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October 17, 2023

Via Federal Express

Barbara Roberti, Zoning Administrator
Town of Wappinger
20 Middlebush Rd
Wappinger Falls, New York 12590-0324

RE: Verizon Wireless "Diddell Rd" Communications Facility
Off Diddell Road (Tax Map No. 6359-01-480600)

Dear Ms. Roberti:

Enclosed please find eighteen (18) copies of Verizon Wireless' supplemental RF report dated September 20, 2023 in response to William Johnson's review letter dated August 31, 2023 in connection with the above-referenced application.

. Should you have any questions, please do not hesitate to contact us.

Very truly yours,

YOUNG SOMMER, LLC

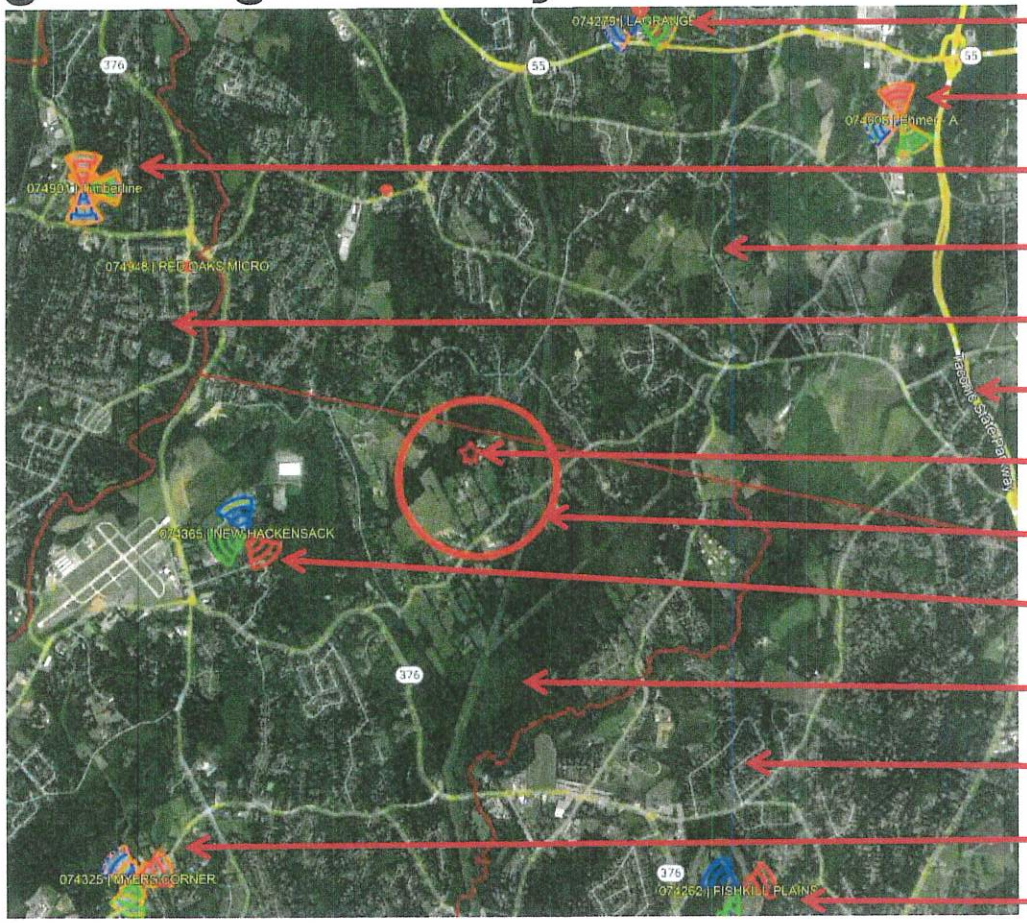
By: Scott Olson
Scott Olson

Enclosure

C: William Johnson (via e-mail)
Malcolm Simpson (via e-mail)

Verizon Wireless Communications Facility

Engineering Necessity Case – "Diddell Rd"



Prepared by: Brendan Hennessy

Project: The project is the installation and operation of a new co-located wireless telecommunications site in the Town of Wappinger (the "Project Facility").

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Sept 20th, 2023

Introduction

The purpose of this subsequent analysis is to summarize and communicate the technical radio frequency (RF) information used in the justification of this new site.

Coverage and/or capacity deficiencies are the two main drivers that prompt the need for a new wireless communications facility/site. All sites provide a mixture of both capacity and coverage for the benefit of the end user.

Coverage can be defined as the existence of signal of usable strength and quality in an area, including but not limited to in-vehicles or in-buildings.

The need for improved coverage is identified by RF Engineers that are responsible for developing and maintaining the network. RF Engineers utilize both theoretical and empirical data sets (propagation maps and real world coverage measurements). Historically, coverage improvements have been the primary justification of new sites.

Capacity can be defined as the amount of traffic (voice and data) a given site can process before significant performance degradation occurs.

When traffic volume exceeds the capacity limits of a site serving a given area, network reliability and user experience degrades. Ultimately this prevents customers from making/receiving calls, applications cease functioning, internet connections time out and data speeds fail. This critical condition is more important than just a simple nuisance for some users. Degradation of network reliability and user experience can affect emergency responders and to persons in a real emergency situation can literally mean life or death.

Project Need Overview

The project area, located in the northern portion of the Town of Wappinger is currently served by two sites. These sites are overloaded requiring capacity relief. Additionally the project area is subject to significant terrain challenges for RF (signal) propagation. This terrain combined with area foliage and long distance prevent effective propagation of Verizon's RF signals into this area compounding the capacity issue with areas of variable coverage creating significant gaps in coverage.

The first serving site is **New Hackensack,** located in the town of Wappinger, is approximately 1.5 miles southwest (of the project location) situated on an existing tower located off **Airport Dr**. While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

The second serving site is **Ehmer,** located in the Town of **La Grange**, is approximately three miles northeast (of the project location) situated on an existing tower located off **Stringham Road**. While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

Available (mid band AWS) carriers at these and other area sites are not capable of effectively serving/offloading the project area due to inherent propagation losses from distance, challenging terrain and in building coverage losses negatively impacting mid band coverage and capacity offload capabilities. There are other Verizon sites in this general area but due to distance and terrain they also do not provide any significant overlapping coverage in the area in question that could allow for increased capacity and improved coverage from other sources.

The primary objectives for this project are to increase capacity and improve coverage throughout the north eastern portion of the Town of Wappinger and Southwestern part of the Town of La Grange, more specifically portions of Diddell Road, Smith Crossing Road, Maloney Road, Orange Hill Road, and Redhawk Hollow Road, as well neighboring residential areas along and near these roads. In order to offload capacity from Ehmer and New Hackensack sites, a new dominant server must be created. This new dominant coverage will effectively offload the existing overloaded sites/cells as well as provide improved coverage where significant gaps exist today.

Following the search for co-locatable structures to resolve the aforementioned challenges and finding none available, Verizon proposes to attach the necessary antenna(s) to a new 120' monopole tower to be located at **Diddell Rd**, Wappinger, NY. Verizon's antennas will utilize 116' for the ACL (Antenna Center Line) with a top of antenna height of 120'. This solution will provide the necessary coverage and capacity improvements needed.

Wireless LTE (Voice and Data) Growth

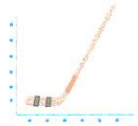
- Wireless smart city solutions are being used to track available parking and minimize pollution and wasted time.
- These same solutions are being used to track pedestrian and bike traffic to help planning and minimize accidents.
- Smart, wireless connected lighting enables cities to control lighting remotely, saving energy and reducing energy costs by 20%.
- 4G technology is utilized to track and plan vehicle deliveries to minimize travel, maximize efficiency, and minimize carbon footprint.
- 4G technology is also used to monitor building power usage down to the circuit level remotely, preventing energy waste and supporting predictive maintenance on machines and equipment.
- Wireless sensors placed in shipments are being used to track temperature-sensitive medications, equipment, and food. This is important for preventing the spread of food-borne diseases that kill 3,000 Americans each year.

Source: Verizon Innovation Center, February. 2018

Wireless is a critical component in schools and for today's students.

- **20,000 learning apps are available for iPads. 72% of iTunes top selling educational apps are designed for preschoolers and elementary students.**
- **600+ school districts replaced text books with tablets in classrooms.**
- **77% of parents think tablets are beneficial to kids.**
- **74% of school administrators feel digital content increases student engagement.**
- **70% of teens use cellphones to help with homework.**

Source: CTIA's Infographics Today's Wireless Family, October, 2017



The average North American smartphone user will consume 48 GB of data per month in 2023, up from just 5.2 GB per month in 2016 and 7.1 GB per month in 2017 .[1]

55% **Of American homes are wireless only.[2]**

In North America, the average household has 13 connected devices with smartphones outnumbering tablets 6 to 1.[3]

1. Ericsson Mobility Report, November 2017
2. CDC's 2018 Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January-July. 2018
3. IHS Market Connected Device Market Monitor: Q1 2016, June 7, 2016

A wireless network is like a highway system...

US, mobile data traffic was 1.3 Exabytes per month in 2016, the equivalent of 334 million DVDs each month or 3,687 million text messages each second according to Cisco VNI Mobile Forecast Highlights, 2016-2021,Feb 2017

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Wireless facilities and property values.

Cell service in and around the home has emerged as a critical factor in home-buying decisions.

National studies demonstrate that most home buyers value good cell service over many other factors including the proximity of schools when purchasing a home.

75% More than 75% of prospective home buyers said a good cellular connection was important to them.[1]

83% The same study showed that 83% of Millennials (those born between 1982 and 2004) said cell service was the most important fact in purchasing a home.

90% 90% of U.S. households use wireless service. Citizens need access to 911 and reverse 911 and wireless may be their only connection.[2]

1 RestMetrical Survey, The Surprising Things Home Buyers Care About More than Schools June 2, 2015
2 CTIA Level 2015

80%+ With over 80% of 9-1-1 calls now coming from cell phones...[1]

240 million 911 calls are made annually. In many areas, 80% or more are from wireless devices.[1]

1. National Emergency Number Association. Enhancing 9-1-1 Operations With Automated Abandoned Callback & Location Accuracy (Motorola Solutions) (August 23, 2018)

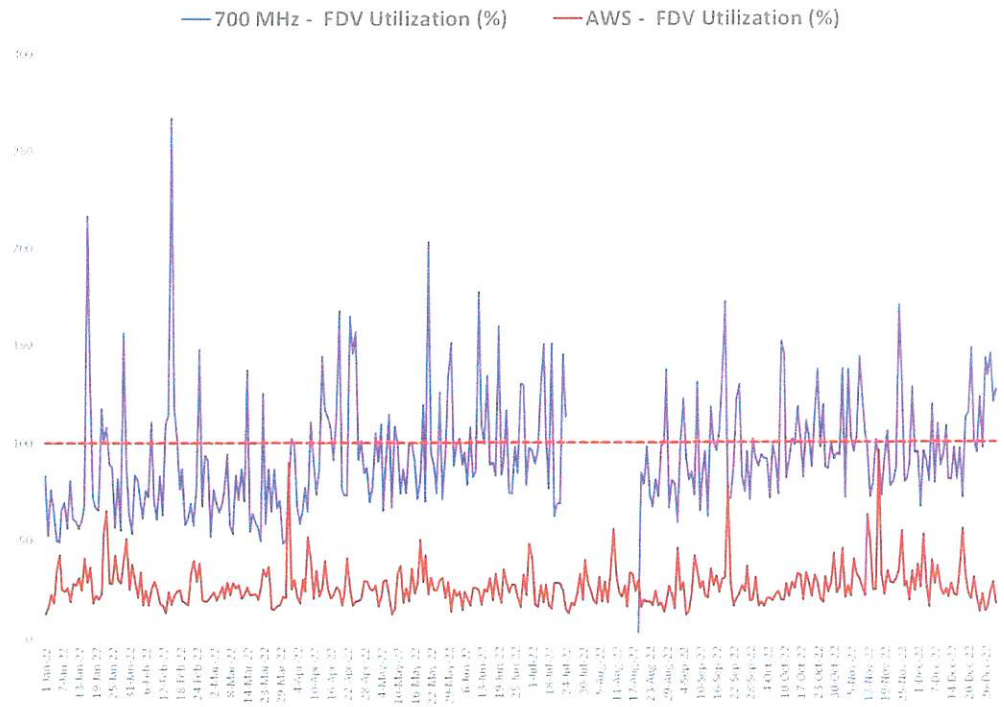
Explanation of Wireless Capacity

Capacity in this analysis is evaluated with up to three metrics further explained below. These metrics assist in determining actual usage for a given site as well as are used to project when a site is expected to run out of capacity (i.e. reach a point of exhaustion where it can no longer process the volume of voice and data requested by local wireless devices, thus no longer providing adequate service).

- Forward Data Volume ("**FDV**"), is a measurement of usage (data throughput) on a particular site over a given period of time.
- Average Schedule Eligible User ("**ASEU**"), is a measurement of the loading of the control channels and systems of a given site.
- Average Active Connections ("**AvgAC**") is a measurement of the number of devices actively connected to a site in any given time slot.

Verizon Wireless uses proprietary algorithms developed by a task force of engineers and computer programmers to monitor each site in the network and accurately project and identify when sites will approach their capacity limits. Using a rolling two-year window for projected exhaustion dates allows enough time, in most cases, to develop and activate a new site. It is critical that these capacity approaching sectors are identified early and the process gets started and completed in time for new solutions (sites) to be on air before network issues impact the customers.

Capacity Utilization
FDV (New Hackensack Gamma)



Summary: This graph shows FDV (**F**orward **D**ata **V**olume) which is a measurement of the customer data usage that this sector currently serves. As this limit is approached, data rates slow to unacceptable levels, potentially causing unreliable service for Verizon Wireless customers.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Gamma** sector of the **New Hackensack** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

Detail: The existing **New Hackensack** sector shown above has exceeded its capability of supporting FDV requirements as shown by the purple line exceeding the max utilization threshold (red dashed line). FDV is one of up to three metrics used in this presentation to evaluate capacity capability in this area. This graph also reveals the inability of the AWS carrier (dark red line) to provide the necessary capacity offload for the low band carrier due to differences in RF propagation characteristics. The solution is network densification.

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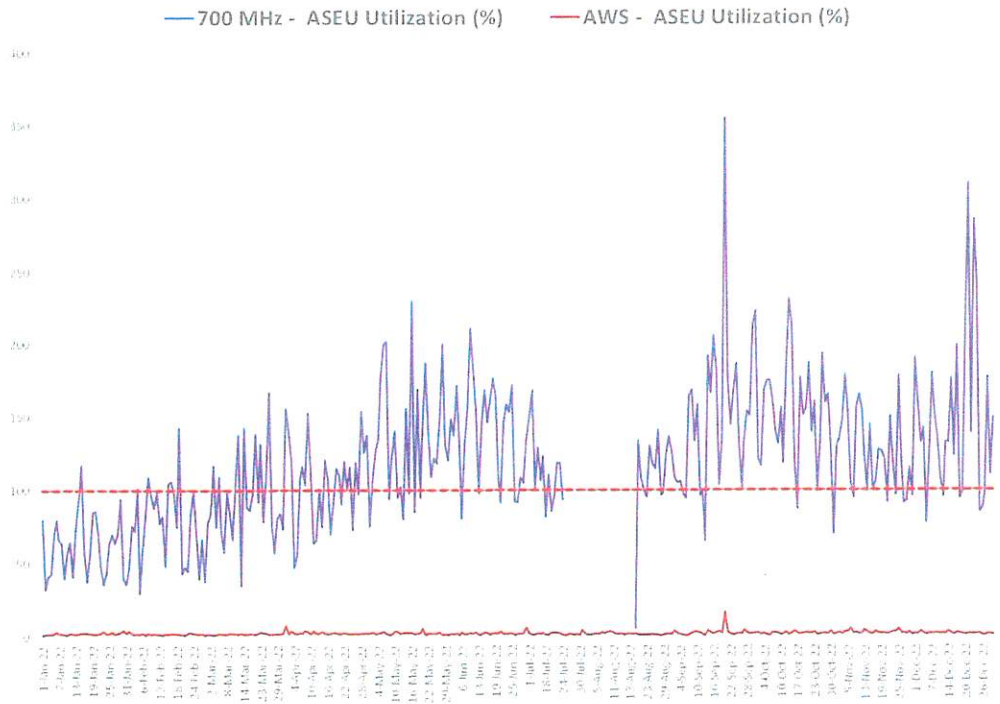
Capacity Utilization
ASEU (New Hackensack Gamma)



Summary: This graph shows ASEU (**A**verage **S**chedule **E**ligible **U**ser). ASEU is a measurement of the loading of the control channels and systems of a given site. The ASEU load is heavily impacted by distant users or those in poor RF conditions.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Gamma** sector of the **New Hackensack** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

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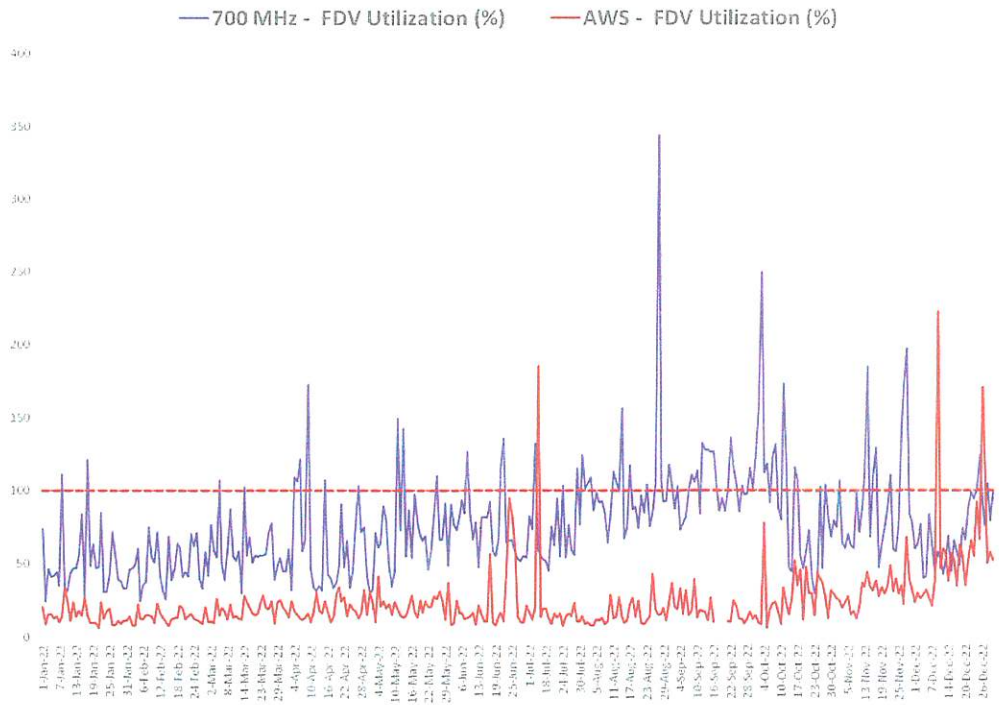
Capacity Utilization
FDV (Ehmer Gamma)



Summary: This graph shows FDV (**F**orward **D**ata **V**olume) which is a measurement of the customer data usage that this sector currently serves. As this limit is approached, data rates slow to unacceptable levels, potentially causing unreliable service for Verizon Wireless customers.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Gamma** sector of the **Ehmer** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

Detail: The existing **Ehmer** sector shown above has exceeded its capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). FDV is one of up to three metrics used in this presentation to evaluate capacity capability in this area.

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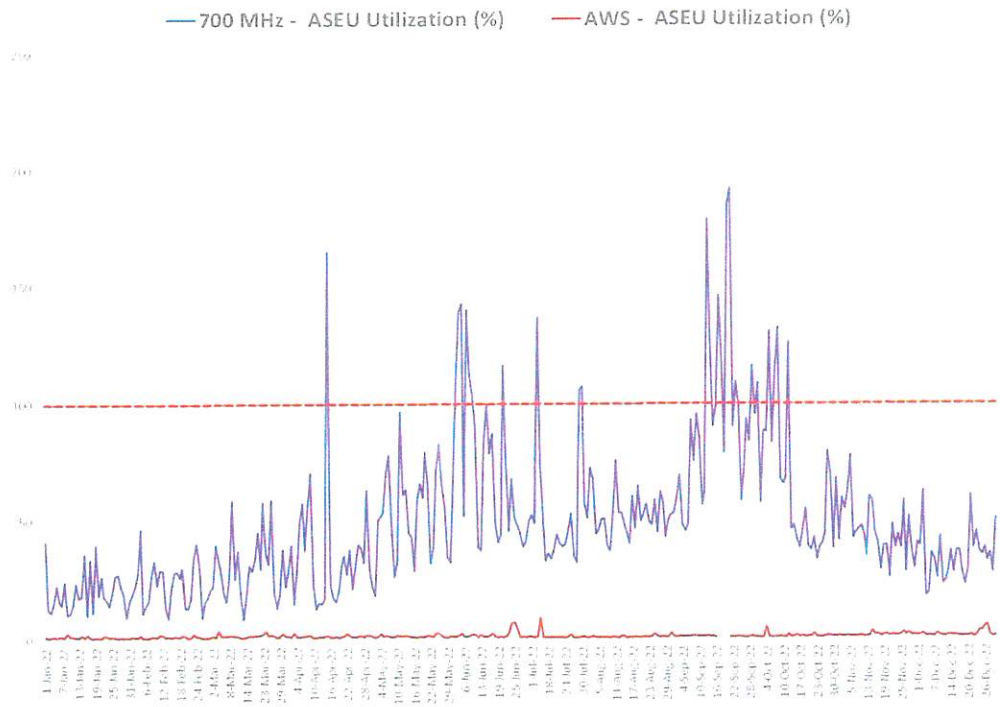
Capacity Utilization
ASEU (Ehmer Gamma)



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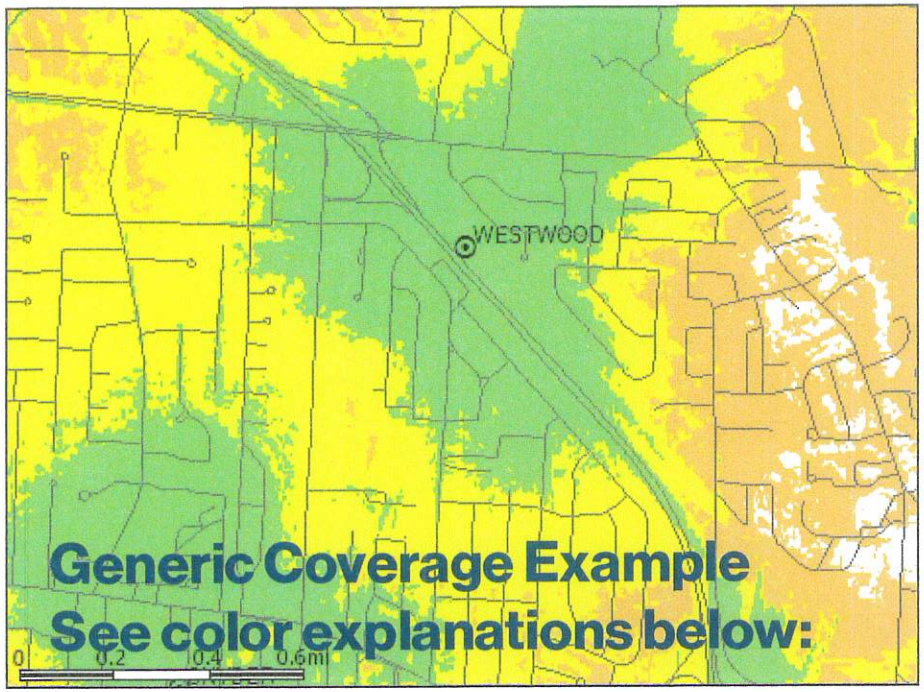
Explanation of Wireless Coverage



Coverage is best shown via coverage maps. RF engineers use computer simulation tools that take into account terrain, vegetation, building types, and site specifics to model the RF environment. This model is used to simulate the real world network and assist engineers to evaluate the impact of a proposed site (along with industry experience and other tools).

Many Verizon Wireless sites provide 4G LTE at 700 MHz and 850 MHz . As capacity requirements increase, higher frequency PCS (1900 MHz) and AWS (2100 MHz) carriers are added. In some mountaintop situations the mid band (higher frequency) AWS and PCS carriers are not fully effective due to excessive distance from the user population.

Coverage provided by a given site is affected by the frequencies used. Lower frequencies propagate further distances, and are less attenuated by clutter than higher frequencies. To provide similar coverage levels at higher frequencies, a denser network of sites is required (network densification).

Note the affect of clutter on the predicted coverage footprint above

**Dark Green >/= -75dBm RSRP, typically serves dense urban areas as well as areas of substantial construction (colleges, hospitals, dense multi family etc.)
Green >/= -85dBm RSRP, typically serves suburban single family residential and light commercial buildings
Yellow >/= -95dBm RSRP, typically serves most rural/suburban-residential and in car applications
Orange >/= -105dBm RSRP, rural highway coverage, subject to variable conditions including fading and seasonality gaps
White = <-105dBm RSRP, variable to no reliable coverage gap area

More detailed, site-specific coverage slides are later in the presentation
*Signal strength requirements vary as dictated by specific market conditions
** Not displayed in example map, layer not used in all site justifications

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Explanation of this Search Area

Diddell Rd Search Area

A **Search Area** is the geographical area within which a new site is targeted to solve a coverage or capacity deficiency. Three of the factors taken into consideration when defining a search area are topography, user density, and the existing network.

- **Topography** must be considered to minimize the obstacles between the proposed site and the target coverage area. For example, a site at the bottom of a ridge will not be able to cover the other side from a certain height.
- In general, the farther from a site the **User Population** is, the weaker the RF conditions are and the worse their experience is likely to be. These distant users also have an increased impact on the serving site's capacity. In the case of a multi sector site, centralized proximity is essential to allow users to be evenly distributed and allow efficient utilization of the site's resources.
- The existing **Network Conditions** also guide the design of a new site. Sites placed too close together create interference due to overlap and are an inefficient use of resources. Sites that are too tall or not properly integrated with existing sites cause interference and degrade service for existing users.
- Existing co-locatable structures inside the search area as well as within a reasonable distance of the search area are submitted by site acquisition and reviewed by RF Engineering. If possible, RF will make use of existing or nearby structures before proposing to build new towers.

To resolve the coverage and capacity deficiencies previously detailed, Verizon Wireless is seeking to add one new cell facility within this area to improve wireless service capacity and coverage. By offloading traffic from **New Hackensack** and **Ehmer** with the proposed site, adequate and reliable service will be restored. The new **Diddell Rd** site will provide dominant and dedicated signal to the identified portions of the Town of Wappinger and Town of La Grange . This helps to improve not only the **Diddell Rd** project area but will also indirectly result with significant improvements in the northern portion of the Town of Wappinger and southwestern portion of Town of La Grange.

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