# Wireless Communications Initiative Master Plan

5th Draft

**April 10, 2018**

# Acknowledgements

(inserted at final draft)

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## Chapel Hill Wireless Communications Initiative

***Introduction***

The Town's wireless communications network and the underlying regulations need to be updated to better serve the community. This coincides with a time when the telecommunications industry is about expand the scope and capacity of the wireless communications network. The purpose of the Chapel Hill Wireless Communications Initiative is intended to address these conditions by developing a framework for the efficient deployment of wireless communications facilities, to support the community's day-to-day domestic, commercial, and institutional activities. To achieve this, CityScape Consultants, Inc. is working with the Town to develop a Wireless Master Plan and corresponding Wireless Ordinance. The outcome will help Chapel Hill make way for future wireless communications infrastructure for better service while protecting community interests.

The Town of Chapel Hill embarked upon the Wireless Communications Initiative in the sprint of 2017 in response to a series of events. There were increasing wireless communications facility (WCF) inquiries and applications, new about forthcoming technology improvements from the telecommunications industry, and a new wireless tower was constructed in Town that displeased residents. Furthermore, there is a climate of Federal and State regulatory amendments, most recently North Carolina HB310, diminishing rules for placing new wireless technology in public rights-of-way. The Master Plan and Ordinance for wireless communications facilities will position the Town to benefit from coming changes as well as guard against unwanted impacts.

***Background***

CityScape Consultants approach to developing the Wireless Master Plan included a process to engage the public and obtain their feedback, determine existing conditions of the wireless network, assess limitations of the network, and develop a plan for future deployment patterns for improvements, followed by recommendations for 10-year deployment objectives. These recommendations will be taken to Town Advisory Boards and the Town Council for recommendations and approval, respectively.

The overall steps in the process to develop the Draft Wireless Master Plan are indicated below:

- Initial public meetings and Council Work session;
- Public poll;
- Inventory of existing wireless infrastructure throughout Town;
- Theoretical propagation mapping;
- Public open house and status report to the Planning Commission;

- Projection maps of potential future network deployment patterns;
- Identification of Town-owned properties that could potentially be part of a network deployment solution for the community and wireless industry;
- Recommendations designed to meet ten-year network deployment objectives;
- Joint Advisory Board Work Session;
- Advisory Board and Council public meetings; and
- Council enactment of Wireless Communication Facility Master Plan and Ordinance.

***Relationship to the Town's Comprehensive Plan***

In addition to providing a road map for future technology improvements, the wireless telecommunications initiative supports several themes and goals from the Town of Chapel Hill's 2020 Comprehensive Plan:

- A Place for Everyone:
  - A welcoming and friendly community that provides all people with access to opportunities (Goal PFE.4);
  - A community of high civic engagement and participation (Goal PFE.5);
- Community Prosperity and Engagement:
  - Foster success of local businesses (Goal CPE.2);
  - Promote a safe, vibrant, and connected (physical and person) community Goal (CPE.3);
- Getting Around:
  - Create a comprehensive transportation system that provides everybody safe and reasonable access to all the community offers (Goal GA.5) ; and
- Good Spaces, New Spaces:
  - A community that welcomes and supports change and creativity (Goal GPNS.6);
- Town and Gown Collaboration:
  - Take full advantage of ideas and resources to create a thriving economy and incorporate and utilize the intellectual capital that the University and Town create (Goal TGC.1);
  - Improve and expand access to the arts, culture, and intellectual purest for both the University and the Town (Goal TGC.1); and
  - Promote access for all residents to health-care centers, public services and active live style opportunities (Goal TGC.6).

***Public Participation***

Public participation is an important element of the Wireless Master Plan process. During plan development, feedback is obtained from residents, elected and appointed officials, the wireless

industry, and other stakeholders regarding current and future wireless deployment practices in Town. Stakeholder feedback has offered guidance to the Town staff and its consultants to build a plan that provides a framework for good mobile phone and wireless service coverage, while minimizing visual impacts from communications facilities. To be as inclusive as possible, a public participation process was devised with outreach that included the following events:

- **September 18, 2017** - Town Council Work Session, with an introduction to Council about the Wireless Communications Initiative and its goals;
- **September 21, 2017** – Kickoff public information meeting introducing the Wireless Communications Initiative Master Plan project, including the following.
    - History of the wireless industry and typical types of infrastructure;
    - A synopsis of existing towers and base stations within the Town's jurisdiction;
    - An introduction to the mapping process including network coverage from existing wireless facilities illustrating network gaps, and theoretical propagation coverage maps;
    - Draft wireless infrastructure inventory; and
    - Polling of participants with continued online polling following the meeting. The poll, consisting of multiple choice questions and open-ended feedback, had a total of 329 responses. Of the 130 open-ended responses received 70% expressed dissatisfaction with wireless service and the need for improvements. There were minimal comments associated with placing new wireless infrastructure on public property, health concerns or aesthetic implications. For summary of results, see Table 1 on following page.

| STATEMENTS | TOP THREE RESPONSES |
|---|---|
| Which best describes you: | 93% Resident; 5% Telecommunications Industry Representative; 2% Business Owner |
| My service provider is: | 47% Verizon; 29% AT&T; 9% Other |
| Network coverage where I live is: | 36% Poor; 29% Good; 19% Acceptable |
| When I travel in and around Town, my network coverage is: | 38% Good; 34% Acceptable; 14% Poor |
| I rely on my mobile device and corresponding services to a great extent: | 71% Agree Entirely; 19% Agree Somewhat; 4% Neutral |
| The quality of wireless telecommunications service is important to me: | 87% Agree Entirely; 9% Agree Somewhat; 2% Neutral |
| I would be willing to tolerate worse wireless telecommunications service to minimize visual impacts associated with the technology: | 44% Disagree Entirely; 29% Disagree Somewhat; 12% Neutral |
| Choose the non-concealed tower you prefer: Monopole, Lattice or Guy with Support* | 53% Monopole; 25% No Preference; 10% None of These |
| Choose the non-concealed tower you prefer: Light Stanchion, Wrapped Pole or Painted Pole* | 27% Painted Pole; 22% Light Stanchion; 21% No Preference |
| Choose the concealed tower you prefer: Flag Pole, Slick Stick, or 3 Legged Pole* | 38% Flag Pole; 24% Slick Stick; 16% No Preference |
| Choose the concealed tower you prefer: Clock Tower, Banner Pole, or Faux Dormer* | 48% Clock Tower; 20% Banner Pole; 15% No Preference |
| Choose the concealed tower you prefer: Bell Tower; Tower as Art; or Monopine* | 58% Tower as Art; 19% Monopine; 9% Bell Tower tied with 9% No Preference |
| Choose the non-concealed base station you prefer: Additional Pole in Utility Easement; Attachment in Utility Easement; or Water Tank* | 32% Water Tank; 22% Attachment in Utility Easement tied with 22% No Preference; 14% Additional Pole in Utility Easement |
| Choose the base station do you prefer: Non-Concealed Rooftop; Non-concealed Below Roof Line; or Concealed Above the Roof top* | 39% Concealed Above Roof Top; 25% No Preference;<br><br>19% Non-Concealed Rooftop |
| Choose the small cell facility you prefer: Non-Concealed; Semi-Concealed; or Concealed* | 44% Concealed; 24% No Preference; 19% Semi-Concealed |

**Table 1: Wireless Communications Initiative Poll Results Summary**

- **November 21, 2017** - Open house and status report to the Planning Commission, including a second draft of the wireless infrastructure inventory map, discussion of network gap analysis and ten-year estimations of needed infrastructure throughout Town, and discussion of poll results;
- **February 12, 2018** – Joint Advisory Board Work Session to review the Wireless Master Plan and Ordinance;
- **February 27, 2018** – Community Design Commission hearing to obtain public feedback and make recommendations to Council for the Wireless Master Plan and Ordinance;
- **March 6, 2018** – Planning Commission hearing to obtain public feedback and make recommendations to Council for Wireless Master Plan and Ordinance;

- **April 18, 2018** – Council public hearing to consider the Wireless Master Plan and Ordinance and obtain public feedback;
- **May 23, 2018** - Council business meeting to consider adopting the Wireless Master Plan and enacting Ordinance.

***Master Plan Preferences***

Based on the wireless facility inventory and gap analysis produced by CityScape Consultants, they have estimated a need for ten to twelve new macro towers, between approximately 70 and 120 feet tall, within the Town over the next decade. In addition, significant numbers of small cell facilities, mounted in the 35 to 40-foot height range, located on poles in rights-of-way, buildings, and other vertical structures, working in conjunction with the macro towers. These new wireless communications facilities will supplement the existing 58 facilities in the inventory that currently service Chapel Hill and increase network capacity to meet the large increases in network demand (see pp. 32-33).

Poll results indicated a strong preference for improvements to service, especially in residential neighborhoods, using existing and concealed facilities where possible, but not at the expense of providing service improvements. Based on this feedback, identified service gaps, and necessary compliance with Federal and State wireless communications regulations, CityScape consultants and Town staff identified the following goals:

- Provide robust wireless connectivity for residents, businesses, visitors and emergency management personnel;
- Protect community aesthetics by planning for well sited, well designed, concealed facilities so that the infrastructure aesthetically fits into the community;
- Manage the number and placement of infrastructure and associated equipment to include buildings, compound areas and ancillary equipment, to promote efficient wireless voice, broadband and public safety service delivery;
- Address safety of telecommunication facilities to minimize possible risk;
- Minimize the placement, frequency and density of new WCFs in the ROW for public safety considerations;
- Provisions to support an organized and efficient means for the wireless communication service industry and public infrastructure to reach residents and subscriber base Town-wide; and
- Maximize Town-owned and other publicly owned assets in order to set design standards and to create revenue opportunities for the overall benefit of the residents.

***Summary***

CityScape Consultants and Chapel Hill Town staff are working with the public, industry, appointed and elected officials to allow for improvements to the Town's wireless communications network needed by the community for day-to-day business and domestic activities. To achieve this, we are proposing the attached Draft Wireless Communications Facilities Master Plan, which will provide the needed structure for updating wireless communications facilities while minimizing impacts to the community. To make the Master Plan operational, Cityscape, in conjunction with Town staff is producing the corresponding regulatory framework with a new Wireless Communications Facilities Ordinance. Please refer to the Wireless Communications Initiative Master Plan and Ordinance for more detail.

# Purpose

## Wireless Communications Initiative Master Plan

***Background***

The Town of Chapel Hill (Town) contracted with CityScape Consultants, Inc., (CityScape) for the development of a Wireless Communications Initiative (WCI), to best identify the most appropriate locations for future siting of wireless infrastructure. The WCI includes the development of a Wireless Master Plan (WMP) and an update of the Town's Land Use Management Ordinance (LUMO). The outcome will help the Town prepare for future wireless communications infrastructure, thereby improving wireless services desired by residents, business owners, students and visitors with minimal impacts.

CityScape developed the WMP in partnership with Town staff, local elected and appointed officials, residents and industry stakeholders. The WMP is designed to balance the goals of providing a robust wireless network throughout Town while minimizing visual impacts of wireless infrastructure.

The WMP is an illustrative planning tool which includes:

- A short history on wireless telecommunications technology;
- An overview on network deployment practices;
- An inventory of existing wireless infrastructure throughout the Town;
- Theoretical propagation mapping;
- Projection maps of potential future network deployment patterns;
- Recommendations designed to meet ten year wireless deployment objectives; and
- Town-owned properties that could potentially be part of a network deployment solution for the wireless industry.

***Wireless Master Plan Scope***

The WMP scope includes the following three (3) phases:

- **Phase 1**: Preliminary research of existing infrastructure for site assessments, base mapping and a project kick off meeting in the form of a public workshop.
- **Phase 2**: Inventory catalog of existing towers and base stations assessed during the site assessment process, theoretical propagation mapping to identify network coverage gaps and synthesis of feed back from the Initial Public Outreach meeting.
- **Phase 3**: Design and development of Draft WMP; existing wireless policy review and ordinance amendment recommendations to the LUMO. A third public workshop to present the draft WMP and zoning recommendations to the Town and wireless stakeholders.

# Chapter 1

## The Telecommunications Industry

Telecommunications is defined as the exchange of information over distances by electronic means and refers to all types of voice, data and or video transmission. Telecommunications includes the transmission of such data via wires or wirelessly and includes a wide range of transmitting technology such as telegraph, telephones, microwave, fiber optics, satellite, radio and television broadcasting and the Internet.

Traditional landline telephone service utilizes an extensive network of copper lines to transmit and receive phone calls between parties. Wireless telephony, also known as wireless communications, includes mobile phones, pagers and two-way enhanced radio systems. It relies on the combination of landlines, cable and an extensive network of elevated antennas most typically found on communication towers to transmit voice and data information.

The current evolution of personal wireless technology is benchmarked by the underlying network platforms and referenced as first, second, third, fourth and fifth generations of wireless deployment (1G, 2G, 3G, 4G and 5G respectively). Copper based connectivity has been the mainstay of the initial wireless technology evolution. With the evolution to 3G and beyond copper wire based technology is no longer sufficient. The popularity of the Smartphone, the demand for faster Internet speed and more bandwidth is leading to the migration from copper to fiber optic communications. Fiber optic communications is a method of transmitting the information by sending pulses of light through an optical fiber. Fiber optics is preferred when high bandwidth or long distance is required. Wireless microwave is used when fiber optics is not available or economical.

Satellite technology, while initially promising, currently cannot compete well with ground-based services due to the physics of speed of light and the long delays created by the great distance between the satellites and end user. Present demand for large data usage compounds complications with this type of technology.

The development of 5G wireless technologies will exponentially expand wireless network capacity by incorporating multiple-input and multiple-output (MIMO) antenna technologies and a wide range of frequency spectrum between 5 and 95 gigahertz (GHz). Fifth Generation advanced technologies will result in much faster download speeds for all devices including Smartphones, other smart devices, and machine-to-machine (M2M) data transmission between automotive vehicles other interconnected equipment such as transportation and logistics, home health care, manufacturing and public safety.

***Wireless Handset Device Evolution***

**Figure 1: 1G, 1984 Mobria Cell Phone (Image: J Bundy)**

During the early 1980's, the first generation, operating in 850 megahertz (MHz) band cellular system, was launched nationwide. The 1G portable cell phone as shown in Figure 1 was boxy in shape and operated much like a small AM or FM radio station. The 850 MHz frequency also known as low band, allows the radio signal from the antenna on the tower to travel beyond five miles provided the transmitting signal has a clear line-of-sight. Customers using a cell phone knew when they traveled outside of the service area because they would hear a static sound on the phone similar to the sound of a weak AM radio station. The signal either faded or remained crackling until the subscriber was within range of another facility.

Originally, the 850 MHz band only supported an analog radio signal. By 2010, 1G was phased out of network design in most urban markets, but still serves as a platform of initial coverage in remote and undeveloped areas.

Early 1992 marked the deployment of 2G technologies operating in the 1900 MHz frequency. The 1900 MHz frequency, also known as high band, converted the technology from an analog to digital signal and primarily allowed for simultaneous phone calls over the digital signal. Calls placed on the 1900 MHz system were audibly clearer than those made on an analog signal. The handsets were much smaller than the 1G cellular phones and the first handsets provided low speed data services such as paging and limited text messaging through the handheld unit. However, 2G had some network functionality trade-offs. The use of high band frequency offers a static free signal but the technology change reduces the service area causing a higher rate of disconnects or dropped calls. The network solution to reduce the number and frequency of dropped calls required significantly more infrastructure for several reasons. First, the propagation signal in the high band does not travel as far as the low band signal. Thus, the number of required facilities almost tripled just to provide basic 2G coverage in the same geographic area as a 1G service area. Second, the industry was reluctant to share tower space with a competitor and many service providers resisted collocating on the same tower. And third, subscriber base and usage grew rapidly so the industry needed more sites to improve network coverage demands by their customers.

**Figure 2: 2G and 4G devices (Image: Answers.com)**

Third generation wireless was launched in the early 2000's and offered improved mobile download speeds and increased penetration of signal strength for indoor environments. This technology also permitted multi-media messaging service (MMS) which increased the character limit on text messaging, allowed photo transfer and provided elementary applications and video conferencing. Figure 2 shows the examples of 2G and 4G phones.

Fourth generation (4G) wireless handsets were introduced in 2010 and with the implementation of the Smartphone it offered a wide variety of new tools and services that provided access to e-mail, news, music and videos. Newer technologies incorporated better cameras for still photos and video, global positioning services (GPS), Internet commerce, and millions of downloadable applications for just about any use.

One of 4G's greatest advancements is the transition to Long Term Evolution (LTE) services as the global cellular network operating standard. Network operating platforms, nationally and internationally, were inconsistent between markets during the implementation of 3G networks because of the adoption of Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) as competing operating platforms. The new universal LTE and LTE-Advanced platforms promote efficient use of spectrum, faster download speeds and continued use of smart devices. The need for additional 4G infrastructure is significant nationwide and the continued deployment of new towers and base stations will be necessary as the industry transitions to 5G networks.

Technology advancements in 2015 resulted in leading edge Smartphones and devices that support video streaming and remote access to Internet based cloud data storage requiring large amounts of bandwidth. Service providers continue to upgrade existing networks by: 1) adding additional infrastructure to improve and increase network capacity; 2) purchasing additional licenses in the 700, 1700-1800, and 2100-2400 MHz frequencies; 3) upgrading equipment at the towers and base stations by adding more antennas and feed lines; and 4) adding remote radio units (RRU) on existing towers to increase efficiency, signal strength and capacity.

In summary, first and second generations provided the initial launch of personal wireless service. Third generation improved data transfer with the addition of MMS and provided some simple applications and games. Fourth generation substantially increased download speeds allowing interactive services on the Smartphone.

Network design and testing for 5G technology is currently underway. Deployments will expand wireless services to the next level and focus on implementation into full broadband service. Developments of 5G at the time of this publication are in the early testing processes therefore network standards are not finalized. Opportunities of 5G will open for additional providers beyond those currently authorized in Chapel Hill. The implementation is highly technical and while many of the same frequencies will be used, all providers will expand into the Super High Frequencies (SHF) between 3 gigahertz (GHz) to 30 GHz and Extremely High Frequencies (EHF), between 30 GHz and 300 GHz spectrum. Fifth generation networks will require lower antenna elevations and facilities to be spaced closer together utilizing smaller antenna. The spacing between facilities is predicted to be between 165 feet to 1,650 feet depending on the population density of the area to be served. Fifth generation networks are


**5G Technology**
**(Image hsc.com)**

anticipated to be sufficient to compete directly with today's fastest computer networks with download speeds above the 100 megabits per second (Mbps). Fifth generation technologies and beyond will allow all forms of communications and entertainment to be streamed, resulting in the eventual elimination of digital subscriber lines (DSL) and cable/satellite TV and will provide the underlying communication technology that will allow vehicles to drive themselves. Like all previous generations, 5G and beyond will require more wireless infrastructure.

### *Antennas and Antenna Arrays*

**Figure 3:**
**Omni Whip Antenna**

Antennas are used for both transmitting and receiving signals. A single omni-directional (whip) antenna, see Figure 3, can be used to transmit and or receive two-way radio, cellular, Personal Communication Systems (PCS), Enhanced Specialized Mobile Radio (ESMR) or Specialized Mobile Radio (SMR) signals. A sectionalized panel antenna array is used to transmit and receive cellular, digital or ESMR wireless telecommunication signals, see Figure 3.

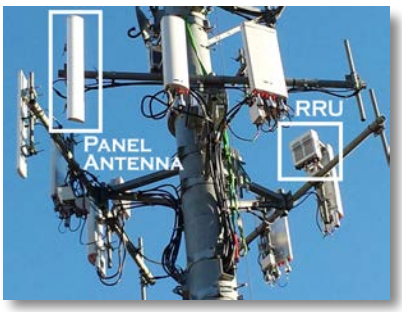



**Figure 4:**
**Panel Antennas with RRU's**

Most service providers are now mounting a power amplifier unit on the tower close to the antenna. The top mounted amplifiers (TMA) and remote radio units (RRU), see Figure 4, provide greater efficiencies and better service in both transmitting and receiving modes. These improvements however come at the cost of higher visual impacts and increased space allocation caused by the increased size and weight of mounted equipment on the infrastructure.

**Figure 5:**
**Microwave Dish Antennas**

Microwave dish antennas, as shown in Figure 5, are used by service providers to send the signal received by the antenna to the supporting network and vice versa. Microwave (point-to-point) is an option for backhaul when fiber is not available, such as remote locations or long distance. Some microwave sites do have fiber and in these locations the fiber greatly enhances the bandwidth capabilities of the network.

### *Macro Towers*

As defined in the Federal Communications Commission (FCC) Report and Order, released October 21, 2014 in WT Docket 13-283, commonly referenced as Report and Order, a wireless tower is "a structure built for the sole or primary purpose of supporting any commission licensed or authorized antennas and their associated facilities". Macro towers are high powered sites intended to cover sizable geographic areas for basic voice service, texting capabilities and Internet access. These taller towers require a strong structure and have large antenna with coaxial cables connecting the antenna to the ground equipment. The macro cell site footprint is large with infrastructure spaced between one and three miles apart. These

facilities can accommodate between 1,750 and 2,500 devices simultaneously for voice and texting, but many less devices when large amounts of data, such as streaming video is being used. Macro towers can either be concealed or non-concealed. The three (3) types of non-concealed towers are guyed, lattice and monopole.

Non concealed macro towers are shown in Figure 6.

**Figure 6: Non-concealed Macro Towers - Guyed - Lattice - Monopole**

Guyed - A style of tower consisting of a single truss assembly composed of sections with bracing incorporated. The sections are attached to each other, and the assembly is attached to a foundation and supported by a series of wires that are connected to anchors placed in the ground or on a building.

Lattice - A self-supporting tapered style of tower that consists of vertical and horizontal supports with multiple legs, cross bracing and metal strips or bars to support antennas. This type of tower is designed to support itself without the use of guy wires or other stabilization devices.

Monopole - A style of freestanding tower consisting of a single shaft usually composed of two (2) or more hollow sections attached to a foundation. This type of tower is designed to support itself without the use of guy wires or other stabilization devices. Monopoles are mounted to a foundation that rests on or in the ground. They are designed so that all feed lines can be installed within the shaft of the structure so they are not visible.

A concealed tower is one that is not readily identifiable as a wireless facility and is designed to visually blend in with its surroundings. Concealed towers are disguised to look like something other than a tower. For example, a faux pine tree is painted and has manufactured branches covering the monopole and antenna. Fiberglass shields cover the antennas on the flagpole and bell tower. There are many other designs of camouflaged towers and base stations and some are difficult to detect.

**Figure 7: Concealed Macro Towers - Monopine - Flag Pole - Bell Tower**

### *Base Stations*

A base station as defined in the FCC Report and Order is, "equipment and non-tower, supporting structure at a fixed location that enables commission licensed or authorized wireless communications between user equipment and a communications network". Examples include transmission equipment mounted on top of buildings, water tanks, tall signage, light poles, silos or any other above ground structure not built for the sole purpose of supporting wireless equipment. Similar to macro towers, base stations can also be concealed. Some types of antenna concealment include faux dormers and chimneys, elevator shafts encasing the antenna feed lines and equipment cabinet, and painted antenna and feed lines to match the color of a building or structure. Examples of base station concealment techniques are shown in Figure 8.

**Figure 8: Concealed Base Stations - Light Stanchion - Building Concealment**

### *Electronic Equipment Cabinet and Feed Lines*

The electronic equipment used to transmit and receive the radio signals from the antenna is installed within an equipment facility and are either cabinets, shelters, pedestals or other similar enclosures. Copper coaxial cable (coax) or fiber optic (fiber) feed lines are used to connect the antenna on the tower or base station to the ground based equipment. The equipment cabinets shown in Figure 9 are typical for service providers operating in the high band frequencies and ground space requirements for this equipment is estimated to be around ten square feet.

**Figure 9: High Band Facility**

The electronics equipment used with low band systems generates substantial heat, and therefore the shelters which house the ground equipment are much larger and generally need a minimum of four hundred square feet. Figure 10 shows a typical configuration for low band ground equipment. The only noise that would typically be generated in the vicinity of any tower or base station would be from an air conditioner or a backup generator that automatically starts in the event of a power failure.

**Figure 10: Low Band Facility**

### *Network Footprint*

Theoretical Root Mean Square (RMS) maps as depicted in Figure 11 represent cell sites with a connected pattern of overlapping circles that illustrate the coverage area for a tower or base station. A wireless device trying to communicate with another device or with the Internet must be within this network coverage area. Wireless devices outside the cell site coverage area will not function reliably. To design the wireless network, radio frequency (RF) engineers overlay circular cells over the geographic area intended for wireless service. The center dot in the middle of the smaller circle is the theoretical ideal location for a tower or base station to serve an intended coverage area, while the outer circles represent the overall coverage area. The smaller circle within each larger circle is called the search area and is considered to be the best location for a new facility. In reality, many cell site patterns are not circular because the coverage area is affected by topography, land cover, climate, type of cell site being constructed and the size and location of the subscriber base.

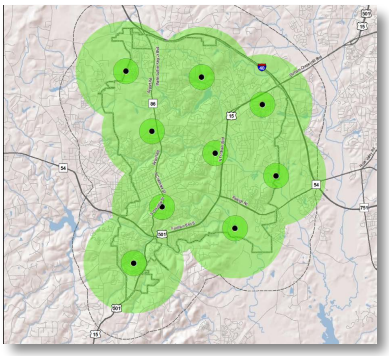


**Figure 11: Theoretical RMS Map**

### *Small Cell Sites*

There are multiple types of infrastructure considered in the small cell category with many options for small cell design. Small cell sites, also known as microcell sites, are connected to form a "mini-network" and are lower powered sites that cover a geographic area less than one half mile in diameter. The smaller picocells have even a much smaller footprint, generally less than 700 feet in diameter. All small cell sites accommodate a much lower number of subscribers and simultaneous devices.

Small cell site antennas, feed lines and associated equipment has a smaller footprint in design as compared to the macrocell site and the antenna is usually mounted at lower elevation (30' to 45') and typically found on light poles, street lights or buildings. Small cell sites can be concealed or non-concealed as shown in Figure 12. The ground equipment consumes less space and can be mounted on the ground, vaulted underground or in or on the structure itself. Small cell sites and nodes are typically installed in densely populated environments such as downtowns, sporting stadiums, malls, office buildings and convention centers.

**Figure 12: Small Cell Facilities - Single Node**

Also in the small cell category are Distributed Antenna Systems (DAS). DAS is a series of low powered antennas, as shown in Figure 13, connected by fiber optics and often used in higher density populated areas. Distributed antenna systems may be deployed indoors (iDAS) or outdoors (oDAS).

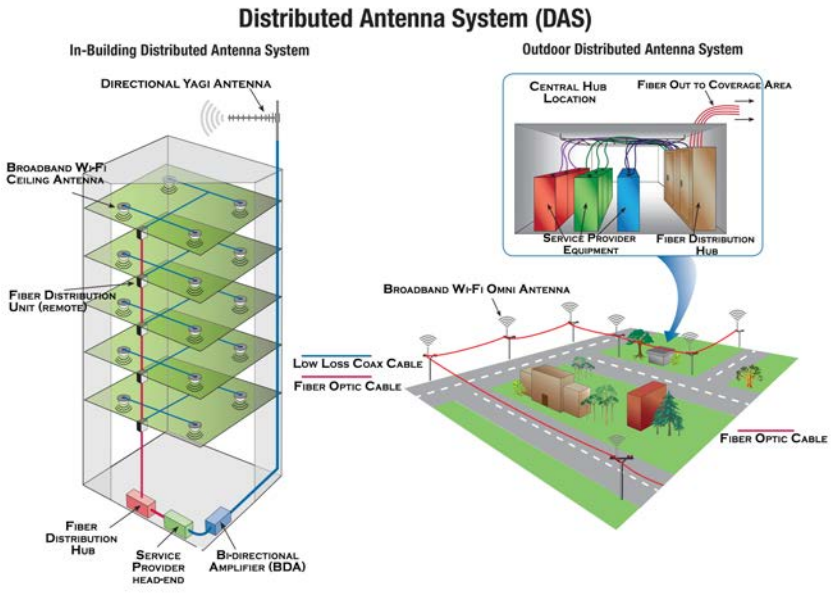



**Figure 13: DAS (Image L-Com Global Connectivity)**

Technological advances and predicted demand for small cell sites have many infrastructure developers racing to obtain leasing rights and approvals for small cell sites in rights-of-way. These companies are seeking quick approval processes and less cost for deployment and there are pros and cons to these types of installations. The pros of small cells in rights-of-way. is that they can be in closer proximity to residential dwellings and vehicles and can attach to existing infrastructure providing much needed capacity relief. The downside to this approach is that rights-of-ways. applicants may try to bypass the local municipalities in an effort to circumvent the ordinance and aesthetic requirements. In July of 2017, the North Carolina Legislature approved House Bill 310 which gives use of public right-of-ways. to the wireless providers for their infrastructure with minimal zoning empowerment to local governments within the State. Local government can still apply objective design standards for decorative utility poles, reasonable concealment, public safety concerns and reasonable spacing requirements to new infrastructure in their rights-of-way. The wireless industry and local communities must find a middle ground as robust wireless networks will require a combination of both small cell and macrocell sites to make a complete wireless network system.

### *Wireless Broadband*

The goal for wireless broadband technology is to provide high-speed wireless Internet access or computer networking access over a wide area. However, this technology is using the same medium that was previously intended for voice communications only. High-speed broadband is necessary for Smartphones, tablets, laptops, hand held devices and many other wireless devices. The FCC recently revised the definition of broadband to mean Internet access with download speeds of at least 25 megabits per second (Mbps) and upload speeds of at least 3 Mbps. Because of this revised standard there are few wireless service providers that can effectively meet present access speeds. The coverage area for wireless broadband will be smaller in size in order to meet FCC defined download speed for subscribers. This will result in the need for more

wireless infrastructure. For purposes of the WMP, the term broadband will be referenced as wireless Internet since most wireless networks do not meet the current definition for download speeds.

For illustrative purposes only and without consideration of any variables, the number of tower sites needed to cover a suburban area of approximately five square miles would be:

- 1G - Analog (1 macro site)
- 2G - Digital TDMA (3 macro sites)
- 3G - CDMA/Email/MMS (5 macro sites)
- 4G - LTE/AWS (8 macro or a combination of macro and small sites)
- 5G - Platform TBD (approximately 80 nodes in addition to above)

***Wireless Telecommunications Summary***

Wireless handset devices used for personal wireless services have changed significantly from the initial launch of cellular phones in the 1980's. From a visual perspective the traditional infrastructure that serves as the network backbone has changed very little. To function best, the service providers still need antennas elevated above tree lines, rooftops and many manmade or natural obstructions. Moisture contained within foliage absorb and refract the signal and create an unpredictable propagation variable. These variable will always be a factor when designing wireless systems. Wireless antennas can function below the tree line but not at the same performance level when compared to antennas placed above the tree line at the same location. For this reason, the industry will continue to prefer placement of their antenna arrays above the tree line or in a favorable location with few manmade obstructions to achieve optimal propagation from the infrastructure so as to maximize their investment in the communities they are servicing. The size of macrocell antennas have changed minimally over the years. Recent inclusion of remote radio heads and tower mounted amplifiers on the antenna mounting structure will generally result in larger and more complex antenna arrays as compared to the earlier 2G and 3G installations.

The monopole and lattice towers remain the most widely used macro tower nationwide. Concealment techniques continue to be used to mitigate the visual impact of infrastructure in areas identified by local governments with visual concerns. As the industry begins to migrate towards 5G many more small cell sites will be implemented, especially in high density areas to meet capacity demands of the service subscribers.

Mergers and acquisitions will continue and the industry will continue to need more infrastructure for the transition to 5G and beyond.

# Chapter 2
## Master Plan Development

***The WMP Design Process***

Many considerations and variables go into the design of the WMP including the size of the study area, seasons, tourism, year round and seasonal residents, topography and location of existing infrastructure in and around the Town.

Mapping for the WMP development process includes:

- Engineering a search radii template and applying it over the jurisdictional boundary of the Town to evaluate theoretical build-out conditions;
- Identifying, assessing, cataloging and mapping exiting tower and base stations;
- Forecasting future wireless infrastructure needs based on existing infrastructure locations, terrain, climate, demographics, population trends, gaps in the existing network and anticipated continued evolution of the industry; and
- Identify appropriate locations for new infrastructure according to surrounding uses and activities, as well as potential visual impacts and public safety concerns.

***Search Rings For Proposed Coverage Areas***

The search area or search ring is part of a site search package provided to a site acquisition consultant who looks for property or existing infrastructure that can be leased to accommodate the required new wireless provider. From an engineering perspective, any location within the search ring is considered to be acceptable however, many times finding an acceptable location within the search ring can be challenging. The location of the selected property in relation to the ideal location within the search ring can dictate the required antenna height.

Generally, in areas where signal coverage is the objective, taller macro towers allow antennas to be mounted at a greater heights to serve a larger geographic coverage areas. Taller towers also provide collocation opportunities by other wireless service providers. Shorter macro towers and small cell antenna poles limit antenna height therefore having smaller geographic coverage. This reduced reach of each facility and can result in a greater number of towers, base stations or poles required within each search ring.

***Search Area Radii for Macro Sites***

Search ring calculations for the low and high band frequencies are shown in Tables 2 and 3. The tables utilize the "Okumura-Hata" propagation path loss formula for low band frequencies and the "COST-231" formula for high band frequencies, respectfully. Maximum coverage radii for typical in-vehicle coverage is calculated for various tower heights, reduced by twenty percent

(20%) to account for a reasonable handoff zone, then divided by four to obtain a search ring radius for each tower height. For example, according to the information in the following tables, antennas mounted at the 100 foot height would have a search ring radius of 0.72 miles for low band antennas, and a 0.36 mile radius for high band antennas.

| ANTENNA MOUNTING HEIGHT | 40′ | 50′ | 100′ | 115′ |
|---|---|---|---|---|
| Radius, miles | 2.28 | 2.53 | 3.6 | 3.88 |
| Allow for handoff | 1.84 | 2.03 | 2.88 | 3.1 |
| Search ring, miles | 0.47 | 0.51 | 0.72 | 0.78 |

**Table 2: Okumura-Hata Propagation Path Loss Formula for Low Band Frequencies**

| ANTENNA MOUNTING HEIGHT | 40′ | 50′ | 100′ | 115′ |
|---|---|---|---|---|
| Radius, miles | 1.21 | 1.33 | 1.82 | 1.95 |
| Allow for handoff | 0.98 | 1.07 | 1.46 | 1.56 |
| Search ring, miles | 0.25 | 0.27 | 0.36 | 0.39 |

**Table 3: Cost 231 Formula for High Band Frequencies**

The service providers primary objective of the first phase of network development is creating coverage over a projected service area. When network coverage is achieved wireless service providers begin to monitor the number of calls.  If the number of simultaneous activities reaches a predetermined maximum number and the facility cannot support the subscriber base, the n the wireless network exceeds the design capacity of that system. Exceeding network capacity equates to overloading the network which results in lost service, dropped calls, or the inability to make calls or use the Internet on the wireless device.

***Theoretical Root Mean Square Maps***

CityScape is often asked to estimate how many towers and base stations it may take to cover a particular geographic area. CityScape uses Root Mean Square (RMS) maps to help the jurisdiction visualize the number of antenna locations that may be necessary to provide wireless communications coverage for a given geographic study area. This hypothetical network identifies the minimum number of tower or base station locations required for one service provider to provide complete coverage without any considerations for terrain, vegetative cover, subscriber base or network capacity.

One of the key variables affecting the theoretical coverage analysis is the assumed height of the antennas on the tower or structure. CityScape reviewed the existing tower and base station inventory and applicable height regulations for the Town and determined the average tower

height used for wireless telecommunications purposes to be around eighty (80) feet. Therefore, an antenna height of eighty (80) feet was chosen for the development of the theoretical RMS coverage maps.

The following examples represent a theoretical build-out of equally apportioned antennas mounted at a tower height of eighty (80) feet for a single service provider that excludes topographic, vegetative cover and population density considerations. The black dot within each larger circle indicates the ideal antenna location while the smaller circle within the larger circle represents the acceptable search ring for locating the tower and antennas.

Figure 14 illustrates that two towers or base stations equally distributed throughout the Town would provide complete low frequency coverage to the defined study area.

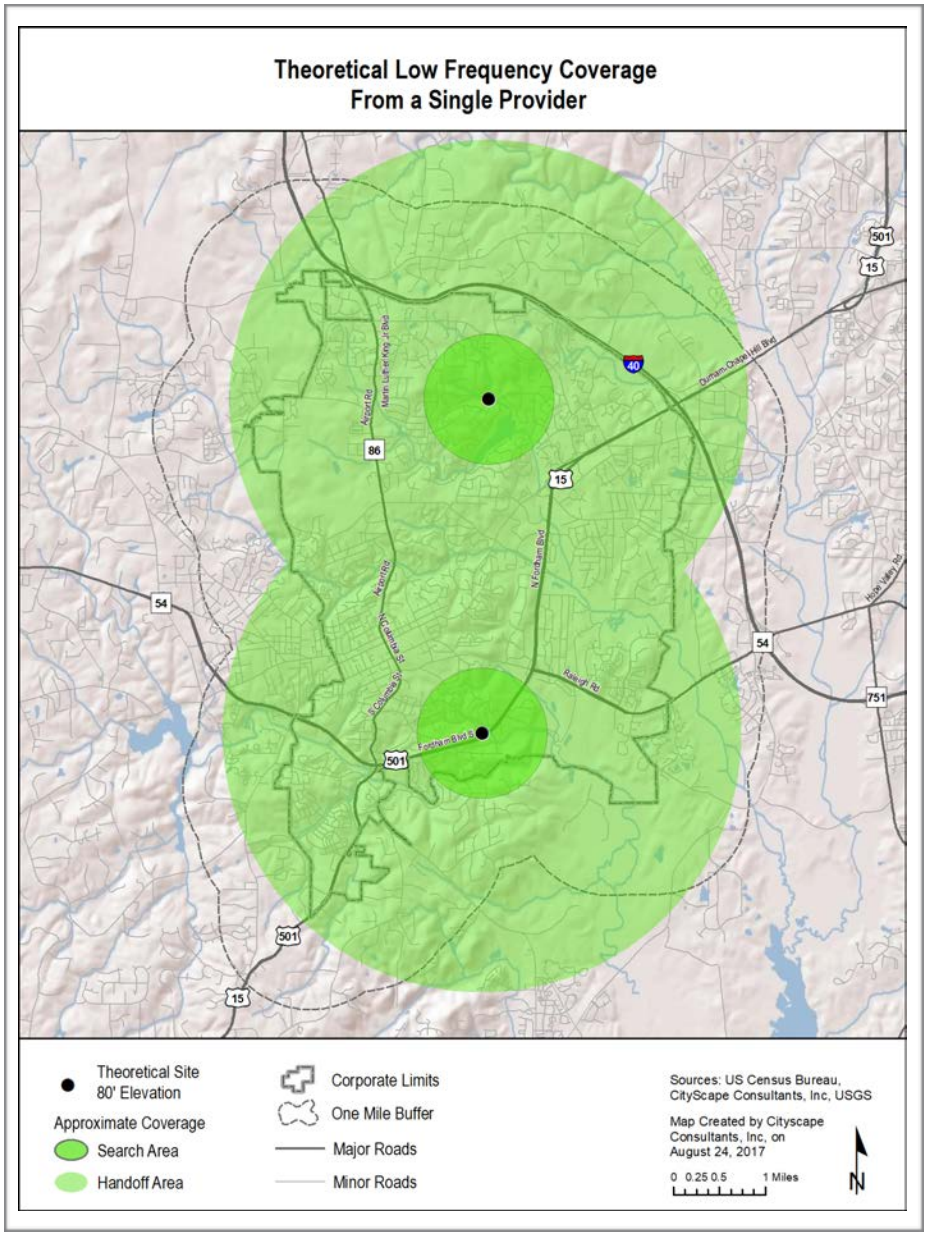



**Figure 14: Theoretical Low Frequency From Single Provider**

Figure 15 illustrates that nine locations would be needed to provide complete high frequency coverage to the same geographic area.

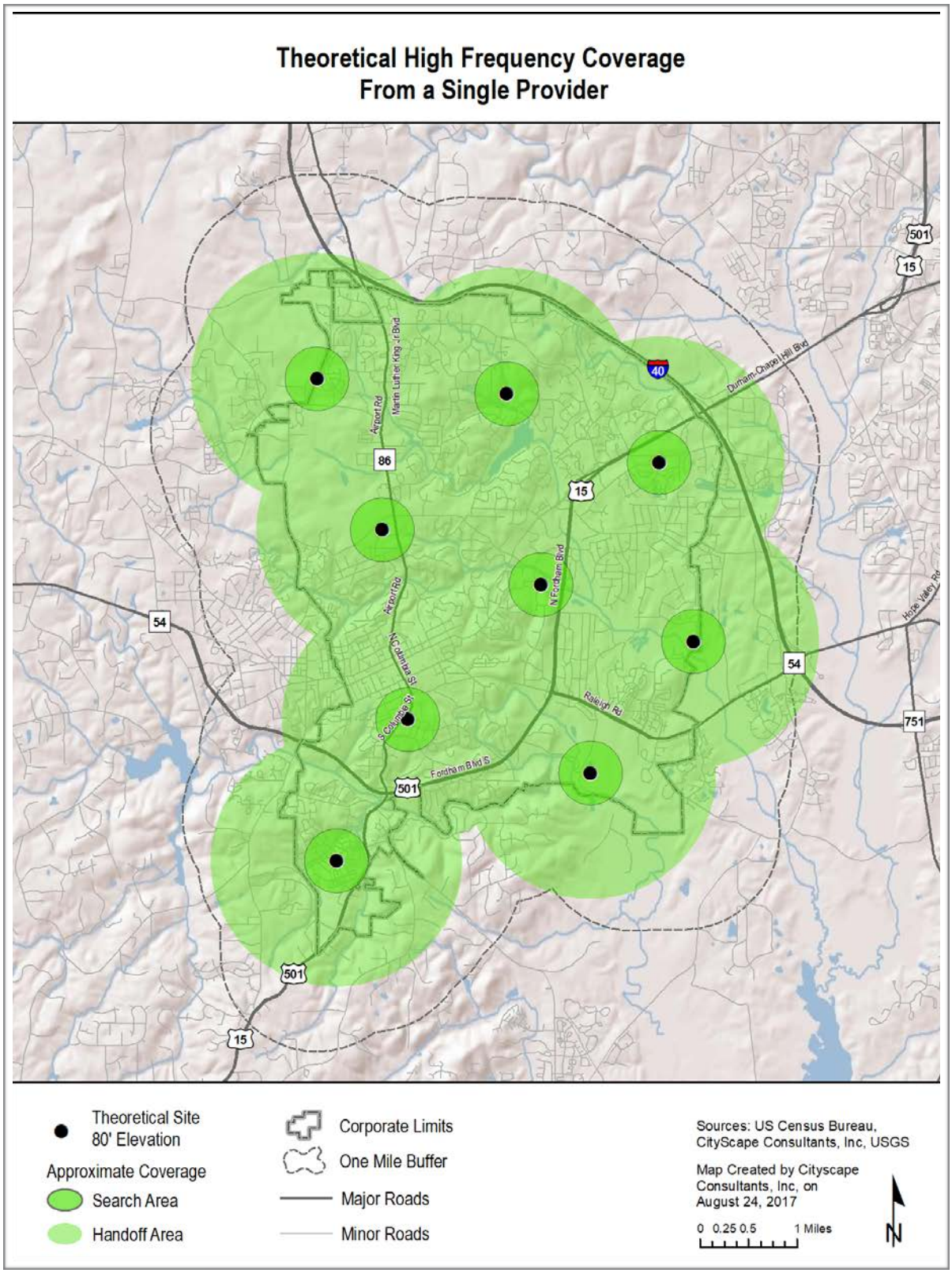



**Figure 15: Theoretical High Frequency From Single Provider**

### *Topographic Variable on Theoretical Coverage*

As previously described in flat terrain and sparsely populated areas, infrastructure prediction is easier. The service area is dramatically impacted by the type of terrain within the signal line-of-sight. Line-of-sight technology works best with an unobstructed path between the facility and the device, however, typically there are obstructions in the way of the wireless signal as it travels from point A to point B. An analogy to consider would be similar to that of a light bulb. The area closest to the bulb is illuminated best. Once obstructions get in the way (i.e: lampshade, walls, doors or objects) the light becomes dimmer. Similarly the line-of-sight for wireless technology becomes a reflected or refracted signal and will fill in some geographic areas, but at a reduced power level.

### *Signal Strength on Theoretical Coverage*

Propagation mapping is a process that illustrates the level of coverage from an individual antenna site. Signal strength in this application is a term used to describe the level of operability of a wireless device. The stronger the signal between the elevated antenna and the wireless device, the more likely the device and all the built-in features will work. A reduced signal causes unsatisfactory service due to dropped calls or data interruption on the wireless device. Distance between elevated antennas and the physical location of the person (indoors or outdoors) using the wireless device, along with any obstructions, are variables that affect signal strength.

In the following maps the level of propagation signal strength is shown through the gradation of colors from yellow to blue. The geographic areas in yellow identify superior signal strength; green equates to areas with average signal strength; shades of blue symbolize acceptable signal strength; and gray shades show marginal or no signal strength. Generally, the closer the proximity to the antenna the brighter shades of yellow within the geographic service area, which means the quality of service is better. As distance increases between the device and the antenna, the green, blue and gray shades appear indicating geographic service areas with average, acceptable and or no signal strength, respectively. Table 4 provides further explanation of the color coding relative to propagation signals.

| SIGNAL STRENGTH COLOR | SIGNAL STRENGTH TITLE | SIGNAL STRENGTH DESCRIPTION |
|---|---|---|
| Yellow | Superior | Strong enough to operate within most buildings |
| Green | Average | Strong enough to operate in a vehicle, but not inside most buildings |
| Blue | Acceptable | Strong enough to operate outside, but not in a vehicle or building |
| Gray | No Service | Marginal or no service |

**Table 4: Propagation Signal Descriptions**

Using the same antenna locations identified in the previous figures, Figures 16 and 17 illustrate the various levels of signal coverage from the site locations including terrain, network capacity and environmental variables. Yellow areas indicate geographic areas with superior signal strength; green areas have average signal strength; shades of blue symbolize acceptable signal strength; and gray shades show marginal or no signal strength. While the industry standards identify green and blue shades as "average" and "acceptable" coverage; customers tend to indicate otherwise.

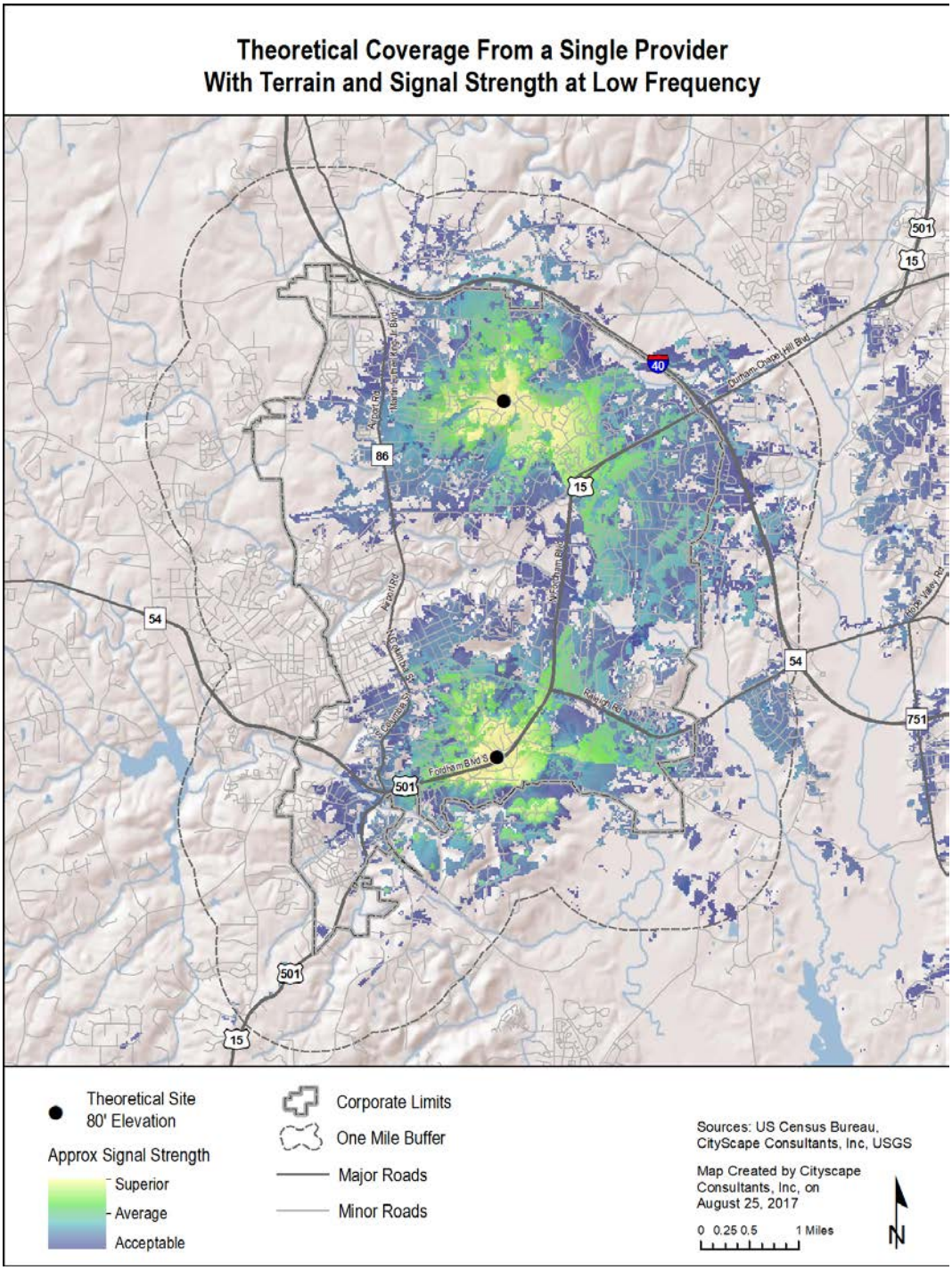



**Figure 16: Future Growth Theoretical Low Frequency with Variables**

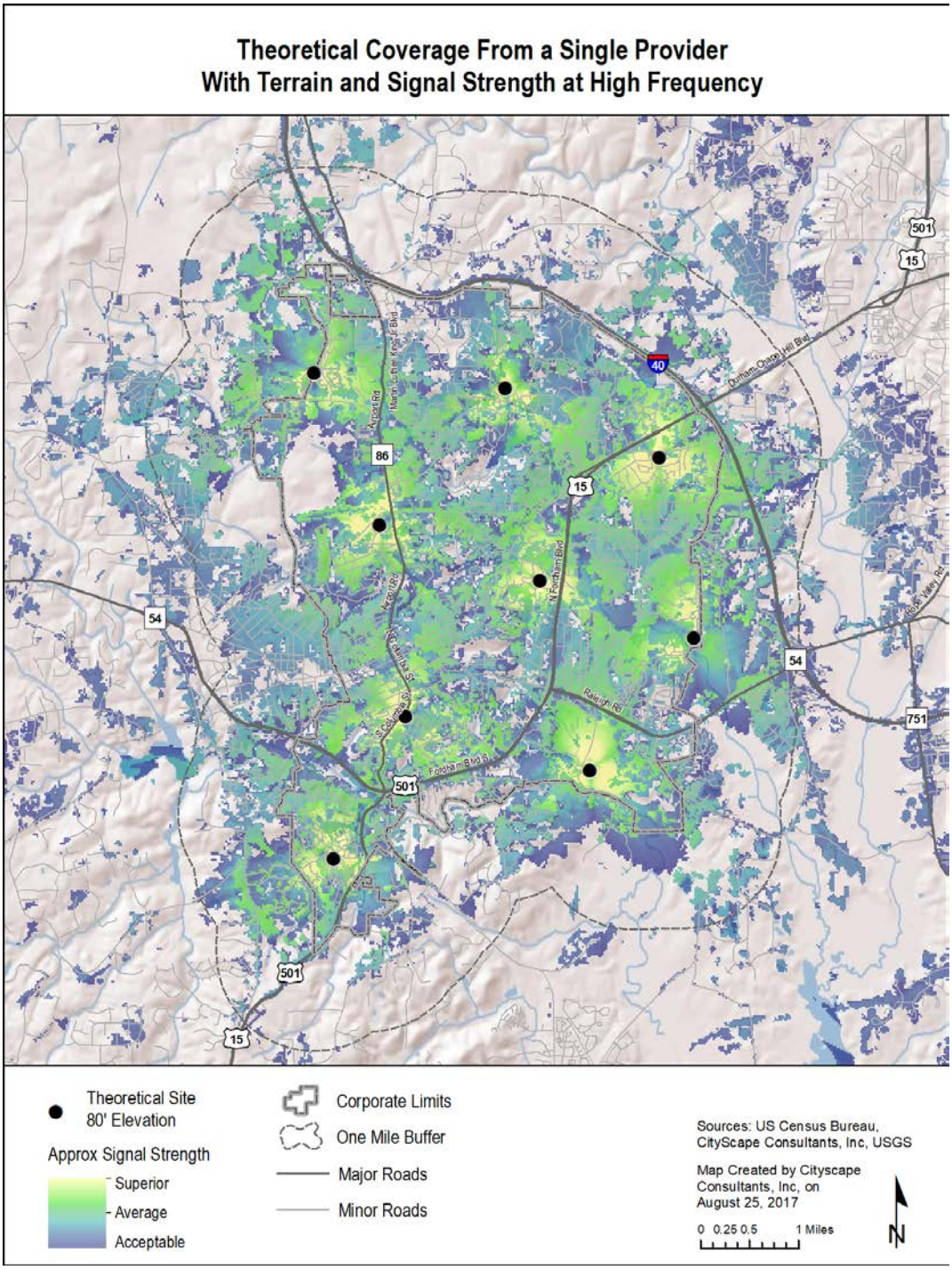



**Figure 17: Future Growth Theoretical High Frequency with Variables**

Most early twenty-first century wireless subscribers demand superior signal strength (as shown on the map in shades of yellow) in their residences, schools, offices, and places frequented for shopping, entertainment and recreation. As consumers continue the trend of terminating traditional landline phone services and using the wireless handset as the primary mode of communication having signal strength inside buildings is paramount to meeting these expectations. Therefore the industries "average" and "acceptable" coverage variables do not necessarily meet current customer demands and expectations.

There is very little yellow or superior signal coverage throughout the geographic area from these theoretical sites within the Town. This indicates the significant need for additional infrastructure to accommodate wireless service providers to improve the quality of network coverage.

***Existing Transmission Equipment***

Prior to granting the cellular licenses in 1980 for the first phase of deployment, the United States was divided into 51 regions by Rand McNally and Company. These regions are described as Metropolitan Trading Areas (MTA). The spectrum auction conducted by the Federal Government for the 1900 MHz bands for 2G (PCS) further divided the United States into 493 geographic areas called Basic Trading Areas (BTA). The Town of Chapel Hill is located in the Charlotte-Greensboro-Greenville-Raleigh MTA (MTA 6) and the Raleigh-Durham, NC BTA (BTA 368). Service providers acquire the rights to deploy their networks by service area and range of spectrum frequency.

Per Section 704 of the Telecommunications Act of 1996, all service providers will require uninterrupted and continuous handoff service throughout the Town. There are at least ten known wireless service providers that each want to compete for the subscriber base in and around Chapel Hill. Each wireless provider will need towers or elevated antenna mounting locations for their network coverage.

Service providers for wireless phone and other companies who have purchased licenses to serve the Town in the lower frequency ranges of 700 - 900 MHz: AT&T; BDCM Fund Adviser, LLC; BPC Spectrum, LLC; DISH; Grain Management; King Street Wireless and Verizon Wireless.

Companies who have purchased spectrum in the higher frequencies of 1700 - 2700 MHz bands include: AT&T Wireless; Clearwire; Inmarsat; Sprint; T-Mobile; the University of North Carolina at Chapel Hill; Verizon Wireless and a variety of broadcast companies.

Most network service providers do not own the antenna mounting structure on which they attach their equipment. Tower companies typically construct and own the tower and lease tower and ground space to service providers. A service provider may also contract with a tower builder to construct a tower in a particular location and once the facility is constructed lease space from the tower owner. Currently there are a number of tower companies within the Town who lease their vertical real estate to the service providers including: American Tower Corporation (ATC), Crown Castle International (CCI), Duke Energy, the University of North Carolina at Chapel Hill (UNC-CH) and Skyway Tower.

***Existing Antenna Locations***

A base map with the existing sites allows for observations and analysis of current and future deployment patterns. The WMP project scope with the Town included research to identify the location of any existing infrastructure, the assessment of each facility and cataloging pictures and data from the assessment process. A listing of facilities was compiled from various databases to begin the process and the final inventory was created after the completed field work. Each site

on the inventory map was assessed and validated for: physical location; type of infrastructure; ownership of the infrastructure; wireless tenants at each facility; and potential for future collocation.

The WMP includes infrastructure sites in the inventory that currently support wireless phone, wireless Internet and microwave infrastructure meeting the FCC definition of a Personal Wireless Service Facility (PWSF). The FCC defines PWSF as,

> "any staffed or unstaffed location for the transmission and/or reception of radio frequency signals or other wireless communications, including commercial mobile services, unlicensed wireless services, wireless broadband services, and common carrier wireless exchange access services as defined in the Telecommunications Act of 1996, and usually consisting of an antenna or group of antennas, transmission cables, feed lines, equipment cabinets or shelters, and may include a tower. The following developments shall be deemed a PWSF: new, replacement, or existing towers, public towers, replacement towers, collocation on existing towers, base station attached concealed and non-concealed antenna, concealed towers, and non-concealed towers (monopoles, lattice and guyed)".

However, there are many additional types of antennas used for a variety of communication purposes throughout the defined study area such as, dispatch, Wi-Fi hot spots, and data links. CityScape included only those classified as PWSF and broadcast towers because of their potential to promote collocation.

CityScape identified and assessed fifty-eight (58) sites that meet the prescribed criteria. One of those sites has two (2) towers so the number of facilities in the catalog inventory is fifty-seven (57). Forty-eight (48) of the sites are within the Town's jurisdiction and nine (9) sites are outside the Town's boundary but are included in the WMP study area as they have an impact on the wireless networks within the Town.

There is great diversity in the type of wireless infrastructure throughout the study area. Within the Town their are a total of seven (7) macro towers. Two (2) are non-concealed guy towers used for radio broadcasting and contain no PWSF on them at this time; two (2) are non-concealed dual purpose monopole towers with light stanchions at the Grey Culbreth Middle School baseball field; two (2) are non-concealed lattice towers (one (1) in the ROW and one (1) at the Friday Center); and one (1) is a concealed slick stick.

There are eleven (11) macrocell base stations of which only one (1) is concealed. Three (3) are mounted on high tension utility distribution poles; two (2) on water tanks; and five (5) on rooftops. There are two independent small cell wireless networks in the Town. This is unique to Chapel Hill because small cell deployment is just beginning and it is unusual at this time in the wireless evolution to find a community with two existing independent small cell systems.

One of the small cell networks is an outdoor distributed antenna network (oDAS) that is owned by ATC with AT&T as the tenant. This network is located in the area south of Estes Drive and north of Umstead Drive and the Bolin Creek area. The oDAS system includes seventeen (17) outdoor nodes. The small cell antennas in this network are mostly located on forty foot (40') tall wooden electrical distribution poles. Nine (9) of these poles existed at the time of deployment (making them base stations since they also serve a utility purpose) and the other eight (8) were installed on new wood distribution poles (towers) for the oDAS network. The oDAS nodes are shown in the inventory as site numbers 7; 9-13; 15-19; and 21, 23-27.

The second small cell network is on the campus of UNC-CH and consists of thirteen (13) rooftop base station facilities. This network is owned by a consortium of three service providers including AT&T, T-Mobile and Verizon and is intended to be a neutral host for all to share. At the time of assessments Verizon appeared to be the only provider on this network.

Within the Town's zoning jurisdiction their are only eight (8) total macrocell towers (only six (6) with PWSFs), and their are forty-one (41) base stations (eleven (11) of which are macrocell). It is unusual to find so few macrocell sites for the size and population density of the Town. Of equal interest is the low usage of concealment for the base stations (only one of the forty-one).

The following Tables 5 and 6 provide an overview of antenna mounting structures found throughout the study area and their varying heights. Table 7 identifies the known infrastructure ownership as of November 2017.

The towers and base stations are shown on the inventory map in Figure 18 and more detailed site information is available in the Inventory Catalog in Chapter 4 of this plan.

The Town is in the process of creating a Geographic Information System (GIS) layer that includes all of the WCF's identified in the Tower and Base Station Inventory (Figure 18) plus existing utility poles owned by Duke Energy, UNC and the Town. We recommend that the Town complete this inventory, locating all utility poles in Chapel Hill, to provide a knowledge base, facilitating the review and approval of future WCF applications.

| INFRASTRUCTURE OVERVIEW | OUTSIDE ROW | IN ROW | TOTAL |
|---|---|---|---|
| Concealed Macro Tower | 2 | 0 | 1 |
| Non-Concealed Macro Tower | 14 | 1 | 16 |
| Concealed Macrocell Base Station | 1 | 0 | 1 |
| Non-Concealed Macrocell Base Station | 10 | 0 | 10 |
| Non-Concealed Small Cell Tower | 0 | 8 | 8 |
| Non-Concealed Small Cell Base Station | 13 | 9 | 22 |
| **TOTAL** | **40** | **18** | **58** |

**Table 5: Infrastructure Overview**

| INFRASTRUCTURE HEIGHT | TOTAL |
|---|---|
| < or = 45′ | 24 |
| 50′ - 80′ | 11 |
| 81′ - 100′ | 8 |
| 101′-125′ | 4 |
| 140′-195′ | 7 |
| 203′-330′ | 4 |
| Unknown | 0 |
| **TOTAL** | **58** |

**Table 6: Infrastructure Height**

| INFRASTRUCTURE OWNER | TOTAL |
|---|---|
| American Tower Corporation | 20 |
| Crown Castle International | 8 |
| Duke Energy | 3 |
| OWASA | 2 |
| UNC-CH | 15 |
| Other | 9 |
| Unknown | 1 |
| **TOTAL** | **58** |

**Table 7: Infrastructure Owner**

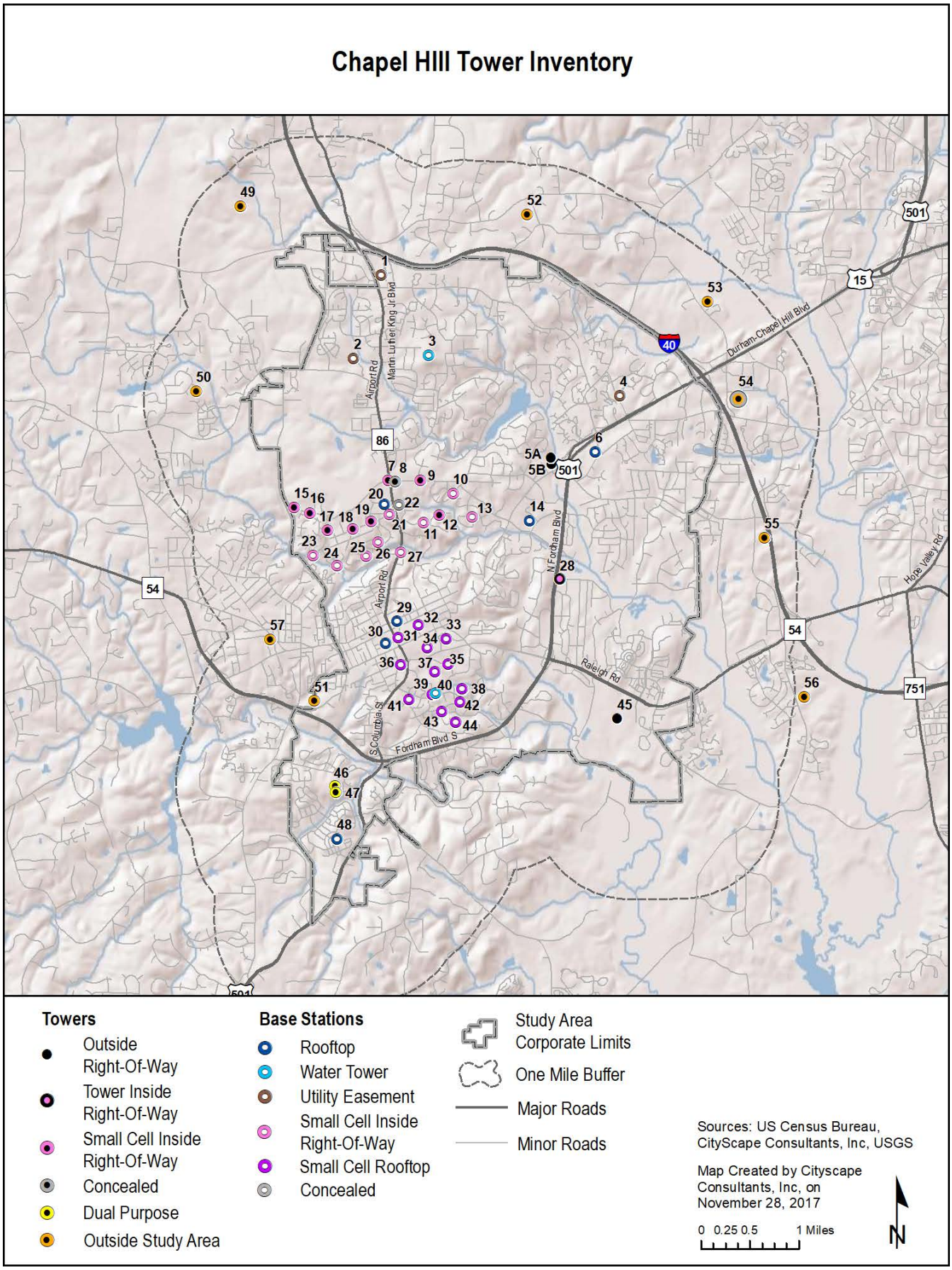



**Figure 18: Tower and Base Station Inventory**

### *Estimating The Wireless Subscriber Base*

Population, location and density are important variables in wireless network design considerations. CityScape compares the United States Census Bureau (US Census) and local information for subscriber base data because growth rates vary between local community estimates and the US Census. According to the US Census the Town is approximately 21.12 square miles and the July 1, 2016 estimated population for the Town was 59,246. The population estimates for the Town in 2010 was 57,233. Based on this information the Town's growth rate has increased 3.5 percent over this six (6) year timeframe. The Town's daytime population increases 52.5 percent with commuter student and work related traffic. Figures 19 and 20 illustrate this daytime to nighttime population change. The areas in darker brown illustrate the most densely populated areas of the Town during peak times of the day and night.

The nighttime population is significantly more spread out throughout the Town in comparison to the high density concentrations of population around the UNC-CH campus and Highways 86, 15 and 501 corridors during the day. This fluctuation is a significant variable affecting wireless network capacity. The maps help illustrate the need to have a blanket of wireless coverage over the Town to meet network demands for both nighttime and daytime wireless subscribers.

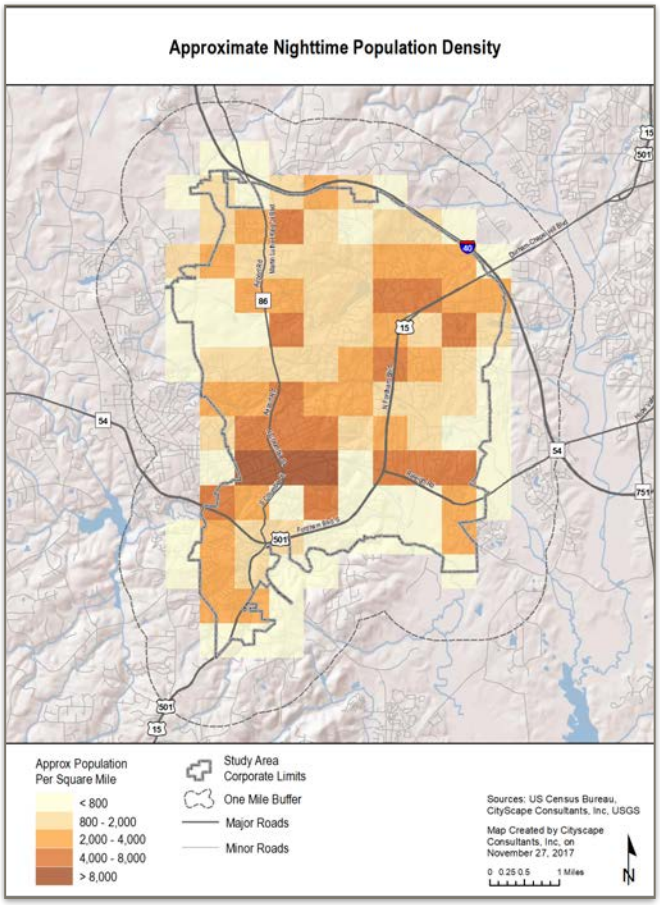



**Figure 19: Approximate Nighttime Population Density**

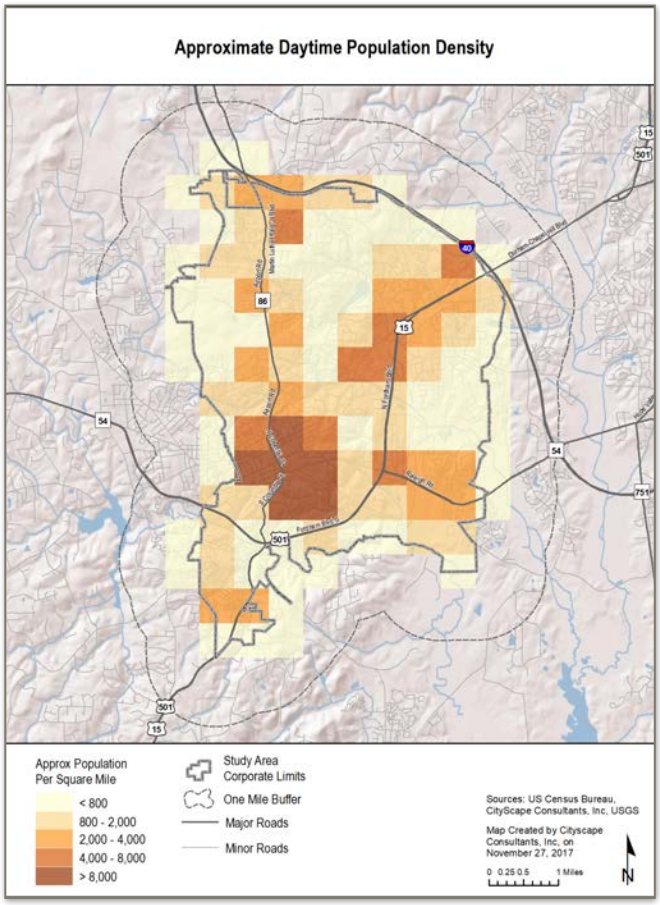



**Figure 20: Approximate Daytime Population Density**

### *Existing Network Coverage*

The next step in the wireless network evaluation process is to examine existing coverage from all known existing PWSF facilities and any other relevant towers and compare that to the population maps to identify coverage gaps within the Town. CityScape acknowledges the existing towers and base stations do not have the same service provider at each site and not all existing infrastructure has sufficient support capacity for all service providers however, the mapping provides a theoretical overview for projection purposes.

Figure 21 demonstrates the theoretical coverage for a single low frequency service provider with antennas mounted at the top mounting position of all known PWSF support structures throughout the Town.

Figure 22 illustrates theoretical coverage for a single high frequency service provider from every known tower and antenna location. Both maps include the existing tower height, census population data, subscriber rate data, terrain, environmental and signal strength variables.

These figures also illustrate the effectiveness of both small cell networks in tandem with macro sites and shows geographic areas with definitive poor and marginal service. Using these gap maps in conjunction with Figures 19 and 20, (the daytime and nighttime population density maps) it is evident there is great need for additional network improvements along the major corridors and in the residential areas.

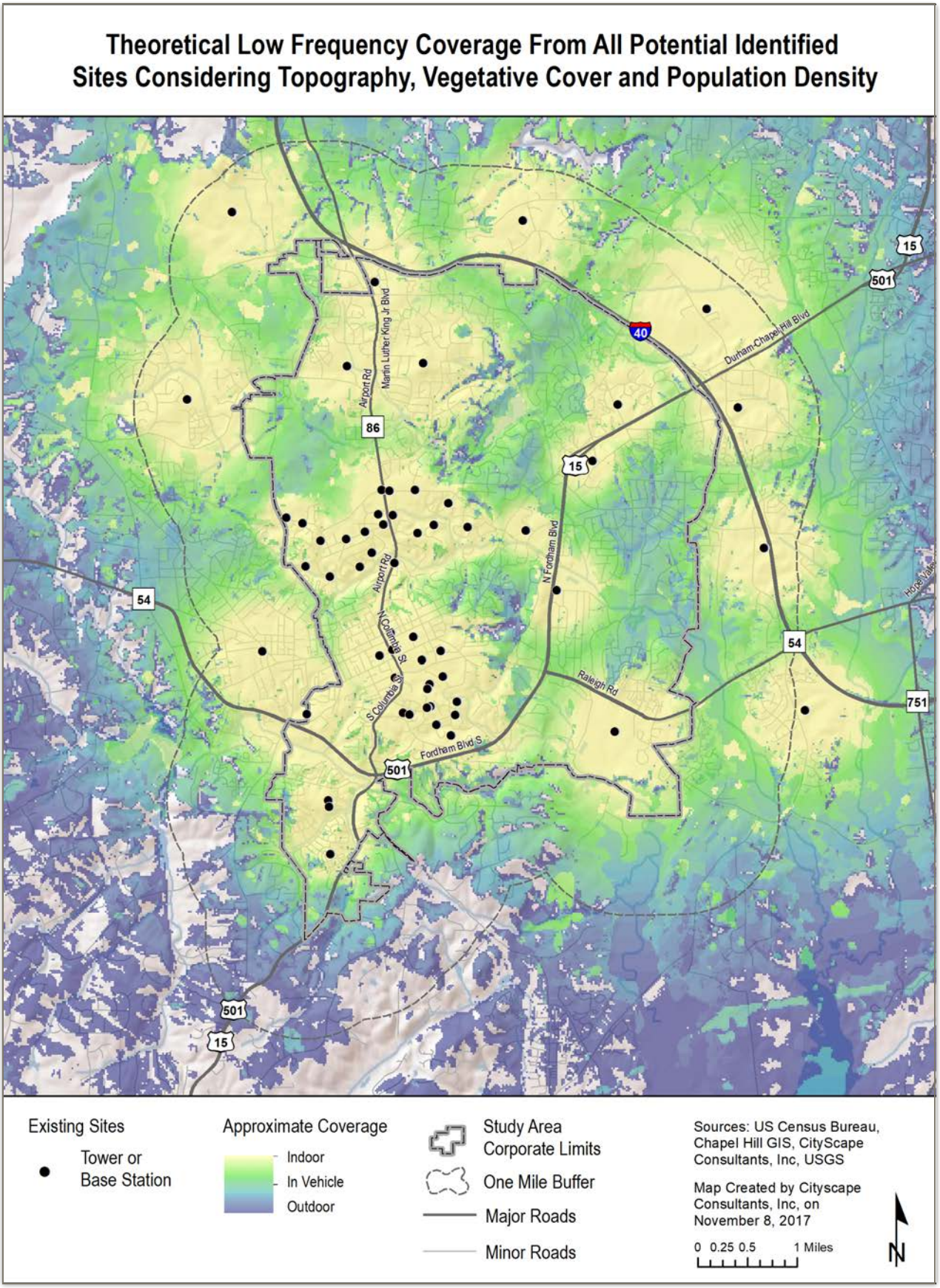



**Figure 21: Theoretical Low Frequency PWSF with Variables**

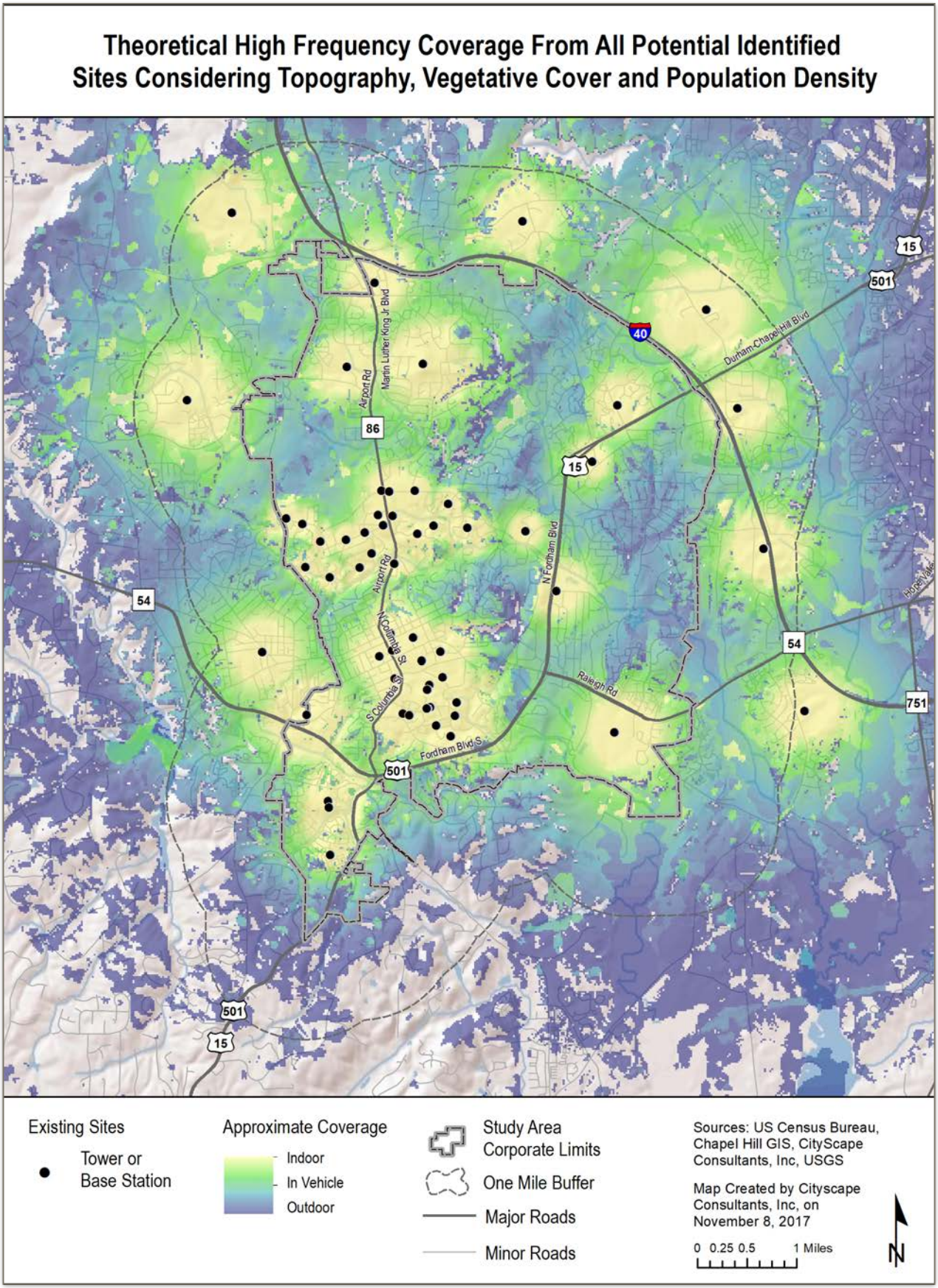



**Figure 22: Theoretical High Frequency PWSF with Variables**

### *10-Year Plan Estimates*

With the exponential growth of Smartphones and other wireless devices, the demands for improved level of services requires more information to be interchanged between the service providers facilities and wireless subscriber's devices. Especially to achieve the proper function of 4G and 5G networks signal density has become much more significant.

The 5G technology is still in development and is predicted to be launched within the next three to seven years. True high-speed data with download speeds in excess of 100 Mbps is expected to be implemented with this 5G technology. The primary objective and criteria of the network design will be the proximity of the wireless source to the customer to accommodate streamed video entertainment. In residential areas the expectation is that one wireless node will be needed for each 10-12 households, equating to one node every 165 to 1,650 feet. For this reason dozens to hundreds of smaller nodes will be needed to meet future wireless network traffic.

Cityscape estimates that it will require between ten (10) and twelve (12) new macro towers approximately 70 to 120 feet tall. Small cell facilities will need to be mounted at about 35 to 40 feet and the total number needed is expected to be in the hundreds along the roadways and on rooftops to meet the Town's anticipated 5G demands over the next decade. It is important to emphasize that the mounting height for small cells is dependent on the number of collocations on each facility. If the proposed facility is a neutral host facility, then multiple service providers would be able to share the same technology platform (set of antennas) and additional height to the structure would not be necessary for each collocation.

This estimate of required facilities is based on the mathematics of the population density; subscriber base and usage; transient movement throughout the Town and how the volume of demand per site can simultaneously be served at any given time.

Figure 23 depicts the relationship between the existing facilities to the blended daytime and nighttime peak population densities across the Town. Each hexagon is 2.5 miles across and contains moderate peak population estimates, represented in light pink and high peak population density shown in red. Each hexagon also contains the macro and small cell facilities that provide services in that sector and indicates the potential demand of services based on population density.

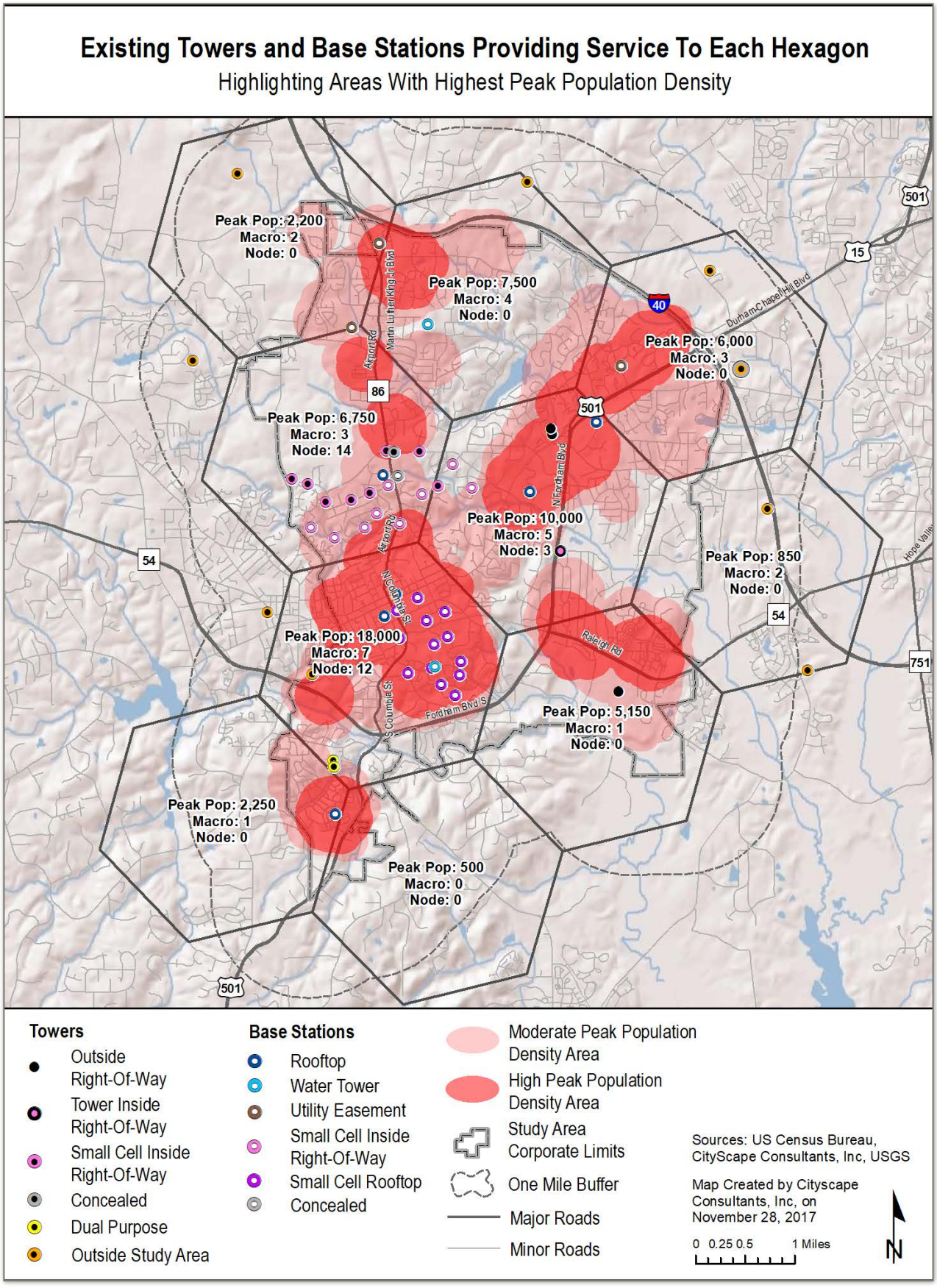



**Figure 23: Existing Towers and Base Stations in Relation to Peak Population Density**

Figures 24 through 26 illustrate the geographic areas where new infrastructure will be needed to meet 4G and 5G deployment. CityScape anticipates the largest number of new macro sites will be needed in the UNC-CH area. CityScape recognizes that UNC-CH has a robust Wi-Fi network for the student, teacher, visitor and medical communities on campus. This network has an impact on the predicted number of macro and small cell site predictions for the campus area. Should the University continue to expand the existing Wi-Fi network then fewer macro sites may be needed in those hexagons. The impact of the Wi-Fi network on the fill in gap analysis is shown in Figure 25. Small cell facilities to accommodate network capacity will be needed along the most heavily travelled thoroughfares and residential areas with peak population densities as shown in Figure 26.

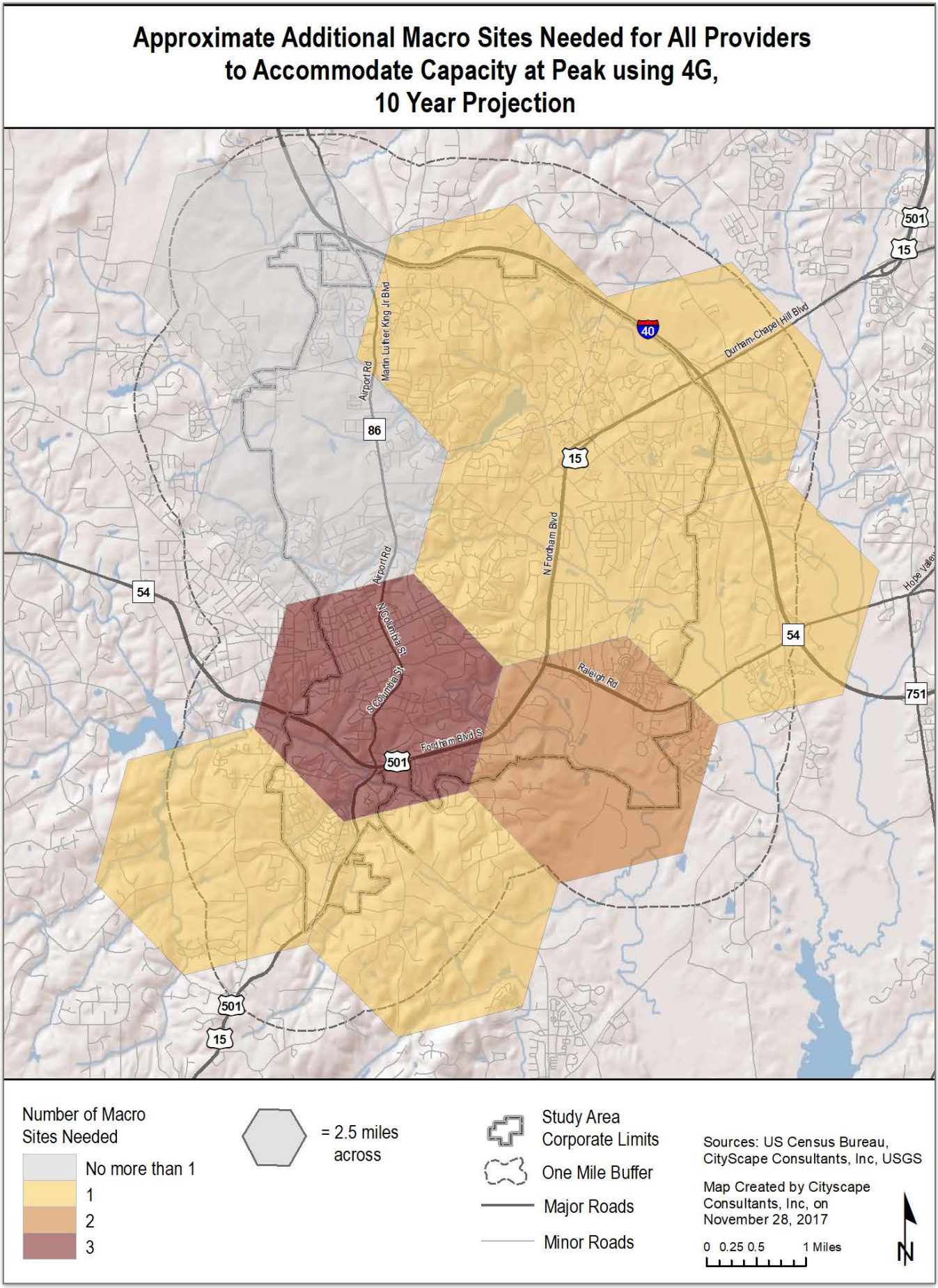



**Figure 24: Theoretical Macro Site Fill-in**

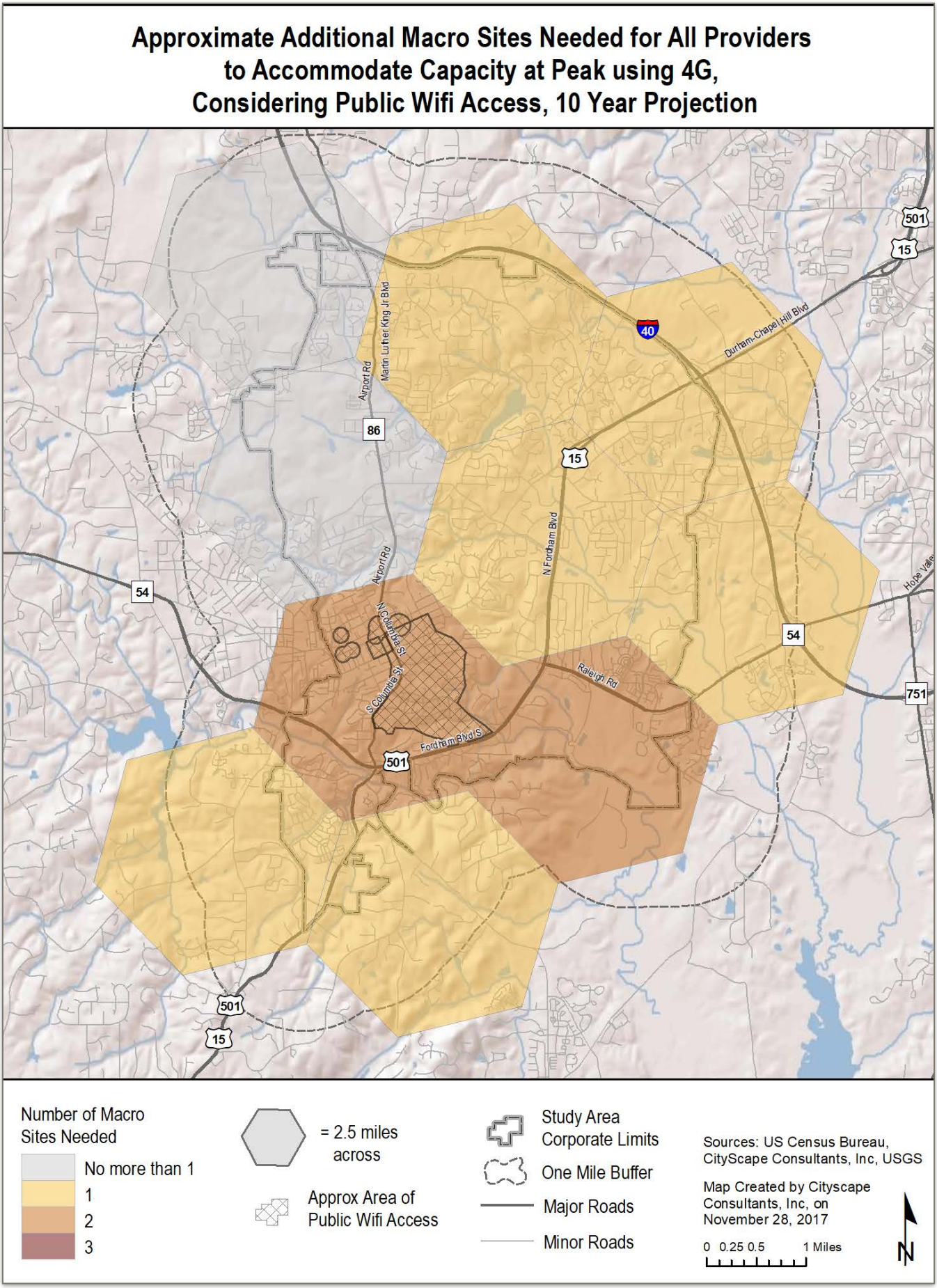



**Figure 25: Theoretical Macro Site Fill-in with UNC-CH Wi-Fi**

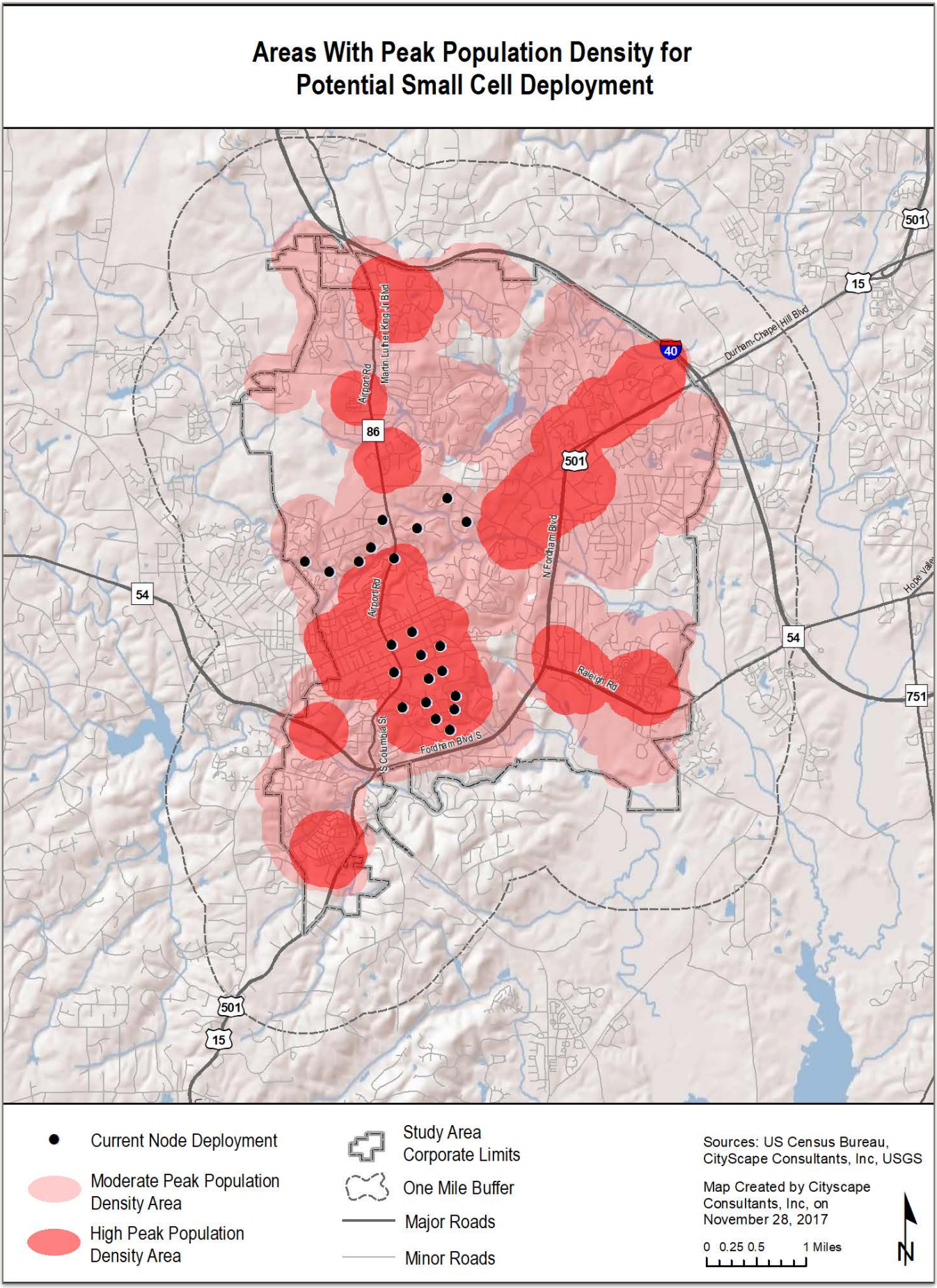



**Figure 26: Theoretical Small Cell Fill-in**

### *Potential Public Properties as Fill-in Sites for Network Gaps*

When publicly owned property is used for wireless infrastructure the Town becomes the landlord and has ultimate control over the design, placement and maintenance of the infrastructure. Many creative concealment techniques are available to the industry and some are more aesthetically pleasing and practical than other types. As local government adopts preferred design standards for publicly owned property, these installations become the standard for future sites developed within the Town's zoning jurisdiction. Leasing public properties for new wireless infrastructure can also generate new sources of revenue along with creating assets for the Town. Additionally, there could be potential availability on the new infrastructure for the use of emergency services and public safety equipment. Table 8 is an alphabetical listing of each of the Town-owned properties that could be suitable for either a macro or small cell wireless facility. The properties listed in this table are shown on the map in Figure 27. The Town would have to review and accept the proposed offer and development by any wireless service provider on any one of these properties prior to installation of new wireless equipment on any Town owned land.

| SITE ID | SITE USE | SITE ID | SITE USE |
|---|---|---|---|
| AA | Public Works | BJ | Open Greenway; Facilities; Public Housing |
| AB | Greenway Easement | BK | Open Greenway; Park |
| AC-AK | Open Greenway | BL | Open Greenway; Facilities; Public Housing |
| AL | Open Greenway | BM | Public Housing |
| AM | Open Greenway; Public Housing | BN | Open Greenway |
| AN | Open Greenway | BO | Open Greenway; Facilities; Public Housing |
| AO | Special | BP | Open Greenway; Facilities; Public Housing |
| AP | Open Greenway; Park | BQ | Park and Parking |
| AQ | Fire Station | BR | Open Greenway; Parking; Historic Downtown; |
| AR-AW | Open Greenway | BS | Public Housing |
| AX | Public Housing | BT&BU | Open Greenway |
| AY-BD | Open Greenway | BV | Park |
| BF | Open Greenway; Park; Fire Station | CD | Open Greenway; Fire Station |
| BG | Recycling Center | CD | Park and Park N Ride |
| BH&BI | Open Greenway | CF | Open Greenway |

**Table 8: Town-Owned Public Properties**

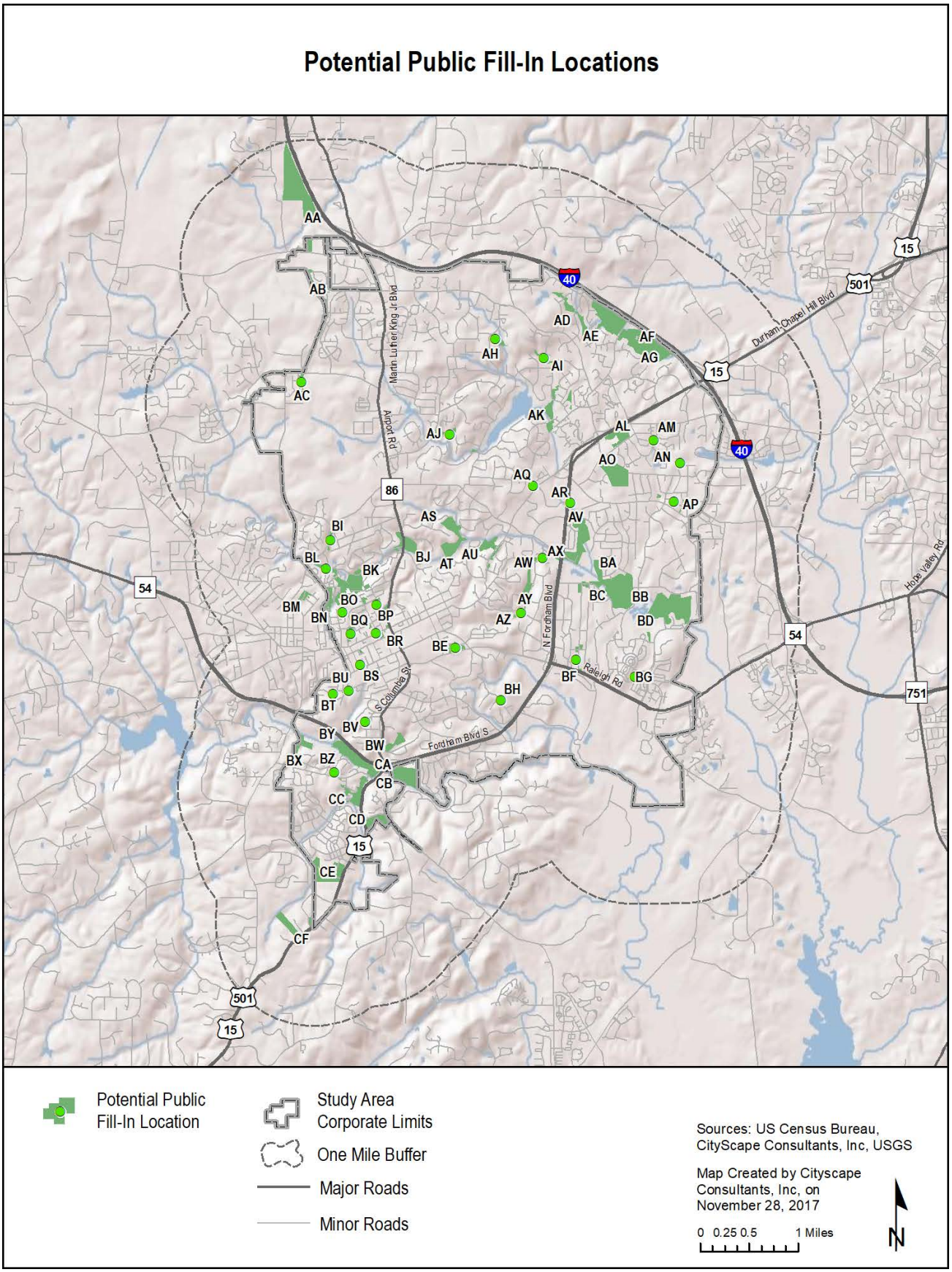



**Figure 27: Town-Owned Fill-in Sites (Subject to Change)**

# Chapter 3

## Wireless Master Planning and Public Policy

***Wireless Deployment and Public Policy***

At the advent of the wireless telephone age, there were only two competing wireless cellular providers and not a lot of need for regulations regarding infrastructure development. However, with the deployment of 2G, six competing PCS providers entered the wireless marketplace which became much more competitive. "Speed to market" and "location, location, location" became the mantra of all the providers. The concept of sharing facilities was not part of the initial strategy as each provider sought to have the fastest deployment in order to develop the largest customer base. This resulted in a quick return on their cost of deployment. However, this also led to non-essential new tower construction without the benefit of appropriate local land use management.

As local governments began to adopt development standards for wireless infrastructure, the wireless industry was often stymied by the local regulations, and sought help from Congress to expedite the deployment of wireless services on spectrum which the wireless providers had bought from the US government. This resulted in the first federal regulation of wireless services. The 1996 Telecommunications Act includes Section 704 (47 USC §332(c)(7), (commonly referenced as Section 704) grants local governments ability to regulated the wireless infrastructure. Section 704 says in relevant part:

- Land use development standards may not unreasonably discriminate among the wireless providers, and may not prohibit or have the effect of prohibiting the deployment of wireless infrastructure.
  For example, some communities adopted development standards restricting the distance between towers to three or more miles. In some geographic locations with sparse populations this might be adequate for 1G deployment; however the laws of physics make it impossible for 2G wireless deployments to meet this spacing requirement. And unintentionally some local governments prohibited the deployment of 2G.
- Local governments must act on applications for new wireless infrastructure within a "reasonable" amount of time but didn't specify what "reasonable" meant.
- Land use policies may be adopted to promote the location and siting of telecommunications facilities in certain designated areas.
- Encourages the use of third party professional review of site applications.
- Prohibits local government from denying an application for a new wireless facility or the expansion of an existing facility on the grounds that radio frequency emissions are harmful to human health provided the wireless service provider met federal standards.

While local governments were adapting their development standards to meet the requirements of Section 704, the industry strategy changed yet again. The cost associated with each provider developing an autonomous inventory of facilities put a financial strain on their ability to deploy networks. As a result, most wireless providers divested their internal real estate departments and sold their tower inventories. This change gave birth to the new industry of vertical real estate development which includes tower builders, tower owners, site acquisition and site management firms.

No longer was a tower being built for an individual wireless service provider, but for a multitude of new wireless tenants. They would share the tower without bearing the individual cost of building, owning and maintaining the facility. Sharing antenna space on a tower between wireless providers became known as collocation.

This change encouraged local governments to adopt new regulations to encourage or require collocation as a means to reduce the total number of new towers. There were unintended consequences of such regulations, including taller, more congested tower structures and delays in construction and implementation because of multiple tenant needs and local regulatory requirements which did not harmonize with industry deployment standards. As a result, the vertical tower industry sought additional federal relief from local regulations to expedite permitting of new wireless infrastructure. In 2009 they received that relief, not from Congress but from the Federal Communications Commission.

***The Shot Clock Ruling***

Because of what the infrastructure industry perceived as intolerable delays in processing wireless infrastructure applications at the local government level, and the imposition by a number of local governments of wireless infrastructure "moratorium", the wireless infrastructure industry petitioned the FCC for relief. The FCC issued what is known as the "Shot Clock" Declaratory Ruling in 2009. The Shot Clock ruling requires infrastructure collocation decisions to be made in 90 days and new tower decisions to be made in 150 days. This put an administrative burden on local governments to process applications and make decisions expeditiously or otherwise the application would be deemed approved. Some communities challenged the FCC's authority to impose these timelines, but the US Supreme Court ultimately decided the FCC was within its authority to impose the Shot Clock on local governments.

The Shot Clock decision only briefly satisfied the wireless infrastructure industry, which continued to seek federal assistance in expediting the deployment of wireless infrastructure and wireless services. As a result, Congress enacted legislation in 2012 which would again change how local government could regulate wireless infrastructure.

### *Section 6409(a) Middle Class Tax Relief and Job Creation Act of 2012*

Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, (codified as 47 USC §1455(a)) is commonly called the "Spectrum Act" and was enacted by Congress to promote wireless deployments of broadband for public safety and commercial purposes. It says, in relevant part:

> "…a State or local government may not deny, and shall approve, any eligible facilities request for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station."
>
> Congress did not provide any definitions or instructions on the terms used in the Spectrum Act, and interpretation of the terms used varied between local government and the wireless infrastructure industry. After acknowledging that Congress did not provide much guidance on what it meant by some of the terms used in the Spectrum Act, the FCC decided it would provide definitions and rules of interpretation to the Spectrum Act, saying that "that clarifying the terms in Section 6409(a) will eliminate ambiguities in interpretation and thus facilitate the zoning process for collocations and other modifications to existing towers and base stations." This resulted in the FCC issuing a response clarifying definitions and meaning to the Spectrum Act in a Report and Order released October 21, 2014 in W.T. Docket 13-238 commonly called the "2014 Report and Order".

In the Introduction of the 2014 Report and Order the FCC states,

> "Demand for wireless capacity is booming: more consumers are accessing mobile broadband every year, driving more innovation and expanding access to public safety. But our ability to meet this demand depends on the infrastructure that supports the services. We therefore take concrete steps to facilitate the deployment of the infrastructure necessary to support surging demand, expand broadband access, support innovation and wireless opportunity, and enhance public safety - all to the benefit of consumers and the communities in which they live. (Paragraph 2)…Accordingly, our actions are intended to encourage deployments on existing towers and structures - rather then entirely new towers in recognition that collocations almost always result in less impact or no impact at all." (Paragraph 3)

So what does this mean and how does it affect local planning agencies nationwide?

First, "[n]otwithstanding section 704 of the Telecommunications Act of 1996 or any other provision of law, a State or local government may not deny, and shall approve, any *eligible facilities request* for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station. An *eligible facilities request* is one that requests modification of an existing wireless tower or base station that involves (a) collocation of new transmission equipment; (b) removal of transmission equipment; or (c) replacement of transmission equipment.

Second, it is important to understand how the FCC in the 2014 Report and Order defines base station, eligible support structure and tower.

- *Base Station*, "a structure or equipment at a fixed location that enables Commission-licensed or authorized wireless communication between user equipment an a communications network. There term does not encompass a tower as defined in this subpart or any equipment associated with a tower. This term includes any structure other than a tower, at the time the relevant application is filed with the State or local government."

- *Eligible support structure,* "any tower or base station as defined in this section, provided that it is existing at the time the relevant application is filed with the State or local government under this section."

- *Tower* means, "any structure built for the sole or primary purpose of support any Commission licensed or authorized antennas and their associated facilities, including structures that are constructed for wireless communications services including, but not limited to, private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul, and the associated site."

The 2014 Report and Order reaffirms that broadcasting infrastructure is also considered a wireless tower or base station for purposes of Section 6409(a) and that transmission equipment includes antennas, cables, and auxiliary power equipment, such as generators.

The FCC further clarified:

> "…the term "existing" requires that wireless towers or base stations have been reviewed and approved under the applicable local zoning or siting process or that the deployment of existing transmission equipment on the structure received another form of affirmative State or local regulatory approval (*e.g.*, authorization from a State public utility commission). Thus, if a tower or base station was constructed or deployed without proper review, was not required to undergo siting review, or does not support transmission equipment that received another form of affirmative State or local regulatory approval, the governing authority is not obligated to grant a collocation application under Section 6409(a)."

A wireless tower that does not have a permit because it was not in a zoned area when it was built, but was lawfully constructed is considered an "existing" tower. In other words, a collocation application that "shall be approved" under Section 6409(a) has to be for a location that has been previously reviewed and approved through the local regulatory approval process and is not a "substantial change" to the original approval.

Under the new FCC definition a "substantial change" to an eligible tower or base station is as follows:

(1) (a) for towers outside of public rights-of-way, it increases the height of the tower by more than 10%, or by the height of one additional antenna array with separation from the nearest existing antenna not to exceed twenty feet, whichever is greater; (b) for those towers in the rights-of-way and for all base stations, it increases the height of the tower or base station by more than 10% or 10 feet, whichever is greater; or

(2) (a) for towers outside of public rights-of-way, it protrudes from the edge of the tower more than twenty feet, or more than the width of the tower structure at the level of the appurtenance, whichever is greater; (b) for those towers in the rights-of-way and for all base stations, it protrudes from the edge of the structure more than six feet; or

(3) it involves installation of more than the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets; or

(4) it entails any excavation or deployment outside the current site of the tower or base station;

(5) it would defeat the existing concealment elements of the tower or base station; or

(6) it does not comply with conditions associated with the prior approval of construction or modification of the tower or base station unless the non-compliance is due to an increase in height, increase in width, addition of cabinets, or new excavation that does not exceed the corresponding "substantial change" thresholds identified above. We further provide that the changes in height resulting from a modification should be measured from the original support structure in cases where the deployments are or will be separated horizontally, such as on buildings' rooftops; in other circumstances, changes in height should be measured from the dimensions of the tower or base station inclusive of originally approved appurtenances and any modifications that were approved prior to the passage of Section 6409(a).

For example, provided the request is not a substantial change then, if the Town previously approved a non ROW macro tower (a.k.a. eligible facility) to be constructed at 100 feet then under Section 6409(a) that tower height can be increased by ten (10) percent or or by the height of one additional antenna array with separation from the nearest existing antenna not to exceed twenty feet, whichever is greater. In the case where 20 feet is the greater, then that eligible 100-foot tower could be increased to 120 feet in height to accommodate an additional collocation (provided the modification does not exceed the six substantial change criteria). For eligible towers in the ROW and for all eligible base stations the height can be increased by ten (10) percent or ten (10) feet, whichever is greater. Thus an existing eligible 100-foot tower in the ROW or any eligible 100-foot base station could be increased in height by right to 110 feet.


Image FCC.Gov

The 2014 Report and Order affirms that these standards apply equally to legally nonconforming structures in the jurisdiction. They too will be eligible for Section 6409(a) modifications.

Finally, the FCC points out that wireless facility modifications under Section 6409(a) should remain subject to building codes and other non-discretionary structural and safety codes. In particular, they clarified that Section 6409(a) does not

"preclude States and localities from continuing to require compliance with generally applicable health and safety requirements on the placement and operation of backup power sources, including noise control ordinances if any."

As for timelines, local government has sixty (60) days to review a new collocation application for an eligible facility under Section 6409(a). The timeline starts when the application is submitted. Local government can then "stop" or "toll" the clock within the initial thirty (30) days if the application is incomplete. The local government's request for additional information "must specify the code provision, ordinance, application instruction, or otherwise publicly stated procedures that require the information to be submitted."

The time clock restarts when the applicant resubmits with the missing information. If the application is still incomplete local government can then "stop" or "toll" the process again by again identifying, in writing, missing information. The clock will restart again upon the second resubmission. After that local government cannot stop the clock because of incompleteness.

If the local government does not complete the application review within sixty (60) days (subject to the tolling provisions above), the 2014 Report and Order adopts a "deemed granted" remedy.

If, after reviewing a proposed Section 6409(a) application, the local government determines that the application request is not eligible for Section 6409(a) processing because it constitutes a "substantial change", then the ninety (90) day timeline from the 2009 Shot Clock ruling applies, starting from the day the Town decides the application is not Section 6409(a) eligible. (However, certain applications may need to be processed in accordance with the North Carolina HB310 statutory law which differs from these federal rules.) The 2014 Report and Order does suggest that the "deemed granted" isn't necessarily the last word on the subject. Acknowledging that judicial determination may be necessary, the 2014 Report and Order states:

> "…. a State or local authority may challenge an applicant's written assertion of a deemed grant in any court of competent jurisdiction when it believes the underlying application did not meet the criteria in [Section 6409(a)] for mandatory approval, would not comply with applicable building codes or other non-discretionary structural and safety codes, or for other reasons is not appropriately "deemed granted".

The takeaway from this part of the 2014 Report and Order is that Section 6409(a) applications must be tailored to request permissible information and then must be acted upon quickly in order to avoid a "deemed granted" remedy.

The 2014 Report and Order continues by pointing out that Section 6409(a) applies only to local government in its regulatory capacity and NOT as a landlord. Should the Town choose, in the capacity as landlord, to limit the number and type of applicants on Town property infrastructure, Section 6409(a) will not apply.

In an important nod to local government, the FCC said in the 2014 Report and Order that it would *NOT* find establishment of a preference for siting on public property in local regulations to be a *per se* violation of Section 704's requirements to not discriminate amongst providers. The 2014 Report and Order said while some preferences coupled with onerous regulations could have that effect those decisions would have to be made on a case by case basis.

***North Carolina House Bill 310***

On July 21, 2017 House Bill 310 was approved and became law. House Bill 310 ("HB310") is, "an Act to reform collocation of small wireless communications infrastructure and aid in deployment of new technologies." The bill expanded existing North Carolina legislation regulating Wireless Telecommunications Facilities within municipalities as set forth in Chapter 160A, North Carolina Statutes (NC Stat. §160A-400.50 et seq., hereinafter "Chapter 160A"). HB310 allows wireless service providers and infrastructure owners to install small cell facilities as defined in the bill on existing structures both in public rights of way and outside of rights of way on any property located other than within single family residential districts, regardless of whether or not an existing antenna is on the facility by right, subject to the following criteria:

- In the ROW the antenna attaching onto an existing pole does not exceed ten (10) feet, or
- In the ROW the erection of a new pole or replacement of a new pole does not exceed fifty (50) feet above ground level in any zoning district other than single family residential, or
- In the ROW, in single family residential districts where utility lines are underground, a new pole shall not exceed forty (40) feet.
- The Town is allowed to review small cell facilities to address aesthetic concerns and require concealment and to require and enforce that all building code standards are being met by the applicant.

Non-substantial collocations of "small cells" within a Town right of way must be reviewed upon receipt to determine if they meet the non-substantial change definitions and the Town must notify applicant in writing within forty-five (45) days of submission if the application is incomplete and advise as to any deficiencies and request resubmittal. If no notice is given, the application shall be deemed complete. The Town shall process such application within forty-five (45) days of being deemed complete or the application will be deemed granted. For new small cells within a Town right of way, the applicant must be notified by the Town within thirty (30) days of submittal of its application as to any deficiencies and request resubmittal. If no notice is given, the application shall be deemed complete. The Town shall process such application once complete within forty-five (45) days from being deemed complete or the application will be deemed granted.)

The Town's land use development standards should be tailored to ensure consistency with the Telecommunications Act of 1996, the Shot Clock ruling, the Spectrum Act, the 2014 Report and Order, as well as applicable State legislation.

### *Wireless Master Planning and Public Policy*

The final step in the wireless master planning process is developing public policy to address filling in network gaps while following federal and state guidelines. The policy addresses the identified gap analysis and maintains clear parameters so wireless service providers can readily and easily deploy their networks.

### *Proposed Policy Changes: Siting Preference*

Based on the votes cast by the participants in the survey 87% agree the quality of wireless telecommunications service is important to them; 71% rely on their mobile devices to great extent; 44% are not willing to tolerate worse wireless service because of aesthetics and 36% experience poor wireless service where they live. Based on the votes of the preferred structures types; 44% prefer concealed facilities over non concealed facilities, especially concerning small cell infrastructure. Interestingly, in the concealment options many indicated "no preference" or "neutral" in the second and third place choice. A form a concealment is preferred, but not if the concealment of the facility results in the industry not building the site. Overwhelmingly, the citizenry want service and they want it as soon as possible, especially in their residential neighborhood.

After reviewing the responses from the pollers, the Town identified the following goals regarding future wireless infrastructure installations within the identified gaps include:

- Providing robust wireless connectivity for residents, businesses, visitors and emergency management personnel;
- Protection of community aesthetics by planning for well sited, well designed, concealed facilities so that the infrastructure aesthetically fits into the community;
- Management over the number and placement of infrastructure and associated equipment to include buildings, compound areas and ancillary equipment, to promote efficient wireless voice, broadband and public safety service delivery and avoid an unnecessary number of telecommunications facilities;
- Addressing safety of telecommunication facilities to avoid potential damage to people and property;
- Minimizing the placement, frequency and density of new WCFs in the ROW for public safety considerations;
- Provisions to support an organized and efficient means for the wireless communication service industry and public infrastructure to reach the citizenry and subscriber base Town-wide; and
- Maximizing Town-owned and other publicly owned assets in order to set design standards and to create revenue opportunities for the overall benefit of the residents.

CityScape recommends the use of a listing of preferred type of infrastructure to fill in the network gaps. The overall goal of the listing of preferred types of infrastructure and preferred locations is to locate and design facilities so they are as inconspicuous as possible. In general, concealed antennas mounted on existing base stations and concealed new base stations are preferred to new non-concealed antennas mounted on new non-concealed facilities. Non-residential locations are preferred over residential locations because such facilities are less noticeable and more accepted by the public. And the use of public land over private land is beneficial to the entire community so it is listed as a preference before private land sites.

The most preferred option is listed first with the least preferred option last. When a lower ranked alternative is proposed the applicant must demonstrate through relevant information why the higher ranked options are not technically feasible, practical or justified given the location of the proposed facilities. This includes, but is not limited to, an affidavit by a radio frequency engineer demonstrating that despite diligent efforts to adhere to the established preferences within the geographic search area and by clear and convincing evidence it is not possible. The applicant must provide such evidence in its application in order for the application to be considered complete.

A draft Wireless Communication Facility Siting Preference is provided in Table 9. For each category below, the order of preference shall be:

1. Town-owned property
2. Other Public property
3. Private property

The sub preferences for private property shall be:

1. Non-residential districts,
2. Multi-family districts (where permitted),
3. Single-family residential districts (where permitted) on lots not used for single-family homes including but not limited to parks, open space, school, religious institutions, and public safety facilities

The Town of Chapel Hill desires to minimize the placement, frequency and density of new WCFs in the ROW for pubic safety considerations and therefore strongly encourages the siting of new WCFs on existing towers and base stations outside the ROW; followed by new base stations outside of the ROW; followed by new concealed base stations inside the ROW over new concealed dual purpose poles or new concealed poles in the ROW.

Permitted WCF Use List is as follows:

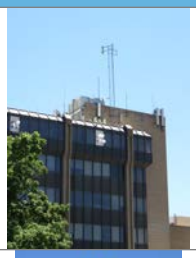
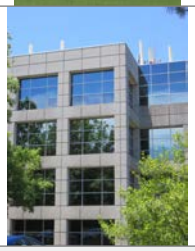
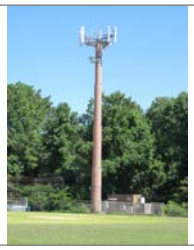
| | WIRELESS COMMUNICATION FACILITY TYPE | TOWER EXAMPLE | BASE STATION EXAMPLE | OTHER EXAMPLES |
|---|---|---|---|---|
| 1 | Collocation on existing tower or base station, located on:<br>A. Town owned land<br>B. Other publicly owned land<br>C. Private Property*<br>D. Rights-of-way |  |  |  |
| 2 | New concealed base station, located on:<br>A. Town owned land<br>B. Other publicly owned land<br>C. Private property*<br>D. Rights-of-way | No picture available |  |  |
| 3 | New non-concealed rooftop base station, located on:<br>A. Town owned land<br>B. Other publicly owned land<br>C. Private property* | Not applicable |  |  |
| 4 | New concealed dual purpose tower, located:<br>A. On Town owned land<br>B. On other publicly owned land<br>C. On private property*<br>D. In rights-of-way |  |  | Not applicable |
| 5 | New non-concealed base station, located in rights-of-way | Not applicable |  |  |
| 6 | New non-concealed tower, located on:<br>A. Town owned land<br>B. Other publicly owned land<br>C. Private property* |  |  | Not applicable |

Table 9: Wireless Communication Facility Siting Preference

**NOTE:** New non-concealed small cell or macrocell base stations is not in the table because going forward all new base stations have to be concealed. Also not in table is non-concealed towers in Rights-of-way because going forward non-concealed towers in rights-of-way are not permitted.

CityScape promotes the use the publicly owned properties for new wireless communications infrastructure. Preferences for deployments on publicly-owned land is anticipated by the FCC. In the Report and Order, paragraph 280 the FCC states,

> "We find insufficient evidence in the record to make a determination that municipal property preferences are per se unreasonably discriminatory or otherwise unlawful under Section 332(c)(7). To the contrary, most industry and municipal commenters support the conclusion that many such preferences are valid."

For this reason, Town-owned and other public properties are included as first options for consideration for the siting of new wireless infrastructure. Siting WCFs on Town-owned properties (Table 8 and Figure 27), would require at minimum a lease negotiation and potentially a Special Use Permit, depending on the type of WCF proposed.

In addition to preferred infrastructure types the draft matrix addresses the approval process. More desirable infrastructures types are recommended for administrative approval and new towers via the approval of a conditional use permit.

The proposed draft Ordinance also addresses the following items:

- Setbacks
- Noise
- Parking
- Signage
- Height
- Lighting
- Abandonment/discontinued use
- Aesthetics and visual impacts
- Public safety
- Approval processes based on state and federal rules

The draft ordinance is available in Appendix B.

# Chapter 4
## Inventory Catalog

***Procedure***

CityScape's assessment process began by conducting extensive online research and collecting assessment data from numerous sources, including but not limited to, Town wireless infrastructure permits, FCC registration and wireless service provider and tower owner direct information. Once the assessment data was collected CityScape prepared mapping using the GIS shape files provided by the Town. CityScape assessed each individual site by visiting each location and acquiring all available information about the facilities including ownership, tenants, type of structure, condition of site, signage etc. All information was assembled into a data table to create the following inventory.

***Evaluation***

Each site was inspected for verification of all data and overall site notations are included in the inventory. CityScape made observations by visual inspection only, whether each support structure has the space to accommodate potential collocations by means of antennas, ancillary equipment and other wireless antenna platform(s) as noted for each facility. Prior to mounting any new equipment, CityScape recommends that structured be analyzed by a structural engineer for their structural capability for supporting any proposed new equipment.

***Representation***

The infrastructure is listed in numeric order and shown on the map in Figure 28. Each number on the map corresponds to site specific information as provided in the catalog inventory. Table 10 represents the color coded corresponding sites. This inventory includes a photograph and vicinity map of each tower or base station, along with detailed information from all data as referenced. Information couldn't be verified or obtained by CityScape or the Town is left blank.

| OUTSIDE R-O-W | TYPE | SITE NUMBERS |
|---|---|---|
| | Non-Concealed Macro Towers | 5A, 5B, 45 |
| | Concealed Macro Towers | 8 |
| | Dual Purpose Macro Towers | 46, 47 |
| | Outside Town Jurisdiction | 49, 50, 51, 52, 53, 54, 55, 56, 57 |
| | Non-Concealed Rooftop | 6, 14, 20, 29, 30, 48 |
| | Water Tower | 3, 39 |
| | Utility Easement | 1, 2, 4 |
| | Small Cell Rooftop | 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44 |
| | Concealed Base Station | 22 |
| **INSIDE R-O-W** | **TYPE** | **SITE NUMBERS** |
| | Macro Tower | 28 |
| | Small Cell Tower | 7, 9, 12, 15, 16, 17, 18, 19 |
| | Small Cell Base Station | 10, 11 13, 21, 23, 24, 25, 26, 27 |

**Table 10: Infrastructure by Site Number**

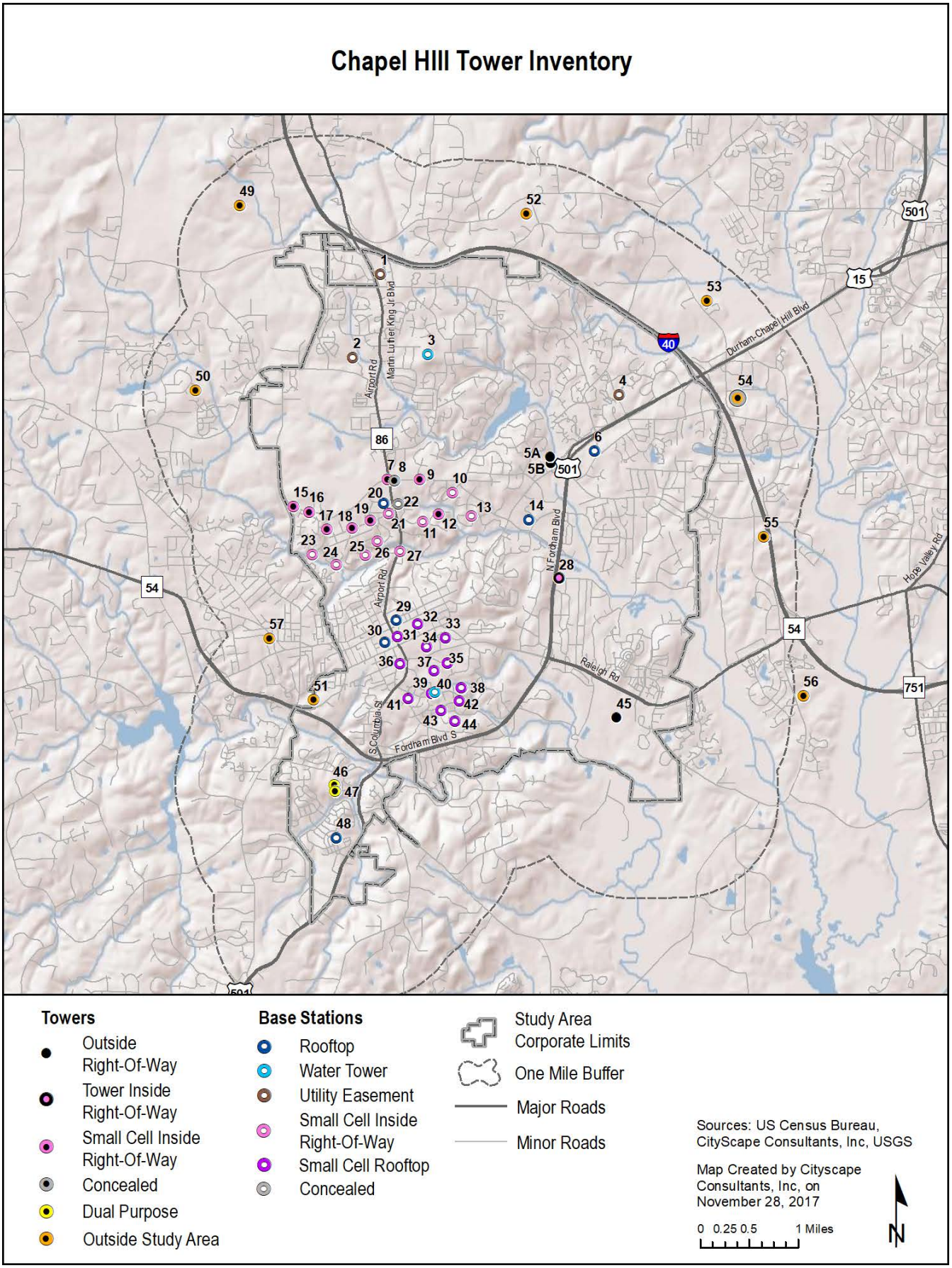
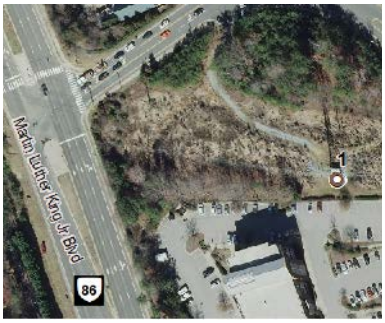



**Figure 28: Tower and Base Station Inventory**

## SITE 1: 1822 Martin Luther King Jr Boulevard

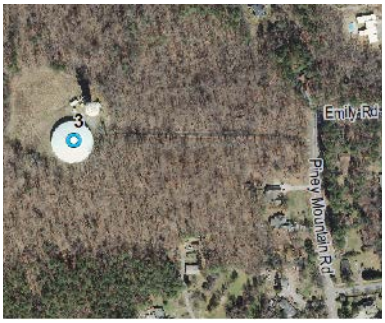



| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Utility Easement |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Utility Pole |
| **ZONING:** | MU-OI-1 | **PARCEL PIN#:** | 9880268514 |
| **FACILITY OWNER:** | Duke Energy | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9658 | **LONGITUDE:** | -79.057725 |
| **HEIGHT:** | 120’ | **COLLOCATION POTENTIAL:** | 1-2 |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 2: 200 Northern Park Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Utility Easement |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Utility Pole |
| **ZONING:** | R-2 | **PARCEL PIN#:** | 9880127274 |
| **FACILITY OWNER:** | Duke Energy | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9534172 | **LONGITUDE:** | -79.0626897 |
| **HEIGHT:** | 120’ | **COLLOCATION POTENTIAL:** | 1-2 |
| **SERVICE PROVIDERS:** | Unknown | | |
| **COMMENTS:** | No signage at the site. | | |

## SITE 3: 609 Piney Mountain Road




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Water Tank |
| **ZONING:** | R-1 | **PARCEL PIN#:** | 9880526223 |
| **FACILITY OWNER:** | Orange County Water and Sewer Authority | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | Nunn Mountain Water Storage Tank | **FCC ASR:** | |
| **LATITUDE:** | 35.9543317 | **LONGITUDE:** | -79.0488342 |
| **HEIGHT:** | 100’ | **COLLOCATION POTENTIAL:** | 0-1 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Cricket, Sprint, Verizon | | |
| **COMMENTS:** | | | |

## SITE 4: 1801 Fordham Boulevard


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Utility Easement |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Utility Pole |
| **ZONING:** | CC-C | **PARCEL PIN#:** | 9799692379 |
| **FACILITY OWNER:** | Duke Energy | **FACILITY OWNER ID:** | Tower Number 9 |
| **FACILITY OWNER SITE NAME:** | Line Index: 1E632 | **FCC ASR:** | |
| **LATITUDE:** | 35.947846 | **LONGITUDE:** | -79.013986 |
| **HEIGHT:** | 80’ | **COLLOCATION POTENTIAL:** | 0-1 |
| **SERVICE PROVIDERS:** | Sprint | | |
| **COMMENTS:** | | | |

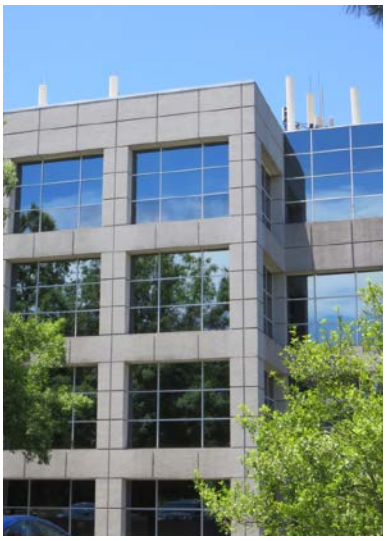
## SITE 5A: 1721 East Franklin Street

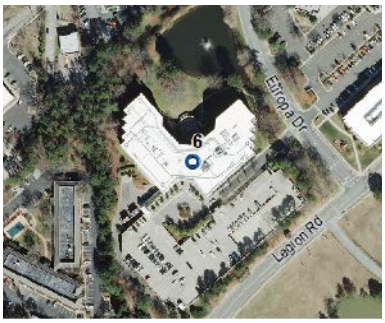

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Unknown | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower | **TYPE:** | Guy |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9799262506 |
| **FACILITY OWNER:** | Rudd Media | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | 1048275 |
| **LATITUDE:** | 35.938661 | **LONGITUDE:** | -79.026658 |
| **HEIGHT:** | 203’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | 1360 WCHL | | |
| **COMMENTS:** | Broadcast Tower | | |

## SITE 5B: 1721 East Franklin Street


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Unknown | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower | **TYPE:** | Guy |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9799261213 |
| **FACILITY OWNER:** | Rudd Media | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | 1048276 |
| **LATITUDE:** | 35.937779 | **LONGITUDE:** | -79.026459 |
| **HEIGHT:** | 203’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | 1360 WCHL | | |
| **COMMENTS:** | Broadcast Tower | | |

## SITE 6: 100 Europa Drive






| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop |
| **ZONING:** | WX-5 | **PARCEL PIN#:** | 9799464897 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9395406 | **LONGITUDE:** | -79.0185304 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Unknown | | |
| **COMMENTS:** | | | |

## SITE 7:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344975 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 4B | **FCC ASR:** | |
| **LATITUDE:** | 35.9352861 | **LONGITUDE:** | -79.0564361 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 8: 835 North Estes Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Concealed Slick Stick |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9789359195 |
| **FACILITY OWNER:** | Skyway Towers | **FACILITY OWNER ID:** | NC-08779 |
| **FACILITY OWNER SITE NAME:** | HW Air | **FCC ASR:** | 1299351 |
| **LATITUDE:** | 35.9351423 | **LONGITUDE:** | -79.0551112 |
| **HEIGHT:** | 80’ | **COLLOCATION POTENTIAL:** | 1-3 |
| **SERVICE PROVIDERS:** | T-Mobile | | |
| **COMMENTS:** | | | |

## SITE 9:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344975 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 5B | **FCC ASR:** | |
| **LATITUDE:** | 35.9352722 | **LONGITUDE:** | -79.05045 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

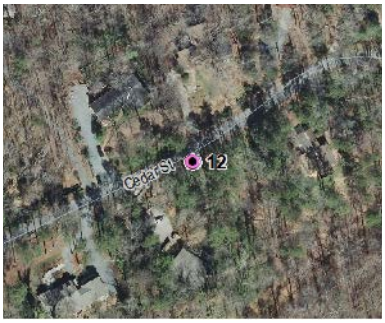
## SITE 10:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344981 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 6B | **FCC ASR:** | |
| **LATITUDE:** | 35.9333518 | **LONGITUDE:** | -79.0444444 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 11:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344990 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 9B | **FCC ASR:** | |
| **LATITUDE:** | 35.9289722 | **LONGITUDE:** | -79.0499694 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 12:

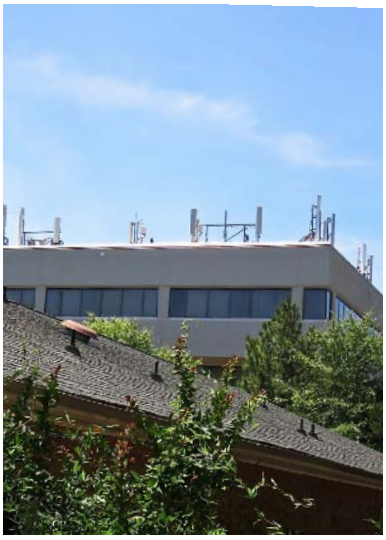



| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344987 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 8B | **FCC ASR:** | |
| **LATITUDE:** | 35.9301639 | **LONGITUDE:** | -79.0470861 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 13:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344984 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 7 | **FCC ASR:** | |
| **LATITUDE:** | 35.9298722 | **LONGITUDE:** | -79.0409861 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 14: 101 Conner Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop |
| **ZONING:** | CC | **PARCEL PIN#:** | 9799038088.004 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9293321 | **LONGITUDE:** | -79.0305049 |
| **HEIGHT:** | 50’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Unknown | | |
| **COMMENTS:** | | | |

## SITE 15:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344973 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 1B | **FCC ASR:** | |
| **LATITUDE:** | 35.9312194 | **LONGITUDE:** | -79.0736139 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 16:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344974 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 2B | **FCC ASR:** | |
| **LATITUDE:** | 35.9304167 | **LONGITUDE:** | -79.0707222 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

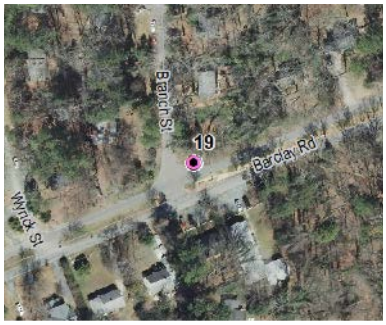
## SITE 17:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345001 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 12B | **FCC ASR:** | |
| **LATITUDE:** | 35.9278167 | **LONGITUDE:** | -79.0674917 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 18:

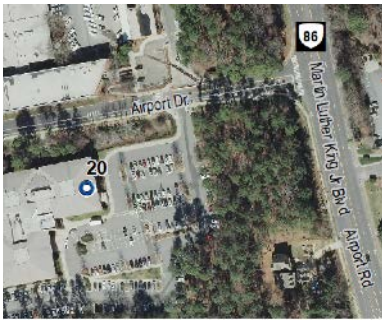

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345031 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 17 | **FCC ASR:** | |
| **LATITUDE:** | 35.928075 | **LONGITUDE:** | -79.062825 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 19:




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344997 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 11B | **FCC ASR:** | |
| **LATITUDE:** | 35.9291389 | **LONGITUDE:** | -79.0594722 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 20: 104 Airport Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9789247373 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9317306 | **LONGITUDE:** | -79.0570834 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Art Lab Building | | |

## SITE 21:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 344993 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 10B | **FCC ASR:** | |
| **LATITUDE:** | 35.9302167 | **LONGITUDE:** | -79.0561194 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

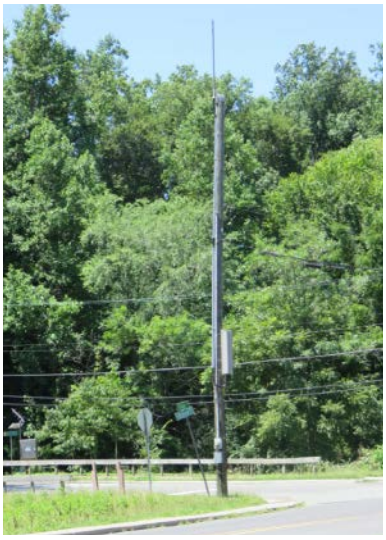
## SITE 22: 930 Martin Luther King Jr Boulevard, Unit 106


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop, Concealed Chimney |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9789348060 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.931634 | **LONGITUDE:** | -79.0544636 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | 2 |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | | | |

## SITE 23:

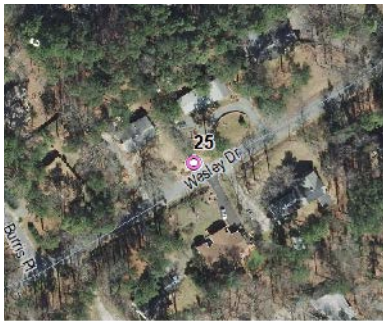

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345012 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 13B | **FCC ASR:** | |
| **LATITUDE:** | 35.9240889 | **LONGITUDE:** | -79.0701278 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 24:




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345015 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 14B | **FCC ASR:** | |
| **LATITUDE:** | 35.9225694 | **LONGITUDE:** | -79.0657778 |
| **HEIGHT:** | 40’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 25:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345029 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 16B | **FCC ASR:** | |
| **LATITUDE:** | 35.92405 | **LONGITUDE:** | -79.0603972 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 26:


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345019 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 15D | **FCC ASR:** | |
| **LATITUDE:** | 35.9261194 | **LONGITUDE:** | -79.0582361 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

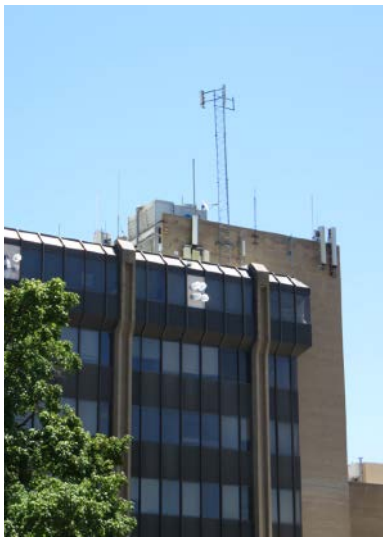
## SITE 27:

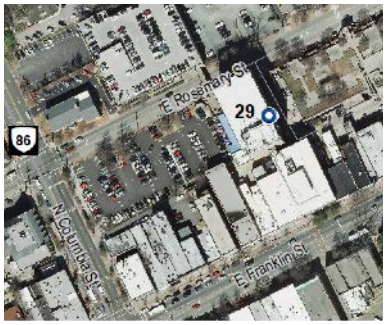

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Wood Pole |
| **ZONING:** | | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 345025 |
| **FACILITY OWNER SITE NAME:** | North Chapel Hill-Node 16 | **FCC ASR:** | Not Required |
| **LATITUDE:** | 35.9245944 | **LONGITUDE:** | -79.0541111 |
| **HEIGHT:** | 39’ | **COLLOCATION POTENTIAL:** | Possibly |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 28: 701 Cleland Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Right-Of-Way |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | R-3 | **PARCEL PIN#:** | |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 840608 |
| **FACILITY OWNER SITE NAME:** | Cleland Rd | **FCC ASR:** | 1284091 |
| **LATITUDE:** | 35.920611 | **LONGITUDE:** | -79.025 |
| **HEIGHT:** | 96’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Sprint, T-Mobile | | |
| **COMMENTS:** | | | |

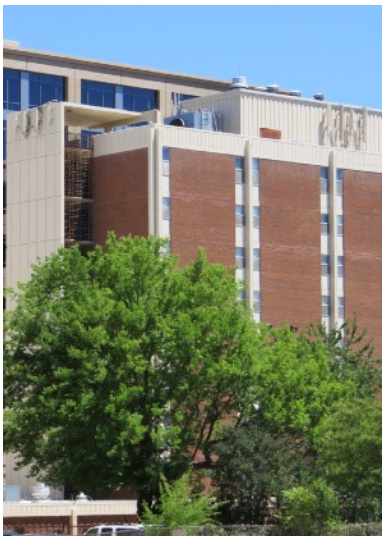
## SITE 29: 136 East Rosemary Street






| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop |
| **ZONING:** | TC-2 | **PARCEL PIN#:** | 9788377517 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.914308 | **LONGITUDE:** | -79.054793 |
| **HEIGHT:** | 70’ | **COLLOCATION POTENTIAL:** | 2 |
| **SERVICE PROVIDERS:** | Unknown | | |
| **COMMENTS:** | | | |

## SITE 30: 123 and 143 West Franklin Street

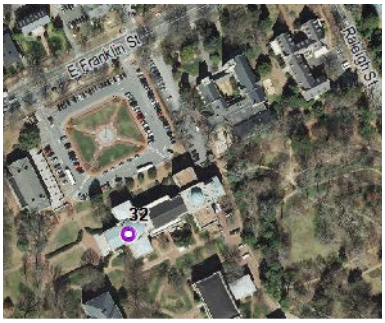



| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop |
| **ZONING:** | TC-3-C | **PARCEL PIN#:** | 9788268572.001 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.911043 | **LONGITUDE:** | -79.056822 |
| **HEIGHT:** | 90’ | **COLLOCATION POTENTIAL:** | 2 |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | East Granville Dormitory | | |

## SITE 31: 125 South Columbia Street

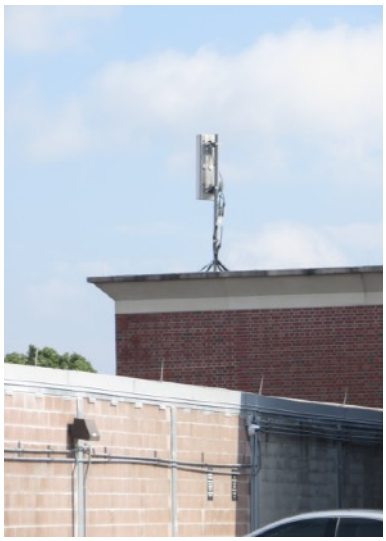

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.911884 | **LONGITUDE:** | -79.054509 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Kenan Music Building | | |

## SITE 32: 222 East Franklin Street




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788368706 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.913783 | **LONGITUDE:** | -79.050789 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Morehead Planetarium | | |

## SITE 33: 365 Paul Green Theater Drive

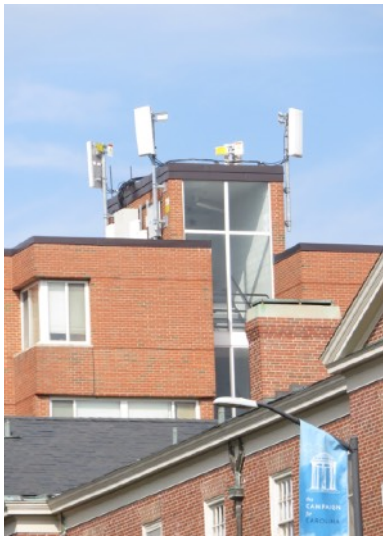


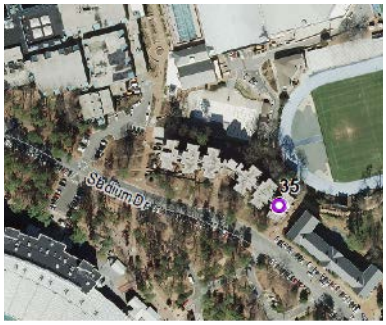

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.911707 | **LONGITUDE:** | -79.045805 |
| **HEIGHT:** | 60’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Cobb Parking Deck | | |

## SITE 34: 203 Lenoir Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell or Macro | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.910393 | **LONGITUDE:** | -79.049185 |
| **HEIGHT:** | 70’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Greenlaw Building | | |

## SITE 35: 101 Stadium Drive



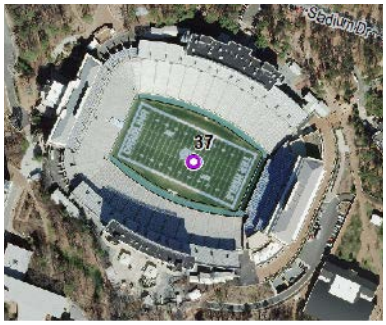



| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.908316 | **LONGITUDE:** | -79.046146 |
| **HEIGHT:** | 80’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Carmichael Building | | |

## SITE 36: 301 Pittsboro Street

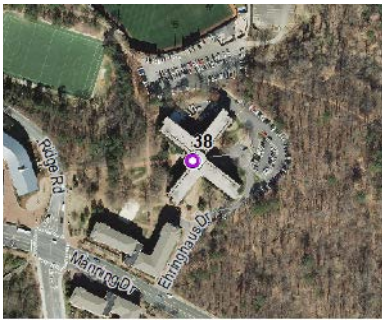

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788358360 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.907836 | **LONGITUDE:** | -79.054092 |
| **HEIGHT:** | 85’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill FedEx Global Education Building | | |

## SITE 37: 104 Stadium Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.907524 | **LONGITUDE:** | -79.047481 |
| **HEIGHT:** | 85’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Kenan Stadium | | |

## SITE 38: 450 Ehringhaus Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.904338 | **LONGITUDE:** | -79.042921 |
| **HEIGHT:** | 70’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Ehringhaus Dormitory | | |

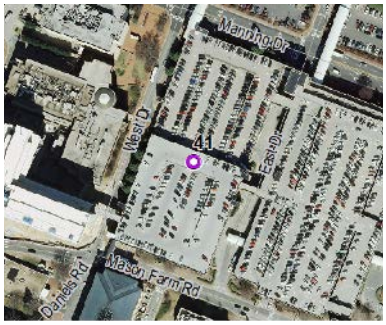
## SITE 39: 251 Manning Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Water Tank |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788268572.001 |
| **FACILITY OWNER:** | Orange County Water and Sewer Association | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.9036464 | **LONGITUDE:** | -79.047681 |
| **HEIGHT:** | 100’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire,Sprint, T-Mobile, Verizon | | |
| **COMMENTS:** | | | |

## SITE 40: 211 Manning Drive

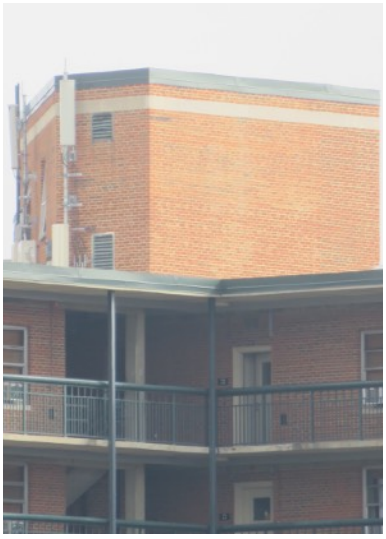

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.903427 | **LONGITUDE:** | -79.048313 |
| **HEIGHT:** | 45’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Unknown | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill ITS Manning Building | | |

## SITE 41: 140 Manning Drive



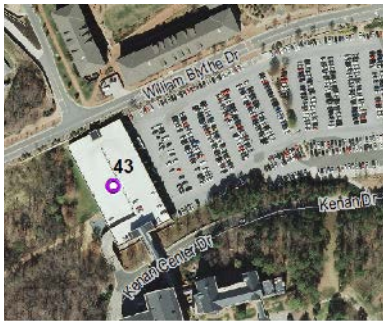

| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.902676 | **LONGITUDE:** | -79.052585 |
| **HEIGHT:** | 60’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Cardinal Parking Deck | | |

## SITE 42: 515 Hinton James Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.90233 | **LONGITUDE:** | -79.043437 |
| **HEIGHT:** | 110’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Likely Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Hinton James Dormitory | | |

## SITE 43: 305 Kenan Center Drive




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788543697 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | 155711 |
| **FACILITY OWNER SITE NAME:** | Node 10 | **FCC ASR:** | |
| **LATITUDE:** | 35.900949 | **LONGITUDE:** | -79.046574 |
| **HEIGHT:** | 55’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | Verizon | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill School of Business Parking Deck. Good signage at this location. | | |

## SITE 44: 300 Skipper Bowles Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Base Station, Small Cell | **TYPE:** | Rooftop |
| **ZONING:** | OI-4 | **PARCEL PIN#:** | 9788628174 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.899387 | **LONGITUDE:** | -79.044012 |
| **HEIGHT:** | 60’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | | | |
| **COMMENTS:** | University of North Carolina at Chapel Hill Dean E. Smith Student Activities Center | | |

## SITE 45: 100 Friday Center Drive


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Lattice |
| **ZONING:** | OI-2 | **PARCEL PIN#:** | 9798518134 |
| **FACILITY OWNER:** | University of North Carolina at Chapel Hill | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | 10048566 |
| **LATITUDE:** | 35.899928 | **LONGITUDE:** | -79.014493 |
| **HEIGHT:** | 195’ | **COLLOCATION POTENTIAL:** | 0-1 |
| **SERVICE PROVIDERS:** | Alltel, AT&T, Sprint, T-Mobile, Verizon, WUNC | | |
| **COMMENTS:** | | | |

## SITE 46: 225 Culbreth Road


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole Light Stanchion |
| **ZONING:** | R-2 | **PARCEL PIN#:** | 9777999032 |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 814444 |
| **FACILITY OWNER SITE NAME:** | Culbreth | **FCC ASR:** | |
| **LATITUDE:** | 35.889839 | **LONGITUDE:** | -79.066067 |
| **HEIGHT:** | 80’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | Verizon | | |
| **COMMENTS:** | | | |

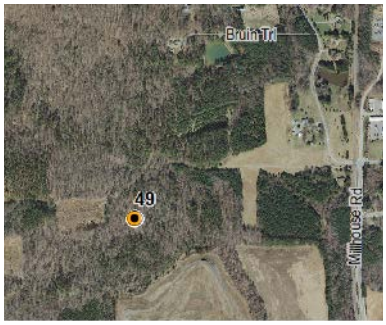
## SITE 47: 225 Culbreth Road


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Public Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole Light Stanchion |
| **ZONING:** | R-2 | **PARCEL PIN#:** | 9777999032 |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 813283 |
| **FACILITY OWNER SITE NAME:** | Chapel Hill 368-207 | **FCC ASR:** | 1281490 |
| **LATITUDE:** | 35.8888889 | **LONGITUDE:** | -79.065917 |
| **HEIGHT:** | 81’ | **COLLOCATION POTENTIAL:** | 1 |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | Meter box for Cricket is empty. | | |

## SITE 48: 410 Market Street, Unit 430


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | Yes | **LOCATION:** | Private Property |
| **CATEGORY:** | Base Station, Macro | **TYPE:** | Rooftop |
| **ZONING:** | NC-C | **PARCEL PIN#:** | 9787055943 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.881941 | **LONGITUDE:** | -79.0656842 |
| **HEIGHT:** | 30’ | **COLLOCATION POTENTIAL:** | Unlimited |
| **SERVICE PROVIDERS:** | T-Mobile | | |
| **COMMENTS:** | | | |

## SITE 49: 1550 Bruin Trail (Orange County)




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | RB | **PARCEL PIN#:** | 9871503254 |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 815051 |
| **FACILITY OWNER SITE NAME:** | HWY 86 | **FCC ASR:** | 1004986 |
| **LATITUDE:** | 35.976019 | **LONGITUDE:** | -79.083444 |
| **HEIGHT:** | 178’ | **COLLOCATION POTENTIAL:** | 2 |
| **SERVICE PROVIDERS:** | AT&T, Verizon, WQDD | | |
| **COMMENTS:** | | | |

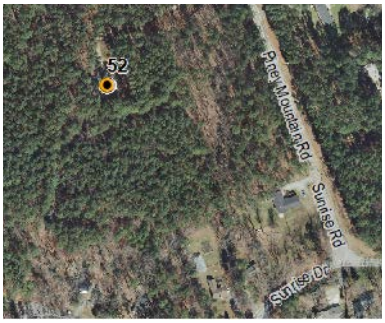
## SITE 50: 200 Redfoot Run Drive (Carrboro)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Lattice |
| **ZONING:** | R2 | **PARCEL PIN#:** | 9870205096 |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 814328 |
| **FACILITY OWNER SITE NAME:** | Chapel Hill (Rev) (Cellular) | **FCC ASR:** | 1002807 |
| **LATITUDE:** | 35.948528 | **LONGITUDE:** | -79.091472 |
| **HEIGHT:** | 220’ | **COLLOCATION POTENTIAL:** | 1-2 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Sprint, T-Mobile, Verizon | | |
| **COMMENTS:** | | | |

## SITE 51: 515 S Greensboro Road (Carrboro)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | M1 | **PARCEL PIN#:** | 9778839403 |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | NC-097443 |
| **FACILITY OWNER SITE NAME:** | Carrboro NC | **FCC ASR:** | 1288292 |
| **LATITUDE:** | 35.9024722 | **LONGITUDE:** | -79.0698861 |
| **HEIGHT:** | 180’ | **COLLOCATION POTENTIAL:** | 0-1 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Cricket, Nextel, T-Mobile | | |
| **COMMENTS:** | | | |

## SITE 52: 7005 Sunrise Road (Orange County)




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | RB | **PARCEL PIN#:** | 9890099717 |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | 272832 |
| **FACILITY OWNER SITE NAME:** | Wooden Bridge | **FCC ASR:** | 1255194 |
| **LATITUDE:** | 35.9748111 | **LONGITUDE:** | -79.0310556 |
| **HEIGHT:** | 146’ | **COLLOCATION POTENTIAL:** | 2 |
| **SERVICE PROVIDERS:** | AT&T, Verizon | | |
| **COMMENTS:** | | | |

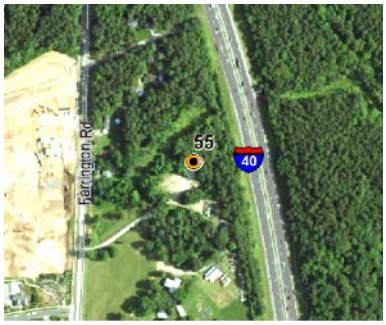
## SITE 53: 2883 Mt Moriah Road (Durham)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Guy |
| **ZONING:** | RS-20 | **PARCEL PIN#:** | Outside County |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 870595 |
| **FACILITY OWNER SITE NAME:** | Chapel Hill (New Moriah Rd) | **FCC ASR:** | 1007494 |
| **LATITUDE:** | 35.96183 | **LONGITUDE:** | -78.998 |
| **HEIGHT:** | 330’ | **COLLOCATION POTENTIAL:** | 0 |
| **SERVICE PROVIDERS:** | AT&T, Cricket, Light Squared, T-Mobile, Verizon, Satellite XM Radio | | |
| **COMMENTS:** | | | |

## SITE 54: 3919 Mt Moriah Road (Durham)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Concealed, Monopine |
| **ZONING:** | RR | **PARCEL PIN#:** | Outside County |
| **FACILITY OWNER:** | American Tower Corporation | **FACILITY OWNER ID:** | NC-273699 |
| **FACILITY OWNER SITE NAME:** | Old Chapel Hill Rd NC | **FCC ASR:** | 1276416 |
| **LATITUDE:** | 35.94738 | **LONGITUDE:** | -78.992346 |
| **HEIGHT:** | 124’ | **COLLOCATION POTENTIAL:** | 1-2 |
| **SERVICE PROVIDERS:** | AT&T | | |
| **COMMENTS:** | | | |

## SITE 55: 5103 Farrington Road (Durham)




| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole/Guy |
| **ZONING:** | F/J-B | **PARCEL PIN#:** | Outside County |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 813607 |
| **FACILITY OWNER SITE NAME:** | Terrace 368-036 | **FCC ASR:** | 1281062 |
| **LATITUDE:** | 35.926778 | **LONGITUDE:** | -78.987639 |
| **HEIGHT:** | 159’ | **COLLOCATION POTENTIAL:** | 0 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Nextel, Sprint, T-Mobile, Verizon | | |
| **COMMENTS:** | Meter box for Time Warner Cable is empty. | | |

## SITE 56: 6605 Farrington Road (Durham)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | Private Property |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | F/J-B | **PARCEL PIN#:** | Outside County |
| **FACILITY OWNER:** | Crown Castle International | **FACILITY OWNER ID:** | 812834 |
| **FACILITY OWNER SITE NAME:** | Pipeline | **FCC ASR:** | 1280174 |
| **LATITUDE:** | 35.903083 | **LONGITUDE:** | -78.980306 |
| **HEIGHT:** | 155’ | **COLLOCATION POTENTIAL:** | 0 |
| **SERVICE PROVIDERS:** | AT&T, Sprint, T-Mobile, Time Warner Cable, Verizon | | |
| **COMMENTS:** | | | |

## SITE : 57 301 West Main Street (Carrboro)


| | | | |
|---|---|---|---|
| **ELIGIBLE:** | | **LOCATION:** | |
| **CATEGORY:** | Tower, Macro | **TYPE:** | Monopole |
| **ZONING:** | | **PARCEL PIN#:** | 9890099717 |
| **FACILITY OWNER:** | | **FACILITY OWNER ID:** | |
| **FACILITY OWNER SITE NAME:** | | **FCC ASR:** | |
| **LATITUDE:** | 35.911599 | **LONGITUDE:** | -79.077897 |
| **HEIGHT:** | 140’ | **COLLOCATION POTENTIAL:** | 0 |
| **SERVICE PROVIDERS:** | AT&T, Clearwire, Public Safety, Sprint, T-Mobile | | |
| **COMMENTS:** | | | |