
RF Report

Proposed Wireless Plan
Falmouth, ME 01960



July 16, 2014

TABLE OF CONTENTS

1. Overview..... 1

2. Introduction..... 1

3. The Proposed Facilities..... 2

4. Coverage and Capacity Objectives..... 3

5. Site Search and Selection Process..... 4

6. Pertinent Site Data..... 5

7. Coverage Analysis and Propagation Plots..... 6

8. Certification of Non-Interference..... 8

9. Summary..... 8

10. Statement of Certification 8

11. Attachments..... 9

LIST OF TABLES

Table 1: Verizon Wireless Site Information Used in Coverage Analysis..... 5

ATTACHMENTS

Attachment A: Falmouth – Existing 700 MHz LTE Coverage

Attachment B: Falmouth – Existing 700 MHz LTE Coverage with Proposed Falmouth 2, Falmouth 3, & Falmouth 4 Sites

Attachment C: Falmouth – Area Terrain Map

1. Overview

Verizon Wireless is providing the following information in support of their forthcoming applications to the Town of Falmouth to install three additional wireless facilities. These proposed facilities consist of a church steeple installation at 340 Foreside Road (referred to herein as “Falmouth 2”), a tower collocation on the existing monopole off of Woods Road in the Falmouth Public Works yard (“Falmouth 3”), and a new monopole facility located at 121 Field Road (“Falmouth 4”).

This report addresses Verizon Wireless’ need for the proposed wireless facilities with respect to the surrounding network of sites. These proposed sites are needed to fill in coverage gaps and provide sufficient capacity in order to improve deficient service areas in Town and provide a reliable communications network in the area.

Included in this package is: a brief summary of each site’s coverage and capacity objectives, maps showing Verizon Wireless’ current network plan, and predicted Radio Frequency coverage of the subject sites and the surrounding sites in Verizon Wireless’ network.

2. Introduction

Verizon Wireless provides digital communications voice and data services using 3rd Generation (3G) CDMA/EVDO technology in the 800 MHz and 1900 MHz frequency bands, and is in the midst of deploying advanced 4th Generation (4G) data services over LTE technology in the 700 MHz and AWS frequency bands as allocated by the FCC. These data networks are used by mobile devices for fast web browsing, media streaming, and other applications that require broadband connections. The mobile devices that benefit from these advanced data networks are not limited to basic handheld phones, but also include devices such as smartphones, PDA’s, tablets, and laptop air-cards. With the evolving rollout of 4G LTE services and devices, Verizon Wireless customers will have even faster connections to people, information, and entertainment.

As explained within this report, Verizon Wireless has identified the need for new facilities to provide the necessary coverage and capacity required to support reliable communications and meet the growing demand in the area. These areas include various portions of the Town of Falmouth.

In order to expand and maintain a robust communications system, Verizon Wireless’ network requires the strategic deployment of antenna structures throughout the area to be covered, which are connected to receivers and transmitters that operate in 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. The signals are transferred through land lines (or other means of backhaul transport) and routed to their destinations by sophisticated electronic equipment. In order for Verizon Wireless’ network to function effectively, there must be adequate overlapping coverage between the “serving cell” and adjoining cells. This not only allows access to the network, but once connected allows for the transfer or “hand-off” of calls from one cell to another, and prevents unintended disconnections or “dropped calls.” Verizon Wireless’ antennas also 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 served by each cell site is dependent 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. As customers move throughout the service area, the transmission from the portable unit is automatically transferred to the Verizon Wireless 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 ability 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 distributed over a larger area. In more densely populated suburban and urban environments, 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 (61% in 2013-2014, 50% CAGR 2013-2018 in North America)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.

By installing the three currently planned facilities, Verizon Wireless will be able to provide improved coverage and additional capacity to the residents and traffic corridors within sections of Falmouth that are currently located within deficient service areas of Verizon Wireless' network.

3. The Proposed Facilities

As shown on the plans to be submitted with each application, Verizon Wireless' proposal at each site consists principally of the following elements:

- 1) A telecommunications equipment shelter to be located within the leased area;
- 2) A mounting structure capable of supporting the antennas and ancillary equipment at the height necessary at each location to provide the required coverage and capacity to the surrounding area;
 - a. "Falmouth 2" consists of a proposed stealth steeple structure to conceal the antennas;
 - b. "Falmouth 3" consists of a collocation on an existing monopole structure;
 - c. "Falmouth 4" consists of a new monopole structure;
- 3) An array of panel antennas mounted to the supporting structure;
- 4) Remote Radio Heads (RRHs) and accessory junction boxes and surge suppressors mounted near the antennas on the support structure;
- 5) A generator for backup power within the leased area;
- 6) Utility connections (power/telco/fiber) near the equipment shelter.

¹ "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018", February 5, 2014, Cisco Systems, Inc. http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf

4. Coverage and Capacity Objectives

As mentioned above, Verizon Wireless is in the process of rolling out its 4G LTE high-speed wireless broadband system in the 700 MHz and AWS frequency bands, as allocated by the FCC. In order to expand and enhance their wireless services throughout New England, Verizon Wireless must fill in existing coverage gaps and address capacity, interference, and high-speed broadband issues. As part of this effort, Verizon Wireless determined that significant coverage gaps and insufficient network capacity exist in and around the Town of Falmouth, ME.

Verizon Wireless currently operates wireless facilities, similar to that of the proposed facilities, within Falmouth and the surrounding cities/towns of Westbrook, Portland, and Cumberland, ME. Due in large part to the distances between the existing sites and the intervening topography, these existing facilities do not provide reliable coverage and sufficient capacity to portions of Falmouth. Specifically, Verizon Wireless determined that sections of central and eastern Falmouth are without reliable service in the following areas and town roads:

- I-295, I-95/295 Connector
- Route 1, north of Route 88 (Foreside Road) including the shopping areas south of Bucknam Road
- Route 88 (Foreside Road), north of Depot Road including the side streets and residential dwellings of Falmouth Foreside
- Route 9 (Longwoods Road), north of Lunt Road
- Woods Road, Woodville Road, Field Road, Winn Road and the surrounding areas of the interior of Town
- Falmouth neighborhoods surrounding these roadways

The proposed “Falmouth 2”, “Falmouth 3”, and “Falmouth 4” sites are needed to fill in these targeted coverage and capacity gaps, in order to improve network quality and reliability to the numerous residents and workers of the area, as well as to the transient subscribers traveling along these roads. As detailed in the following sections, these deficient service areas are due to the inability of neighboring sites to provide reliable coverage and sufficient capacity to serve the ever increasing demand for wireless services.

5. Site Search and Selection Process

To find a site that provides acceptable service, fills the gaps in coverage, and provides sufficient capacity relief, computer modeling software is used to define a search area. The search ring identifies the area within which a site could be located (assuming that sufficient height is used) that would have a high probability of meeting the coverage and capacity objectives established by the Verizon Wireless RF (Radio Frequency) engineers.

Once a search ring is determined, Verizon Wireless' real estate specialists search within the defined area (and on occasion just outside this area) for existing buildings, towers and other structures of sufficient height that would meet the defined objectives. If none are found, then the focus shifts to "raw land" sites. Even if a site meets the technical objectives established by the RF engineers it can still be rejected if it does not meet the requirements of the Real Estate and Construction departments. Every effort is made to use existing structures before pursuing a "raw land" build to minimize the number of towers throughout the towns being serviced.

Due to the largely residential makeup of Falmouth Foreside, the "Falmouth 2" search ring identified one potential candidate, which is the proposed facility at 340 Foreside Road. The "Falmouth 3" search process determined that collocating on the existing monopole at the Falmouth Public Works yard would be the best solution for that particular area. The "Falmouth 4" search did not uncover any existing structures suitable to meet the coverage and capacity needs of the area, and it was determined that a proposed facility including a new monopole would be needed to fulfill the network objectives.

6. Pertinent Site Data

Table 1 below details the site-specific information for the existing and proposed Verizon Wireless sites used to perform the coverage analysis and generate the coverage plots provided herein.

Site Name	Address	City	Location		Structure Type	Antenna Height (ft AGL)	Status
			Latitude	Longitude			
Cumberland	Range Way	Cumberland	43°45'49.3" N	70°13'46.2" W	Lattice	148	On-Air
Falmouth	503-525 Presumpscot Street	Portland	43°41'58.7" N	70°15'28.5" W	Monopole	150	On-Air
Falmouth N	12 Victoria Lane	Falmouth	43°45'28.2" N	70°19'13.7" W	Guyed	177	On-Air
Gray 2	Long Hill Road	Gray	43°51'3.8" N	70°18'4.2" W	Lattice	248	On-Air
Portland 2	202 Woodford Street	Portland	43°40'14.5" N	70°17'15.7" W	Steeple	68	On-Air
Portland N	220 Riverside Industrial Parkway	Portland	43°42'21.6" N	70°18'38.6" W	Guyed	272	On-Air
Westbrook	115 Hardy Road	Falmouth	43°44'38.0" N	70°20'3.0" W	Guyed	187	On-Air
Westbrook DT	East Bridge Street	Westbrook	43°41'48.5" N	70°21'43.6" W	Guyed	110	On-Air
Yarmouth	221 Bluff Road	Yarmouth	43°48'48.0" N	70°10'11.0" W	Water Tank	75	On-Air
Falmouth 2	340 Foreside Road	Falmouth	43°44'27.9" N	70°12'14.8" W	Steeple	60	Proposed
Falmouth 3	Woods Road	Falmouth	43°44'6.6" N	70°14'30.2" W	Monopole	87	Proposed
Falmouth 4	121 Field Road	Falmouth	43°45'19.3" N	70°16'22.2" W	Monopole	120	Proposed

Table 1: Verizon Wireless Site Information Used in Coverage Analysis²

² Some sites listed in this table are outside the plot view but are included for completeness of information.

7. Coverage Analysis and Propagation Plots

The plots provided in this report show coverage for the 700 MHz frequency range and were produced using deciBel Planner™, a Windows-based RF propagation computer modeling program and network planning tool. The software takes into account the geographical 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.

The plots included as attachments show coverage based on RSRP signal strengths of -90 dBm, and -95 dBm in green and orange, respectively. All other areas (depicted in white) fall within coverage areas characterized by poor service quality, low data throughput, and the substantial likelihood of unreliable service.

Attachments A - C are discussed below:

Attachment A titled “Falmouth – Existing 700 MHz LTE Coverage” shows the coverage currently provided to the area from the “On-Air” sites listed in Table 1. The green shaded area represents the desired level of coverage for this area, whereas the orange areas represent a slightly lower signal strength. As shown in this plot and described in the Coverage and Capacity Objectives section of this report, there are expansive areas within Falmouth that do not have reliable service. These coverage gaps include I-295, the I-95/295 Connector, Route 88 (Foreside Road), Route 1, Route 9, Field Road, Woodville Road, Winn Road and the neighborhoods adjacent to these roads.

Attachment B titled “Falmouth – Existing 700 MHz LTE Coverage with Proposed Falmouth 2, Falmouth 3, & Falmouth 4 Sites” shows the composite coverage of the three proposed facilities, combined with the coverage from the surrounding “On-Air” Verizon Wireless sites.

Falmouth 2:

Due to the sharp dropoff in terrain from west to east and the relatively low available antenna height, Verizon Wireless has designed “Falmouth 2” as a two-sector antenna installation, with antenna azimuths directed to the north and south along Route 88 (Foreside Road). The proposed facility consists of two-sets of stacked antenna arrays. The upper antenna centerline is at 63’ AGL (above ground level) and the lower set is proposed to be at 56’ centerline. All antennas and ancillary equipment will be concealed within the proposed fiberglass steeple. This proposed facility expands coverage to:

- ~ 1.8 mi along Route 88, between Sanderson Road in Cumberland and Applegate Lane in Falmouth
- ~ 1,200 additional residents in the area³

In addition to the new areas of reliable service provided, “Falmouth 2” would also provide capacity relief to the “Falmouth” site, located 4 mi to the south, that is currently providing some degree of service in the Foreside, albeit highly unreliable. This large pocket of low-level service creates an additional capacity burden on the “Falmouth” site, which ultimately impacts the quality of service provided to all users served by this site.

³ Population counts are based upon 2010 U.S. Census Data

Falmouth 3:

A key objective of this proposed site is to fill in coverage gaps along I-295, the I-95/295 Connector, Route 1, Route 9 (Longwoods Road) and the surrounding areas. Although specific details related to the design of the proposed site are currently being worked out, the intention is to collocate on the existing monopole located within the Falmouth Public Works yard. The monopole currently supports an installation for U.S. Cellular, and Verizon Wireless is pursuing the second available height of approximately 87' centerline. The proposed "Falmouth 3" site will expand coverage to:

- ~ 1.8 mi I-95/I-295 Connector
- ~ 0.9 mi along I-295
- ~ 0.9 mi along Route 1
- ~ 1.5 mi along Route 9
- Shopping/commercial areas between I-295 and Route 1, south of Bucknam Road

In addition to expanding the areas of reliable service by filling in the coverage gaps along these main roadways, "Falmouth 3" is also intended to be the primary offloading site for the "Falmouth" site discussed above. "Falmouth" is quickly approaching its capacity limits to support the usage demand in the area, so it is critical for Verizon Wireless to integrate a facility to maintain the desired level of service in this area of Falmouth.

Falmouth 4:

This proposed facility is intended to expand coverage to the interior sections of Falmouth, and also provide capacity relief to the "Falmouth N" site, located to the west of I-95. Because the search for a facility did not identify any existing structures that could be used for collocation, the proposed facility at 121 Field Road includes a 120' monopole structure. "Falmouth 4" will expand reliable coverage to:

- ~ 0.5 mi along Winn Road
- ~ 0.5 mi along Woodville Road
- ~ 0.6 mi along Field Road
- ~ 500 residents in the surrounding area

"Falmouth 4" will also provide sufficient capacity relief to the "Falmouth N" site.

Attachment C titled "Falmouth – Area Terrain Map" details the terrain features of Falmouth around the existing and proposed sites, which play a key role in determining site designs and dictating the unique coverage achieved from a given location. This plot is included to provide a visual representation of the ridges and valleys that must be considered when siting a wireless facility and designing a wireless network. The lower elevations are depicted in the blue, green, and yellow shades, whereas the higher elevations are shown in orange, red, and white.

8. Certification of Non-Interference

Verizon Wireless certifies that the proposed facility will not cause interference to any lawfully operating emergency communication system, television, telephone or radio, in the surrounding area. The FCC has licensed Verizon Wireless to transmit and receive in the Upper C-Block of the 700 MHz band, B-Block of the Cellular (850 MHz) band, the E, F, and C5 Blocks of the PCS (1900 MHz) band, and the B and F Blocks of the AWS (2100 MHz) band of the RF spectrum. As a condition of the FCC licenses, Verizon Wireless is prohibited from interfering with other licensed devices that are being operated in a lawful manner. Furthermore, no emergency communication system, television, telephone, or radio is licensed to operate on these frequencies, and therefore interference is highly unlikely.

9. Summary

Verizon Wireless has determined that additional facilities are needed to provide improved service and capacity in the Town of Falmouth, ME. As part of the Verizon Wireless build-out of 4G LTE service in Cumberland County, the proposed facilities at 340 Foreside Road (“Falmouth 2”), Woods Road (“Falmouth 3”), and 121 Field Road (“Falmouth 4”) will provide the necessary capacity and improved coverage to the targeted areas, including key roadways such as the I-95/295 Connector, I-295, Route 1, Route 88 (Foreside Road), Route 9 (Longwoods Road), Winn Road, Woodville Road, and the surrounding areas. The proposed sites were chosen in consideration of the existing neighboring site designs and the presence of existing structures in the area. This allows for a balance between satisfying the coverage and capacity needs of the network, while simultaneously limiting the impact on the surrounding neighborhoods. Without the installations at each proposed site, Verizon Wireless will be unable to provide reliable 4G LTE wireless communication services in these areas of Falmouth; therefore Verizon Wireless requests that the Town of Falmouth act favorably upon the proposed facilities.

10. Statement of Certification

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

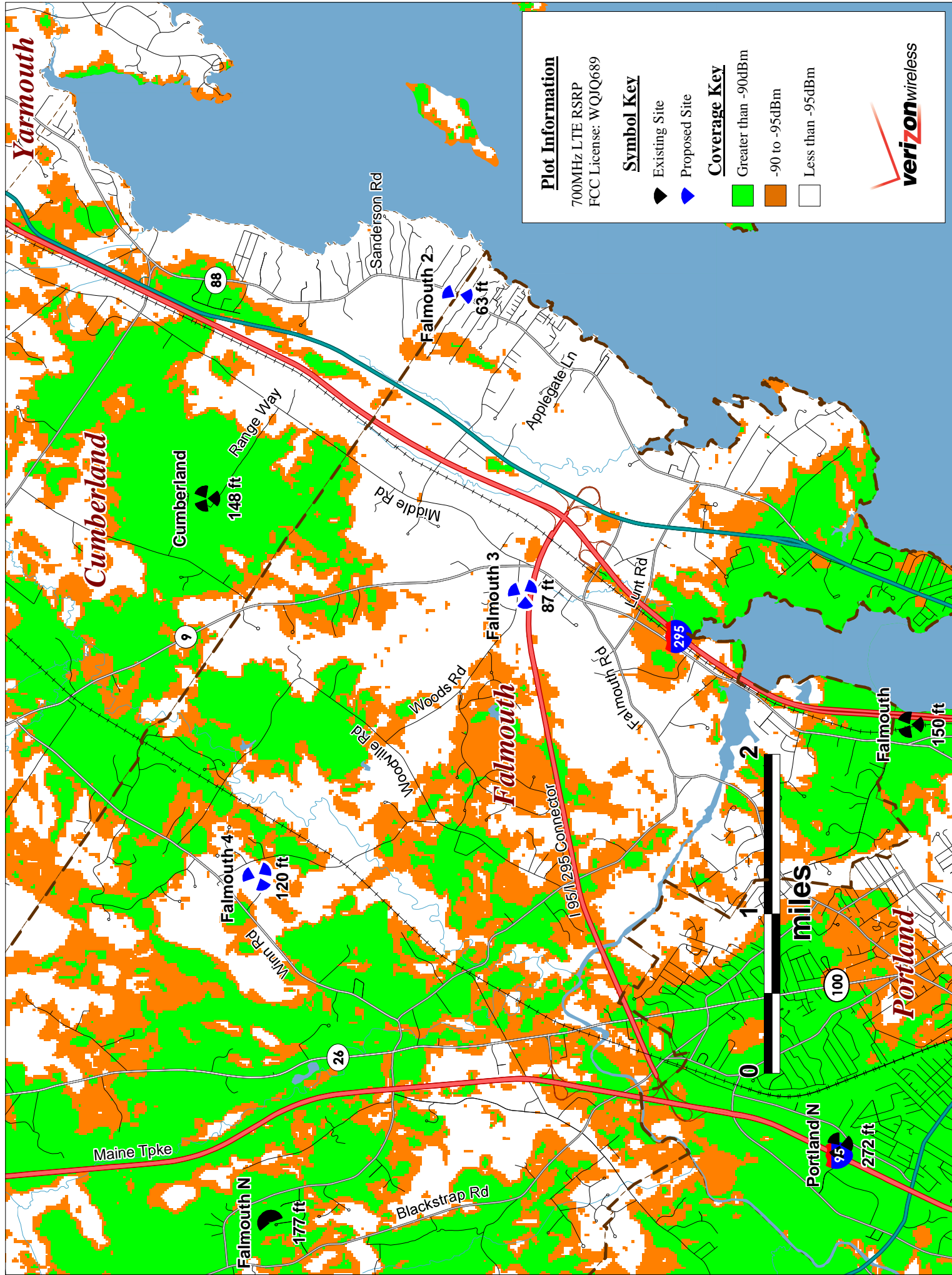


Keith Vellante
C Squared Systems, LLC

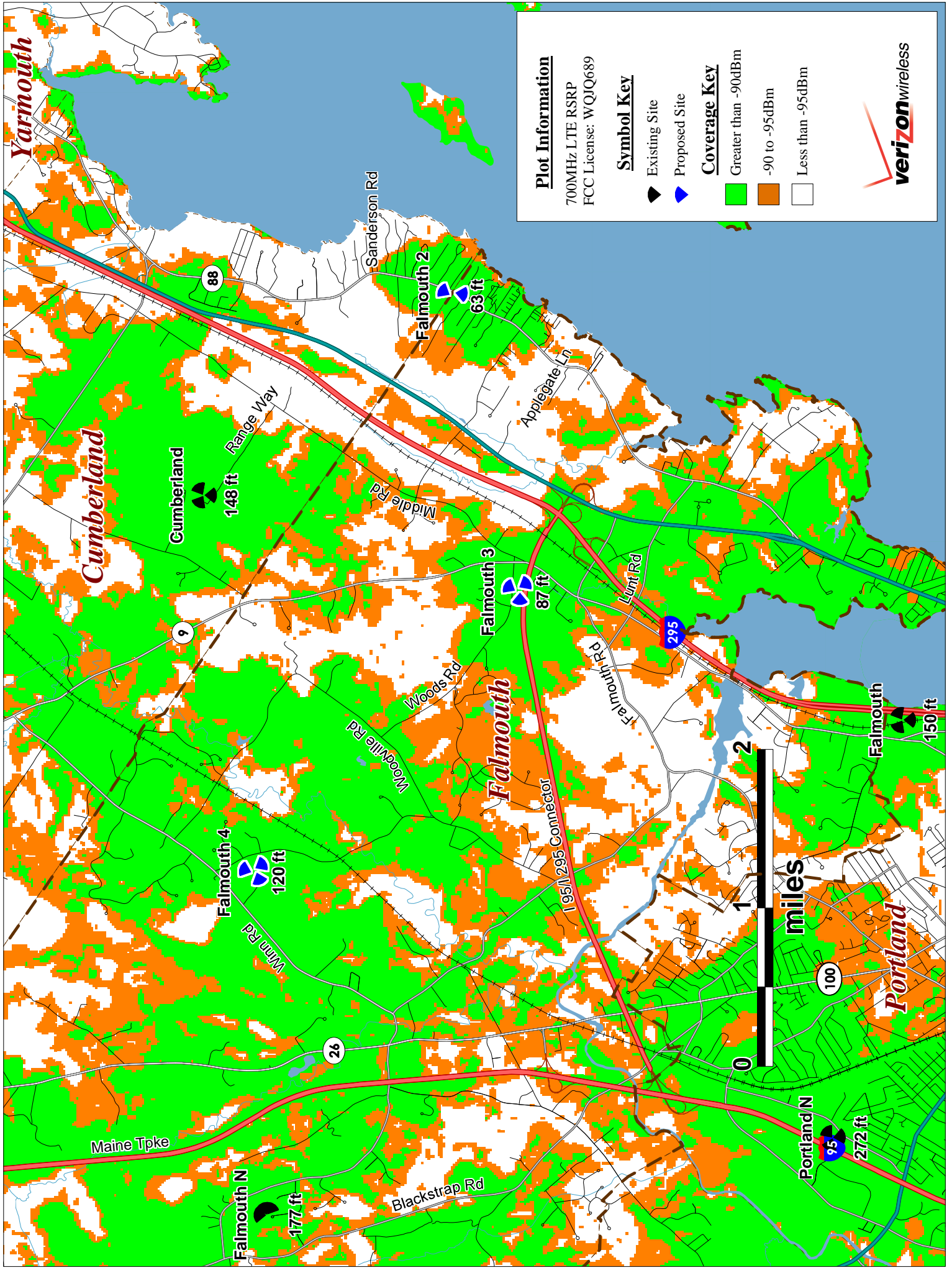
July 16, 2014
Date

11. Attachments

Attachment A: Falmouth - Existing 700 MHz LTE Coverage



Attachment B: Falmouth - Existing 700 MHz LTE Coverage with Proposed Falmouth 2, Falmouth 3, & Falmouth 4 Sites



Attachment C: Area Terrain Map

