Wireless Communication Master Plan

Kick Off Meeting

Fauquier County

Susan Rabold, Project Manager

CityScape Consultants, Inc.

May 24, 2017

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CityScape Consultants, Inc.

- Company started in Florida in 1997
- Offices in Florida, Georgia, North Carolina and Washington, DC
- Exclusively serve government clientele with unbiased information
- Company goals & objectives consistent with Federal Statutory, Decisional and Regulatory Law
- Assists local government with:
  - Wireless Master Planning
  - Site Application Engineering review
  - Ordinance review
  - Leasing and Development of Public Land

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CityScape Consultants, Inc.

Management Team

- Richard Edwards, President, Partner, Engineer
- Anthony Lepore, Esq., Vice President, Partner
- Kay Miles, Vice President, Partner
- Jonathan Edwards, P.E., Principal Engineer
- Susan Rabold, Project Manager
- Elizabeth Herington-Smith, Government Relations/Marketing Manager

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Introduction to Wireless Telecommunications

The Wireless Industry

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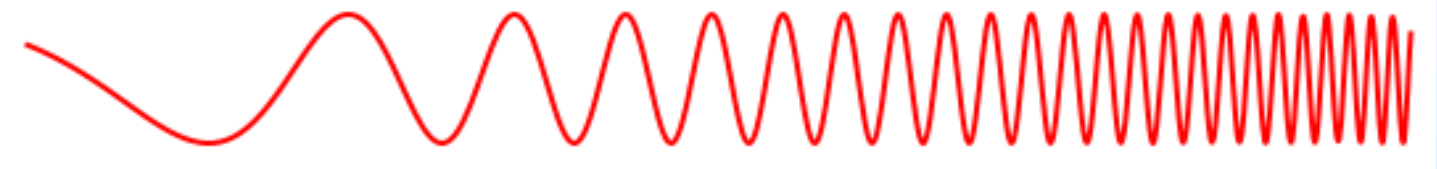
Wireless Telecommunications History

- 1G service provided voice calls only.
- 2G service included voice, texting and data.
- 3G service offered in early 2000's improved data speeds.
- iPhone in 2007 offers thousands of applications.
- 4G service on AWS and LTE began around 2010 and increased data speeds; included new 700 & 2100 MHz frequencies.
  - Even smaller handsets, increased battery power and offer more features
- Wireless phones for voice & Broadband for Internet

Site Location Considerations – *Spectrum*, Coverage, Capacity



- Wireless service providers do not all use the same frequencies.
- Lower frequencies (700, 850 MHz) propagate farther than higher frequencies (1900, 2100 MHz).
- Spacing of cell sites is influenced greatly by the frequencies that a service provider can use in an area.

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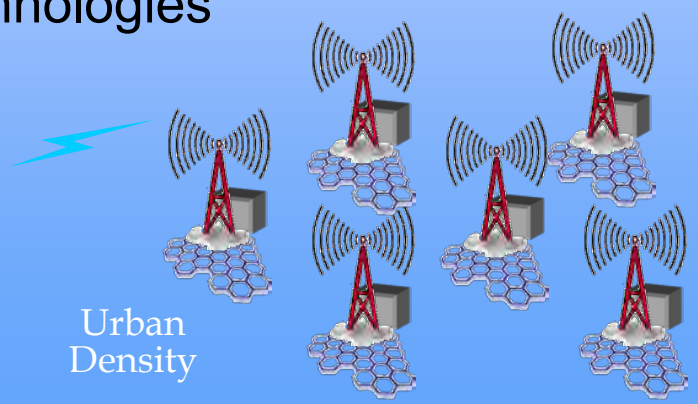
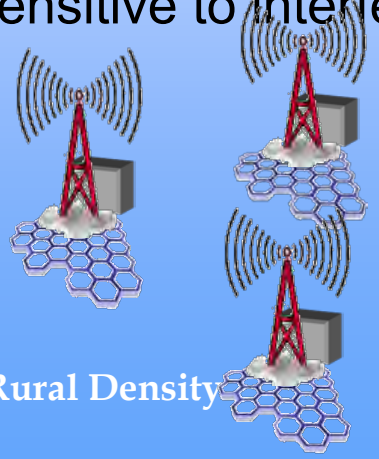
Site Location Considerations – Spectrum, *Coverage*, Capacity

- More people with more smartphones using data intensive applications such as Facetime, streaming HD video, Internet, Pandora, Facebook, etc.
  - 39% of U.S. households have “cut the cord” – they are wireless only
  - 45 Million Americans use mobile phones as their primary internet access devise
- Existing towers reach service provider capacity and create demand for more cell towers
- LTE has stricter alignment tolerances and is more sensitive to interference than older technologies





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Source: CTIA Wireless Quick Facts, 2015

Site Location Considerations – Spectrum, Coverage, ***Capacity***

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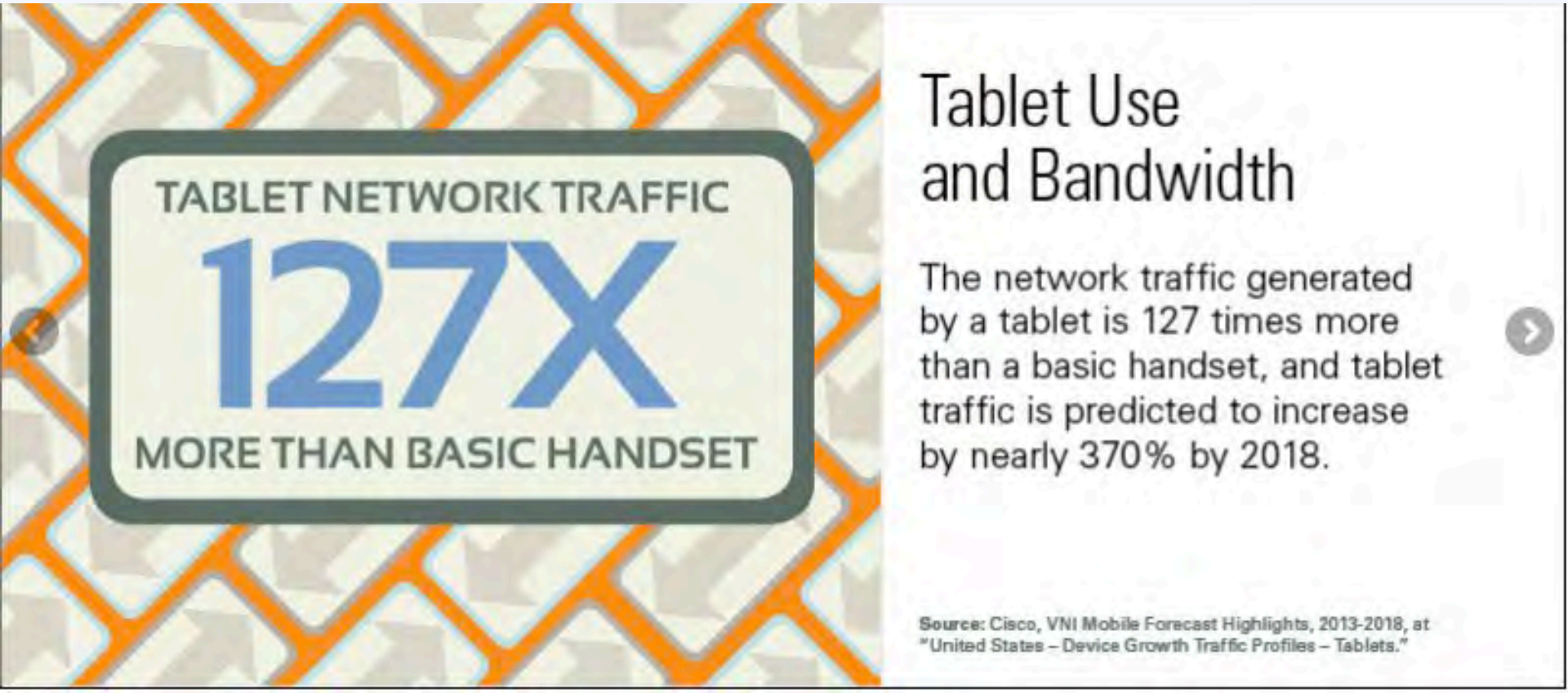
Site Location Considerations – Spectrum, Coverage, ***Capacity***



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Source: CTIA Wireless Quick Facts, 2015

Infrastructure

Microwave commonly used for backhaul

Panel Antennas with RRU's

Omni-directional whip type antenna

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Tower and Base Station Ground Equipment

Typical Low Frequency (700-800 MHz) Ground Equipment

Typical High Frequency (1900-2400 MHz) Ground Equipment

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Non-Concealed Macro Towers

Monopole
Self Support

Lattice
Self Support

Guy
With Support

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Collocation on Macro Towers

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Concealed Freestanding Macro Towers

Flag Pole

Slick Stick

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Concealed Freestanding Macro Towers

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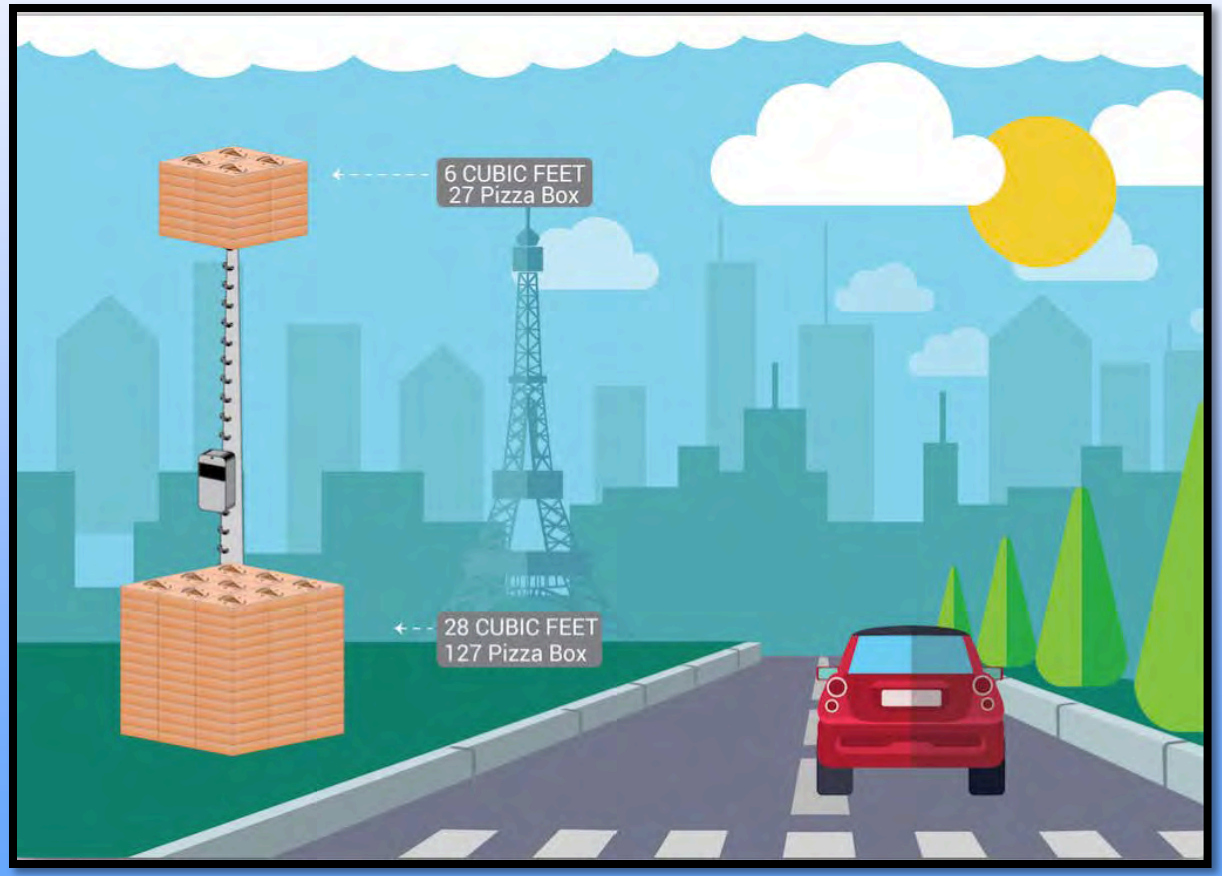
Small Cell Facility

Antenna no more than six cubic feet;
All other equipment no more than 28 cubic feet in volume



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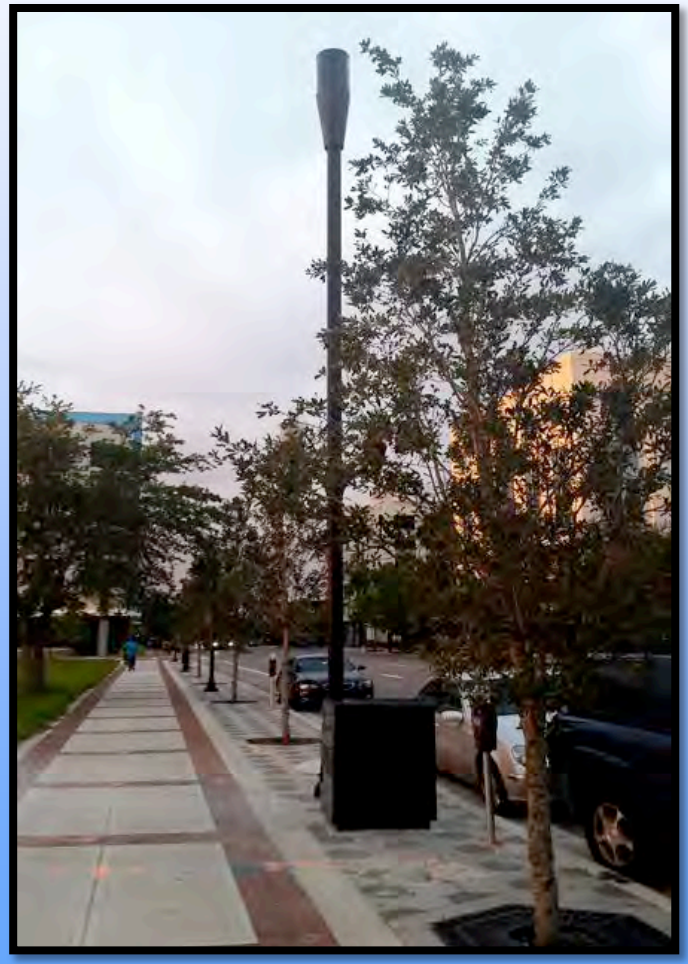
Micro-Wireless Facility

Cell facility no larger then 24” in length, 15” in width and 12” in height with an exterior antenna no longer than 11”



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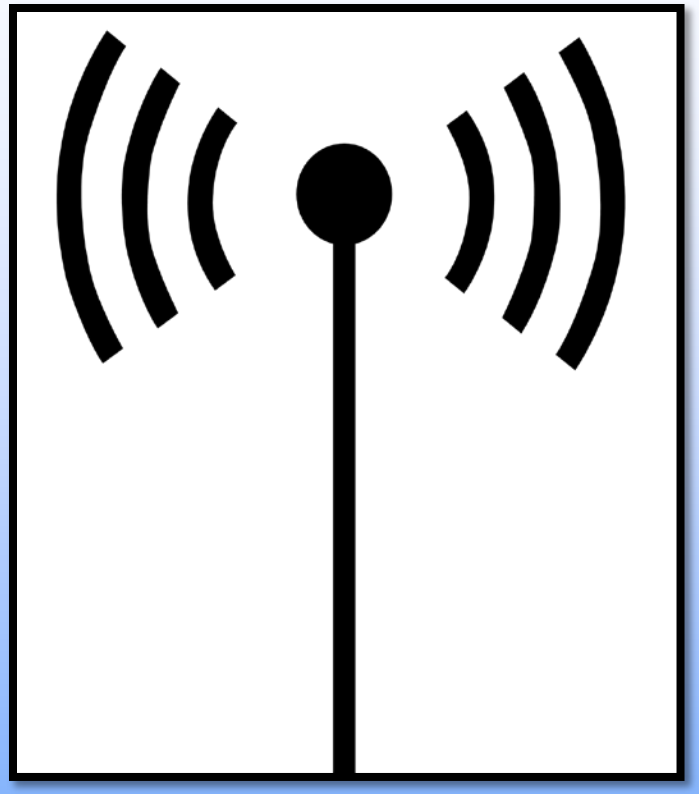
Challenges of Cell Siting

- Availability of potential tower sites to provide coverage where people are: living, working, playing…
- Speed to market
- Access to subscriber base
- Structural analysis on existing towers



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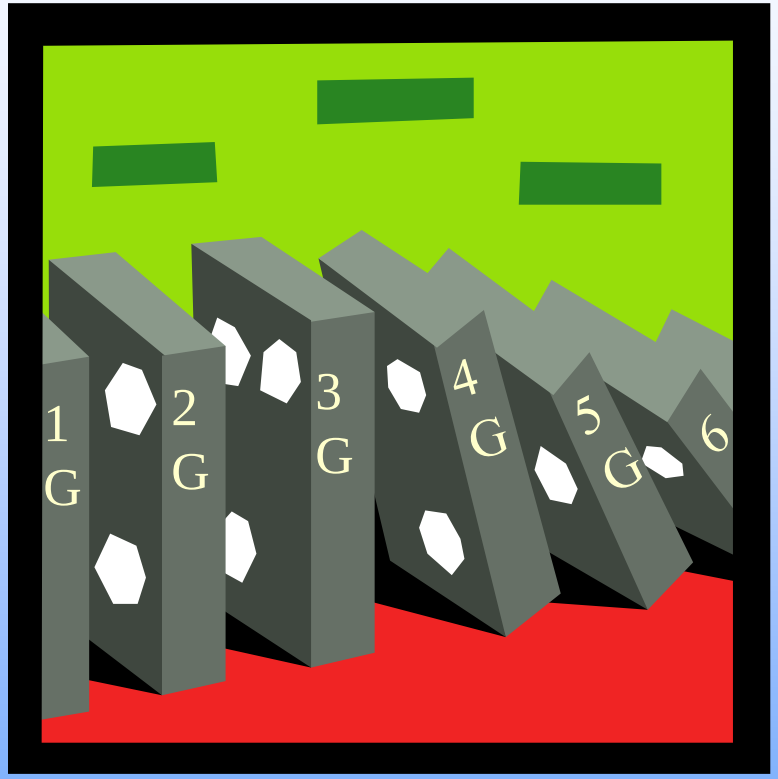
Projected Network Demand

(by the year 2020 wired services may be virtually non-existent)



- Airtime minutes to increase as wired lines are replaced
- Airtime minutes increase as more services are added to the handsets
- Emerging technologies of wireless internet and mobile commerce to compete and coexists with traditional wireless telecommunications services
- More wireless infrastructure necessary to meet demands placed on existing networks

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Wireless Telecommunications Regulatory Perimeters

Federal Statutory, Decisional and Regulatory Law As it Relates to Zoning

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Federal Legislation Section 704

47 USC §332(c)(7) (a/k/a Section 704 of the Telecommunications Act of 1996)

- Preserves local zoning authority but requires local government to regulate in a manner that does not:
  - discriminate among providers of functionally equivalent services
  - prohibit or have the effect of prohibiting the provision of personal wireless services
- Requires local government to make written decisions on siting applications that are based on substantial evidence and not on speculation or because of federally preempted reasons (such as concerns about Radio Frequency ("RF")

Federal Legislation Section 704

- Must allow for the carriers to deploy their systems
- Must act expeditiously in these requests
- Must treat providers equally by providing equal access to "functionally equivalent services" (Cellular/PCS/Data)
- Local government's land development standards may not supersede or undermine areas of federal jurisdiction
- Enables Federal Government to use Federal property, rights-of-way and easements for leasing for new telecommunications infrastructure
  - Sets precedence for use of public property

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What Cannot be Regulated

- Requirements for tower lighting and markings are exclusively regulated by the FAA/FCC
- Local government may be able to require dual lighting systems and can require support structures to be lighted as long as they comply with FAA codes

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What Cannot Be Regulated

Radio Frequency emissions are exclusively regulated by federal standards

- RF from antenna is non-ionizing radiation
- The FCC's Office of Engineering Technology (OET) issued a Bulletin detailing the regulations for RF Exposure (OET Bulleting No. 65).
  - Industry has to comply with the standards in this bulletin
  - Local government can only require a statement or a copy of the studies to be submitted with an application to ensure compliance; but cannot regulate beyond this perimeter

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FCC Report and Order

(Released October 21, 2014 in W.T. Docket 13-238 commonly called Report and Order

The Spectrum Act

Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, referenced as the "Spectrum Act" was enacted by Congress to promote wireless deployments of broadband for public safety and commercial purposes. As stated in the Spectrum Act,

> "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."

Eligible Facility Request – means any request for modification of an existing tower or base station that does not substantially change the physical dimensions of such tower or base station involving: collocation; removal of transmission equipment; or replacement of transmission equipment.

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FCC Report and Order

(Released October 21, 2014 in W.T. Docket 13-238 commonly called Report and Order

Transmission Equipment means equipment that facilitates transmission of any Commission-licensed or authorized wireless communications service…", including but not limited to antennas, receivers, cables, cabinets and power supplies.

Eligible Support Structure means any tower or base station provided that is is **existing** (means reviewed and approved under the applicable zoning or siting process…) at the time the relevant application is filed with the State or local government.

- **Wireless Tower** means a structure built for the sole or primary purpose of supporting any commission licensed or authorized antennas and their associated facilities

- **Base Station** means equipment and non-tower supporting structure at a "fixed" location that enable licensed or authorized wireless communications between user equipment and a communications network

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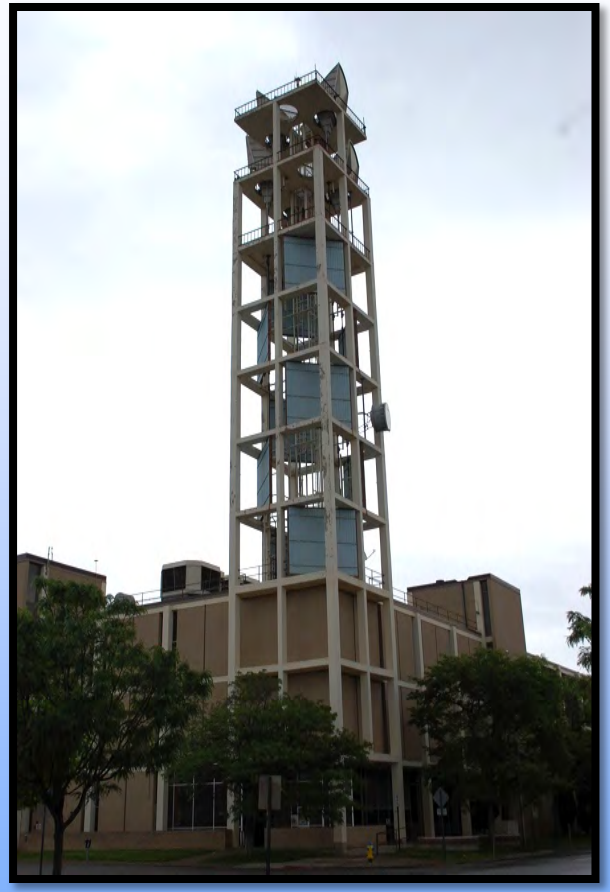
Examples of Transmission Equipment

Towers (concealed and non concealed) for PWSF



Commercial and Private Mobile

Amateur Radio

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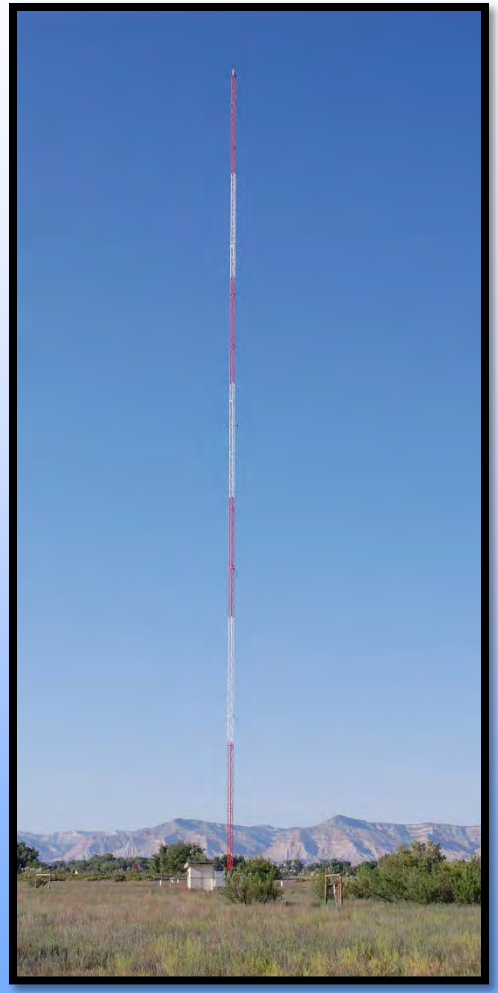
Examples of Transmission Equipment



Broadcast Facilities

Microwave

Satellite

Emergency Services

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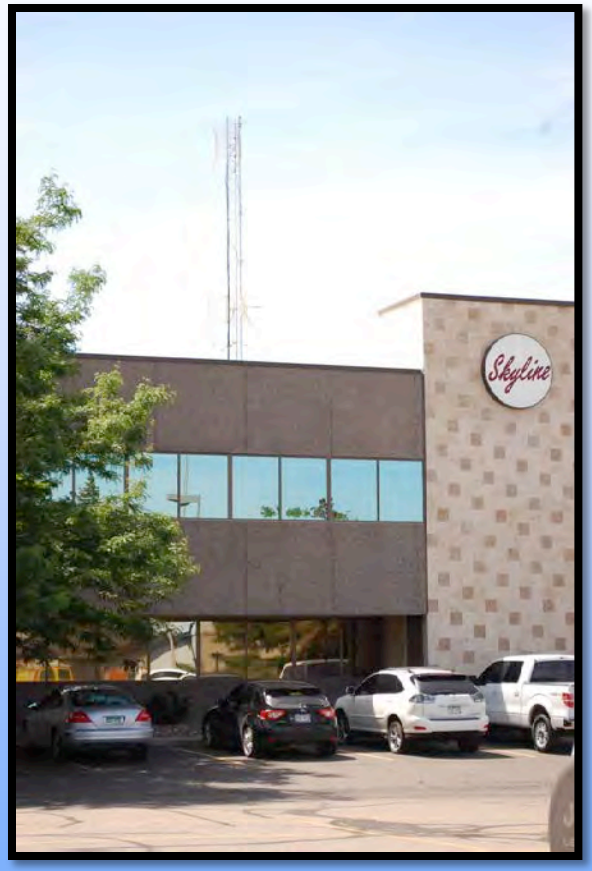
Examples of Transmission Equipment



Commercial and private mobile (dispatch radio systems)

Wi-Fi Hot Spots

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Examples of Towers and Base Station

Towers

Base Station

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FCC's Report and Order Clarification & Implementation of Section 6409(a) of the Spectrum Act

- A modification substantially changes the physical dimensions of a tower or base station (and therefore falls outside Section 6409 (a) if it meets any one of the following items:
  - For towers outside the public rights-of-way (ROW), it increases the height of the tower by more than 20' or 10%, whichever is greater;
  - For those towers in the ROW and for all base stations, it increases the height of the tower or base station by more than 10% or 10', whichever is greater;

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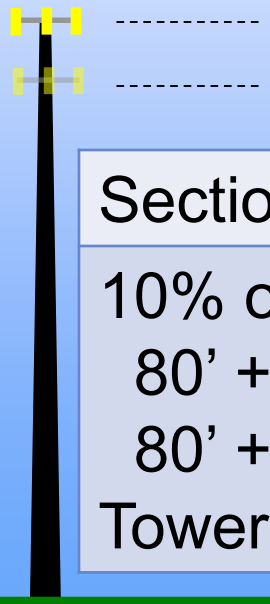
Vertical Height Increase Example

96” to 105”
antenna heights
(average 8’3”)



20’ increase to 100’ new height
80′ original tower height

Section 6409(a)
10% of 80’ is 8’ 80’ + 8’ = 88’ 80’ + 20’ = 100’ Tower could increase to maximum of 100’*

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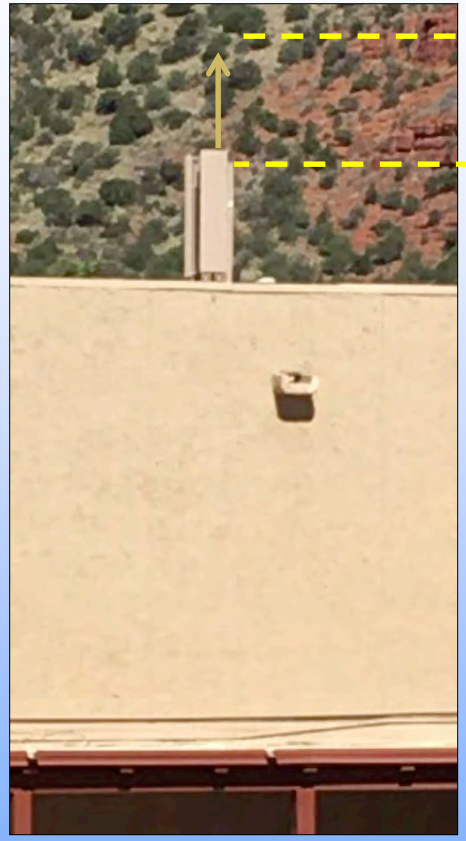
* Still subject to FAA height increase approval

Example of Base Station Modification



10’ increase to 40’ new height

30′ original base station height

Section 6409(a)
10% of 30’ is 3’ 30’ + 10’ = 40’ (this is the greater) Base Station could increase to maximum of 40’* and meet definition of substantial

- Area of Base Station is entire rooftop once approved.
- Cannot require additional concealment if original “eligible facility” is not concealed.

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* Still subject to FAA height increase approval

FCC's Report and Order Clarification & Implementation of Section 6409(a) of the Spectrum Act

- A modification substantially changes the physical dimensions of a tower or base station (and therefore falls outside Section 6409 (a) if it meets any one of the following items:
  - For towers outside the ROW, it protrudes from the edge of the tower by more than 20', or more than the width of the tower structure at the level of the appurtenance, whichever is greater; for those towers in the rights-of-way and for all base stations, it protrudes from the edge of the structure more than 6';

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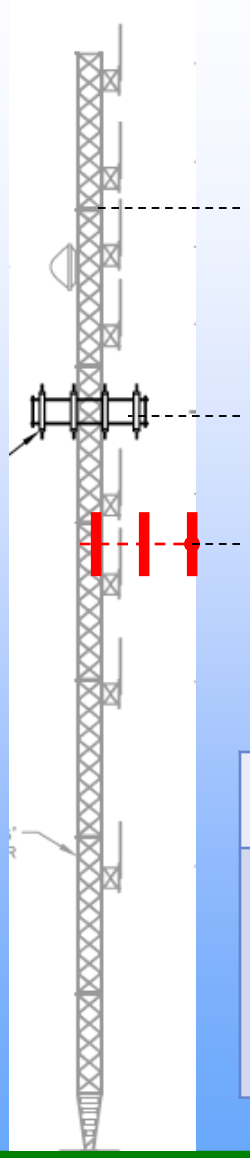
Tower Width Increase Example Outside ROW



Width of tower is 3’

Appurtenance is 10’ from edge of tower

Appurtenance could extend up to 20’ from edge of tower

Section 6409(a)
• 20’ from edge of tower or • Width of tower at level of appurtenance • Whichever is greater

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FCC's Report and Order Clarification & Implementation of Section 6409(a) of the Spectrum Act

- It involves installation of more than the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets;
- It entails any excavation or deployment outside the current site of the tower or base station; or
- It would defeat the existing concealment elements of the tower or base station; or
- It does not comply with conditions associated with the prior approval 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.

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FCC's Report and Order Clarification & Implementation of Section 6409(a) of the Spectrum Act

- Local government can require compliance with generally applicable building, structural, electrical and safety codes or with other laws codifying objective standards reasonably related to health and safety.
- Collocations meeting the standards as defined in the Order and/or Section 6409 are to be approved within a 60 day time frame, excluding any tolling periods for incomplete applications

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FCC's Report and Order Clarification & Implementation of Section 6409(a) of the Spectrum Act

- If existing wireless tower or base station was built without local review, or wasn't required to have local review, or doesn't have existing equipment that required local review, *no obligation for local authority to approve collocation under Section 6409 or the Order.*
  - The local government has 90 days (per the 2009 Shot Clock) to decide to approve or deny requested modifications in this case.

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Code of Virginia, Chapter 22 of Title 15.2 an article numbered 7.2 Zoning for Wireless Communications Infrastructure 4/26/17

- Locality shall not require a special exception, special use permit, or variance for any small cell on an existing structure
  - May require administrative review
  - Allow an applicant to submit up to 35 permit requests on a single application
- 60 days to review and approve or deny applications; additional 30 days if agreed by both applicants. Only reasons for disapproval:
  - Potential interference with other existing or already planned for public safety
  - Public safety or other critical public service needs
  - On publicly owned or controlled property
  - Conflict with historic property

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Code of Virginia, Chapter 22 of Title 56 Chapter 15.1 Wireless Communications Infrastructure 4/26/17

- Access to the public rights-of-way by wireless service providers and wireless infrastructure providers
- 60 days to review and approve or deny application; additional 30 days if agreed by both applicants
- Maximum fee for review $250
- May construct new wireless support structures in the rights-of-way
- May replace existing poles with new wireless support structures

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Examples of Installations in Right-of-Way in the County

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Introduction to Wireless Communications Master Planning

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What is a Wireless Telecommunication Master Plan

The Goal of the Master Plan is to facilitate the creation of an optimized wireless telecommunications environment that is efficient, capable, and meets the long-term forecasted user requirements of the businesses, residents and visitors in Fauquier County while minimizing visual impact of the new infrastructure.

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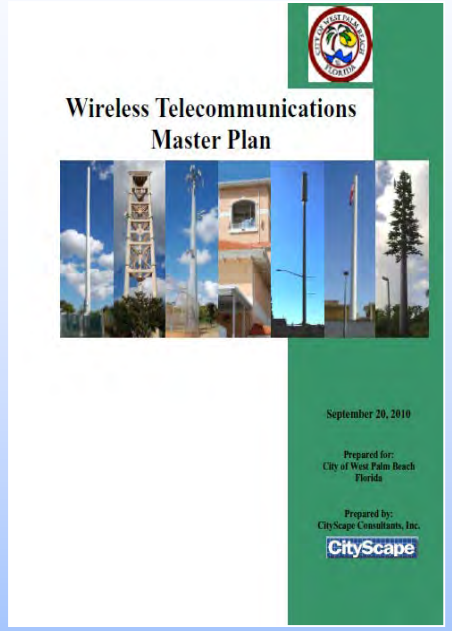
Included in a Wireless Master Plan

Engineering Working with Variables

- Providers & Tower Owners
- Topography
- Population Trends
- Transportation Networks
- Location of Subscriber Base
- Climate
- Future Network Requirements



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Wireless Communications Mapping

- Theoretical Root Mean Square Maps
- Theoretical Composite Maps
- With Consideration of Topography, Vegetative Cover and Population Density for Low and High Frequency; and Fill-In Sites with 10-Year Projection Maps with same variables

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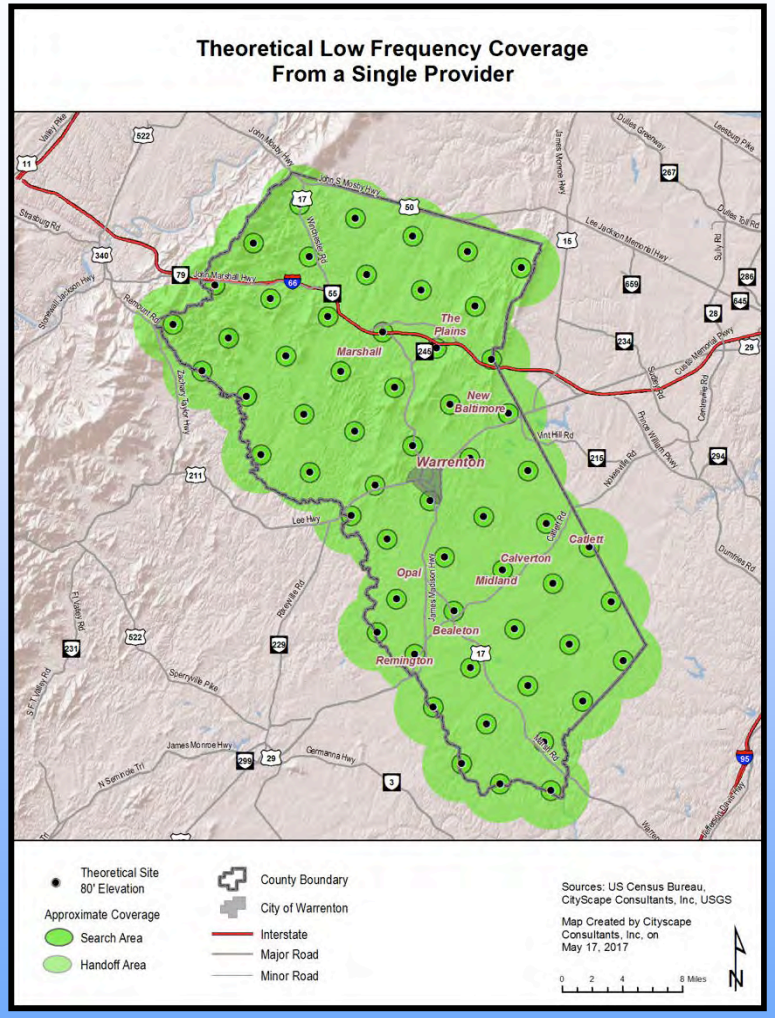
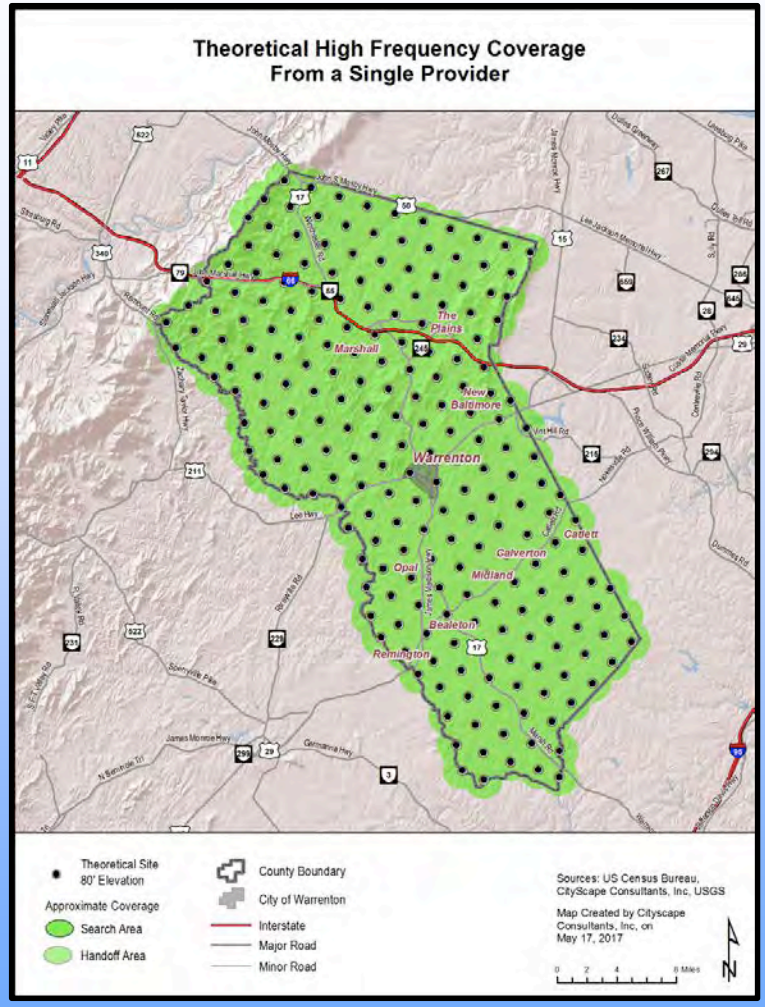
Theoretical RMS Maps



59 Low Frequency Sites



224 High Frequency Sites

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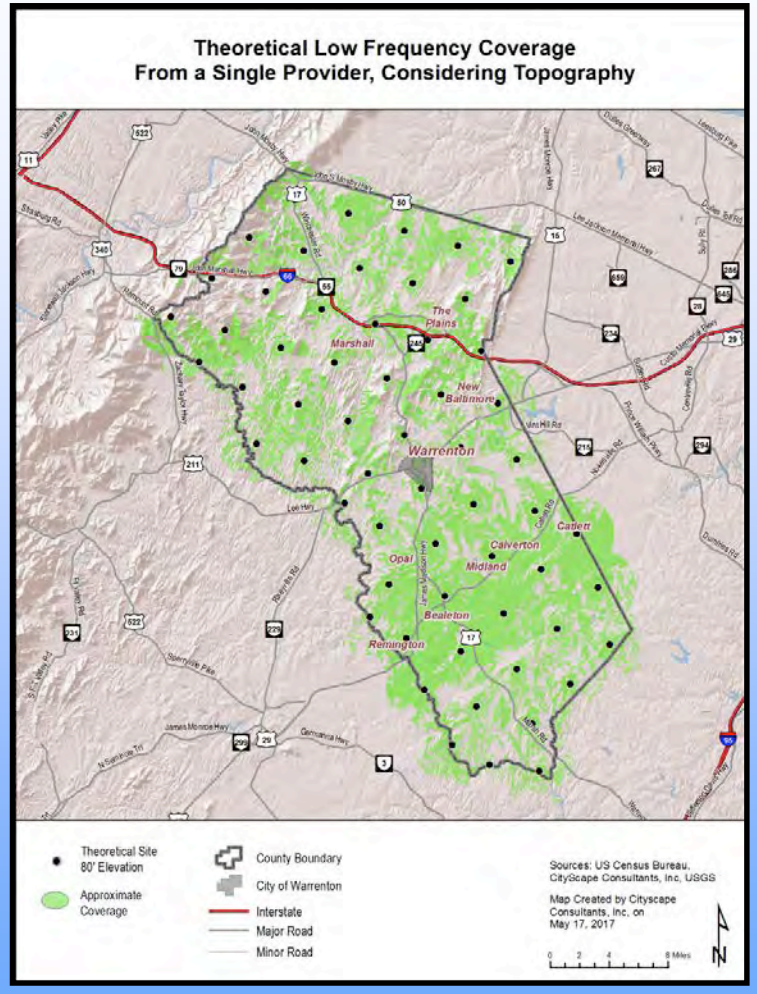
Theoretical RMS Maps With Terrain



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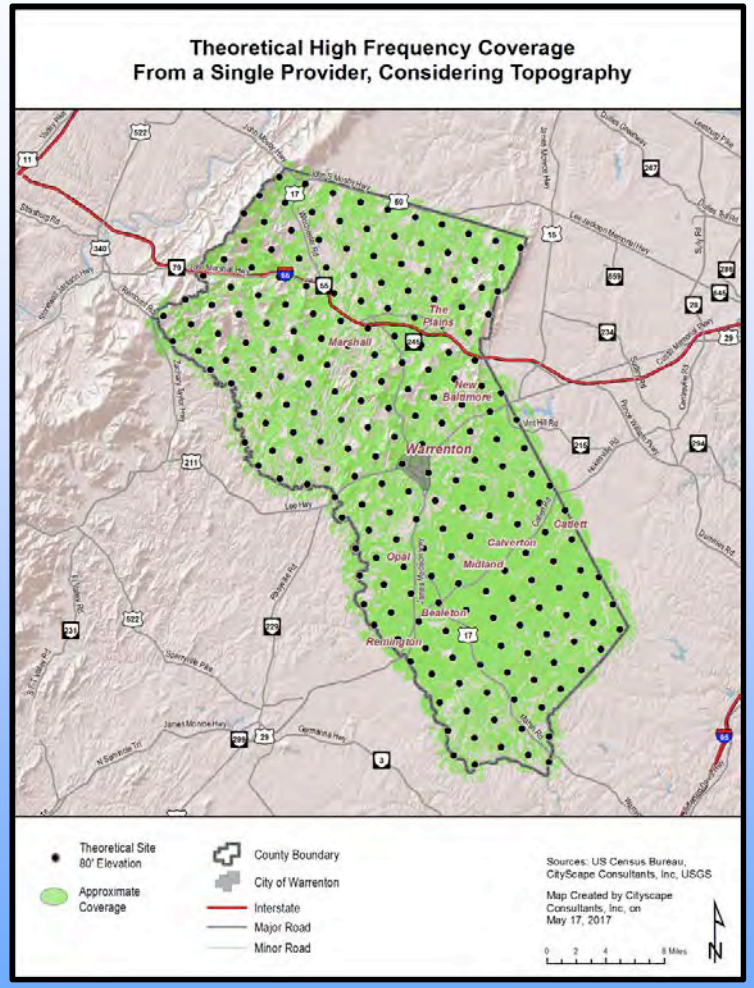

224 High Frequency Sites

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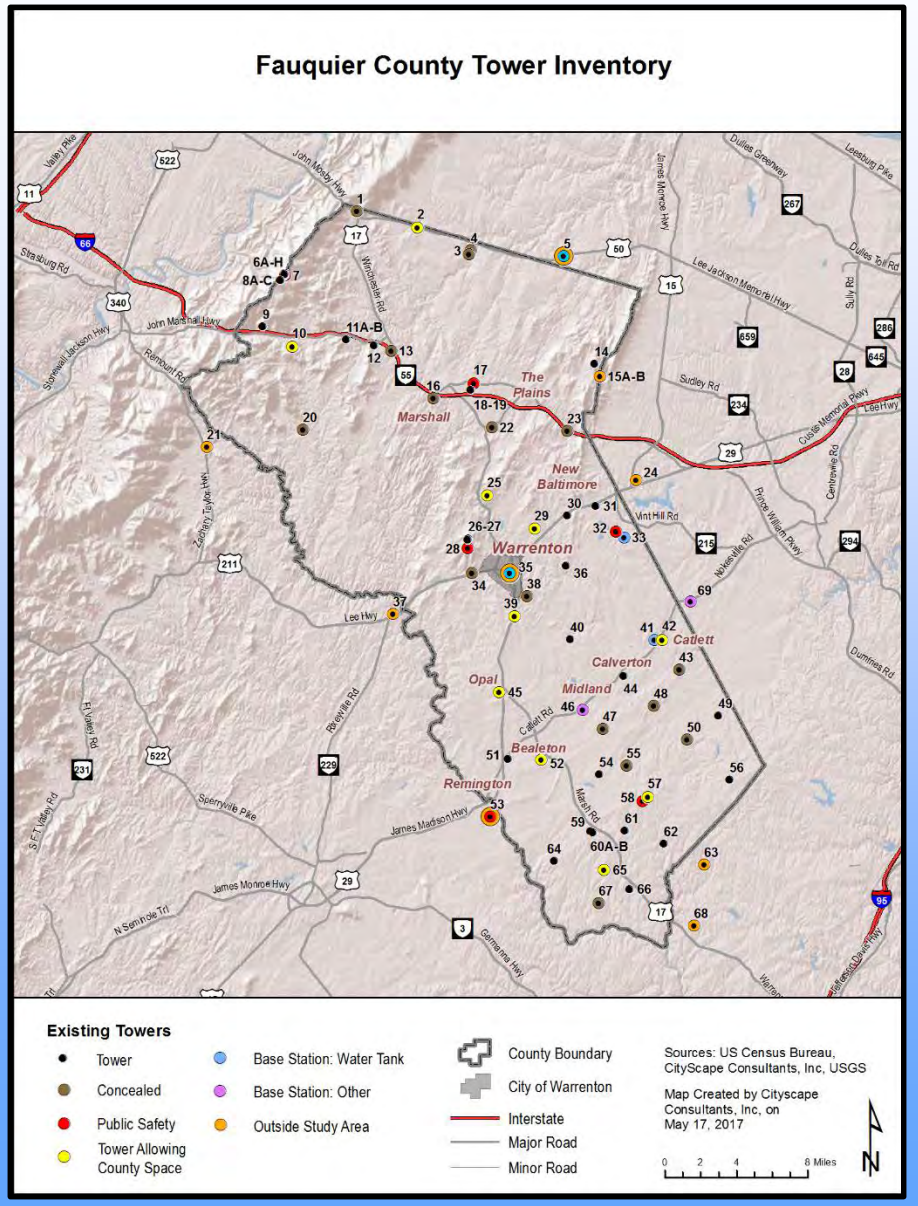
Existing Wireless Inventory

Infrastructure Count:

- 70 In County
- 2 Proposed in County
- 11 Outside County



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Existing Wireless Inventory

Based on Fauquier County's Current Ordinance

Inventory Includes:

- Existing antenna-support structures (towers and base stations) for PWSF and 2-way communications for emergency services
- CityScape has identified 70 inside the County (2 of which are proposed) and 11 outside the County

Inventory Excludes:

- Data, video or information transmission as part of the day-to-day operations of a commercial business, including for example, processing of credit card sales, automatic inventory control
- All users (both commercial and residential) of a wireless Internet service for which a send/receive antenna is required to be located at the point to use
- Non-commercial antennas and wireless communications facilities used solely for transmission and/or receipt by a single user, including for example, satellite dishes for TV reception less than 1 meter in diameter

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Current Wireless Service Providers

Service Provider	Frequency Band	Type Service
AT&T	Low and High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
Clearwire Spectrum Holdings III, LLC	High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
Dish	Low	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
Dominion 700, Inc.	Low	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
F Corporation	High	Broadband*; Fixed Wireless; Phone; Television
George Mason University Instructional Foundation Inc.	High	Broadband*; Fixed Wireless; Television
Inmarsat Plc	High	Phone; Satellite
Sprint (Nextel Communications and some Clearwire Spectrum Holdings II, LLC)	High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television

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- Broadband As Listed in FCC License But Not By Current Definition
- Bold Indicates Services Providers Found in the Study Area.

Current Wireless Service Providers

Service Provider	Frequency Band	Type Service
T-Mobile	Low and High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
Verizon Wireless (Cellco Partnership)	Low and High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television
Wireless Properties of VA, INC	High	Broadband*; Fixed Wireless; Mobile Radio; Phone; Television

- Broadband As Listed in FCC License But Not By Current Definition
  - Bold Indicates Services Providers Found in the Study Area.

Tower owners include but are not limited to:

- American Tower; Crown Castle International; SBA; the service providers listed above; broadcast companies; and the Fire Districts

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Existing Wireless Inventory

Structure Type	Total Number
Monopole	15
Lattice	30
Guy	5
Wood/Laminate	3
Wrap	1
Base Station	6
Faux Tree	9
Faux Silo	9
Painted	1

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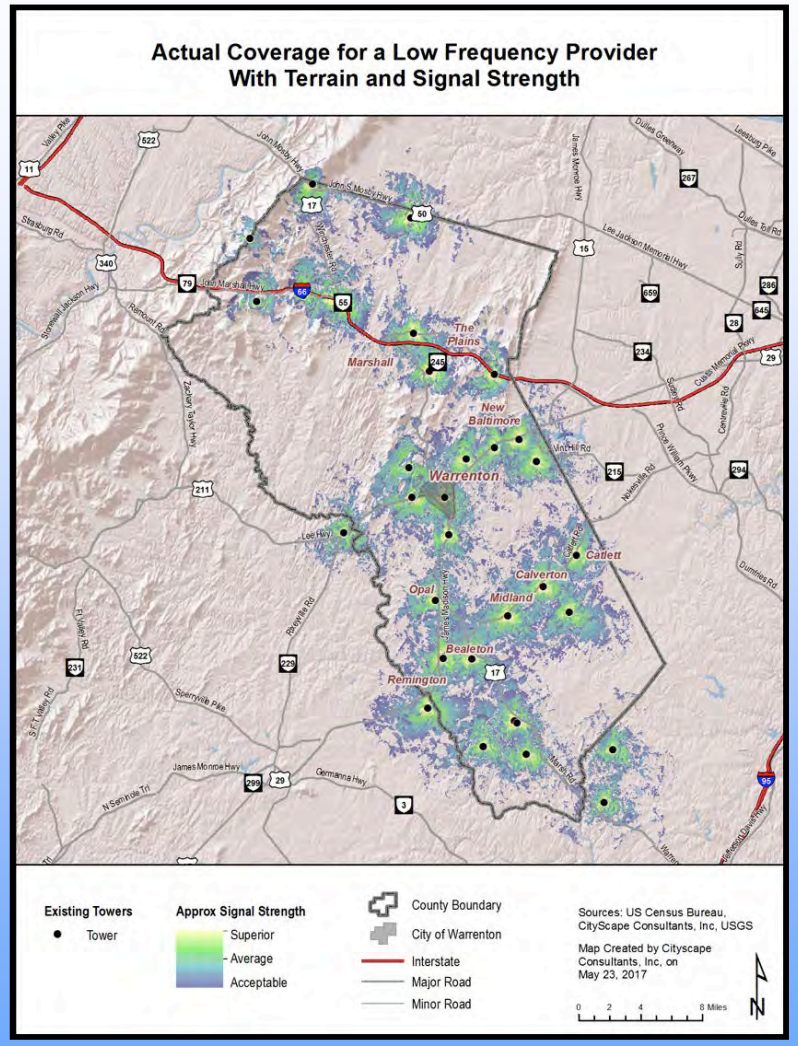
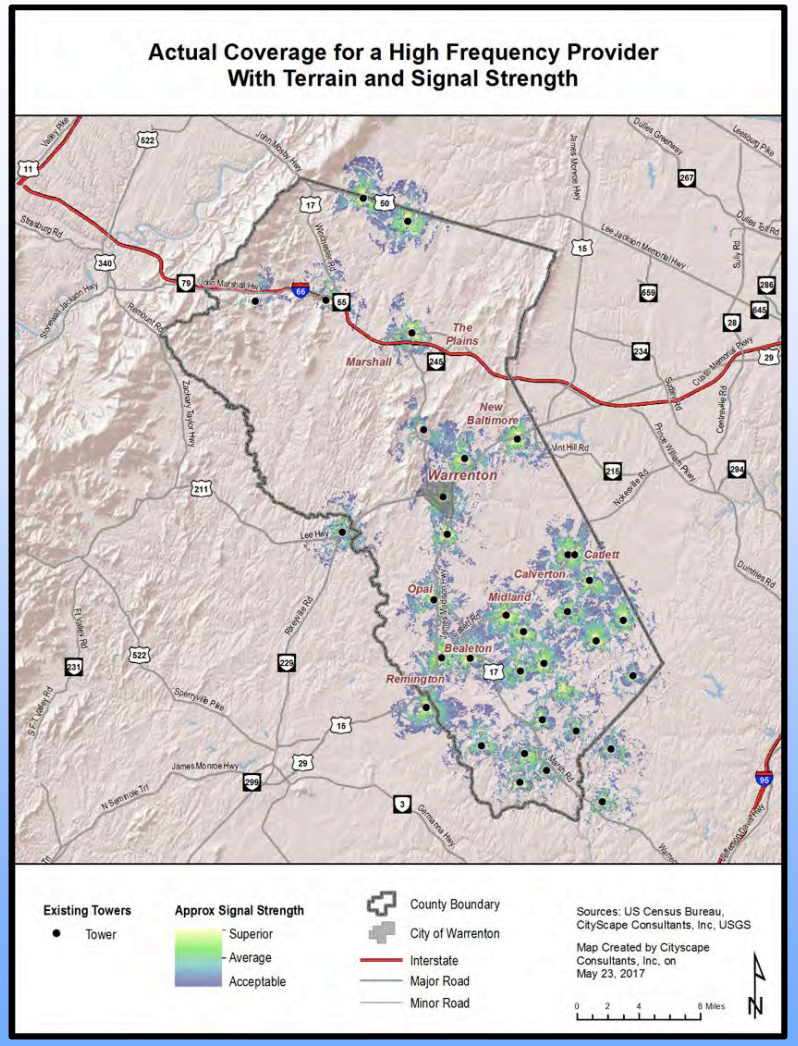
Theoretical RMS Maps With Terrain



33 Low Frequency Sites



35 High Frequency Sites

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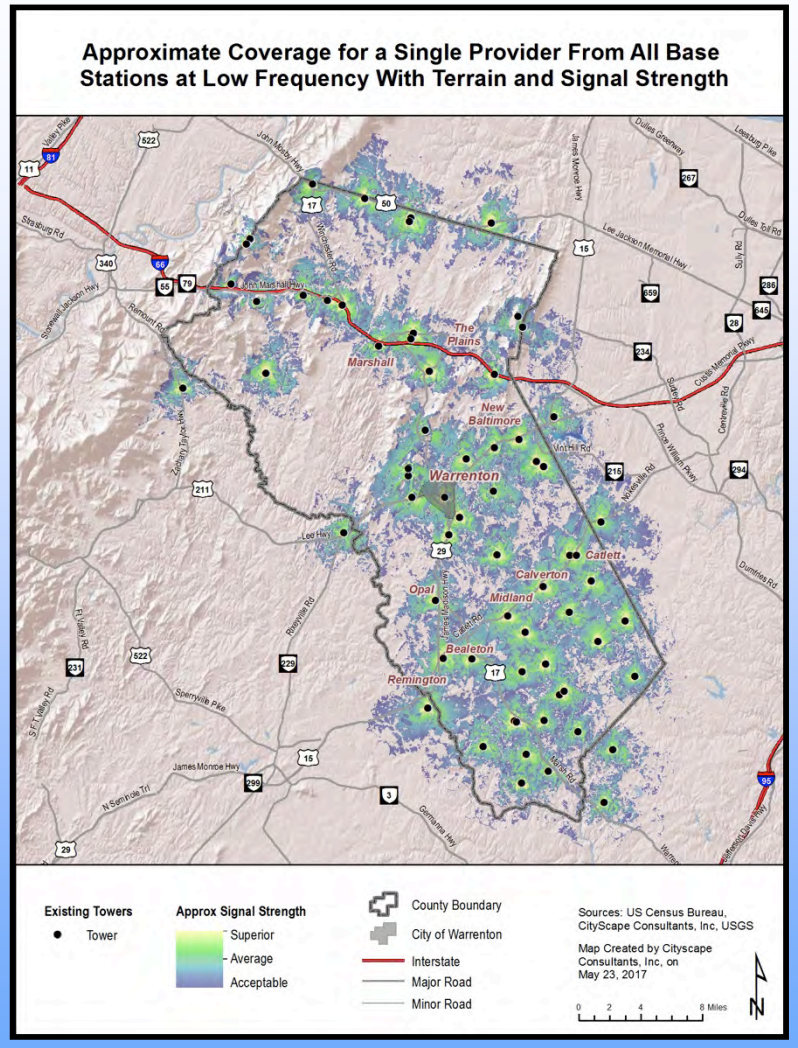
Theoretical RMS Maps With Terrain



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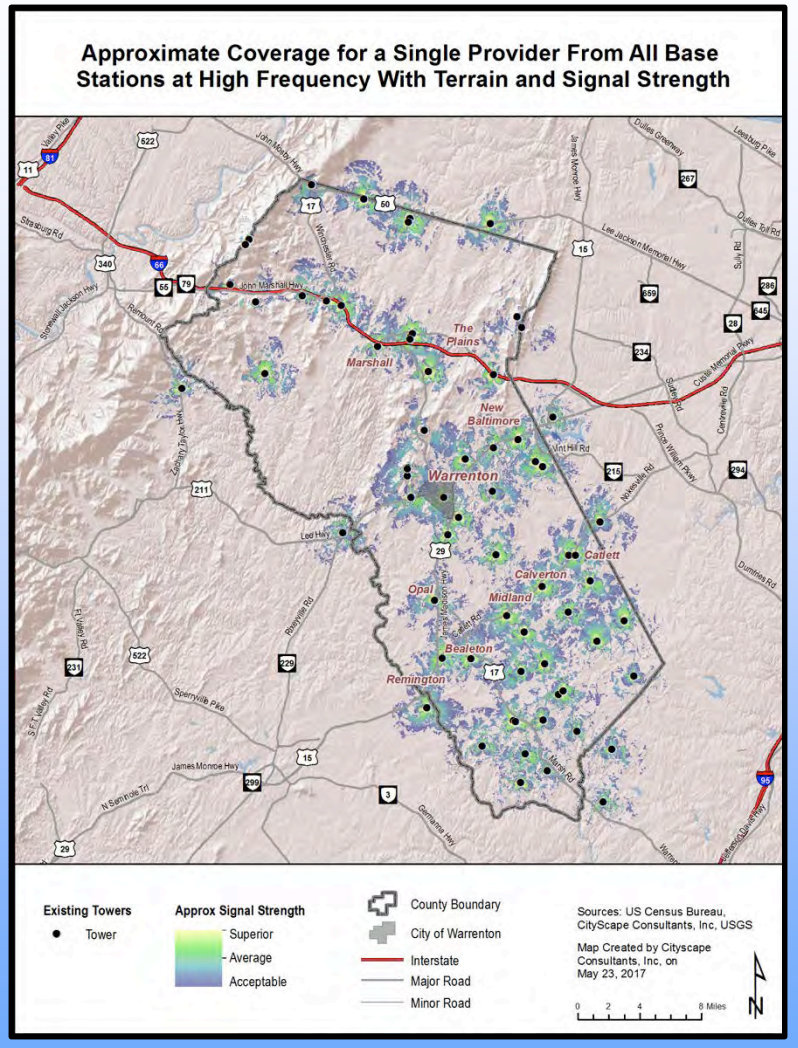

33 High Frequency Sites

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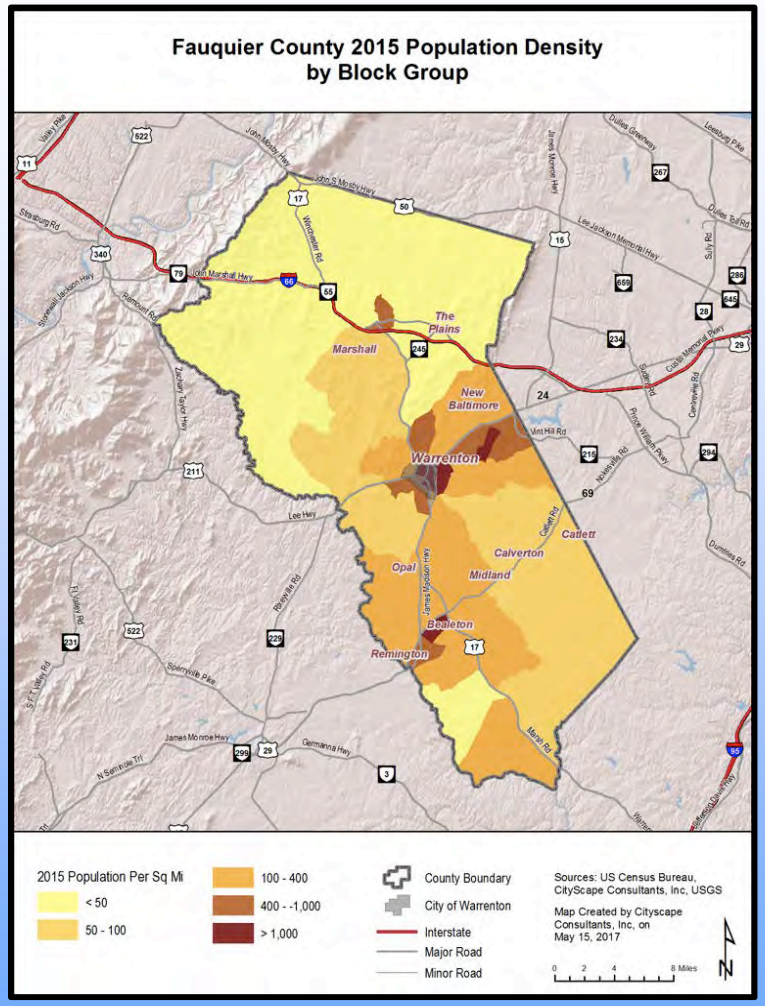
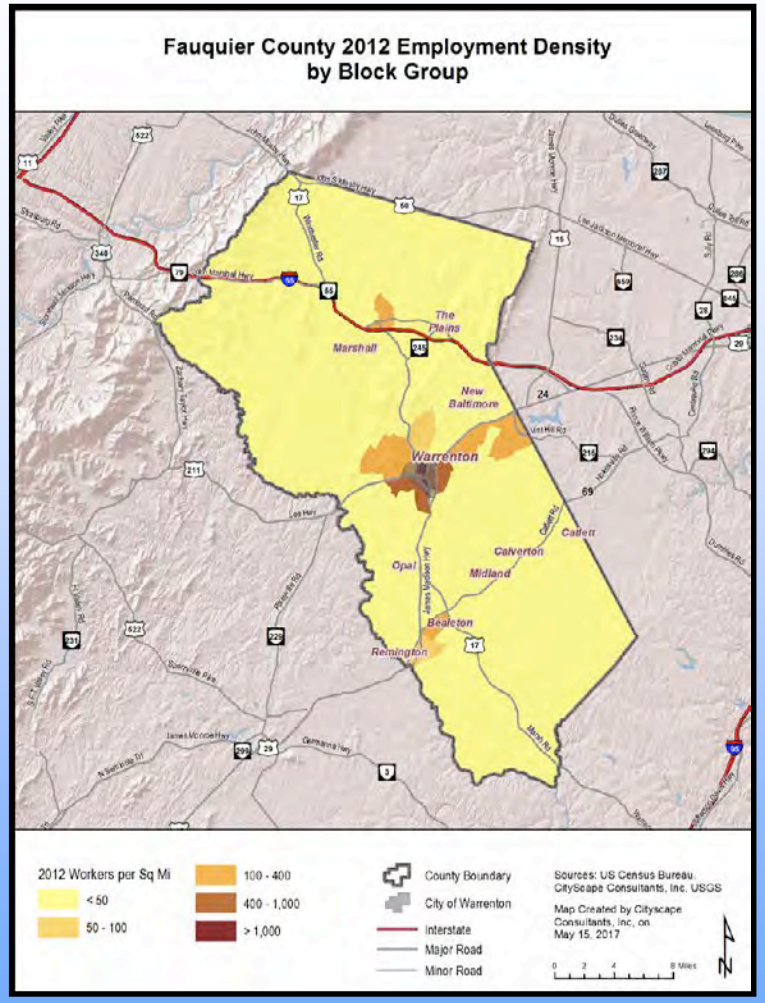
Population Density





US Census Blocks

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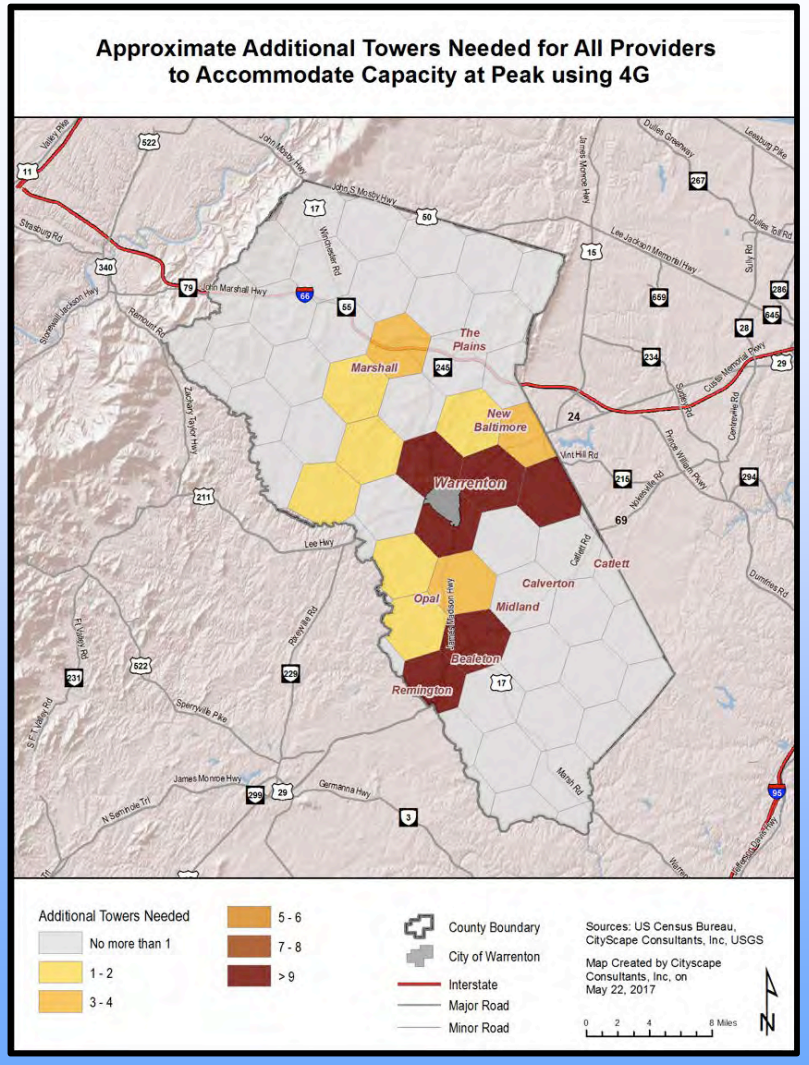
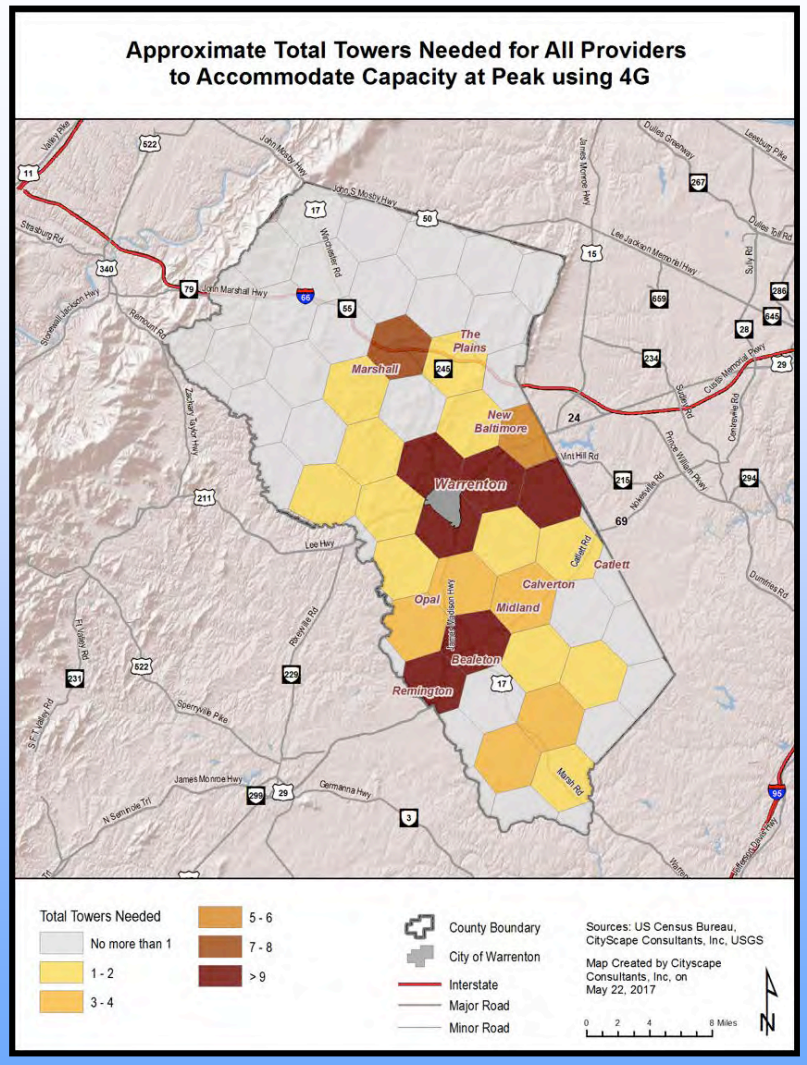
Draft Initial Gap Analysis





Estimates based on where people live and business locations

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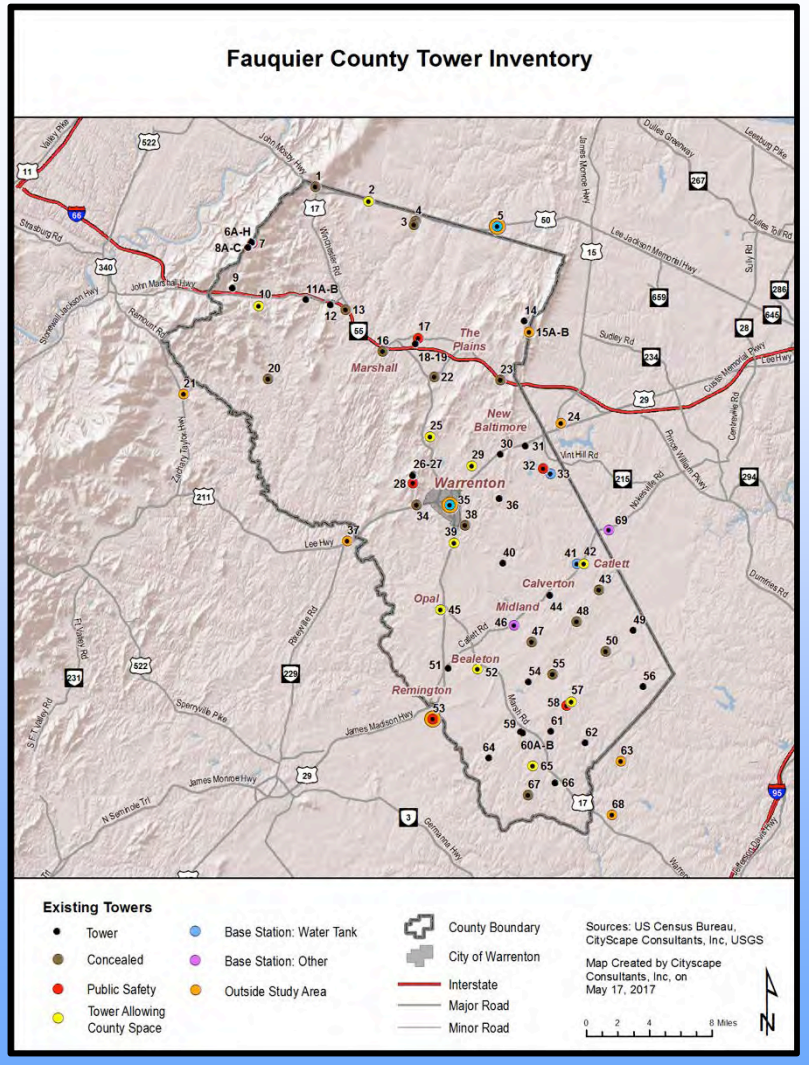
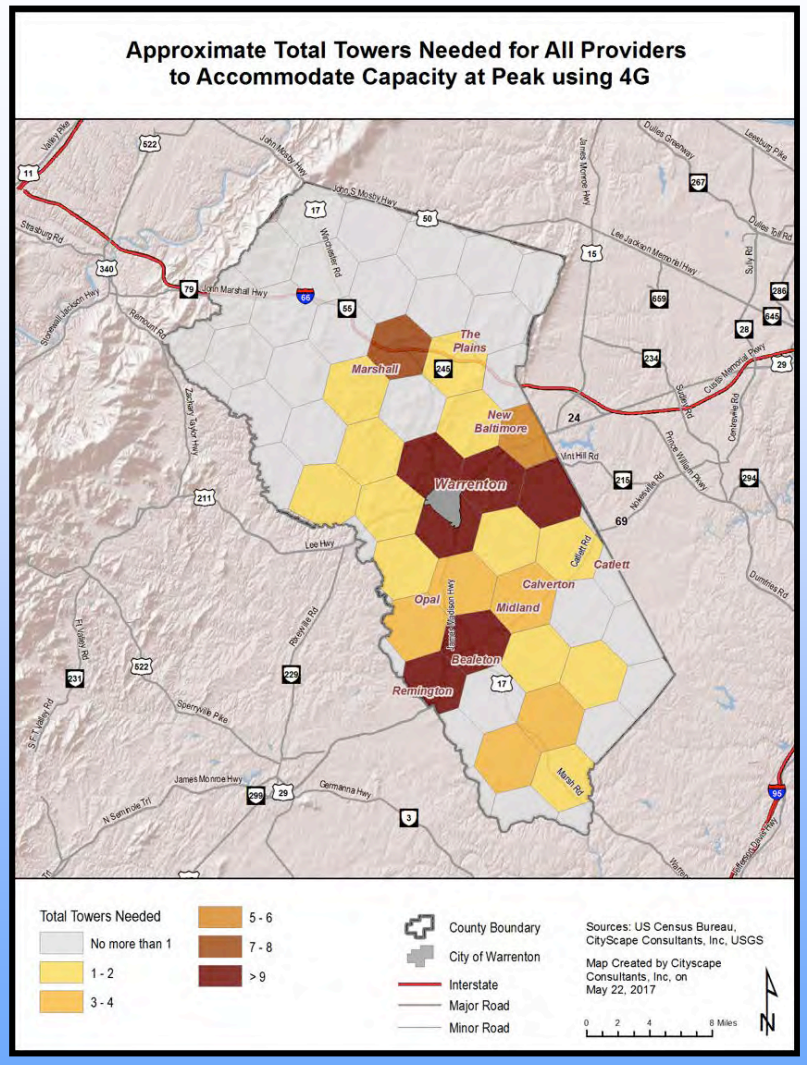
Draft Initial Gap Analysis





Estimates based on where people live and business locations

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Introduction to Wireless Telecommunications Land Use Regulations

Master Planning and Zoning

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What Can Be Regulated

- Protection of Public Health, Safety and Welfare
- Development Standards:
  - Landscaping
  - Height
  - Infrastructure Type
  - Siting strategies
  - Setbacks
  - Location Preferences
  - Fencing
  - Signage
- Geographical Particulars

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Zoning Solutions

Wireless Telecommunication Regulations **should** include the following:

- Statement of Intent or Purpose of Regulations
- Hierarchy of Preferred Types of Facilities depending on community likes and dislikes, including use of public facilities
- Zoning Chart encouraging preferred types and discouraging non-preferred types of facilities
- Provisions to enable expert review of applications
- Uniform process that does not discriminate unduly among any providers of wireless services
- Hierarchy of submittal requirements, less extensive for preferred facilities and more extensive for non-preferred facilities

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Tower Height and Collocation

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Preferred Locations and Preferred Types

Locations:

- Existing Towers
- Rooftops
- Steeples
- Water Tanks
- Zoning Districts
- Publicly-owned Land
- Light Stanchions

Types:

- Concealed Attached Antenna
- Non-concealed Attached
- Collocation
- Mitigation/replacement
- Concealed Freestanding Tower
- Non-concealed Freestanding Tower

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Observations

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Observations

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County-Owned Land Benefits

- Industry will need additional sites; aggressively seeking use of Right-Of-Way and seeking to lessen government control of deployment practices
- Use of County-owned properties makes the County the landlord resulting in maximum control of site development standards.
  - Precedence setting & revenue generating opportunity
  - Potential parallel with County objectives for expanding emergency services and broadband deployment

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Wireless Communications Master Planning

Next Steps

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Next Steps

- Finish Assessments
- Finalize Inventory Map
- Create Catalogue of Inventory
- Finalize Propagation Mapping
- Identify possible County-owned properties for future fill-in infrastructure?
- Land Use Planning recommendations based on master planning maps
- Ordinance revisions meeting recent Report and Order and amended Code of Virginia

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Questions and Open Discussion

Thank you!

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