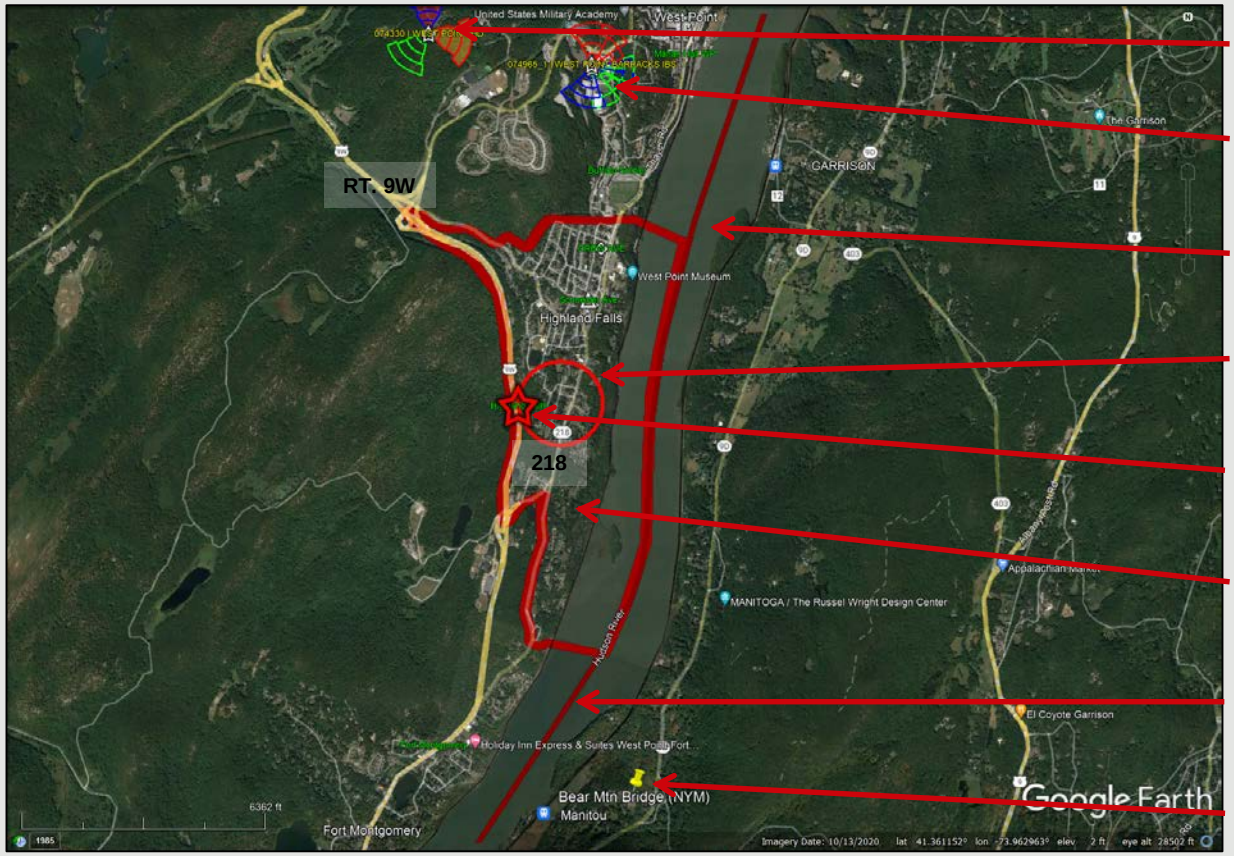
# Verizon Wireless Communications Facility

## Engineering Necessity Case – "Highland Falls"




West Point HD Site

West Point Campus Site

Hudson River

Search Area

Project location (Highland Falls)

Village of Highland Falls

Orange/Putnam Co Line

Bear Mtn Bridge Macro

**Prepared by: Michael R. Crosby, RF Engineer IV, Verizon Wireless**

**Project: The project is the installation and operation of a new tower co-located wireless telecommunications site in the Village of Highland Falls (the "Project Facility").**

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Revised: Aug 30th, 2022

# 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.

***Note that, while Verizon Wireless provides sufficient evidence to establish the existence of a coverage gap and capacity need in this case, the FCC recently confirmed that federal law does not require a provider to establish the existence of a coverage/capacity gap to establish the need for a site. There are several ways by which an applicant can establish site need. See Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment," FCC 18-133, 85 FR 51867, at ¶ 37 (October 15, 2018) (confirming that the test for establishing an effective prohibition is whether "a state or local legal requirement materially inhibits a provider's ability to engage in any of a variety of activities related to its provision of a covered service," and this test is met "not only when filling a coverage gap but also when densifying a wireless network, introducing new services or otherwise improving service capabilities") (emphasis added).***

# Project Need Overview

The project area, located in the western portion of the Village of **Highland Falls** is currently served by two sites. These sites are overloaded requiring capacity relief. Additionally the project area is subject to significant terrain and or foliage challenges for RF (signal) propagation. This terrain and and/or foliage combined with 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 **Bear Mtn Bridge,** located in the Town of Phillipstown, is approximately two miles southeast (of the project location) situated on an existing tower located off Mary's Way (off 9D). While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and or foliage + distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

The second serving site is **West Point Campus,** located in West Point, is approximately one and three quarter miles north (of the project location) on an existing football stadium off Howze Pl. While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and or foliage + 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 portions of the Village of Highland Falls, more specifically portions of Rt. 9W, Rt. 218, Old State Rd, Roe Ave, Laurel Ln, Cedar Ln, Villa Pkwy, Mearns Ave, Walnut Ave, Rt. 9D, Walker Rd, Pellwood Lake Rd, Ondaora Pkwy, Regina Rd, Highlands Hwy Dept, as well as neighboring residential and commercial areas along and near these roads. In order to offload capacity from Bear Mtn Bridge and West Point Campus, 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 65' monopole tower located at Highlands Hwy Dept, 1530 Rte 9W, Highland Falls, NY 10928. Verizon's antennas will utilize 63' for the ACL (Antenna Center Line) with a top of antenna height of 65'. This solution will provide the necessary coverage and capacity improvements.

# 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]**


**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.


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


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

1. RootMetrics/Money, The Surprising Thing Home Buyers Care About More than Schools, June 2, 2015
2. CTIA, June 2015


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)

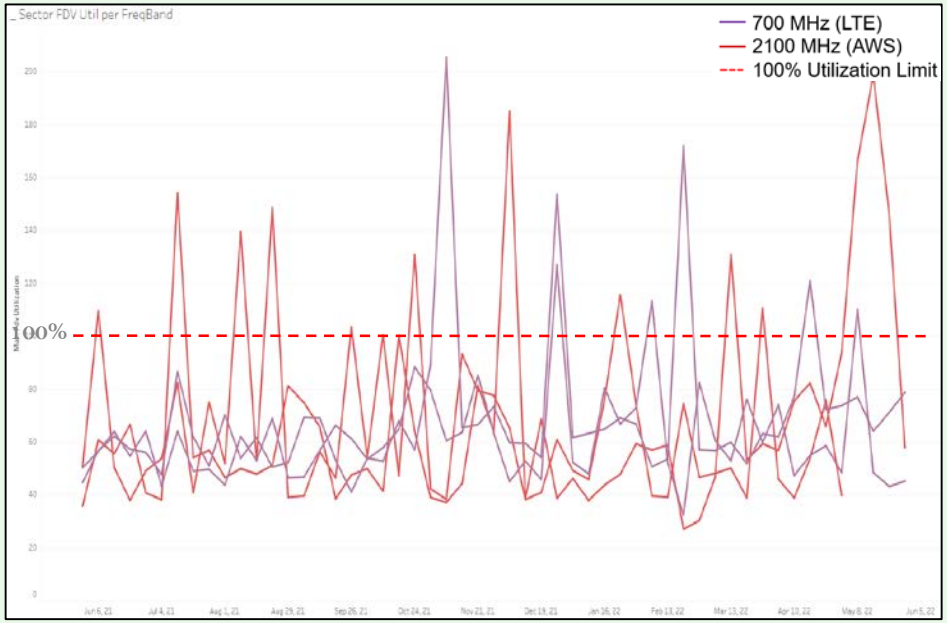
# Explanation of Wireless Capacity

**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 (Bear Mtn Bridge Alpha and 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 **Alpha and Gamma** sectors of the **Bear Mtn Bridge** 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 **Bear Mtn Bridge** sectors shown above have exceeded their 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 (Bear Mtn Bridge Alpha and 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 **Alpha and Gamma** sectors of the **Bear Mtn Bridge** 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 **Bear Mtn Bridge** sectors cannot support the traffic demand throughout the extent of the large geographic area they cover. **Bear Mtn Bridge** is overloaded, as shown by the purple actual use line exceeding the red dashed exhaustion threshold. The solution is network densification.

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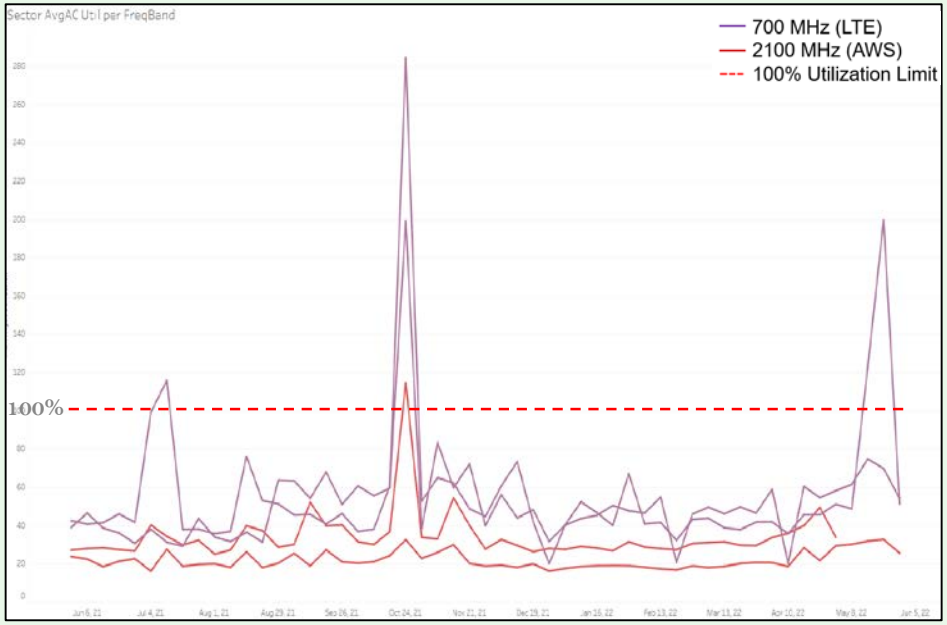
# Capacity Utilization AvgAC (Bear Mtn Bridge Alpha and Gamma)




**Summary**: This graph shows AvgAC (**A**verage **A**ctive **C**onnections). AvgAC utilization by carrier is a measurement of max active connection capacity per sector in any given time slot. When this limit is reached, no additional devices will be able to connect to the site, resulting in connection failures and dropped calls.

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 **Alpha and Gamma** sector of the **Bear Mtn Bridge** 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 **Bear Mtn Bridge** sectors cannot support the traffic demand throughout the extents of the large area it covers. This site has reached overloaded conditions, as shown above.

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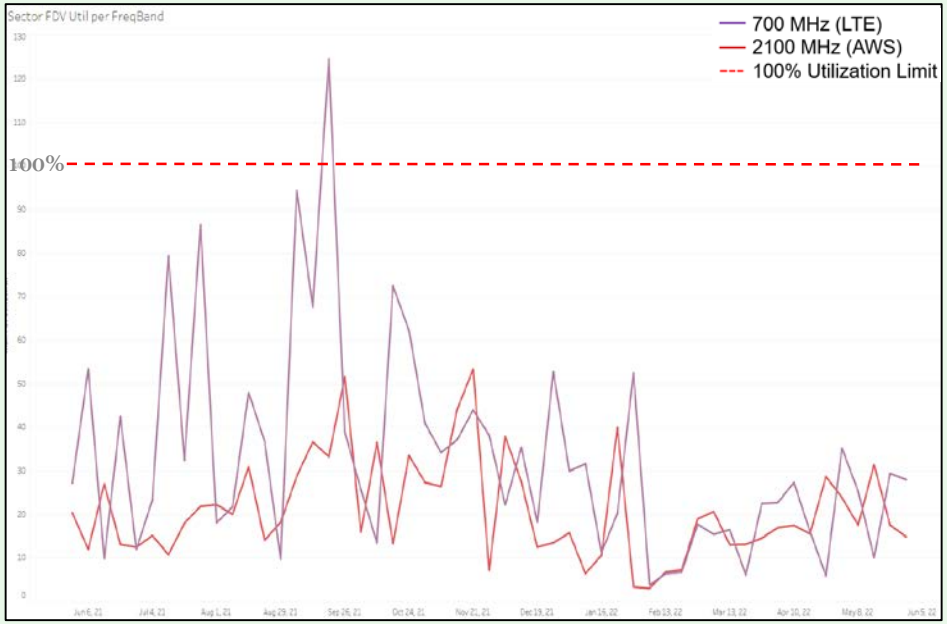
# Capacity Utilization FDV (West Point Campus Epsilon)




**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 **Epsilon** sector of the **West Point Campus** 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 **West Point Campus** 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). Normal coverage and capacity capabilities this campus site provides to the surrounding area including Highland Falls are compromised during games or other mass calling events on campus. In order to provide adequate and reliable service to Highland Falls and the surrounding area network densification including the proposed site are required.

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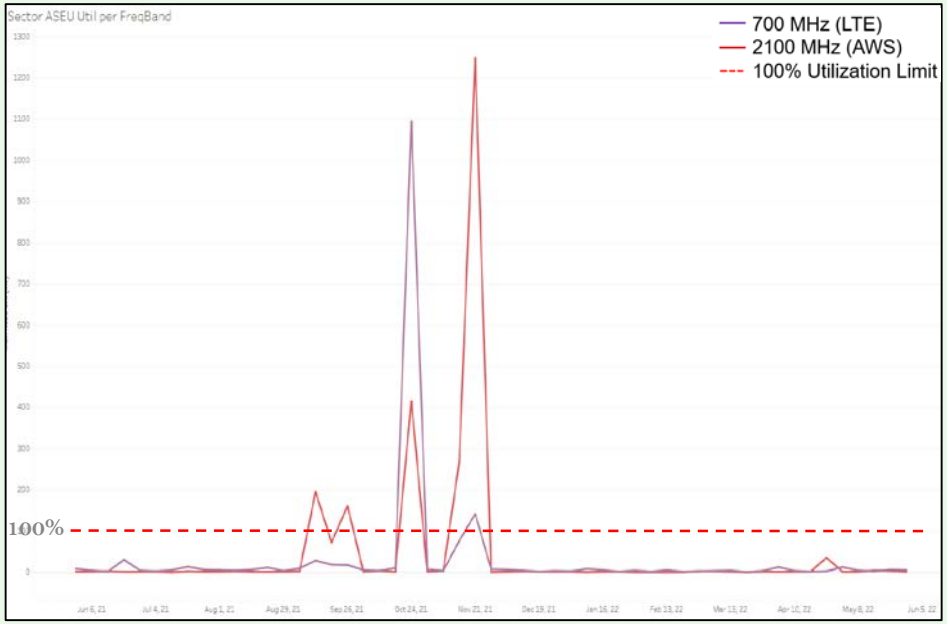
# Capacity Utilization ASEU (West Point Campus Epsilon)




**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 **Epsilon** sector of the **West Point Campus** 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 **West Point Campus** sector cannot support the traffic demand throughout the extent of the large geographic area it covers. **West Point Campus** is overloaded, as shown by the purple actual use line exceeding the red dashed exhaustion threshold. Normal coverage and capacity capabilities this campus site provides to the surrounding area including Highland Falls are compromised during games or other mass calling events on campus. In order to provide adequate and reliable service to Highland Falls and the surrounding area network densification including the proposed site are required.

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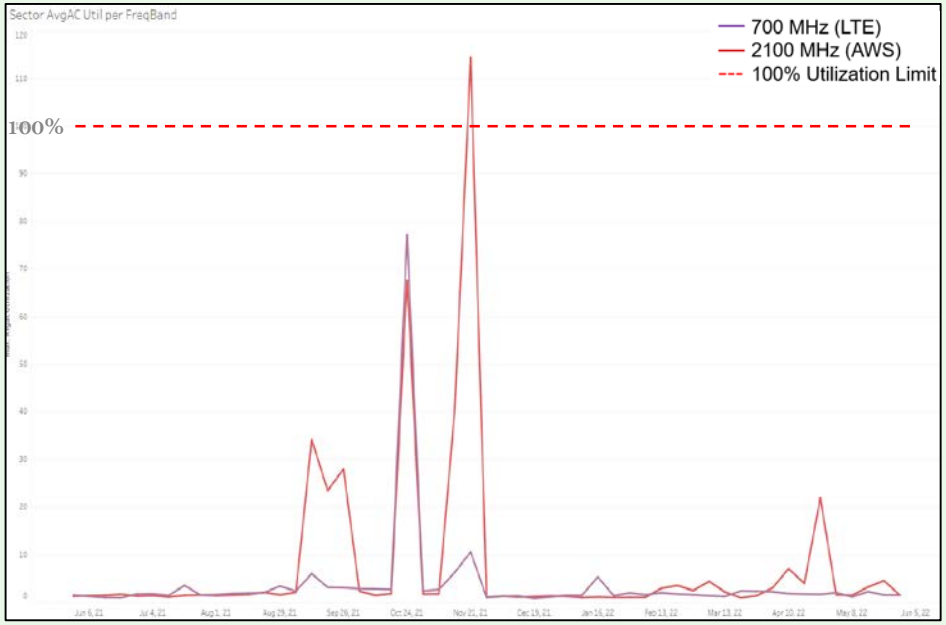
# Capacity Utilization AvgAC (West Point Campus Epsilon)




**Summary**: This graph shows AvgAC (**A**verage **A**ctive **C**onnections). AvgAC utilization by carrier is a measurement of max active connection capacity per sector in any given time slot. When this limit is reached, no additional devices will be able to connect to the site, resulting in connection failures and dropped calls.

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 **Epsilon** sector of the **West Point Campus** 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 **West Point Campus** sector cannot support the traffic demand throughout the extents of the large area it covers. **West Point Campus** has reached overloaded conditions, as shown above.

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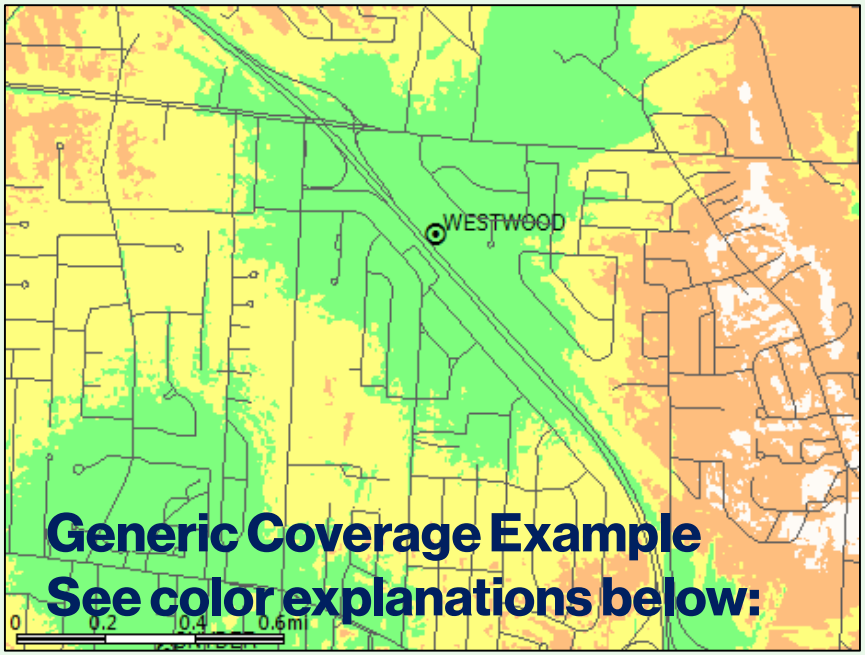
# Explanation of Wireless Coverage




**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 3G CDMA at 850 MHz and 4G LTE at 700 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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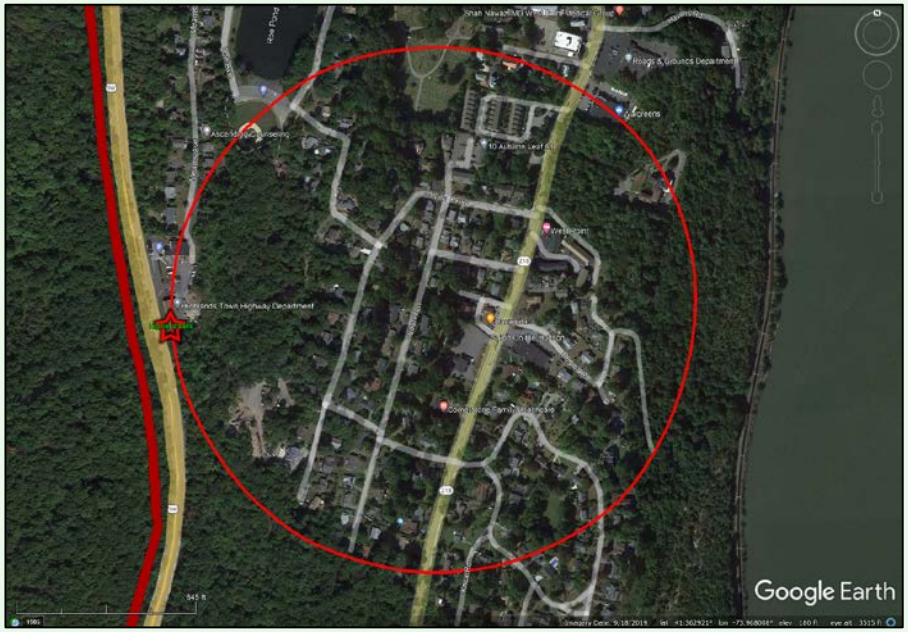
# Explanation of this Search Area




Highland Falls 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 **Bear Mtn Bridge and West Point Campus** with the proposed site, adequate and reliable service will be restored. The new **Highland Falls** site will provide dominant and dedicated signal to the identified portions of the Town/Village of **Highland Falls**. This helps to improve not only the **Highland Falls** project area but will also indirectly result with significant improvements to the above mentioned overloaded sites ultimately improving larger serving areas of **Highland Falls** and **Phillipstown** surrounding the **Highland Falls** project area.

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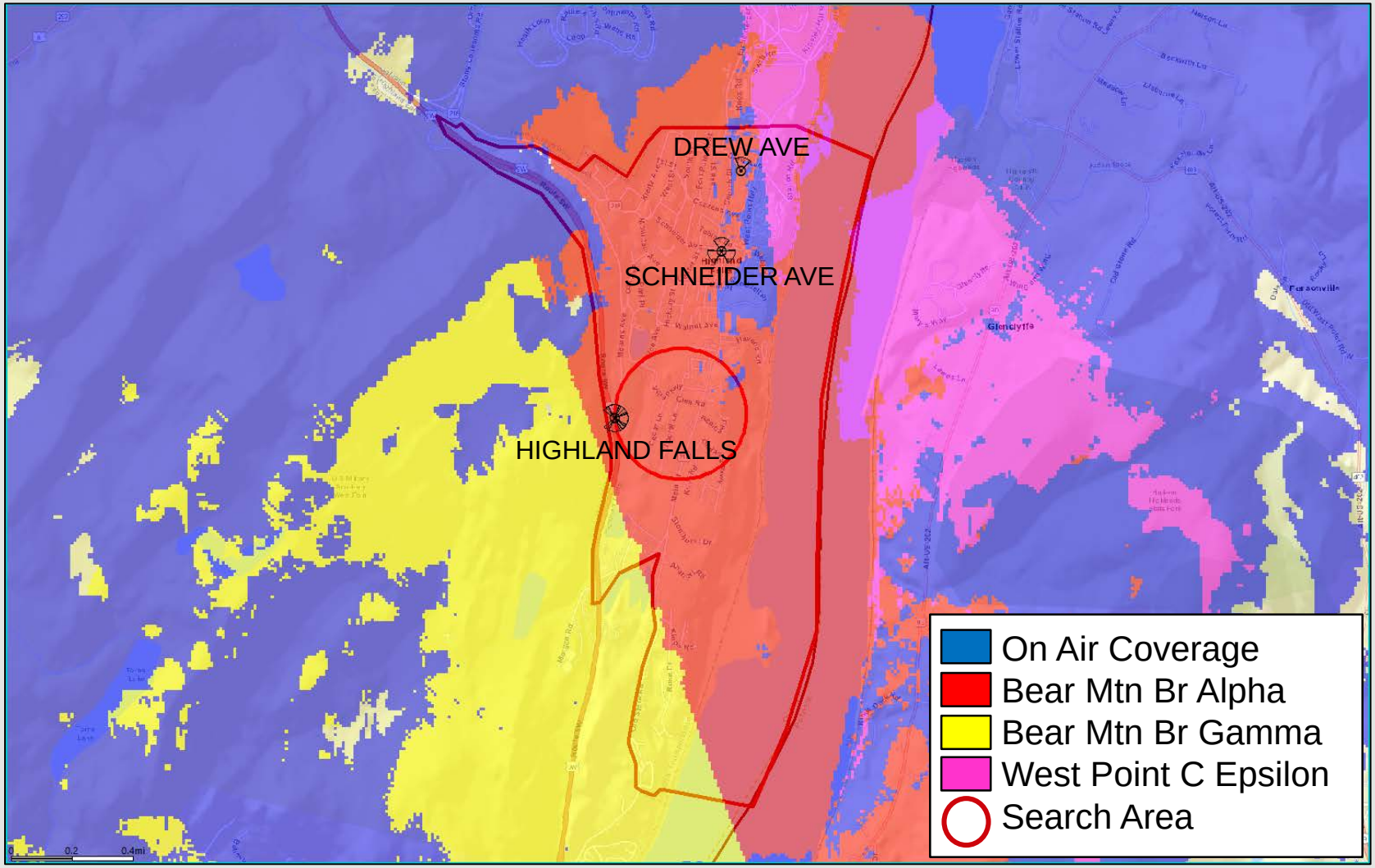
# Existing 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents low band coverage from existing sites, with the sites in need of capacity offload detailed in the legend above. Dark blue coverage is from other on air sites.

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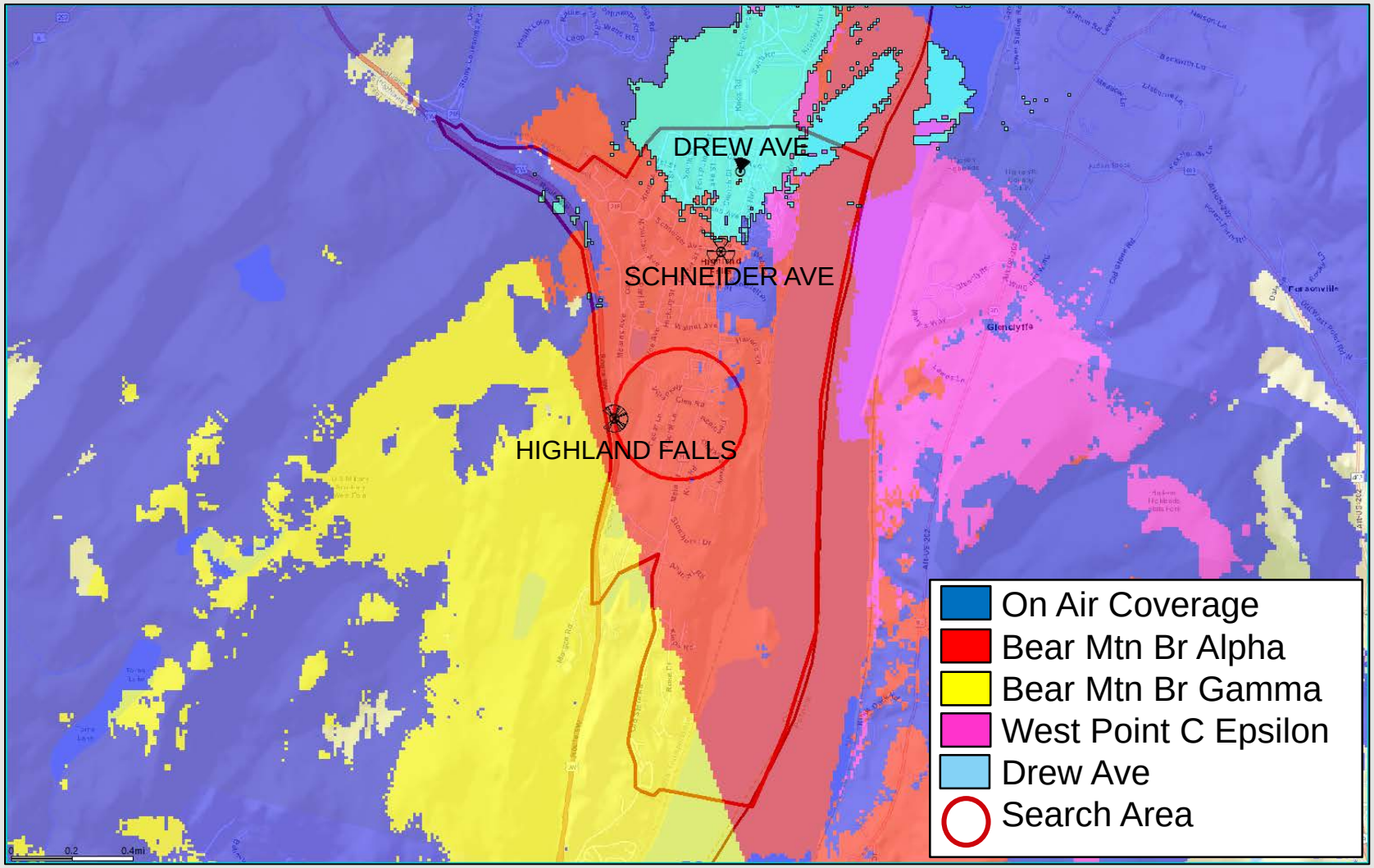
# Existing (+ Drew Ave) 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents low band coverage from existing sites + Drew Ave (planned site), with the other sites in need of capacity offload detailed in the legend above. Dark blue coverage is from other on air sites.

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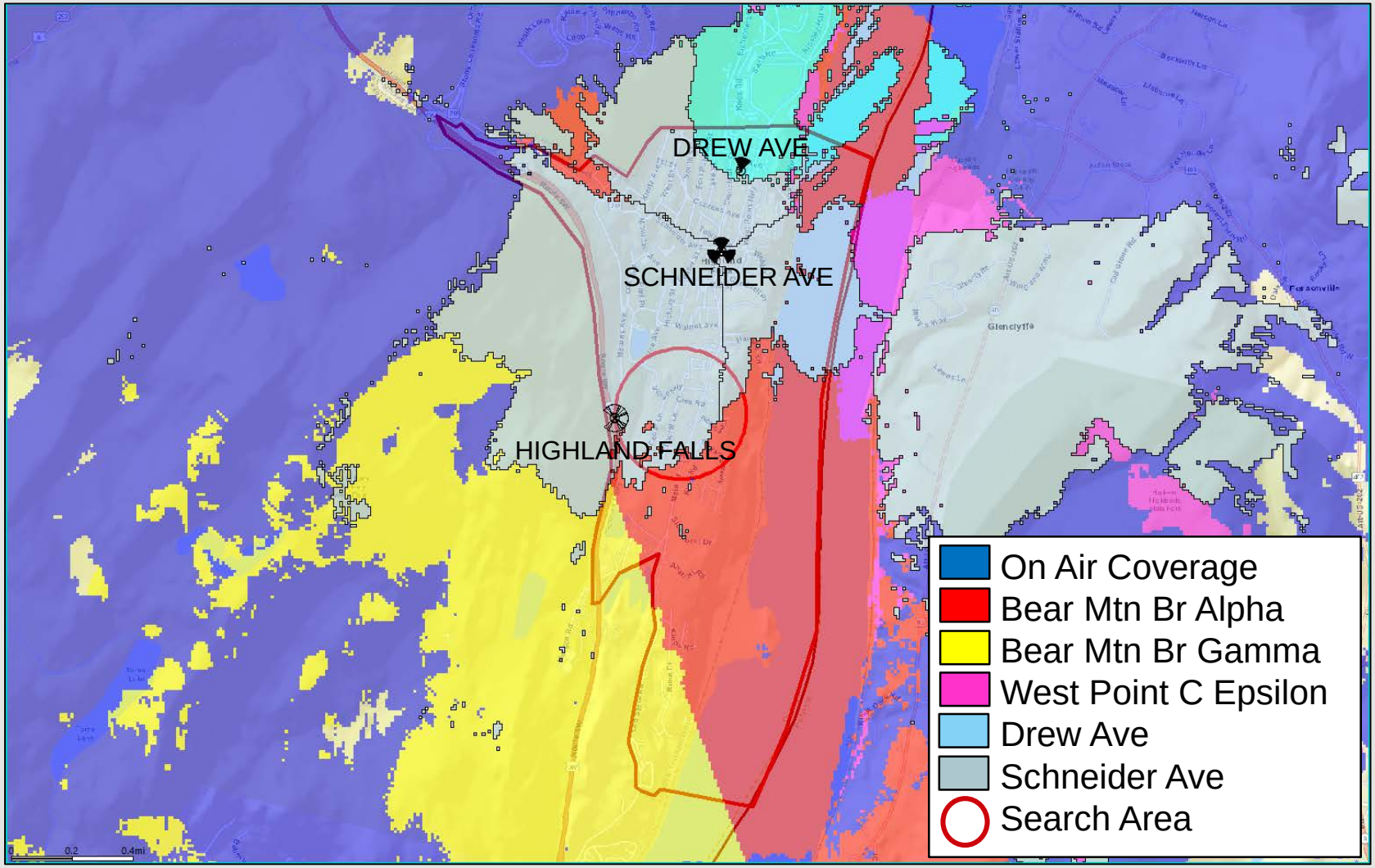
# Existing (+ Drew and Schneider) 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents low band coverage from existing sites + Drew and Schneider Ave, with the other sites in need of capacity offload detailed in the legend above. Dark blue coverage is from other on air sites.

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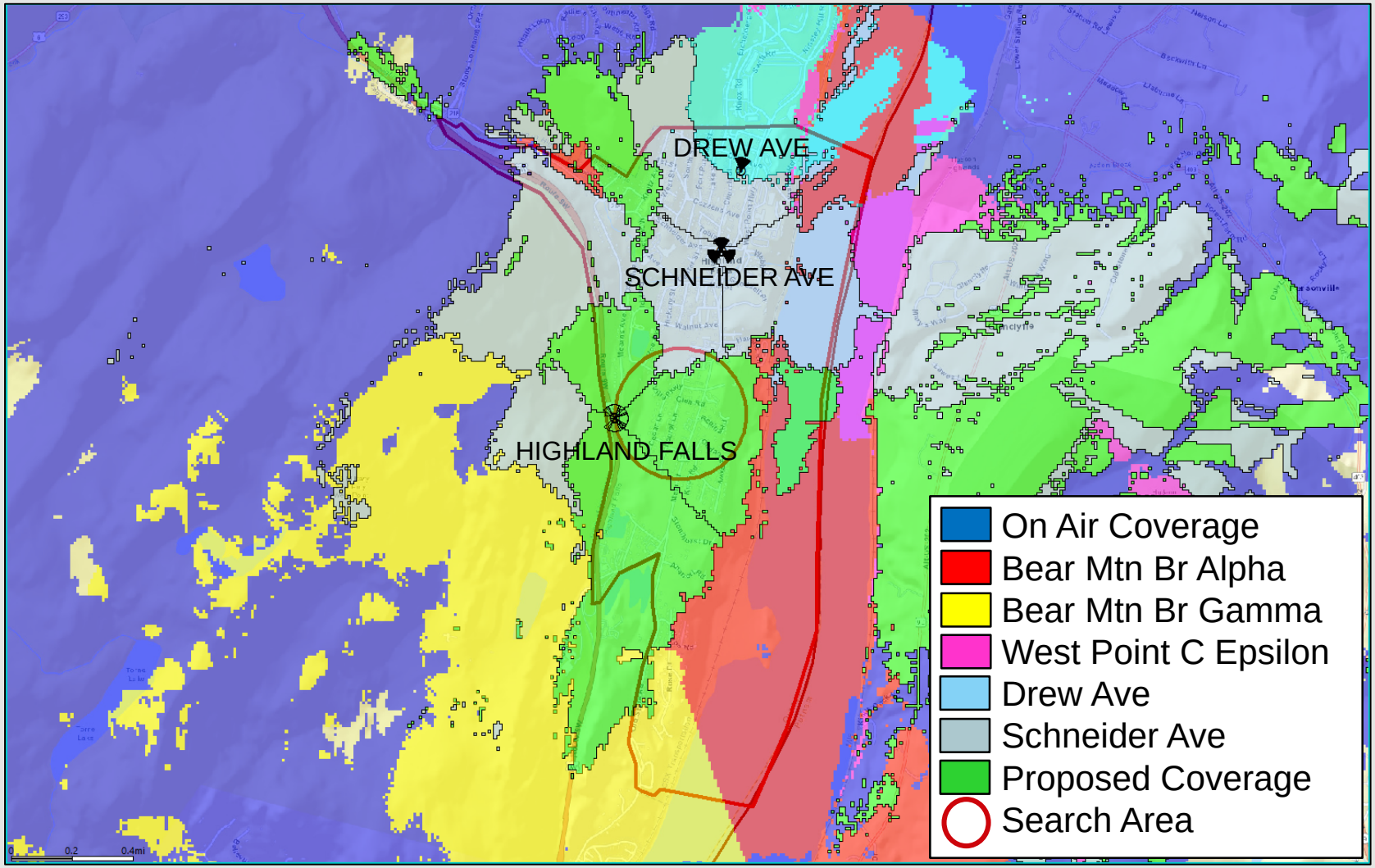
# Proposed (+ Drew and Schneider) 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new Highland Falls site dominant signal area (at 63' ACL).




The map above adds the low band footprint of the proposed Highland Falls site in green. The combined Highland Falls, Schneider Ave and Drew Ave best server footprints provide improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the existing overloaded sectors identified in the image above.

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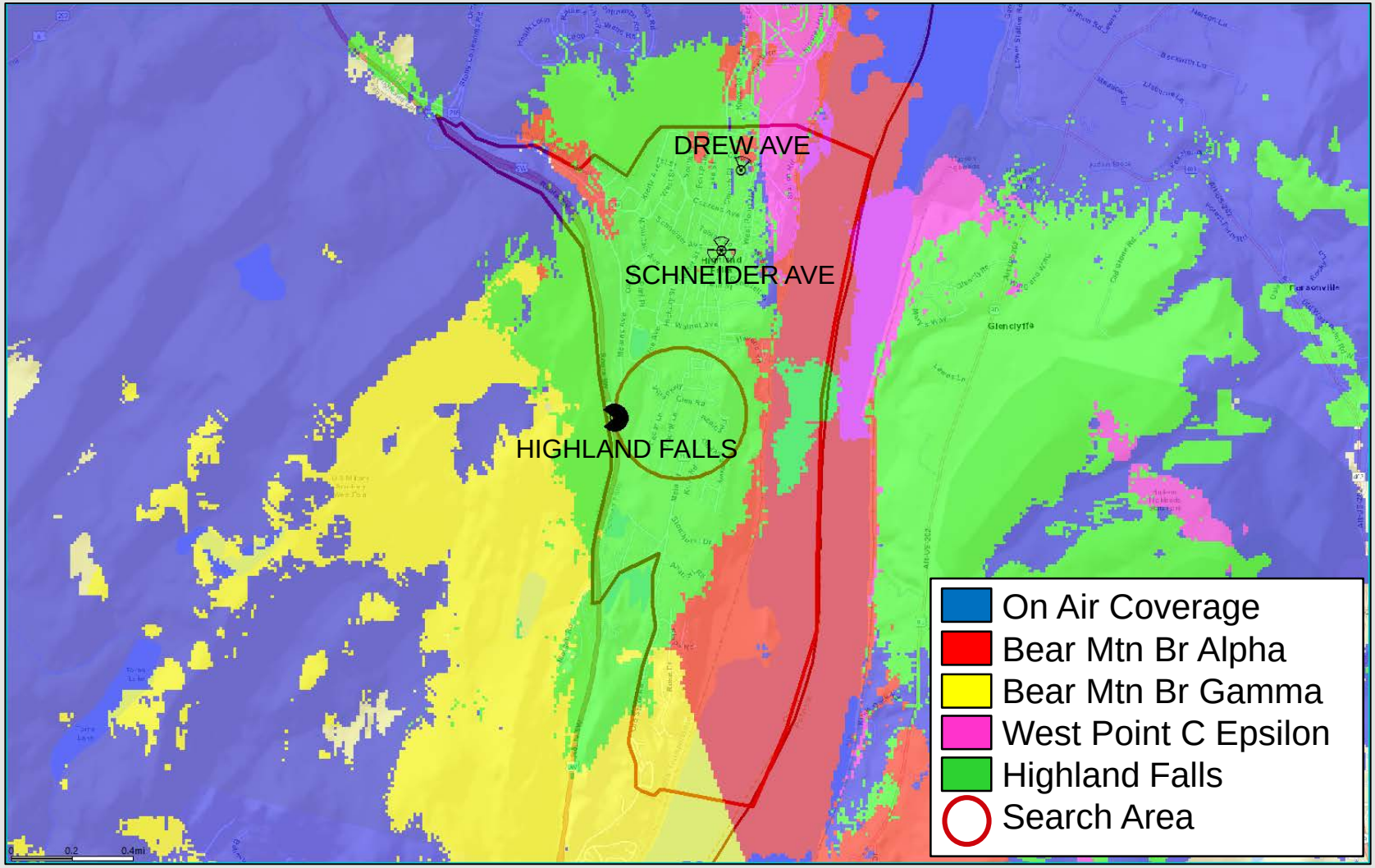
# Proposed (w/o Schneider and Drew) 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new Highland Falls site dominant signal area (at 63' ACL).




The map above adds the low band footprint of the proposed Highland Falls site in green (without Drew and Schneider Ave). The green best server footprint provides improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the existing overloaded sectors identified in the image above.

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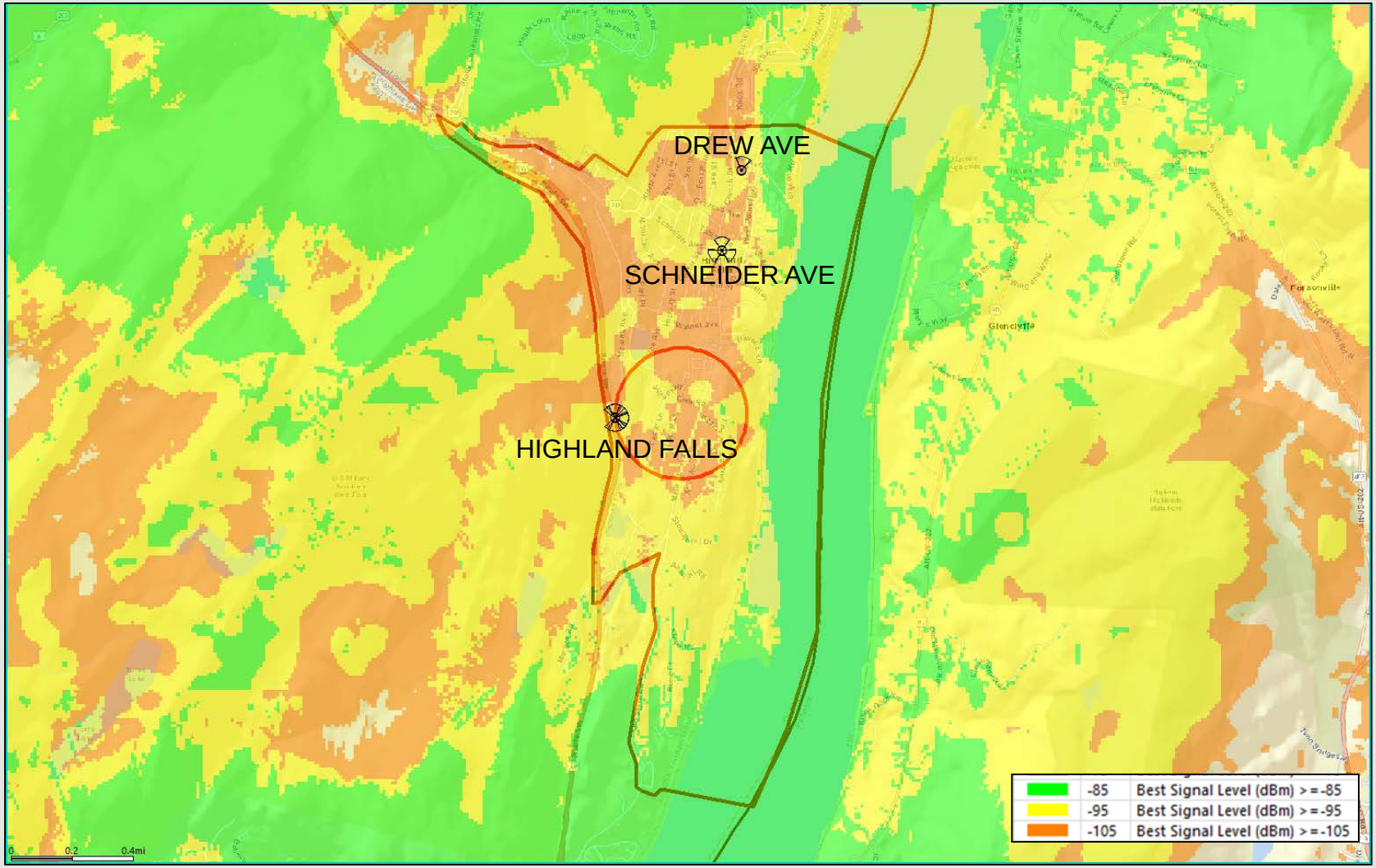
# Existing 700MHz Coverage

This coverage map shows how weak the RF conditions are in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents low band signal strength coverage from existing sites.

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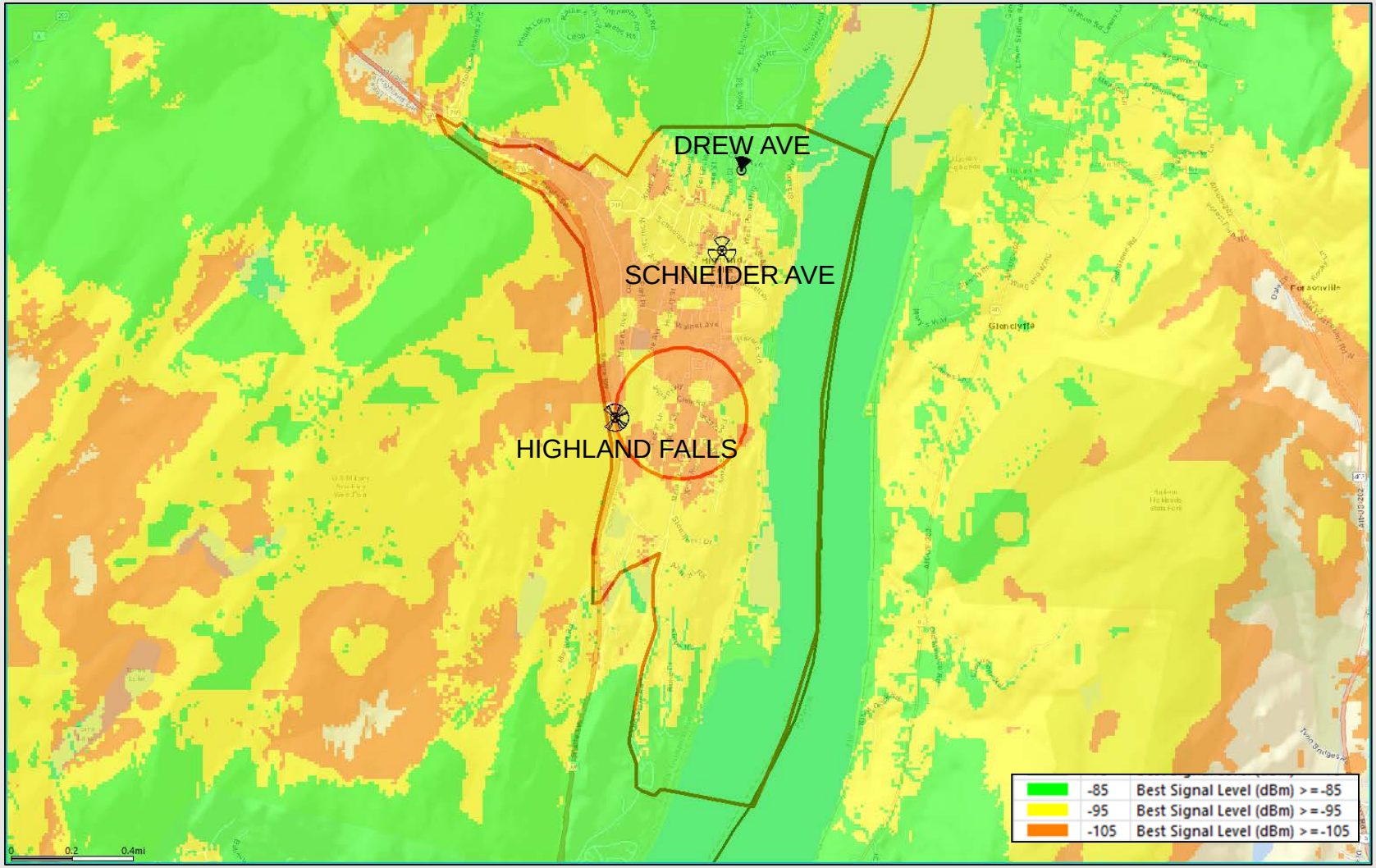
# Existing (+ Drew Ave) 700MHz Coverage

This coverage map shows the Drew Ave site impact to the weak RF conditions in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents low band signal strength coverage from existing sites with the addition of the planned Drew Ave site.

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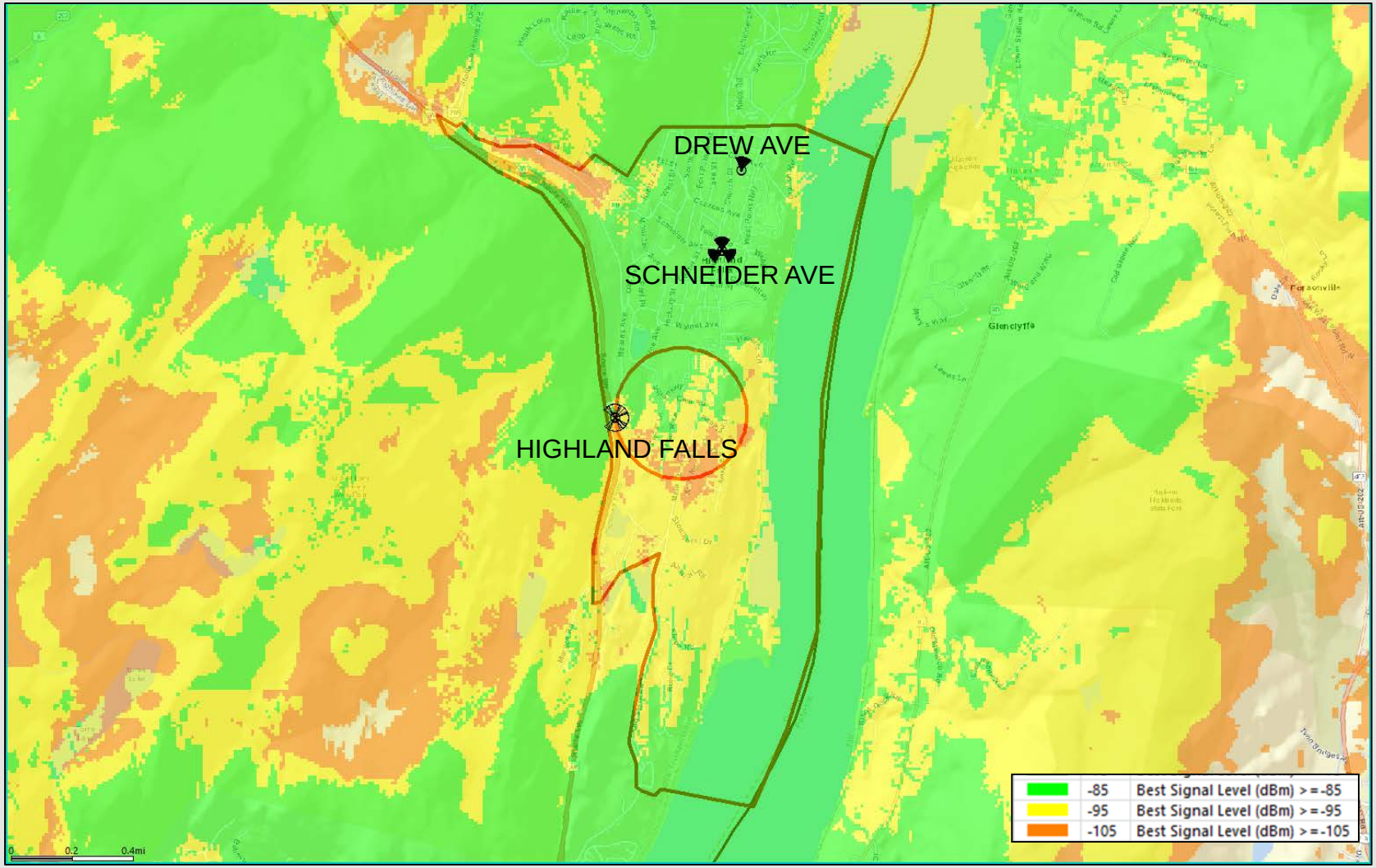
# Existing (+ Drew and Schneider) 700MHz Coverage

This coverage map shows the Drew and Schneider Ave site impact to the weak RF conditions in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents low band signal strength coverage from existing sites with the addition of the planned Drew and Schneider Ave sites.

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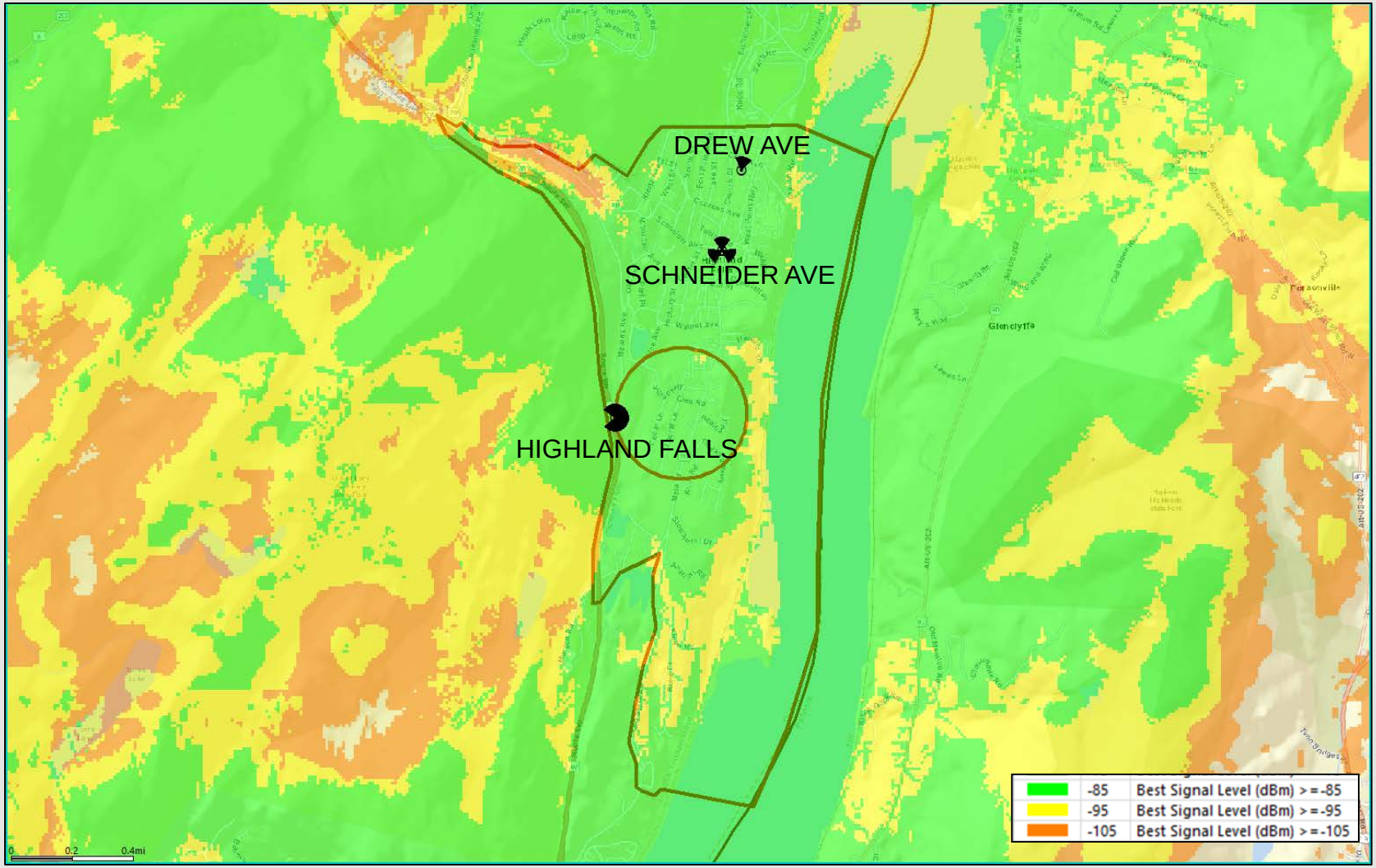
# Proposed (+ Drew and Schneider) 700MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Highland Falls project area (Highland Falls at 63' ACL).
*Refer to slide 12 for further explanation of these color thresholds*




The map above adds the low band footprint of the proposed Highland Falls site along with the planned Drew and Schneider Ave sites. The significantly improved signal strength corresponds to improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the aforementioned existing overloaded sectors currently serving the Highland Falls project area.

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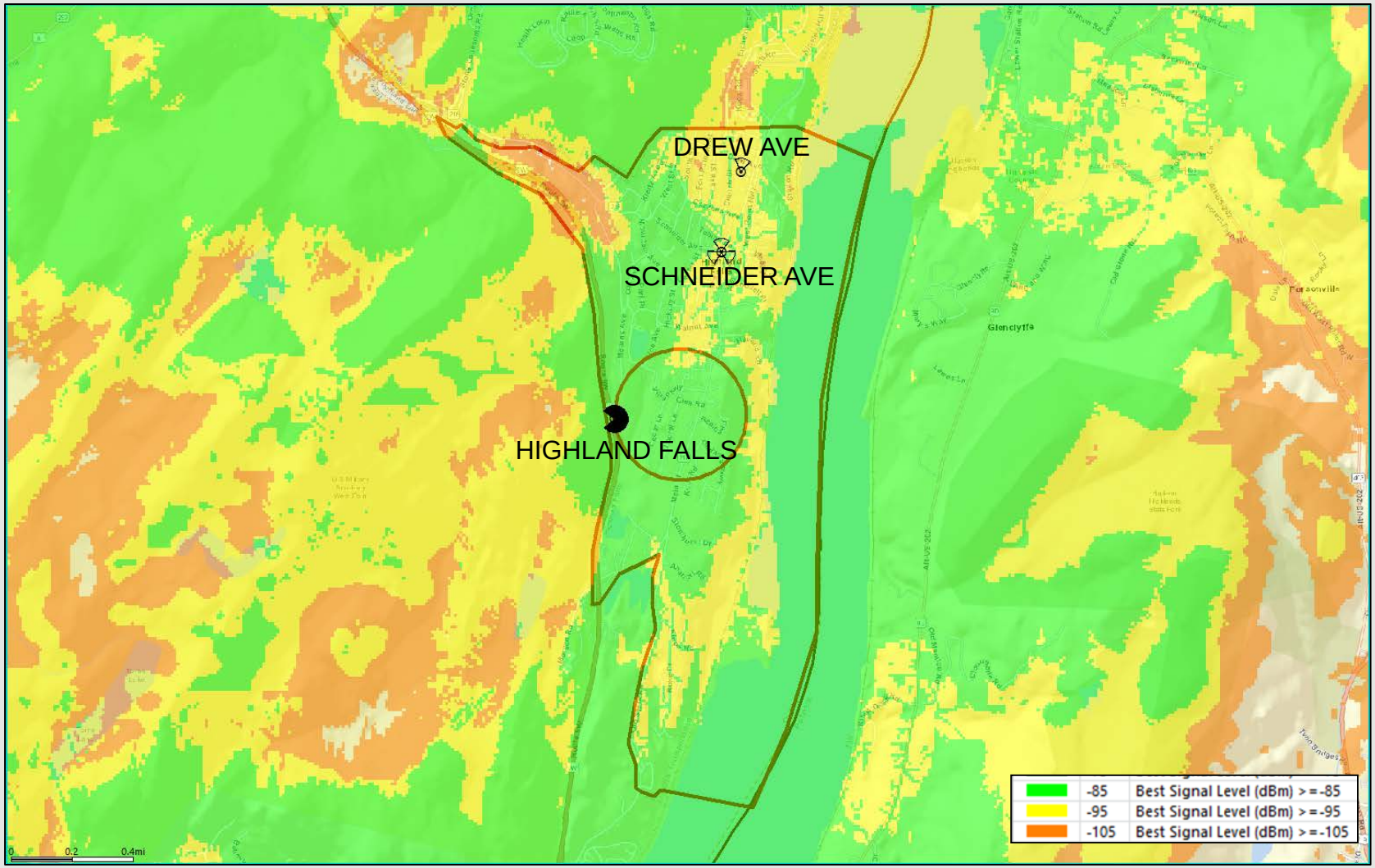
# Proposed (w/o Drew and Schneider) 700MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Highland Falls project area (Highland Falls at 63' ACL).
*Refer to slide 12 for further explanation of these color thresholds*




The map above adds the low band footprint of the proposed Highland Falls site (without Drew and Schneider Ave sites) to existing signal strength coverage. Highland Falls is designed to work in concert with Drew and Schneider Ave as a three part solution for the Village of Highland Falls and surrounding area.

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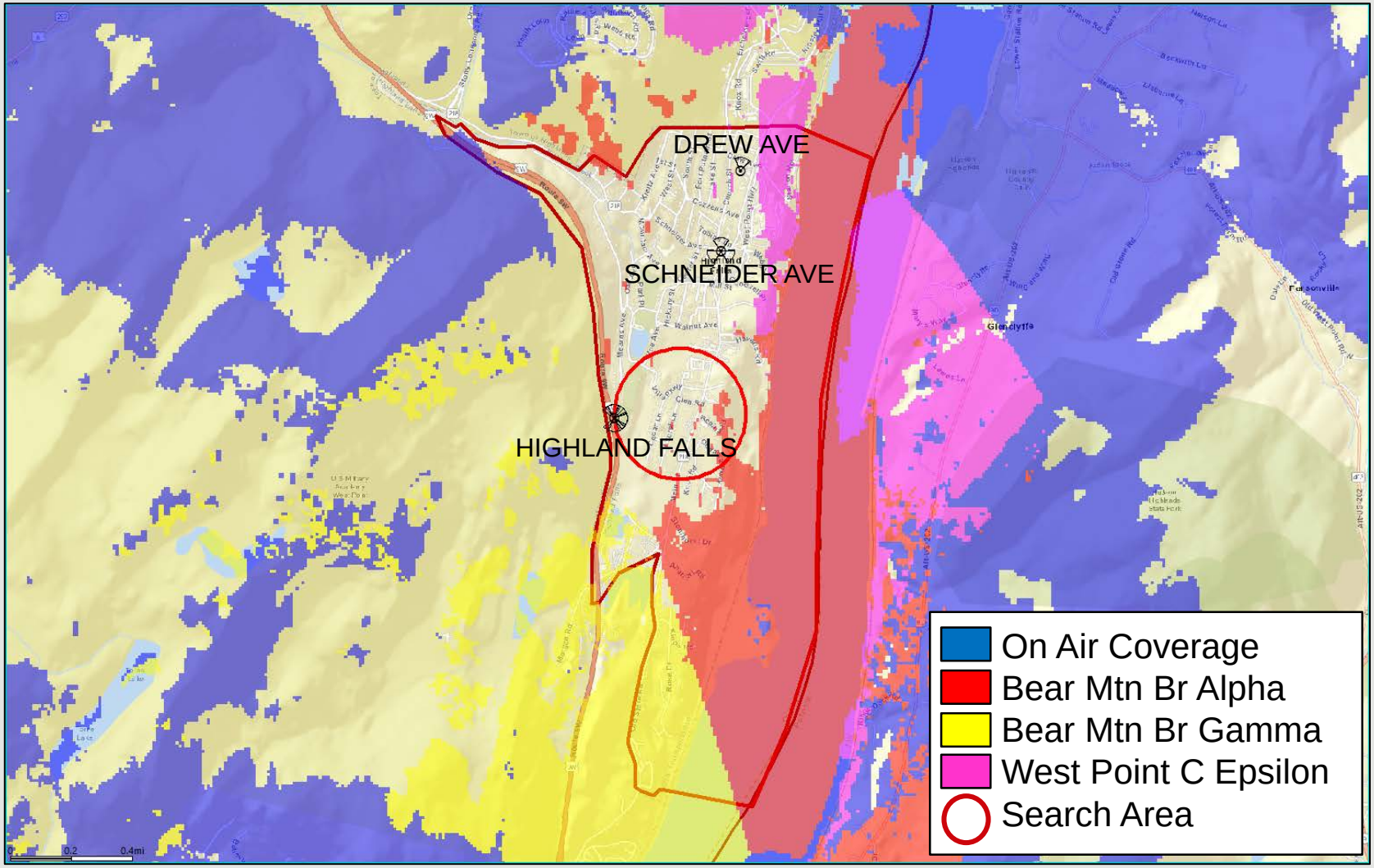
# Existing 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents mid band coverage from existing sites, with the sites in need of capacity offload detailed in the legend above. Blue coverage is from other on air sites.

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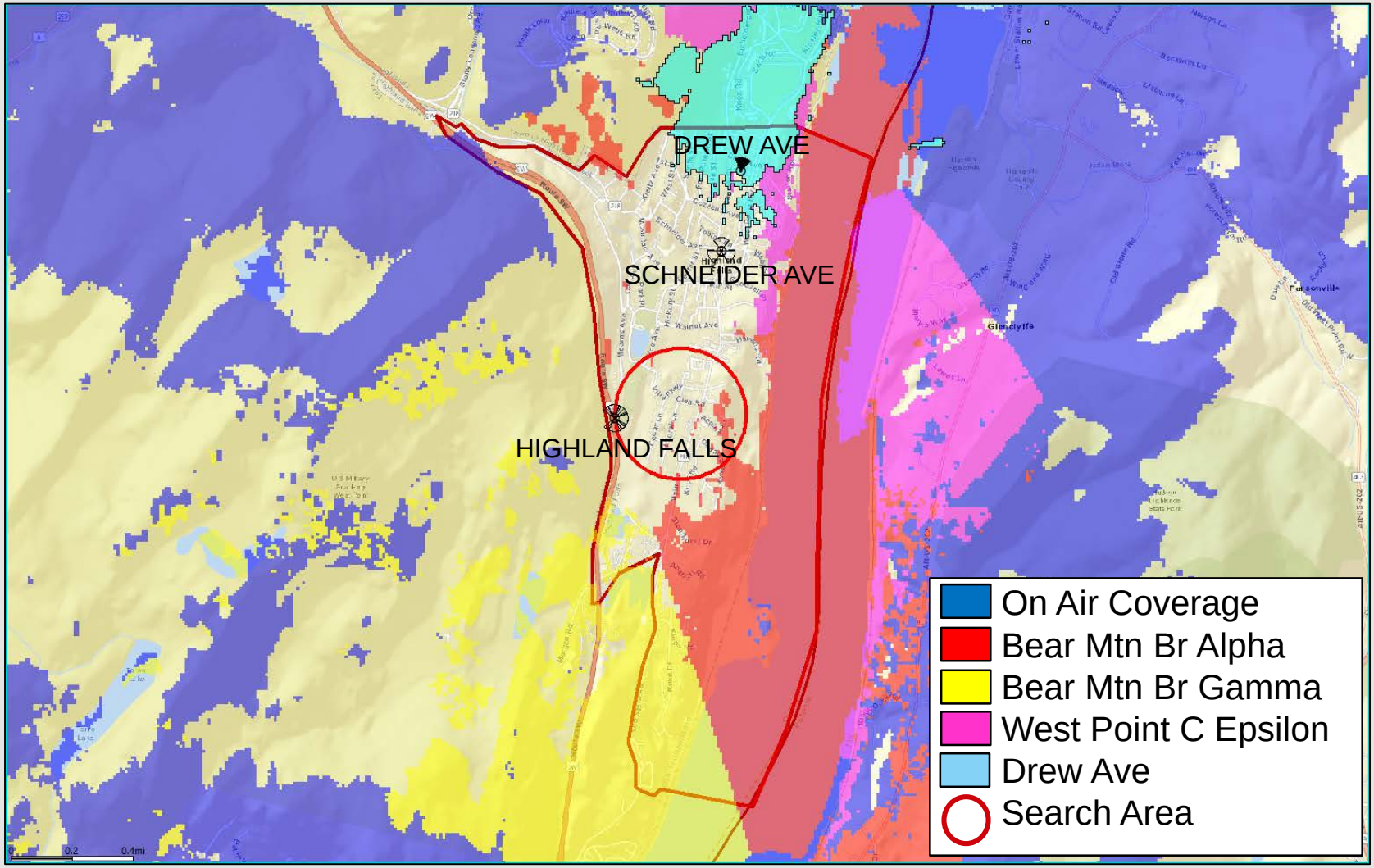
# Existing (+ Drew Ave) 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents mid band coverage from existing sites + Drew Ave (planned site), with the other sites in need of capacity offload detailed in the legend above. Dark blue coverage is from other on air sites.

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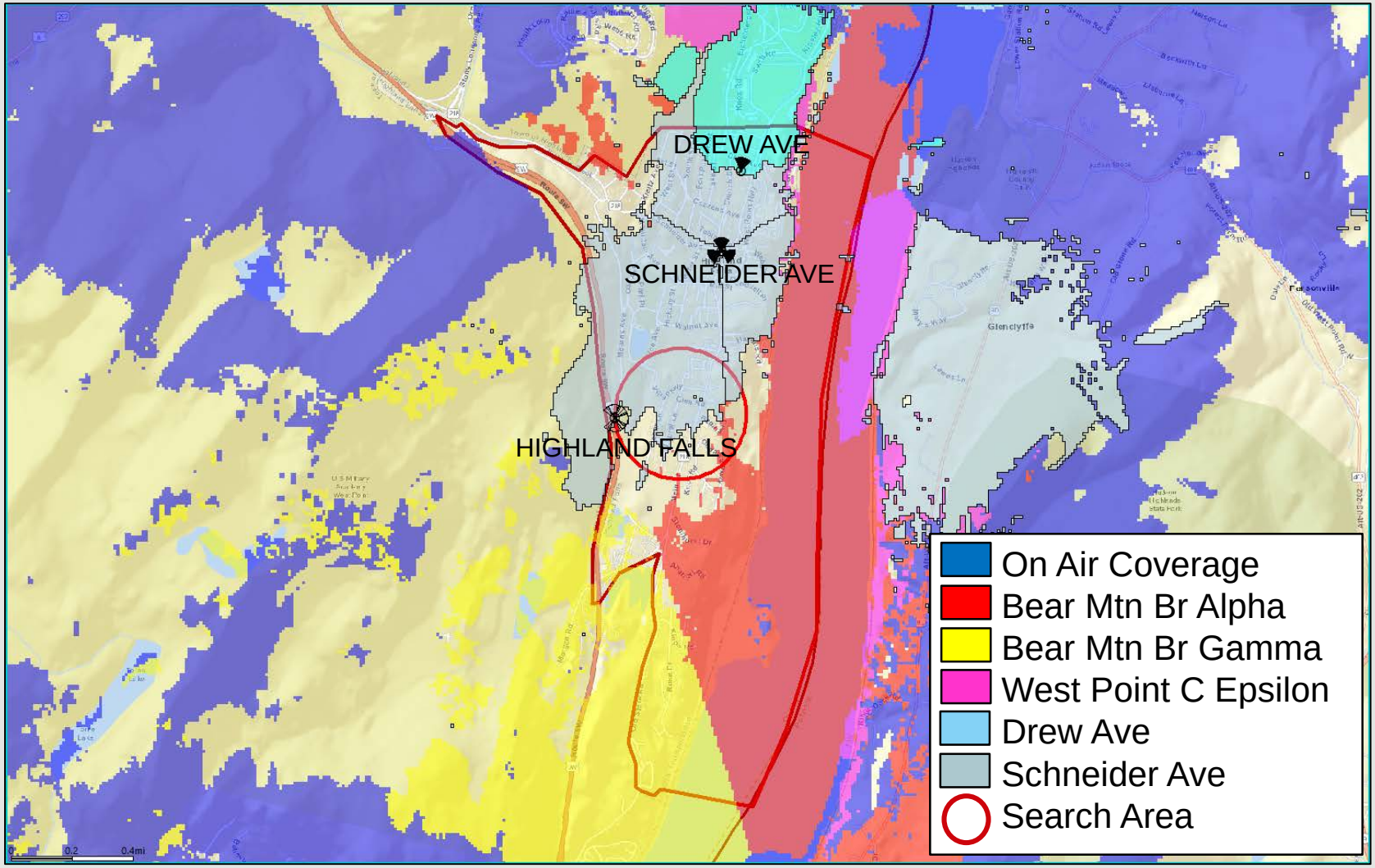
# Existing (+ Drew and Schneider) 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.




The map above represents mid band coverage from existing sites + Drew and Schneider Ave, with the other sites in need of capacity offload detailed in the legend above. Dark blue coverage is from other on air sites.

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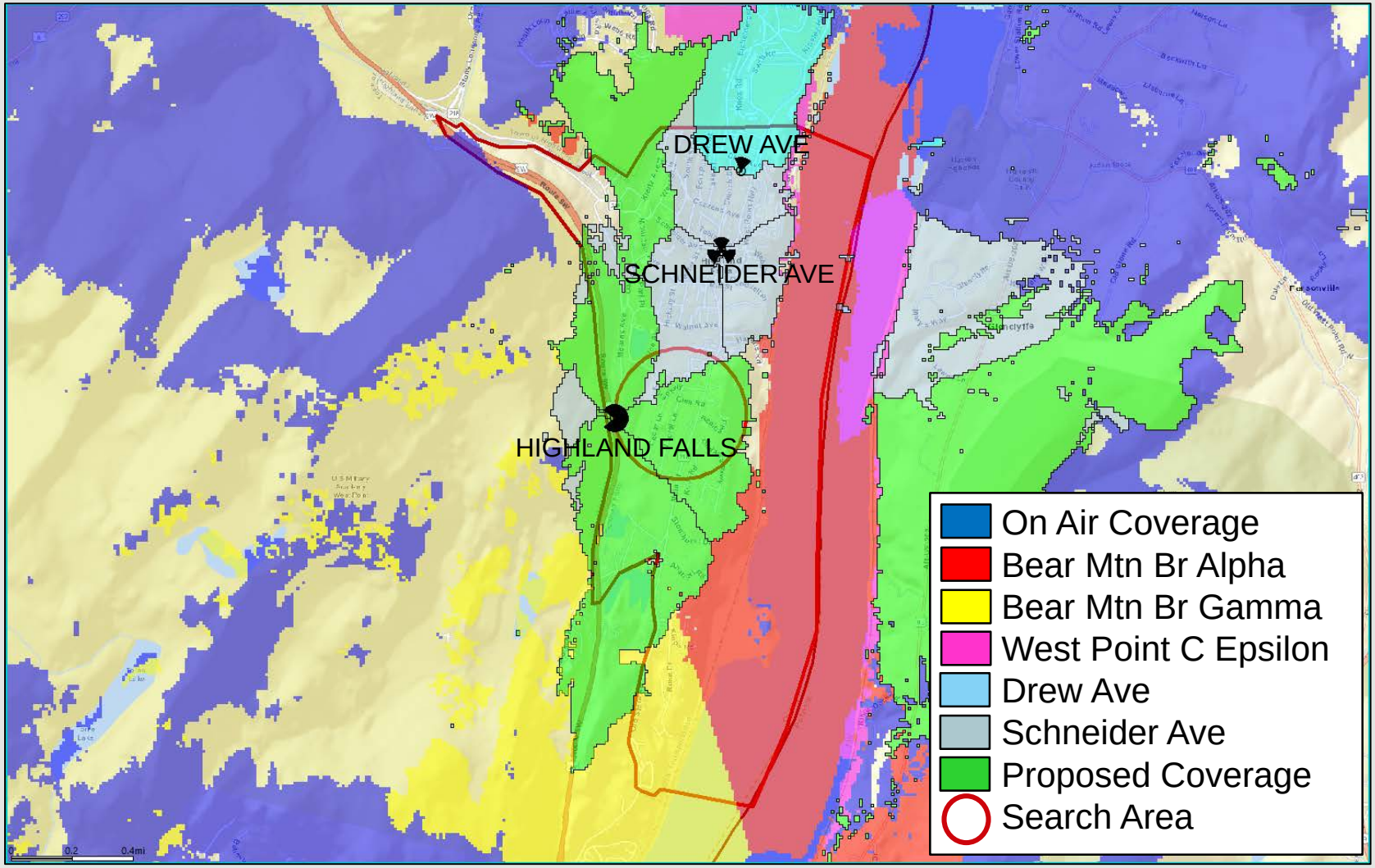
# Proposed (+ Drew and Schneider) 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new Highland Falls site dominant signal area (at 63' ACL).




The map above adds the mid band footprint of the proposed Highland Falls site in green. The combined Highland Falls, Schneider Ave and Drew Ave best server footprints provide improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the existing overloaded sectors identified in the image above.

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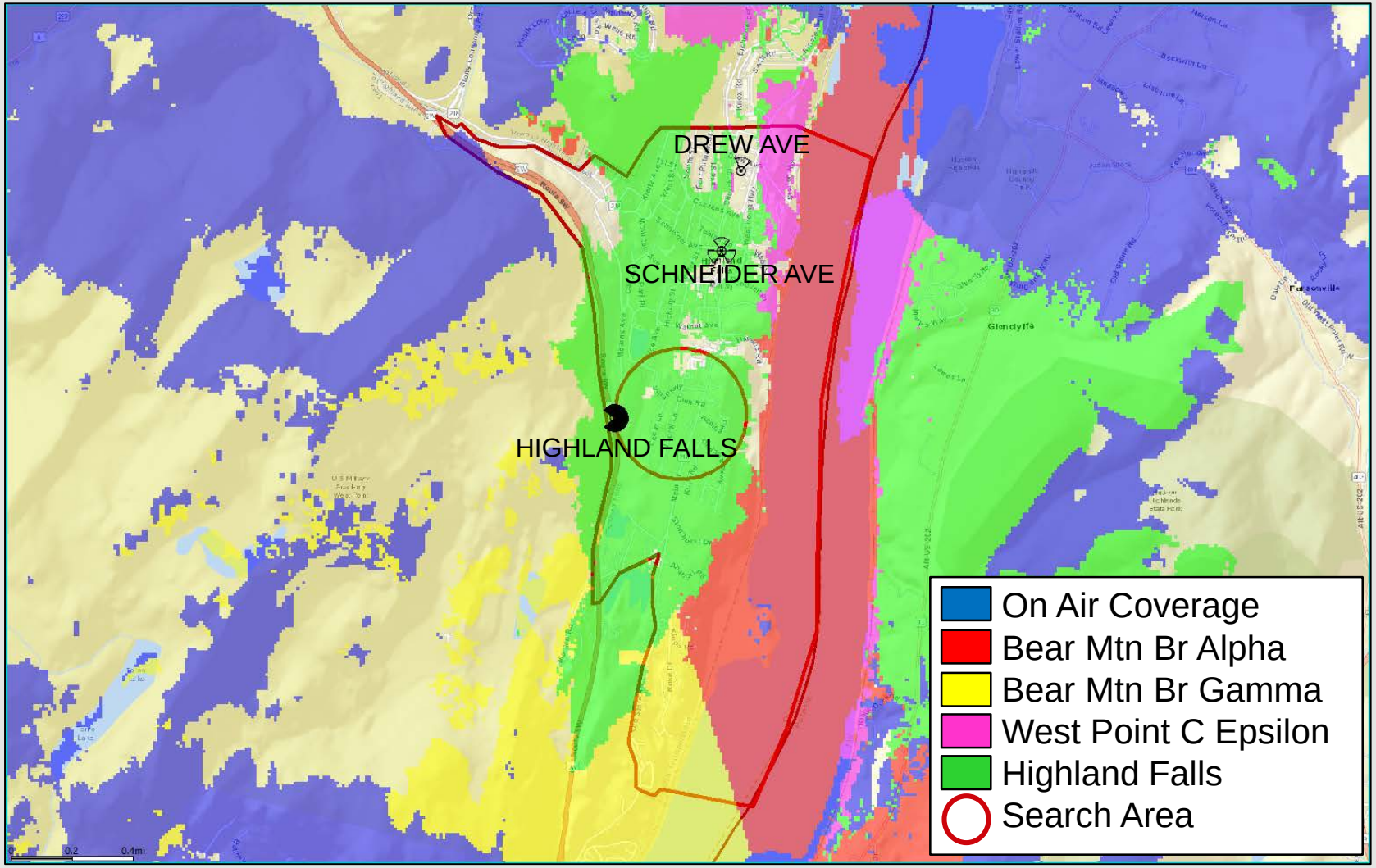
# Proposed (w/o Schneider and Drew) 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area (at 63' ACL).




The map above adds the mid band footprint of the proposed Highland Falls site in green (without Drew and Schneider Ave). The green best server footprint provides improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the existing overloaded sectors identified in the image above.

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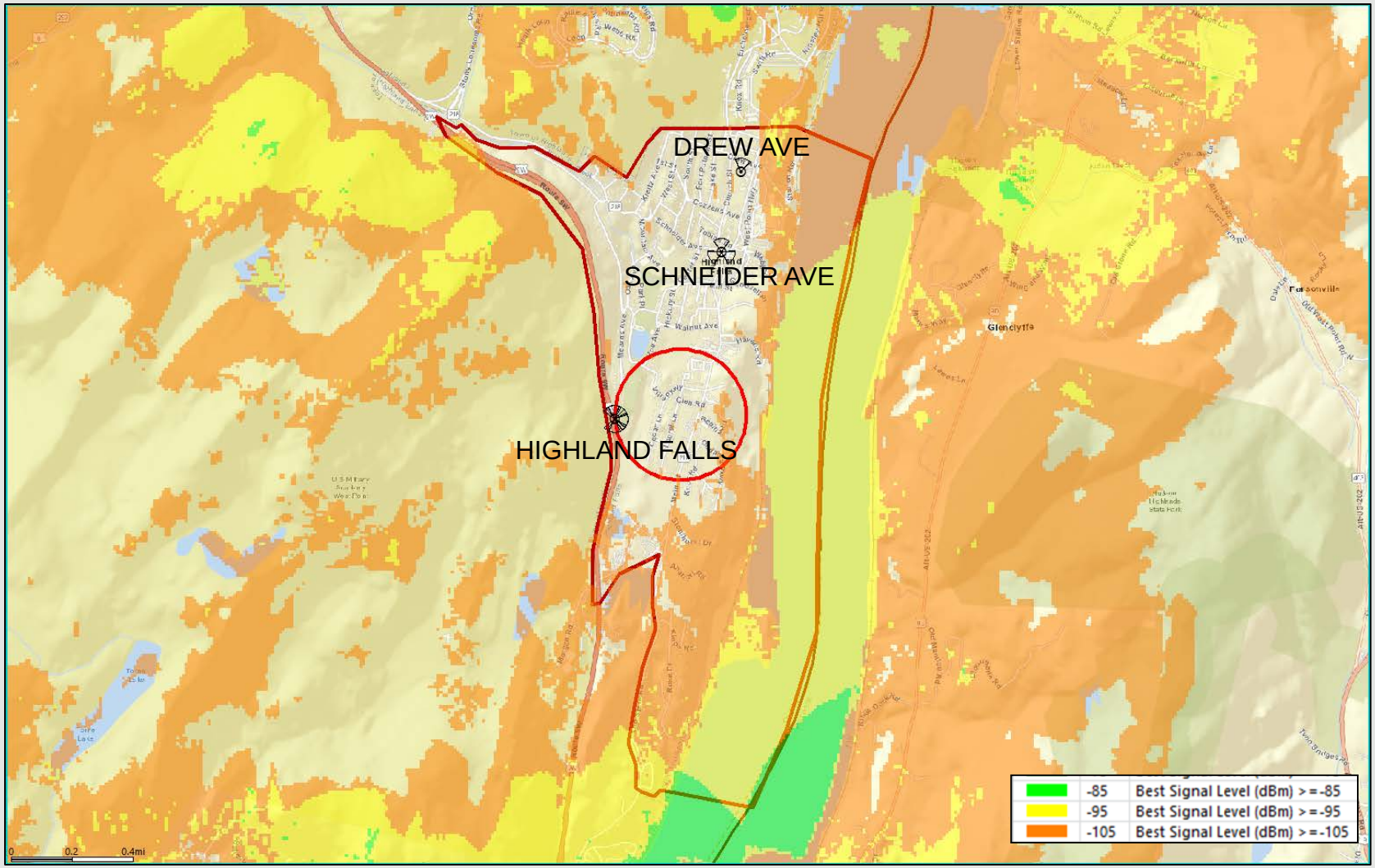
# Existing 2100MHz Coverage

This coverage map shows the RF conditions in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents mid band coverage from existing sites. This 2100MHz signal is very weak throughout the project area. Additional mid band network densification is required to resolve these conditions.

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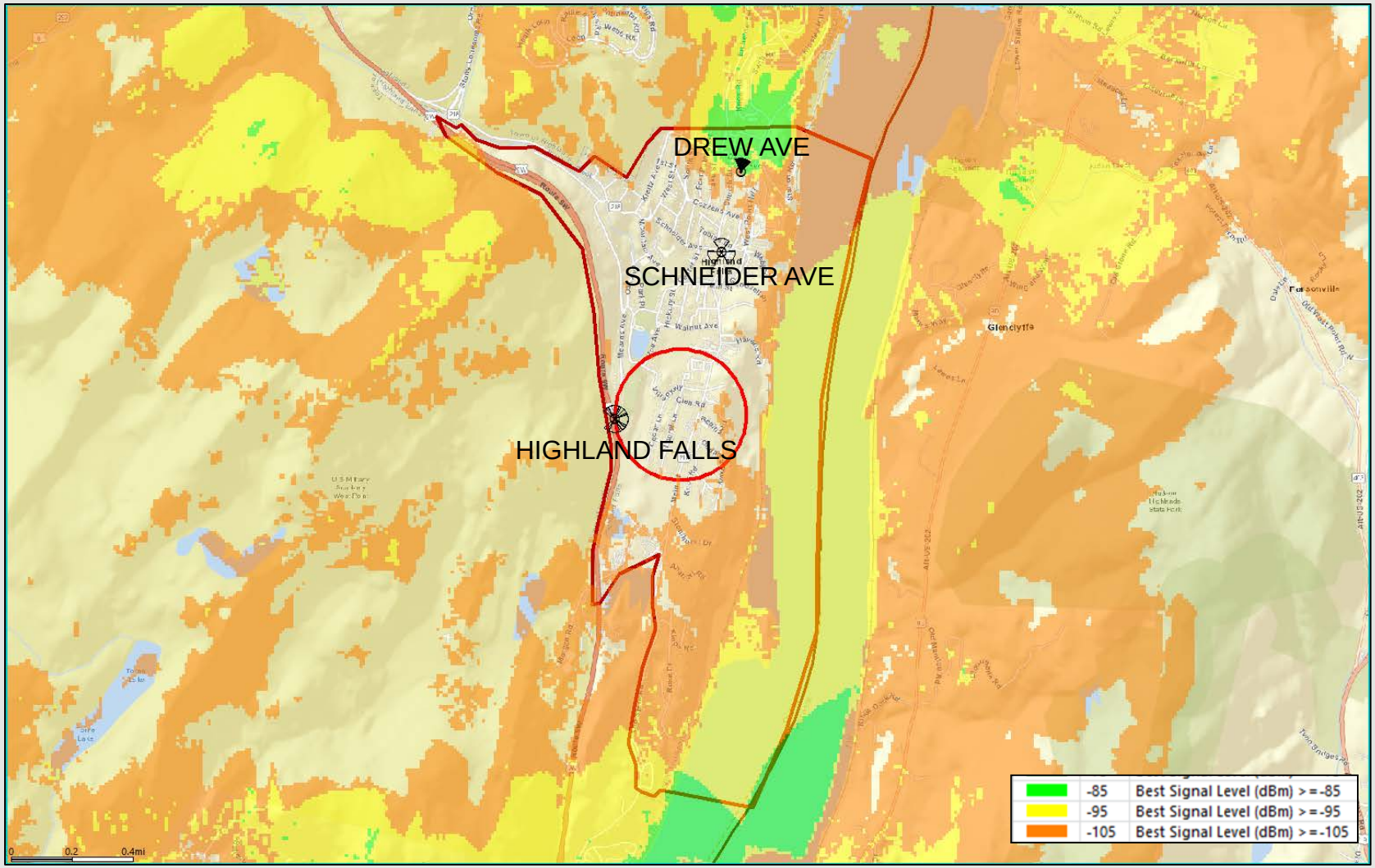
# Existing (+ Drew Ave) 2100MHz Coverage

This coverage map shows the Drew Ave site impact to the weak RF conditions in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents mid band coverage from existing sites with the addition of the planned Drew Ave site. This 2100MHz signal is very weak throughout the project area. Additional mid band network densification is required to resolve these conditions.

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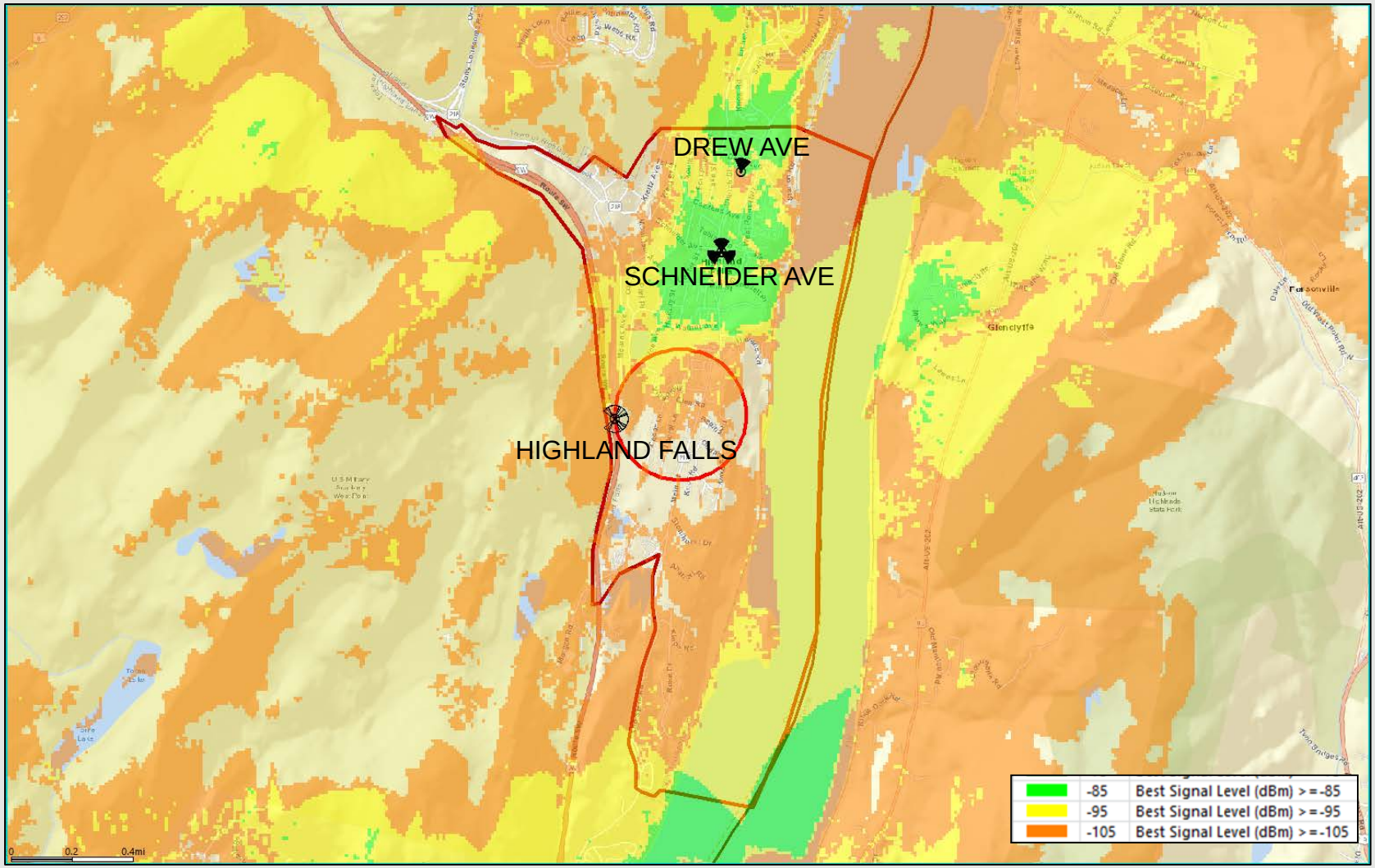
# Existing (+ Drew and Schneider) 2100MHz Coverage

This coverage map shows the Drew and Schneider Ave site impact to the weak RF conditions in and around the Highland Falls site area.
*Refer to slide 12 for further explanation of these color thresholds*




The map above represents mid band coverage from existing sites with the addition of the planned Drew and Schneider Ave sites. This 2100MHz signal is very weak throughout the project area. Additional mid band network densification is required to resolve these conditions.

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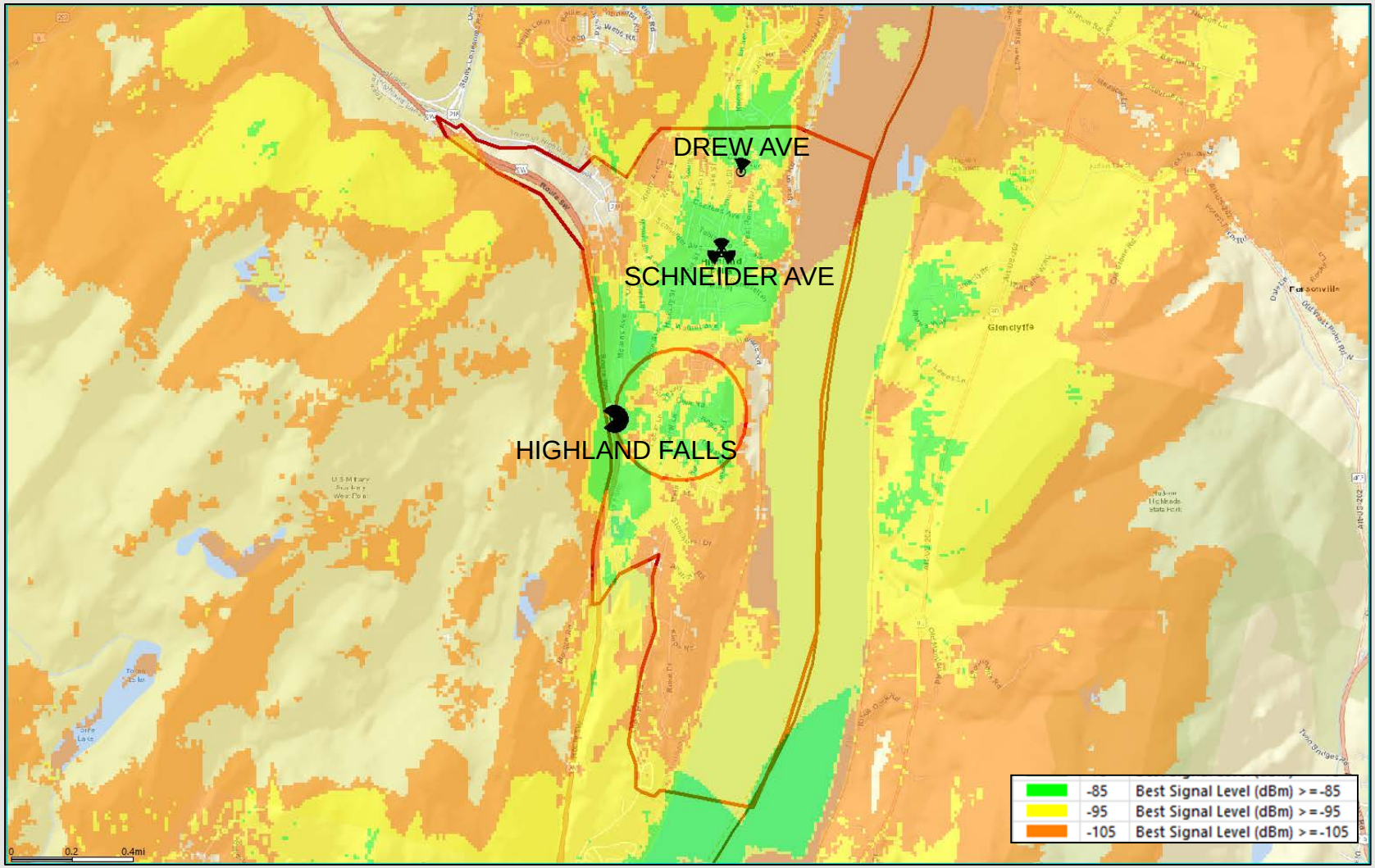
# Proposed (+ Drew and Schneider) 2100MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Highland Falls project area (Highland Falls at 63' ACL).
*Refer to slide 12 for further explanation of these color thresholds*




The map above adds the mid band footprint of the proposed Highland Falls site along with the planned Drew and Schneider Ave sites. The significantly improved signal strength corresponds to improved coverage and capacity throughout the identified significant gap area. This will help to resolve the coverage and capacity issues impacting the aforementioned existing overloaded sectors currently serving the Highland Falls project area.

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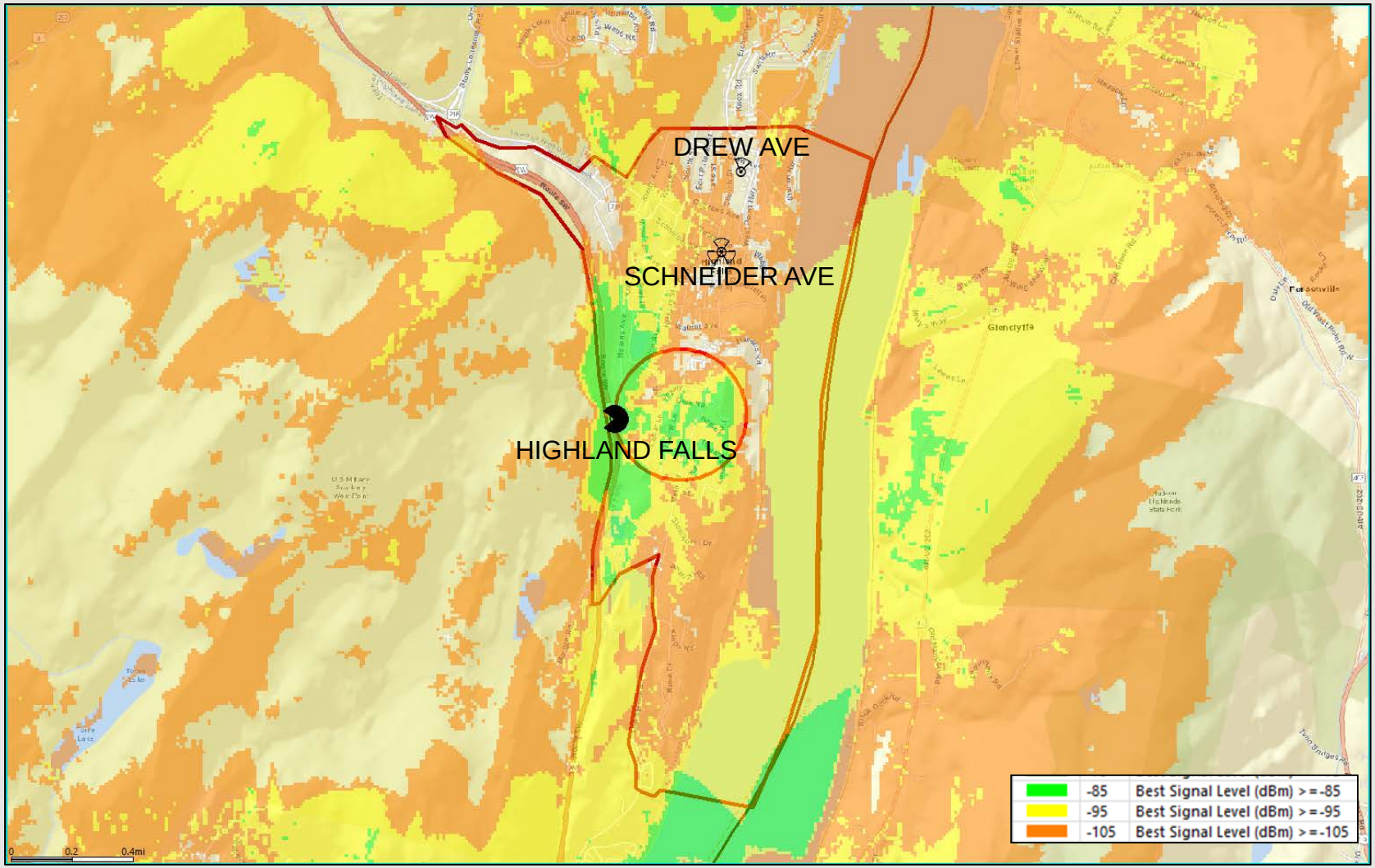
# Proposed (w/o Drew and Schneider) 2100MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Highland Falls project area (Highland Falls at 63' ACL).
*Refer to slide 12 for further explanation of these color thresholds*




The map above adds the mid band footprint of the proposed Highland Falls site (without Drew and Schneider Ave sites) to existing signal strength coverage. Highland Falls is designed to work in concert with Drew and Schneider Ave as a three part solution for the Village of Highland Falls and surrounding area.

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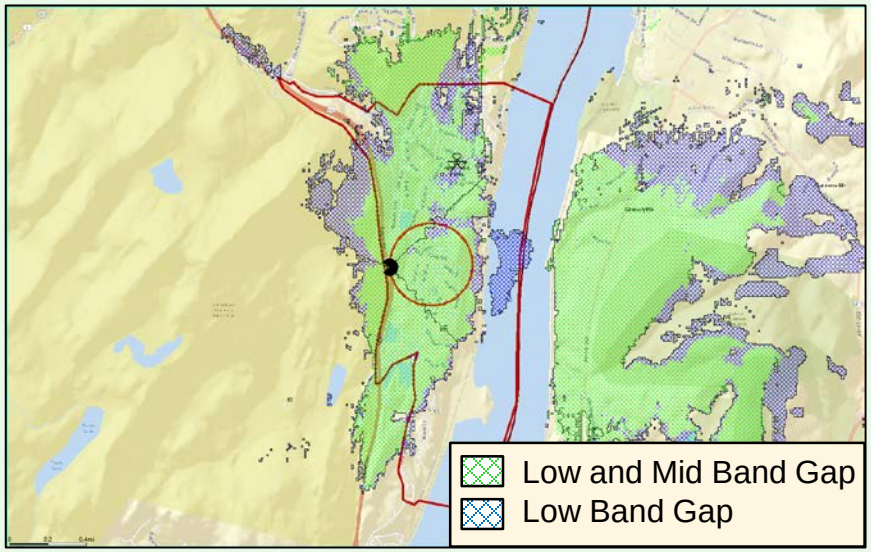
# RF Justification Summary




The proposed site at 63' ACL resolves the substantial and significant gaps in coverage and capacity impacting the Highland Falls project area. The gaps are shown in the above graphic: The shaded areas as detailed in the legend represent gaps in coverage and capacity that the Highland Falls (site) will resolve.

The network was analyzed to determine whether there is sufficient **RF coverage and capacity** in the **Village of Highland Falls**. It was determined that there are significant gaps in adequate LTE service for Verizon Wireless in the 700 and 2100MHz frequency bands. In addition to the coverage deficiencies, Verizon Wireless' network does not have sufficient capacity (low band or mid band) to handle the existing and projected LTE voice and data traffic in the area near and neighboring the proposed **Highland Falls** facility ("targeted service improvement area"). Based on the need for additional coverage and capacity while considering the topography and specific area requiring service, any further addition of capacity to distant existing sites does not remedy Verizon's significant gap in reliable service. Therefore, the proposed facility is also needed to provide "**capacity relief**" to the existing nearby Verizon Wireless sites, allowing the proposed facility and those neighboring sites to adequately serve the existing and projected capacity demand in this area.

With the existing network configuration there are significant gaps in service which restricts Verizon Wireless customers from originating, maintaining or receiving reliable calls and network access. It is our expert opinion that the proposed height will satisfy the coverage and capacity needs of Verizon Wireless and its subscribers in this portion of the **Town/Village of Highland Falls** and the **Highland Falls** project area. The proposed location depicted herein satisfies the identified service gaps and is proposed at the minimum height necessary for adequate service.

*Michael R. Crosby*

Michael R. Crosby
Engineer IV – RF Design
Verizon Wireless

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