# Review of Vertex Tower Application for Conway

*Fred Goldstein, Interisle Consulting Group, 2/11/2020*

Vertex Tower Assets LLC has filed an Application for Special Permit and Zoning Variance to build a Wireless Communications Facility overlooking 1384 S. Deerfield Rd., Conway. The proposed structure would be a "monopine" stealth tower 140 feet tall, capable of supporting four mobile carriers' equipment at about 145', 135', 125' and 115' above ground level. The specific site is 1912 feet south of the road. The primary purpose of the proposed tower is to allow mobile carriers to fill in a coverage gap in the Rt. 116 (S. Deerfield Rd.) corridor north and northwest of the tower.

Both Town and federal laws are potentially applicable. 47 U.S.C. 332(c)(7), part of the Telecommunications Act, protects the right of localities to enforce zoning codes for wireless towers but only to the extent that the zoning does "shall not prohibit or have the effect of prohibiting the provision of personal wireless services". While not explicitly cited in the application, local zoning bodies do need to keep it in mind, as it has been invoked in numerous places. Nonetheless the application need not be granted as proposed if an adequate alternative is available, or if limiting its waivers do not substantially impair service.

The proposed height of the facility is intended to allow the fourth provider, at the 115' level, to have adequate coverage, taking treetops into account. An antenna must be well clear of the local trees, as well as not be blocked by terrain. Even if Vertex only has one customer currently lined up to use the tower, it would be imprudent to build one that did not have room for additional users, in order to minimize the need for more towers in the future. The tower site itself is more than 300 feet higher than the road.

## Terrain in the vicinity of the proposed facility

The proposed site is on a ridge that runs along the eastern edge of the Town of Conway and into the northwestern corner of Deerfield. This gives the proposed facility a line-of-sight view towards the Connecticut River to the southeast, though another ridge east of Rt. 5 limits coverage due east. Another ridge runs approximately a mile and a quarter to the west of the proposed site. Conway Center is west of that latter ridge. Rt.116 essentially winds through a hollow between Roaring Brook Road and Deerfield. All of these ridges are taller than any proposed or existing telecommunications facility.

## Existing facilities

A list of 11 existing sites within 7.5 miles of the proposed site was included in the application. Only one is in Conway, the water tower at 8 Ashfield Road. This is only 60' high and while it provides AT&T coverage to Conway Center, it does not reach over any of the nearby hills. No existing sites are in or overlook the valley west of the proposed site.

## Coverage modeling methodology

Coverage models were built based upon the proposed location and radio frequencies. Lower frequency signals are less sensitive to foliage blockage, and have greater coverage for the same power level. AT&T and Verizon typically build out coverage cells using frequencies in the 700 MHz band, so coverage models were built for a frequency of 750 MHz They may also use the 1900 MHz PCS band and the AWS-1 band that, using both 1700 and 2100 MHz, straddles it. Thus a 1900 MHz frequency was used for the second set of models.

The modeling software used for this study was RadioMobile. This derives coverage maps based upon publicly available digital elevation maps generated some years ago by the Space Shuttle (SRTM). It also uses public land-cover models to determine ground cover. Both are mapped to a one arc-second unit of area. Coverage is generally projected atop Open Street Map, itself layered atop a topographically shaded map. (The relative density of these layers can be adjusted in RadioMobile.) This report is accompanied by the .png pictures generated by RadioMobile, which are also accompanied by the .kml files enabling them to be viewed in Google Earth or other compatible software.

Maps were generated for both 700 and 1900 MHz, but using two different antenna elevations above ground: 46 meters (150 feet[1]), representing a possible appurtenance on the upper bay of the tower, and 37 meters (121 feet), between the third and fourth potential bay down from the top. The model's tree height was assumed to be 22 meters (72 feet) for deciduous forests, 30 meters for evergreens, and 25 meters for mixed forests. (Both types of trees occur on the property, individually and mixed.) Directional antennas were not assumed; coverage was calculated in all directions. In practice the carrier will generally use a set of sectoral antennas for every direction they intend to cover.

Coverage was also modeled from the identified existing sites to determine if they had coverage to the gap area noted in the application.

The model assumed a 700 MHz band base station transmitter power of 30 watts and a 15.5 dB gain antenna. The 1900 MHz power was also 30 watts, and an 18 dB antenna gain was assumed. Carriers have considerable flexibility in choosing antennas; the 30 watt power level is typical of a macro cell. An acceptable receive signal level on the user's cell phone was assumed to be -92 dBm, though signals not stronger than -86 dBm are shown in yellow on the coverage maps, vs. green for stronger ones. This is a technology-independent signal level, not the LTE-specific value RSRP, and is based on straightforward path loss modeling.

## Coverage mapping results

### Exiting sites and coverage gaps

The permit application shows a lack of existing coverage in an area near the tower, especially around Rt. 116. Gaps are also noted around Fournier Rd., Matthews Rd., Graves Rd., Hoosac Rd., and Boyden Rd. Note that 700 MHz coverage from the top of the tower is shown here; 1900 MHz coverage would be less.

[1] The application states "156' to top of highest appurtenance".

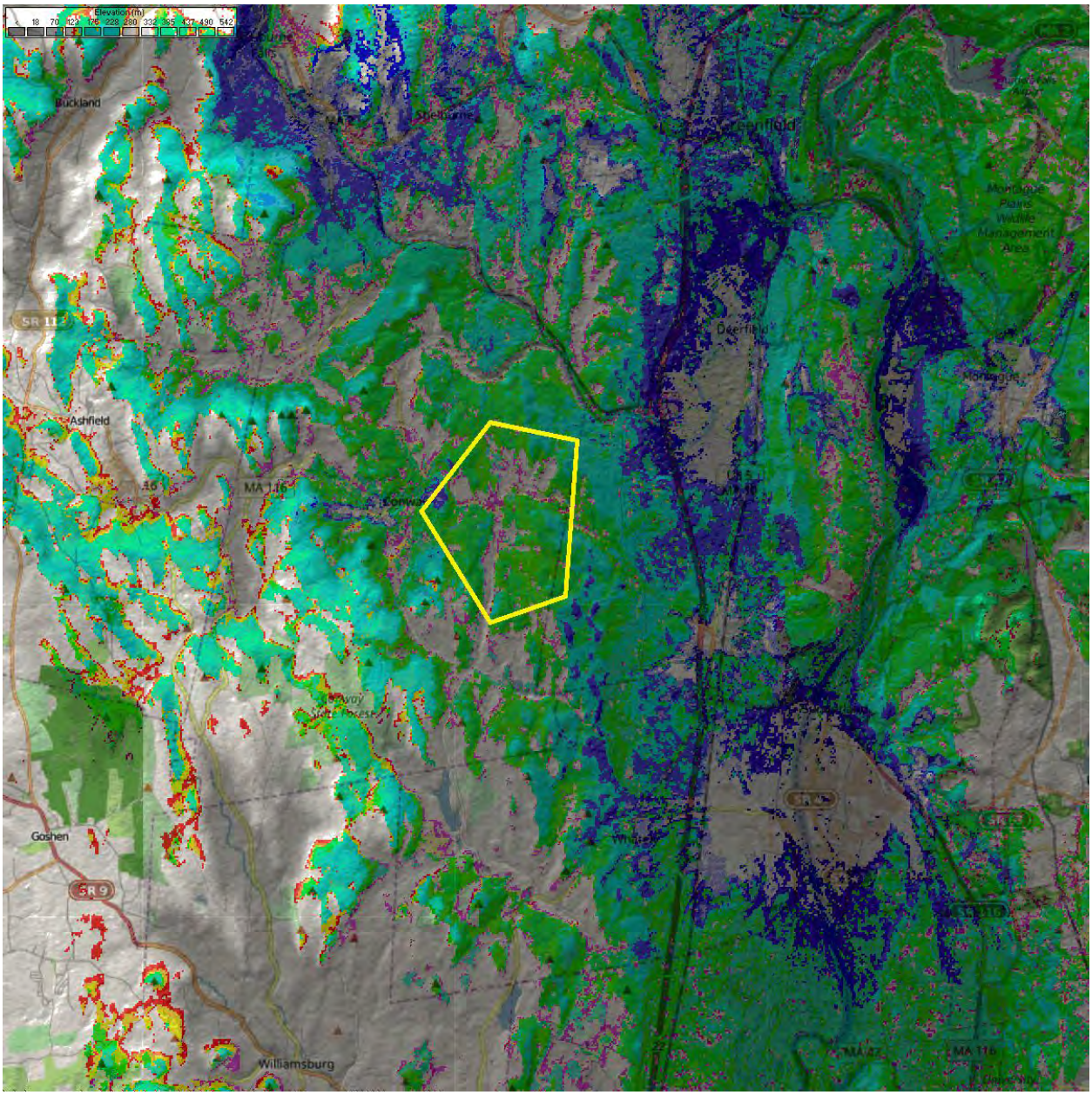


*Figure 1. Coverage composite on 700 MHz, from identified existing cell sites, with gap area indicated by yellow line. Rainbow scaling shows red for marginal coverage, then orange, yellow, green and blue for stronger signal coverage.*

The application states that "Vertex has determined that a wireless transmission facility located at or near to the proposed Facility would facilitate wireless communications within the local area along South Deerfield Rd, South Mill River Rd, Lee Rd and surrounding areas of Conway." South Mill River Rd. and Lee Rd. are in Deerfield, just east of Conway. They do not appear to be actually unserved now, but are likely to receive relatively weak signals from existing towers.

## Ashfield Road

The site at 8 Ashfield Road does not cover the target area. It is confined largely to the immediate vicinity of the town center surrounding the water tower:

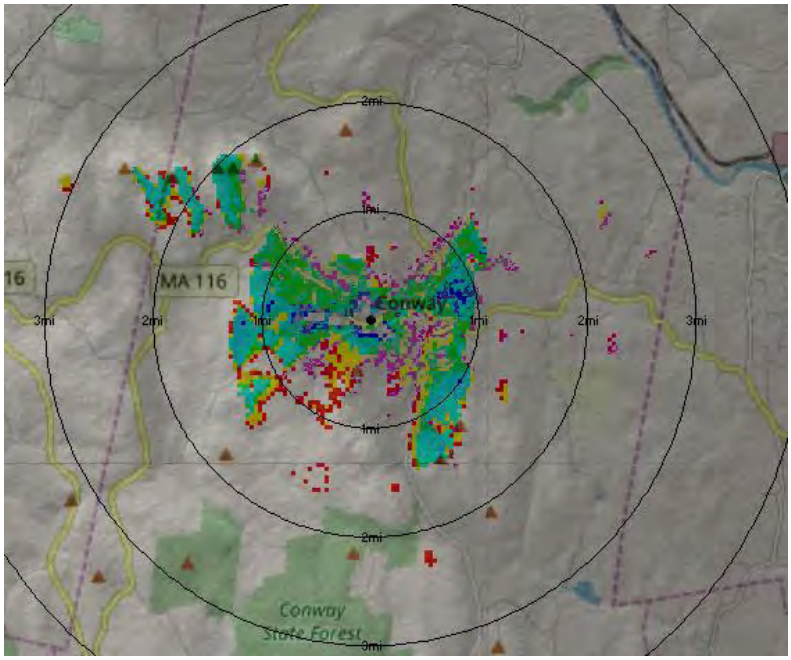


*Figure 2. Coverage from 8 Ashfield Road water tower on 700 MHz.*

## Old Pine Nook Rd.

Another nearby tower is on Old Pine Nook Rd. in Deerfield (misidentified as Old Nook Pine Rd. in the Application). This 120’ tower on the ridge between Deerfield Center and the Connecticut River has coverage into parts of Conway, but not most of the target area.

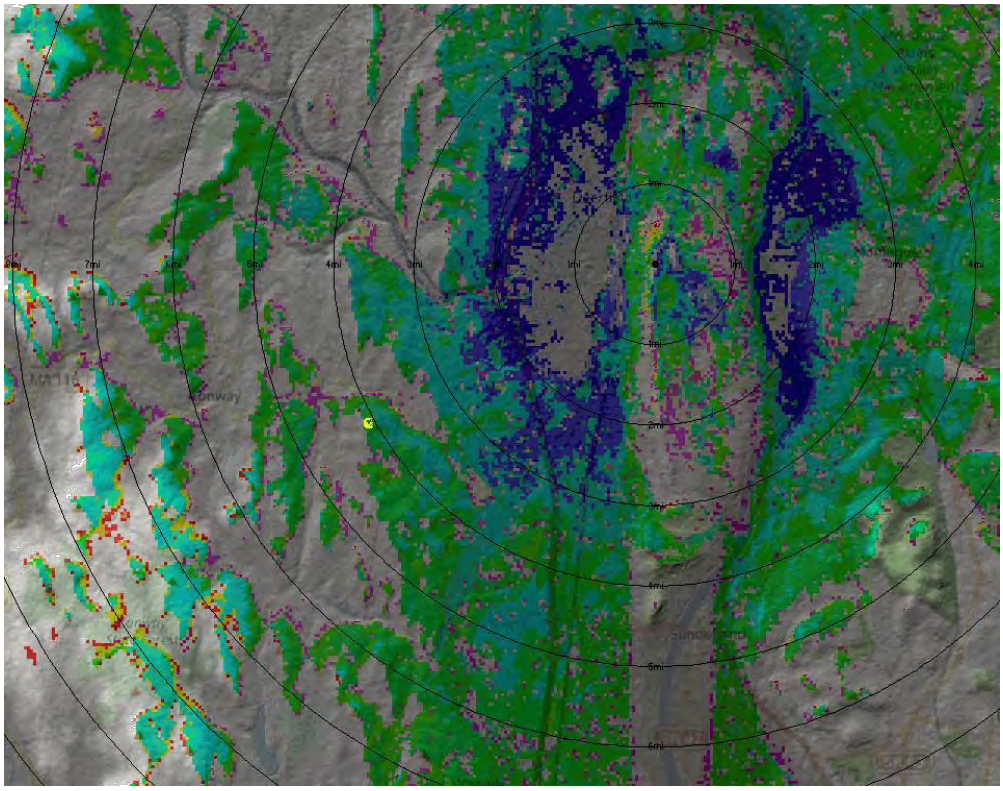

*Figure 3. Coverage from Old Pine Nook Rd. tower. Proposed tower is yellow dot.*

## Coverage from proposed facility

The proposed facility does provide the proposed coverage over the indicated gap area along the Rt. 116 corridor. Mapping over a wider area than is shown in the application shows that it also provides coverage into Deerfield and parts of Whately and Sunderland. (resulting in 213 square km. of pictured coverage.)

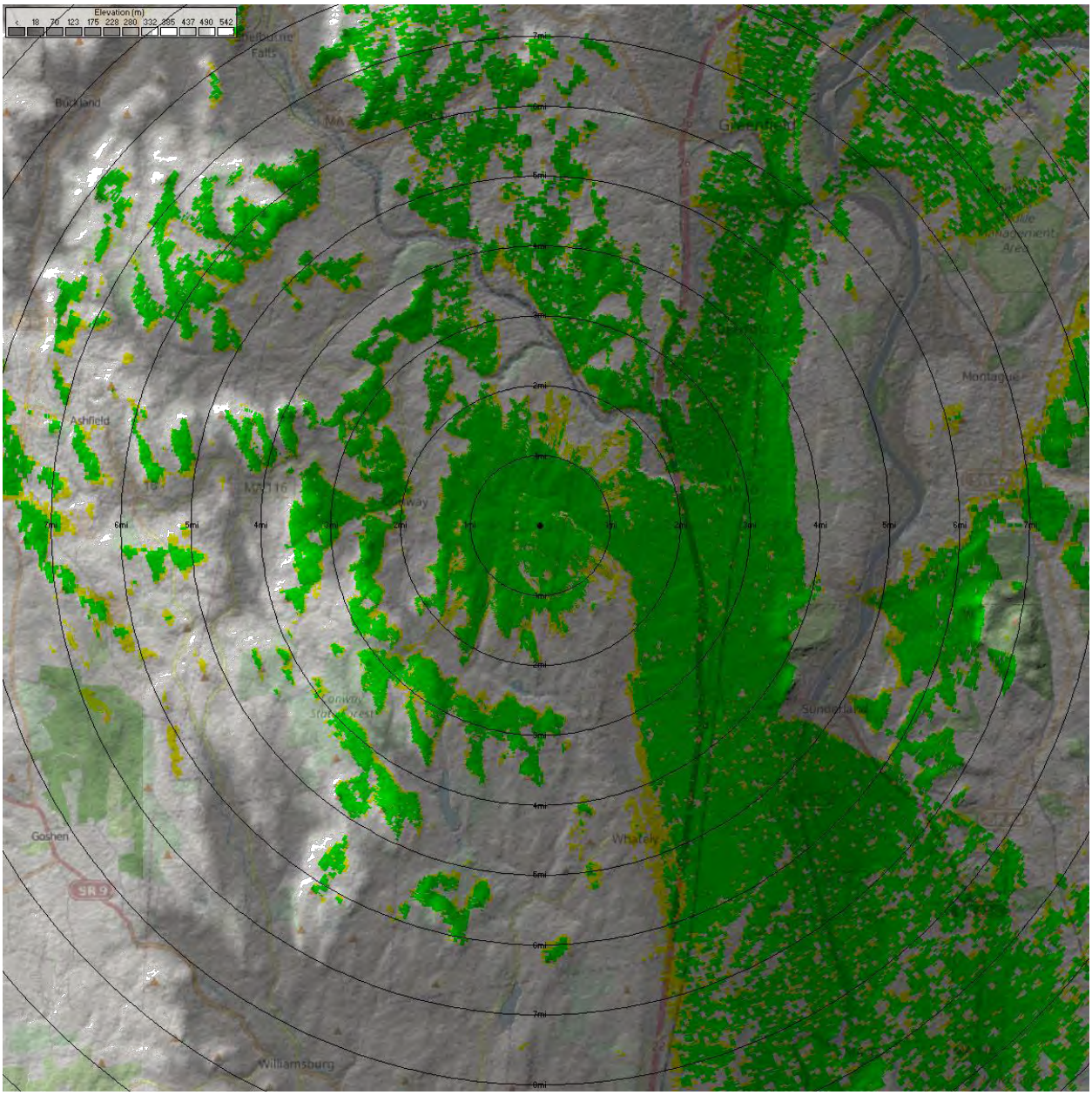


*Figure 4. Coverage from proposed site, 700 MHz, at 46 meter antenna elevation*

Using the lower elevation reduces proposed coverage only slightly, about 8% (196 sq. km).

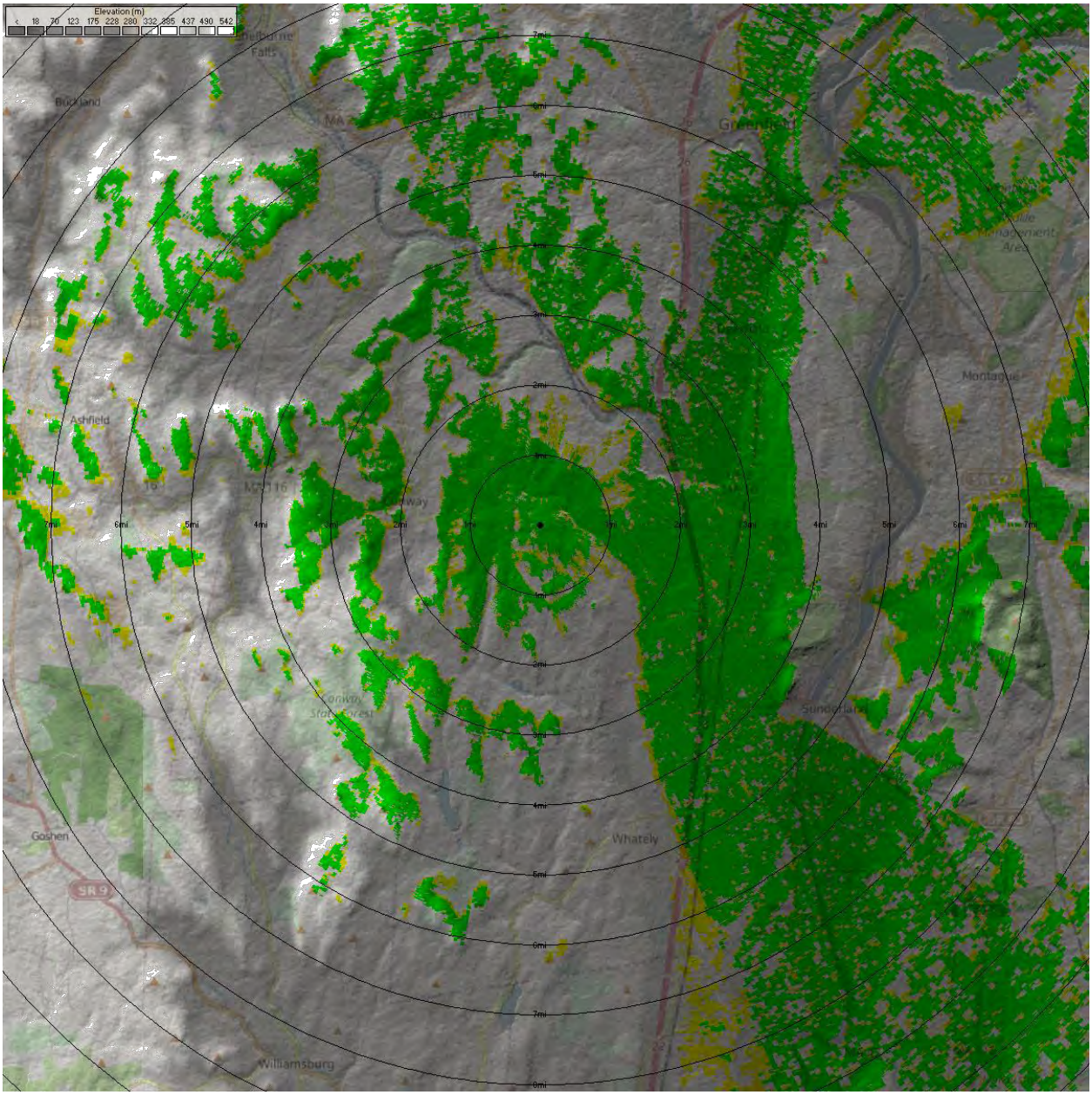


*Figure 5. Coverage from proposed site, 700 MHz, at 37 meter antenna elevation*

The 1900 MHz band does not penetrate foliage nearly as well as 700 MHz, and given the heavy tree cover in the area, shadowing by trees is a significant issue on any of the bands above 1000 MHz. Coverage is thus much reduced. AT&T, Sprint and T-Mobile all have spectrum in the 600-800 MHz range, for maximum coverage, and 1700/2100 MHz (AWS) or 1900 MHz (PCS) spectrum for additional capacity.

The 1900 MHz coverage area from the top of the tower is about 32% less (145 km) than the 700 MHz coverage area. While the lowest berth (37m) clears the local trees, its predicted coverage on 1900 MHz is quite a bit smaller, about 38% less (132 sq. km) than 700 MHz from the top.

Nonetheless considerable coverage into the Connecticut Valley and parts of Rt. 91 and Rt. 5 is achieved. And parts of the Rt. 116 corridor in Conway are still reached. Of course the second collocator will be able to get closer to the top[2] than the fourth, and it is highly speculative as to how many will end up using the tower.

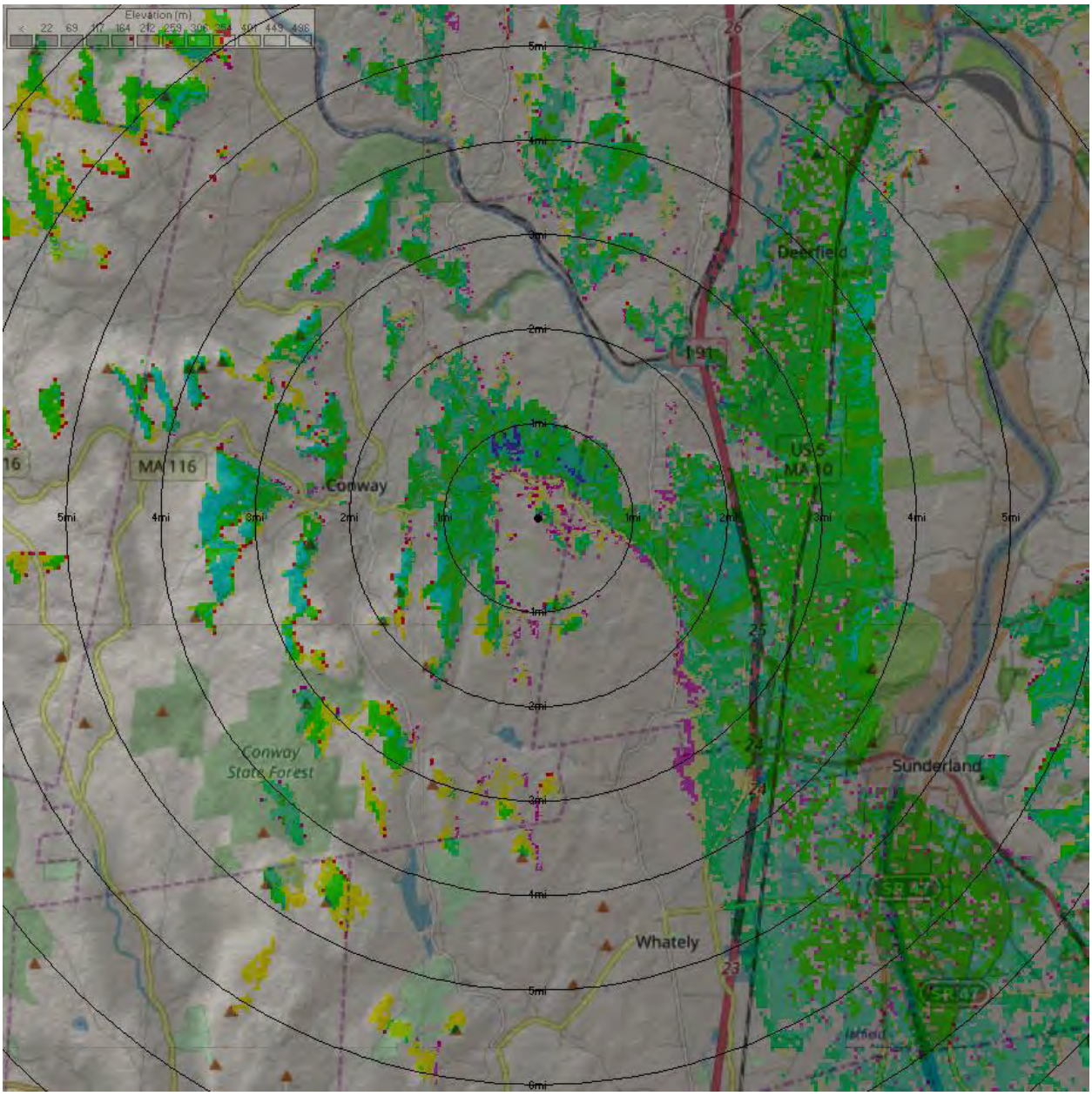


*Figure 6. Coverage from proposed site, 1900 MHz, at 37 meter antenna elevation*

*It must be noted* that predicting propagation is *not* an exact science. Tree heights and density vary, and the impact of foliage at any given frequency is only roughly estimated by prediction

[2] A tower tenant may choose a lower position in exchange for lower rent: Not only is the top position most generally desirable, but it also creates the most wind load. The same antenna at a lower position will use less of the tower's wind-handling capacity.

algorithms. The impact of terrain is well studied, but clutter losses – caused by trees and buildings –.are much less predictable.

The coverage predictions in the application thus appear to be reasonable, and the proposed tower will fill in a coverage gap in Conway, as well as adding coverage in towns to the east. It does not appear to be higher than necessary to support multiple carriers.