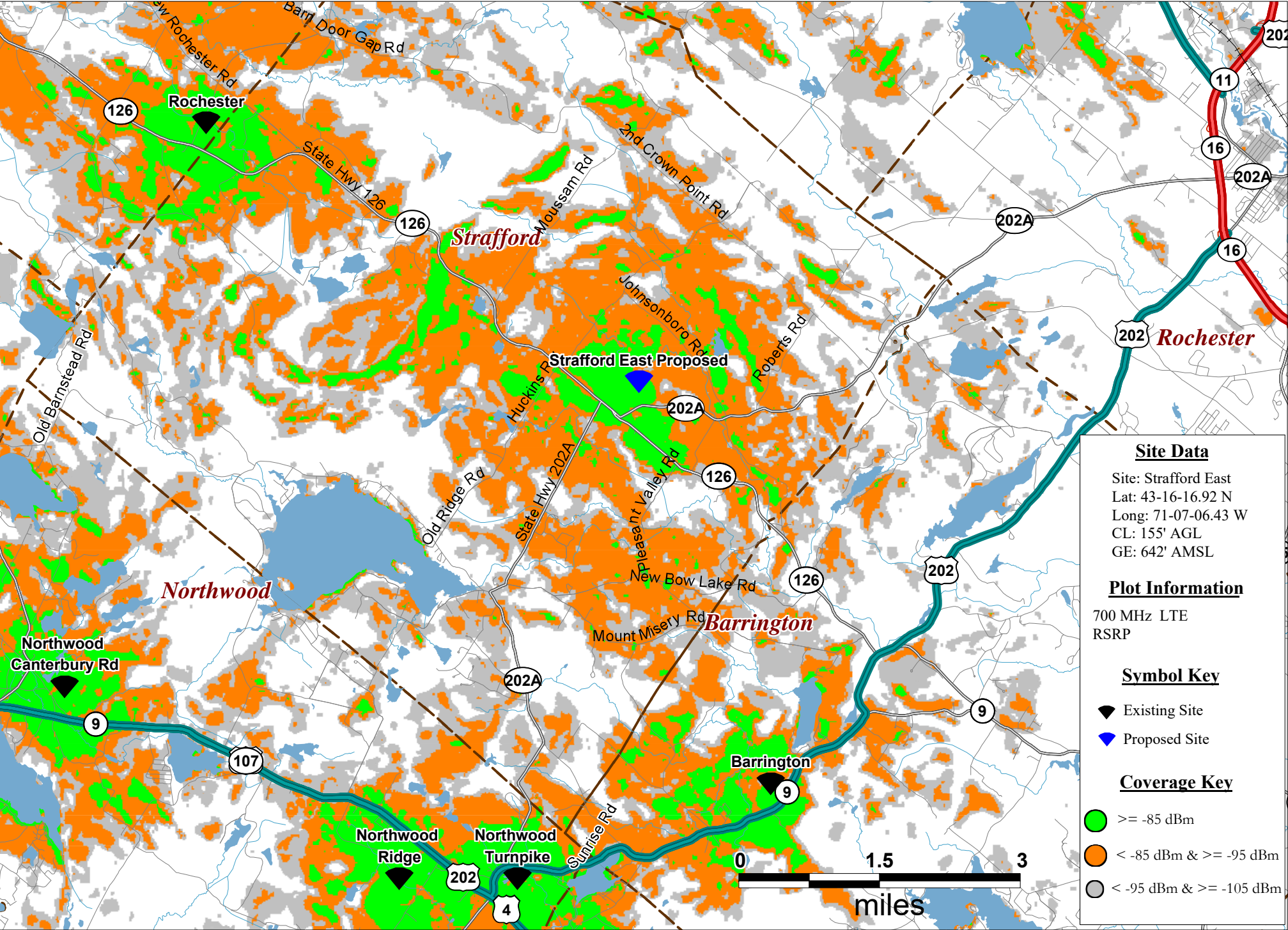
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9. Attachments

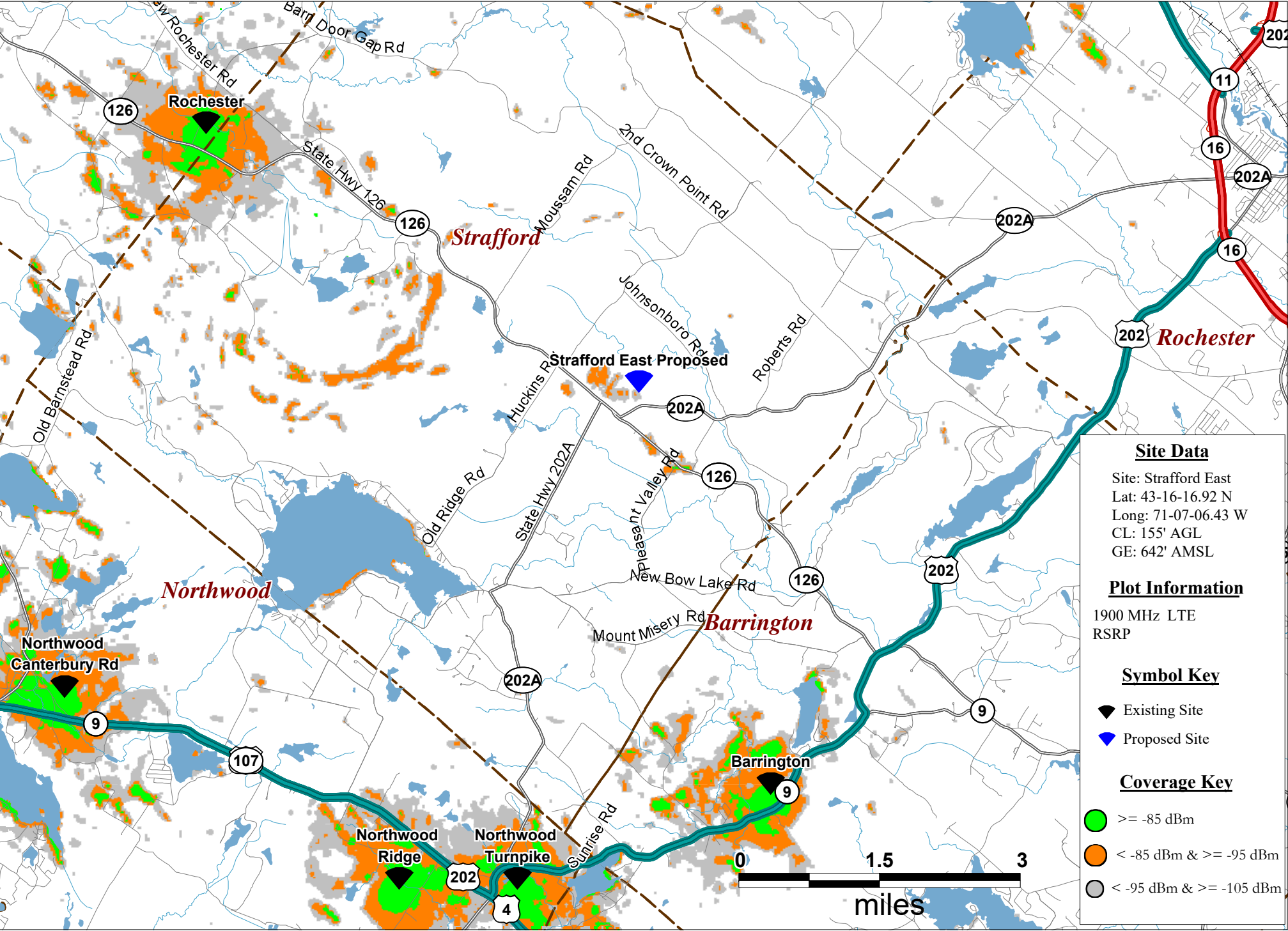
Attachment A:
Strafford East - Existing 700 MHz LTE Coverage



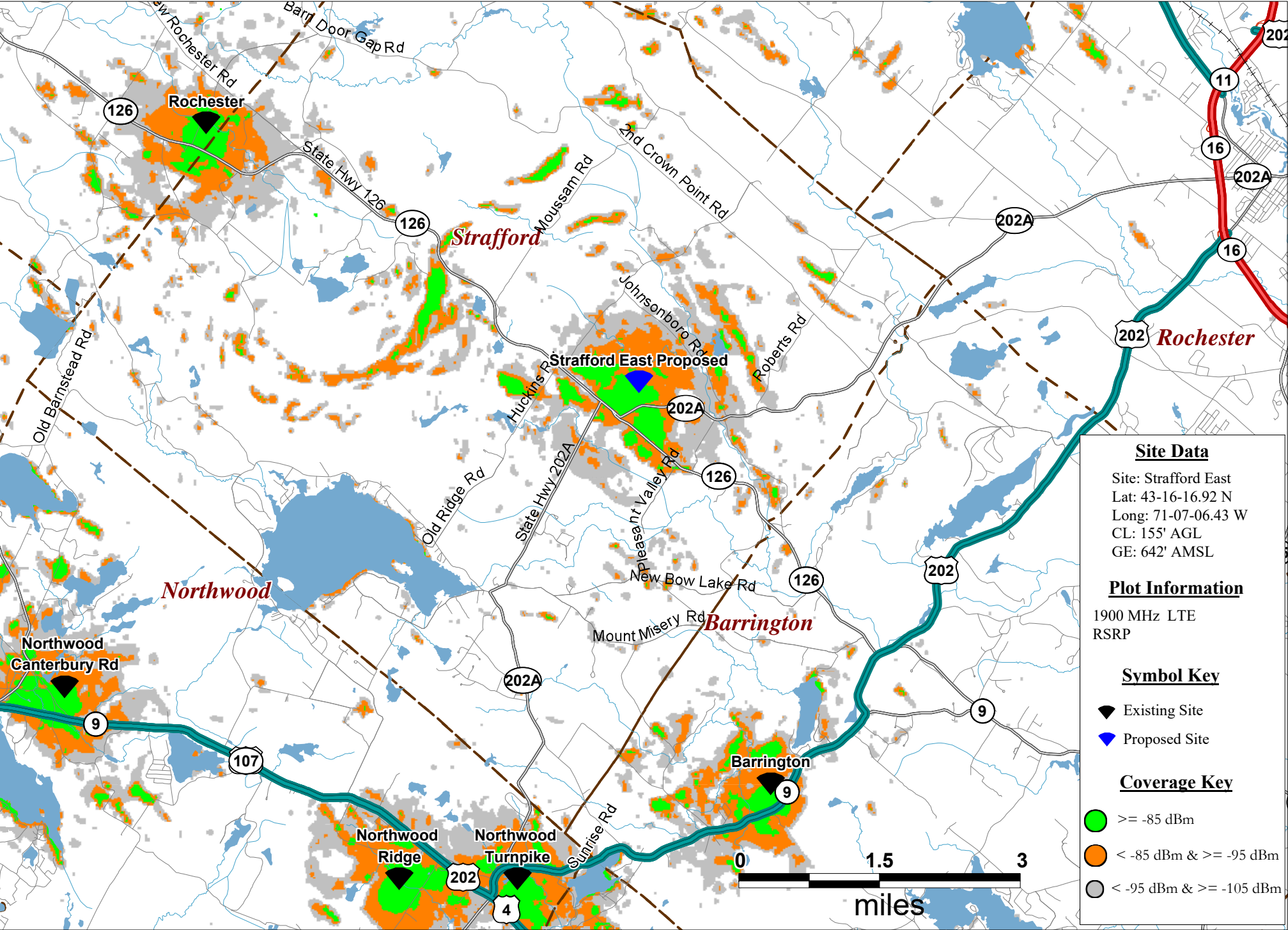
Attachment B:
Strafford East - Existing & Proposed 700 MHz LTE Coverage



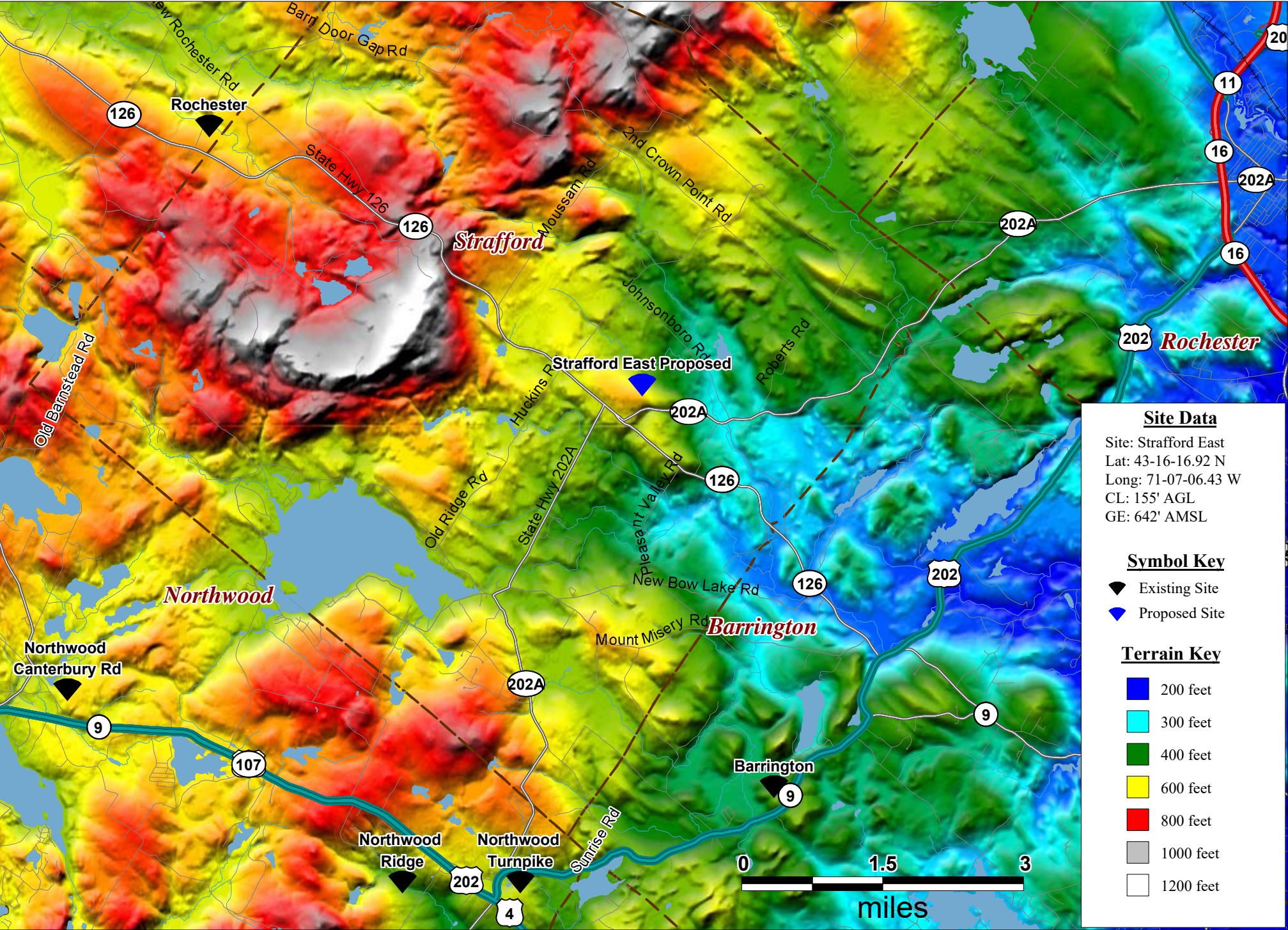
Attachment C:
Strafford East - Existing 1900 MHz LTE Coverage



Attachment D:
Strafford East - Existing & Proposed 1900 MHz LTE Coverage



Attachment E:
Strafford East - Area Terrain Map



Attachment F:
Strafford East - Neighbor Sites & Radial Distances

