IDK
Communications

April 27, 2017

Mr. Ethan J. Croce
Senior Planner
Town of Falmouth
271 Falmouth Road
Falmouth, ME 04105

RE: Verizon Application – 175 Falmouth Road

Dear Mr. Croce,

IDK Communications ("IDK") has been tasked with the following scope pertaining to the above referenced subject.

1.) Review the technical information and coverage analysis for existing and proposed sites provided by the applicant, application dated July 25, 2016 as well as the supplemental information dated January 31, 2017
2.) Review the RF site parameters provided by the applicant
3.) Perform an independent coverage analysis
4.) Provide a written summary report with outputs

Radio Frequency (RF) Coverage Analysis:

When analyzing a site for radio frequency propagation several factors contribute to the overall performance. Of great importance are factors such as height above average terrain, tree density, building density and construction, frequency and equipment performance specifications.

The following paragraphs identify characteristics of each item used in determining overall performance.

Equipment specifications:

It is important to first determine whether a candidate site is limited by the radio path from the handset in a vehicle or building to the radio base station at the tower or by the radio path from the base station at the tower to the handset in a vehicle. In most cases because of the limited output power of the handset the path from the vehicle or inside a building to the radio base station at the tower is your limiting factor. Once this is known input parameters for both the base station and the handset are used to calculate the overall receive parameter used in the propagation modeling.

Height above average terrain:

Another important factor in determining a site's viability is how high the antennas will be in relation to the surrounding terrain. In the cellular/PCS world being at a maximum height above the average terrain is not necessarily a good thing since the systems are designed to provide handoffs to adjacent sites. Cellular/PCS carriers will re-use frequencies at different sites so it is important not to create interference with themselves. This philosophy differs from that of older wireless paging systems for example where sites were picked for their greater heights above average terrain. Cellular/PCS sites are picked by how they relate to the area that requires coverage. These areas are where the general population lives and commutes. A site that provides for coverage within a geographical area does not need to be on the highest point for that area but rather an area that provides enough clearance above the average terrain.

Tree Density:

Going along with height above average terrain is tree density. This factor is important because where the height of the antennas just clears the overall tree canopy in the surrounding area there may be additional losses associated with foliage. This loss can vary depending on types of trees and the density of the area. These losses are taken into account when determining propagation. It is also important to note that tree losses at the PCS and AWS frequencies of 1900/2100 MHz are greater than the cellular frequencies of 700/800 MHz. Verizon's application is for operating in the 700 MHz frequency range.

Building Density and Construction:

Another factor in the determination of propagation is the building density and construction. Buildings can exhibit different types of losses depending on the construction material. Appropriate RF parameters for building density can be used when modeling coverage for areas such as Falmouth.

Input parameter values are chosen and then used in statistical calculations to determine if a viable signal is available for a particular area. In some cases coverage deficient areas are caused by shadows from particularly high terrain. Elimination of the deficient area may sometimes only be accomplished by increasing antenna height or by selecting an alternative site if the heights become too great.

Site Configuration Options

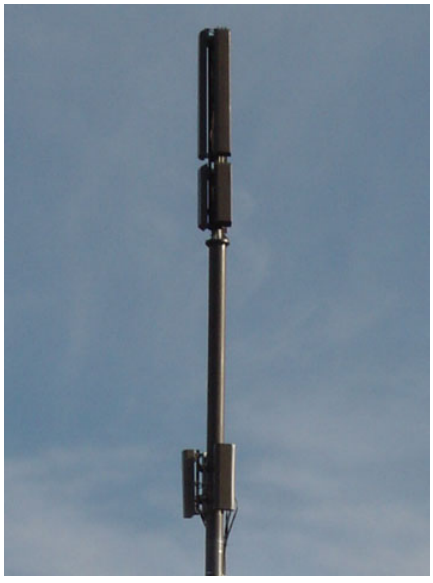
Antenna Support Structures

When designing an antenna site there are several options with respect to the structure that supports the antennas. Two of the most basic structures are lattice and monopole towers.

The lattice tower consists of three or four legs with interconnecting braces and is capable of heights in excess of 300 feet. The lattice towers can be either guyed with wires or self-supporting. With structural capacity being equal the self-supporting structures are wider than the guyed counterpart version.

The monopole structures are possible to heights of 190 feet. As their heights increase so does the complexity of the foundations used to support the structure. Antennas can be either mounted on the exterior of the pole with the transmission lines inside the pole or they can be mounted inside the pole with the transmission lines. Mounting the antennas inside the pole creates a more stealth design and they can also be disguised as flagpoles or trees. Mounting antennas within a pole however will cause the carriers to take up more vertical space (i.e. taller structure) and may reduce the amount of co-location. If antennas are mounted outside the pole they can be flush mounted to the exterior of the pole to reduce the visual impact. Doing this would also have the same result as mounting the antennas inside with respect to the structure height and co-location opportunities. The pictures below offer three types of antenna installations outside of a monopole.

Non-Flush Mount Install



Flush Mount Install

Monopine Stealth

Equipment Powering

Typically a cell/PCS carrier constructs a site with an electrical feed and a backup option in the event of an AC failure. The electrical feed to a site is either supported overhead by utility poles or is trenched underground through conduits.

The backup power option can consist of various options such as a propane or diesel generator, batteries or fuel cells. Out of all these options the generator would be the loudest when activated. Typically for maintenance purposes the generators are run a few times a month.

Sometimes sites are designed to have one backup power option to supply multiple Cell/PCS installations. This eliminates additional equipment on the ground.

Coverage Analysis:

IDK was tasked to validate the radio frequency performance of the Verizon data that was supplied to the Board. Verizon provided proposed and existing system information for its radio sites. The site data together with information from the Town were used in IDK's RF analysis. The output of these analyses is a map or plot that depicts the radio frequency propagation prediction for each site. IDK has presented an analysis using the 700 MHz frequency band currently used by Verizon.

The sites used by IDK in the analysis are as follows:

1.) Existing and planned Verizon radio sites in Falmouth and adjoining municipalities
2.) Proposed site at 175 Falmouth Road
3.) Alternative site at Town Hall
4.) Alternative site at Town DPW

The alternative sites are ones that fall in close proximity to the proposed location and the identified targeted area of coverage as identified in the supplemental engineering.

Results:

Propagation analysis was performed using the existing and proposed Verizon radio sites along with alternative candidates. Maps are included with this report that depict the results with the LTE coverage areas for each site in green, orange and grey. Areas with green represent reliable LTE coverage. Areas with less than reliable coverage are depicted in orange. Areas in grey represent minimal LTE coverage and areas in white offer no reliable LTE coverage. The following paragraphs identify each scenario with the associated results:

FIGURE 1

IDK ran coverage for all existing Verizon sites to determine if a LTE coverage gap existed in the Town of Falmouth. The results show that indeed there exist gaps in LTE coverage in targeted areas along Falmouth Road, Woods Road, Woodland Road including the Woodland Golf Course and the associated adjoining roads off of these main areas. This map takes into account all built and planned Verizon sites including the SBA site on Route 1 in Falmouth.

FIGURE 2

IDK ran a coverage analysis to determine the impact to coverage by adding the proposed site on 175 Falmouth Road using an antenna height of 107 feet. The site offers LTE coverage to the gap areas of Falmouth Road, Woods Road, Woodland Road including the Woodland Golf Course and the associated adjoining roads off of these main areas.

FIGURE 3

IDK next looked at the possibility of lowering the antenna height at the proposed location to validate the requested height. At a height of 87 feet LTE coverage degraded in the targeted area with impacts to Woods Road and the Woodland Golf Course areas and along sections of Falmouth Road.

FIGURE 4

IDK next looked at an alternative location at the Falmouth Town Hall. IDK ran several potential antenna heights at this location but even with an antenna height of 180 feet it did not provide the same level of LTE coverage afforded by the proposed location to the targeted areas.

FIGURE 5

IDK next looked at an alternative location at the Falmouth DPW. IDK ran several potential antenna heights at this location but even with an antenna height of 180 feet it did not provide the same level of LTE coverage afforded by the proposed location to the targeted areas.

FIGURE 6

IDK then examined the possibility of using the DPW and Town Hall sites as a replacement for the proposed location. Figures 4 and 5 looked at those sites individually at antennas heights of 180 feet and this Figure utilizes both together. As this Figure shows, the coverage from the two sites does not match the proposed site for the targeted areas, specifically along the Falmouth spur, the Woods Road and Woodlands Drive and parts of Falmouth Road. This is due in large part to the DPW and Town

Hall sites having a lower height above mean sea level as well as the DPW site being too far to the east from the targeted area. In addition, the DPW site is only 0.75 miles from an existing Verizon site which duplicates a lot of the existing coverage.

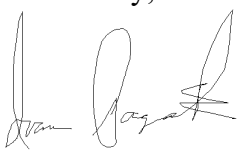
Coverage Summary

The following summarizes the findings of the coverage scenarios:

- Today there exist LTE coverage gaps in the Town of Falmouth for Verizon, specifically in the targeted areas along Falmouth Road, Woods Road, Woodland Road including the Woodland Golf Course and the associated adjoining roads off of these main areas.
- The proposed site at 175 Falmouth Road at 107 feet provides LTE coverage to the targeted areas.
- Lowering the height to 87 feet at the proposed location will degrade LTE coverage to the targeted areas.
- An alternative site at the Town Hall at a height of 180 feet will still not provide the level of LTE coverage afforded by the proposed site to the targeted areas.
- An alternative site at a height of 180 feet at the Town DPW will still not provide the level of LTE coverage afforded by the proposed site to the targeted areas.
- Utilizing both the DPW and Town Hall sites does not equal the amount of coverage from the proposed location in the targeted areas.

IDK has no other comments regarding the referenced application and site plans and find that standard engineering practice was used in their coverage analysis. If you have any questions please feel free to contact me at (978) 375-7914.

Yours truly,



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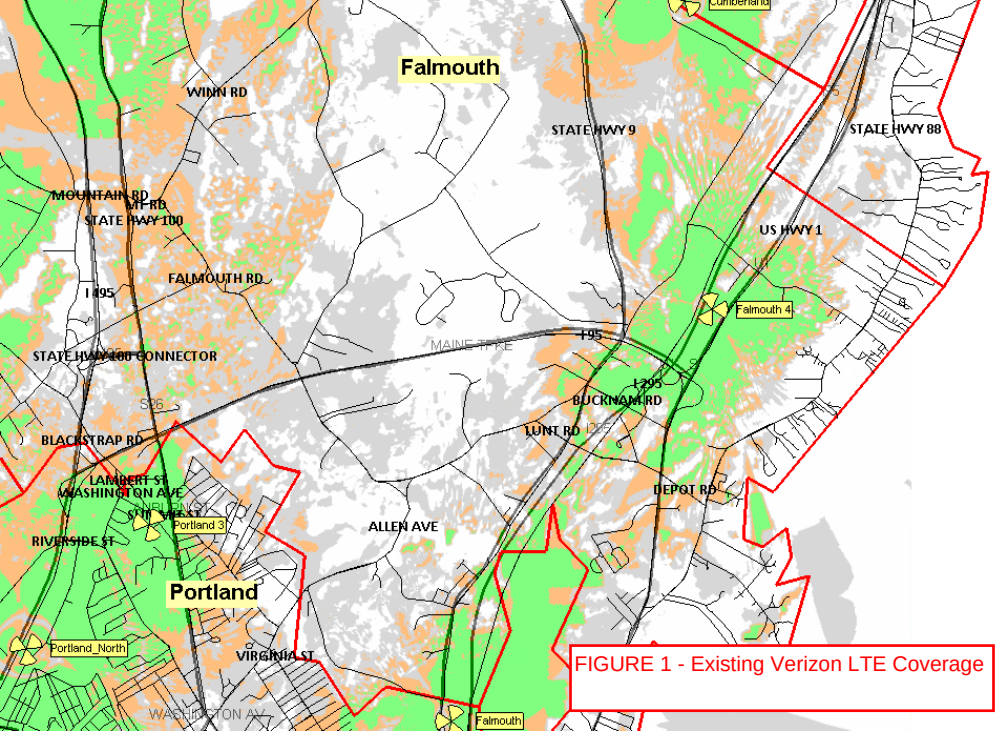

FIGURE 1 - Existing Verizon LTE Coverage

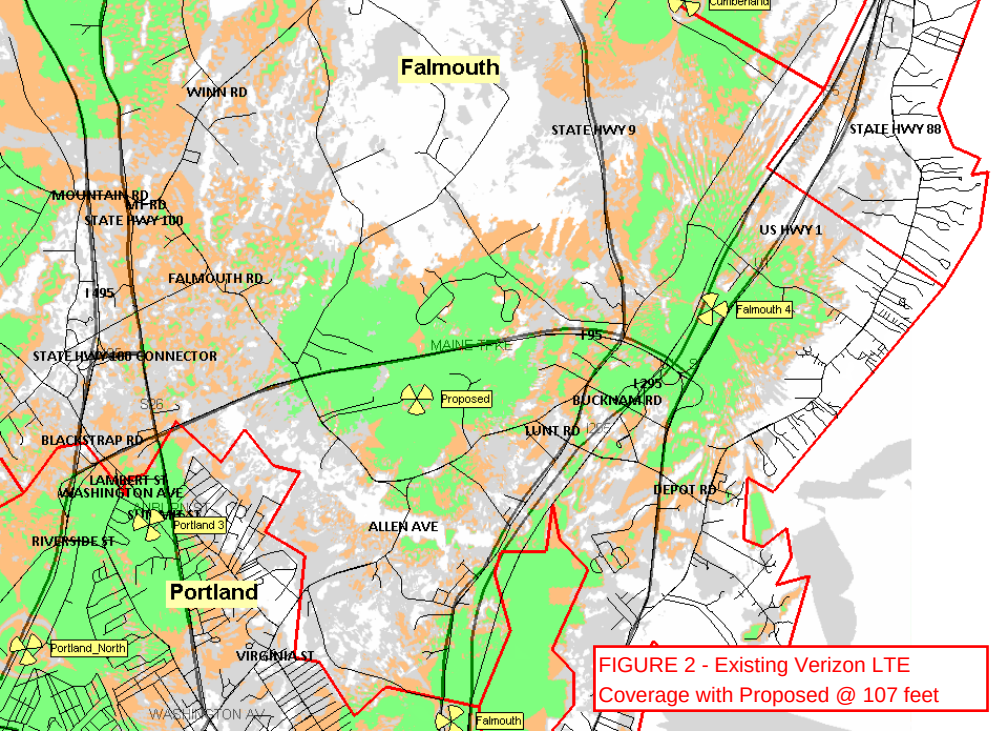

FIGURE 2 - Existing Verizon LTE Coverage with Proposed @ 107 feet

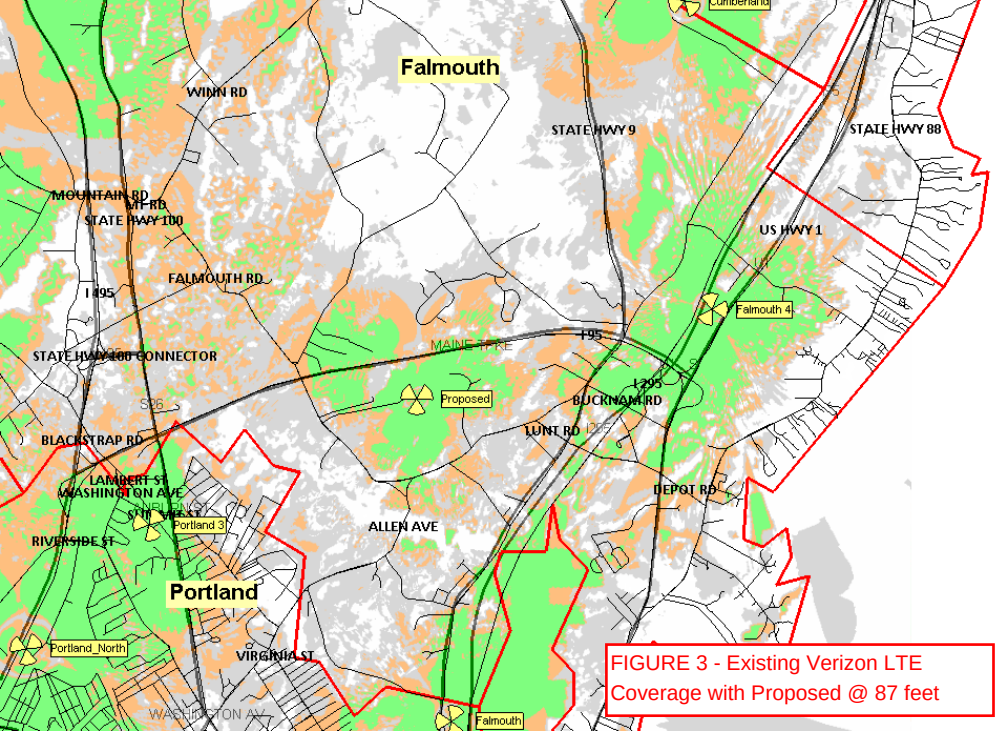

FIGURE 3 - Existing Verizon LTE Coverage with Proposed @ 87 feet

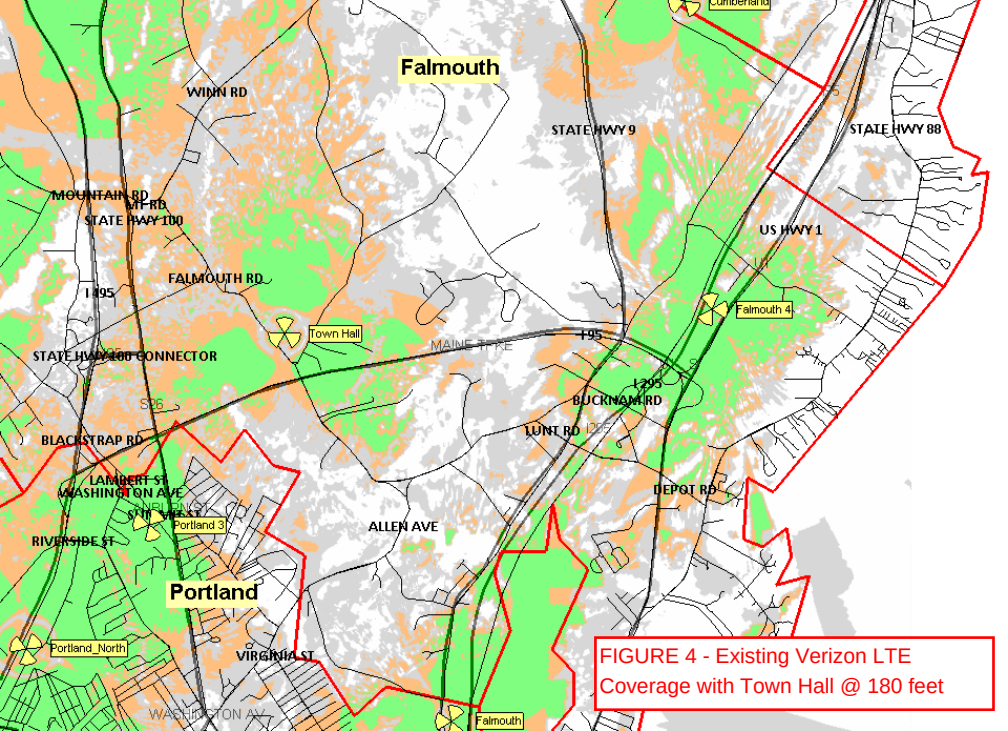

FIGURE 4 - Existing Verizon LTE Coverage with Town Hall @ 180 feet

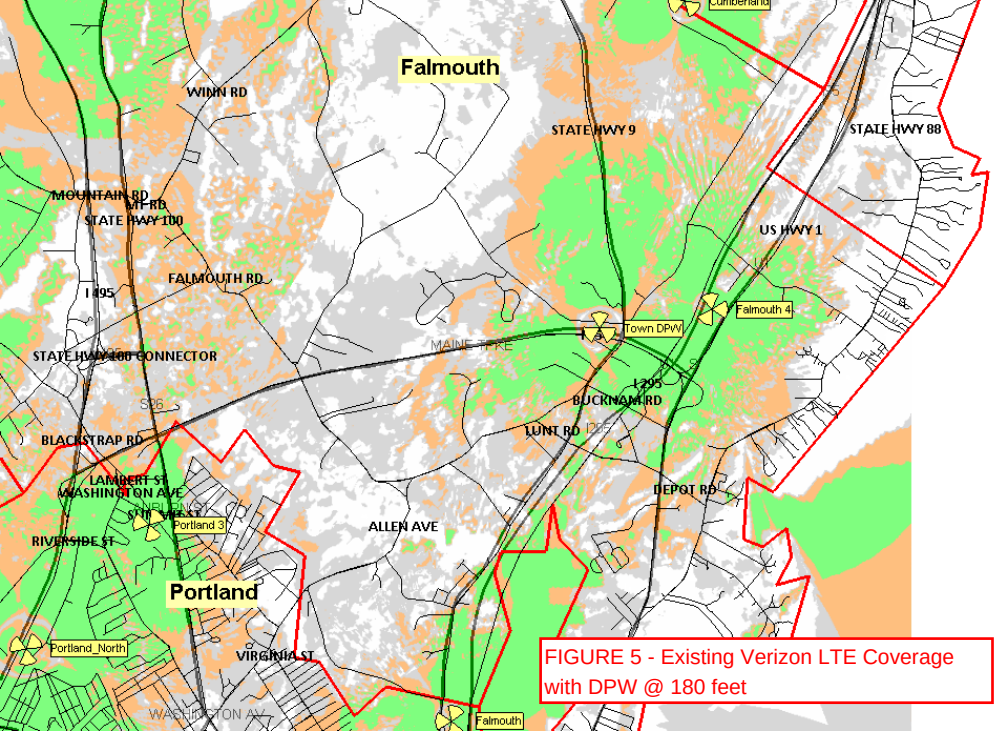

FIGURE 5 - Existing Verizon LTE Coverage with DPW @ 180 feet

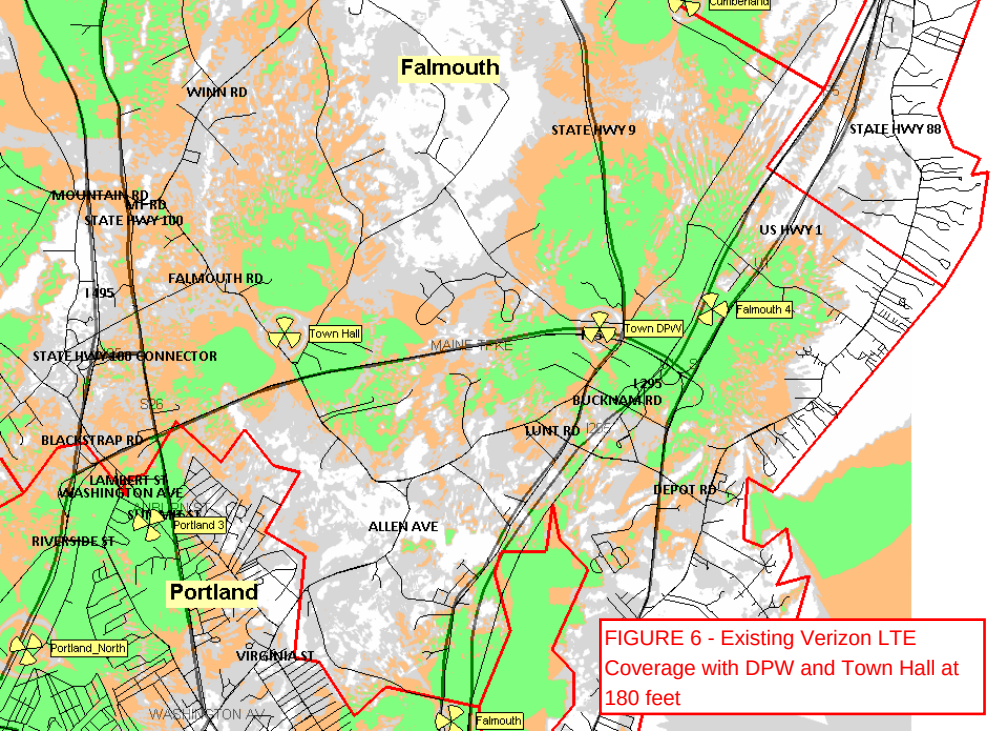

FIGURE 6 - Existing Verizon LTE Coverage with DPW and Town Hall at 180 feet