Verizon Wireless Communications Facility

Engineering Necessity Case – “Big Indian FD”

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

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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 primary driving conditions that typically prompt the need for a new wireless communications facility/site. All wireless customers depend on their wireless provider's ability to provide **adequate and reliable coverage** where needed. In areas where coverage does not exist the user can not make a connection which is categorized as a "Gap in Service" lacking adequate and reliable coverage. Where coverage exists but is over utilized this can also result with the user not being able to successfully use the connection which is also a "Gap in Service" and categorized as lacking adequate and reliable coverage. The service deficiencies sought to be remedied by this proposed cell site include a significant number of failed calls, resulting in users being unable to connect and/or maintain a connection capable of supporting a reasonably uninterrupted communication.

- **Coverage** can be defined as the existence of radio frequency signal of usable strength and quality/capacity 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 or other data). 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 make the difference between life and 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 has 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 northern portion of the Town of **Shandaken** is currently served by two distant sites. These sites are unable to adequately serve the project area from these relatively distant locations. Specifically, the project area is subject to significant terrain and or foliage challenges for RF (signal) propagation. This terrain and or foliage combined with long distance prevent effective propagation of Verizon's RF signals into this area creating significant gaps in service.

- The first serving site is **Margaretville,** located in the Town of Shandaken, is approximately 5 miles north west (of the project location) situated on an existing tower (160' ACL) located off Kelly Rd. 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 **Shandaken,** located in the Town of Shandaken, is approximately 2.75 miles north east (of the project location) on an existing tower (165' ACL) off Rudy Frank Rd. 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) 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 or 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/foliage 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 provide and or improve coverage throughout the northern portion of the Town of Shandaken, more specifically portions of Rt 28, Fire House Rd, Oliverea Rd, Maben Rd, and Church Rd, as well as the surrounding residential areas, including Big Indian Park and Big Indian Oliverea FD. In order to provide adequate coverage and capacity, a new dominant server must be created. This new dominant coverage will 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 utility pole located at ***8 Firehouse Rd, Big Indian, NY 12410***. Verizon's antennas will utilize 47.7' ACL (Antenna Center Line) with a top of antenna height of 50'. This solution is the minimum height necessary to provide the coverage and capacity improvements needed.

Wireless 4G/5G Safety and Growth

Staying ahead of demand.

A wireless network is like a highway system...

More wireless traffic needs more wireless facilities just like more vehicle traffic needs more lanes.

- Many wireless users share each cell site and congestion may result when too many try to use it at the same time.
- Wireless coverage may already exist in an area, but with data usage growth increasing exponentially each year, more capacity is needed.
- To meet capacity demands, we need to add more sites closer to users and strategically spaced with other cell sites to provide the reliable service customers have come to expect from Verizon.

The monthly data traffic in North America is projected to amount to 19.55 exabytes (the equivalent of over four billion DVD's) by 2027. In 2021, the average data

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Health and safety background.

Health and safety organizations worldwide have studied potential health effects of RF emissions for decades, and studies continue.

The Federal Communications Commission (FCC) guidelines for operating wireless networks are based on the recommendations of federal health and safety agencies including:

- The Environmental Protection Agency (EPA)
- The Food and Drug Administration (FDA)
- The National Institute for Occupational Safety and Health (NIOSH)
- The Occupational Safety and Health Administration (OSHA)
- The Institute of Electrical and Electronics Engineers (IEEE)
- The National Council on Radiation Protection and Measurements (NCRP)

Wireless technology, equipment and network operations are highly regulated.

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 homebuyers value good cell service over many other factors including the proximity of schools when purchasing a home.

90% Of single family homebuyers consider an area of good cellular service somewhat important or very important when buying a home.[1]

87% Of prospective homebuyers identified faster mobile phone connections as somewhat or very important when looking at 5G and a potential home.[1]

71% of adults live in wireless-only households.[2]

Connectivity at home.

The demand for access to wireless broadband continues.

People continue to rely more and more on their wireless broadband for work and personal uses.

82% Of voters say wireless is important driving innovation in the U.S.[1]

55GB 17.4 to 55 gigabytes. The average monthly usage of mobile data per smartphone in 2022 and 2028.[1]

523M 523 million wireless connections as of 2022.[1]

1. CTIA Infographics (9/21/24)

Wireless connectivity is critical in schools and communities.

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

20k Learning apps are available for iPads.

72% Of iTunes top selling educational apps are designed for preschool 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.

Reliable and Critical Communications

More people than ever before rely on wireless connections to manage their lives and businesses.

Verizon is expanding its wireless network to meet the growing demands of today and tomorrow.

But it takes time.

466

Globally, total mobile network data traffic will grow to an estimated 466 EB per month by the end of 2029.[1]

76%

of adults and 86.8% of children live in wireless-only households.[2]

74%

Of Americans say government should make it easier to build wireless networks.[3]

The reliability of your cell phone is never more important than when crisis strikes.

That's when a simple call or text message can make the difference between life and death.

We build reliability into every aspect of our wireless network to keep customers connected when you need it most. Reliability starts when we choose the safest, most secure locations for our wireless equipment. The likelihood of earthquakes, and risk from wildfires, mudslides, floods, hurricanes and more are all considered. When disaster strikes, we coordinate with first responders and can mobilize charging stations, special equipment, emergency vehicles and more to support local, state and federal agencies in all 50 states.

80%

Of 911 calls originate from a cell phone.[1]

240

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

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Wireless is a critical component in today's medical fields.

Smart pill bottles and cases can help patients and their caregivers track medication usage, ensuring medications are taken on time and correctly. This supports increased medical compliance, provides more consistent care, and enables preventative care, keeping patients in their homes longer and reducing the number of emergency visits to the doctor's office or hospital.

Wireless connected glucose monitors, blood-pressure cuffs, and EKGs can track a patient's vital signs and catch an issue before it turns into an emergency.

Pacemakers and sleep apnea monitors can be tracked remotely.

Routine eye exams can be conducted with a wireless device connected to a smartphone, bringing solutions and services to low-income and remote areas that would otherwise go unsupported.

Wireless is a critical component in today's communities.

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.

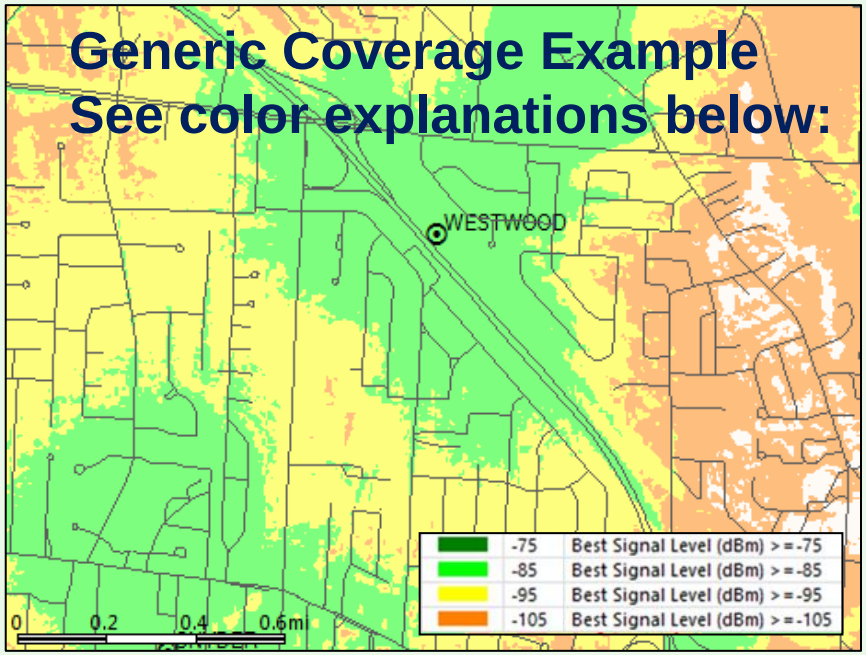
Smart, wireless connected lighting enables cities to control lighting remotely, saving energy and reducing energy costs by 20%.

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 foodborne diseases that kill 3,000 Americans each year.

Explanation of Wireless Coverage



**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 market and conditions*
*** Not displayed in example map, layer not used in all site justifications*

Coverage is best conveyed via coverage maps. RF engineers use computer simulation tools (in this case Verizon uses Forsk Atoll) which takes into account terrain, vegetation, building types, and other site/network specifics to model the RF environment. This propagation model is used to simulate the real world network and assist RF Engineers to evaluate the impact of a proposed site (along with industry experience and other tools). Network design, performance evaluation and development needs have become far too complex for drive test data and dropped call records which for many years have become antiquated and simply not effective in visually communicating gaps (need) in coverage or capacity capability for 4 and 5G networks.

Upstate NY Verizon Wireless sites provide customers service using several FCC licensed frequencies including 700 and 850MHz. To resolve capacity congestion for these coverage layers higher frequency (and bandwidth) PCS (1900 MHz), AWS (2100 MHz) and C-Band (3700MHz) mid band carriers are added however due to differences in propagation characteristics, many gaps in coverage and capacity still remain requiring network densification to resolve. In some mountaintop or long distance situations the mid band (higher frequency) AWS, PCS and C-Band carriers are either not or not fully effective due to excessive distance (path loss). This is because the site is located too far from the user population to provide adequate and reliable service. Although exclusively regulated by the FCC and subject to market adjustment as needed, it is worth noting that all of the propagation slides in this RF Justification are generated using the max power of the LB and MB Samsung radio capabilities.

Signal strength throughout a given site's coverage area is subject to the limitations of the frequencies used. Lower frequencies with narrower bandwidth propagate further distance, and are less attenuated by clutter than higher frequencies with wider bandwidth. Unfortunately due to relatively narrow spectrum available these low bands can become quickly overloaded especially where similar signal strength from mid band carriers are not available. Similar coverage levels from mid band carriers are needed to resolve capacity issues (including the ability to make and receive voice calls). In order to provide similar coverage levels using the higher capacity/higher frequencies, a denser network of sites is required (network densification). Modern 4 and 5G networks are designed and intended to combine or use more than one frequency band at a time. This is called carrier aggregation which is not effective when the mid band signal is too weak or nonexistent. This means that site justification including ACL requirements must be derived from mid band capabilities. It is critical to understand the relationship between low band capacity and mid band coverage especially when reviewing the need for new suburban and rural morphology sites.

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Explanation of Big Indian FD Search Area

Big Indian FD Search Area

A **Search Area** is the geographical area within which a new site is targeted to solve a coverage and 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 providing a new dominant signal area with the proposed site, adequate and reliable service will be restored. The new **Big Indian FD** site will provide dominant and dedicated signal to the identified portions of the Town of **Shandaken**.

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Existing Low Band (700/850MHz) 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 coverage from existing sites. Blue coverage is from other on air (Low Band) sites. Notice the lack of a dominant server throughout the **Big Indian FD** project area. This reveals several sites that are stretching their coverage capabilities excessively which results with poor coverage and performance capabilities.

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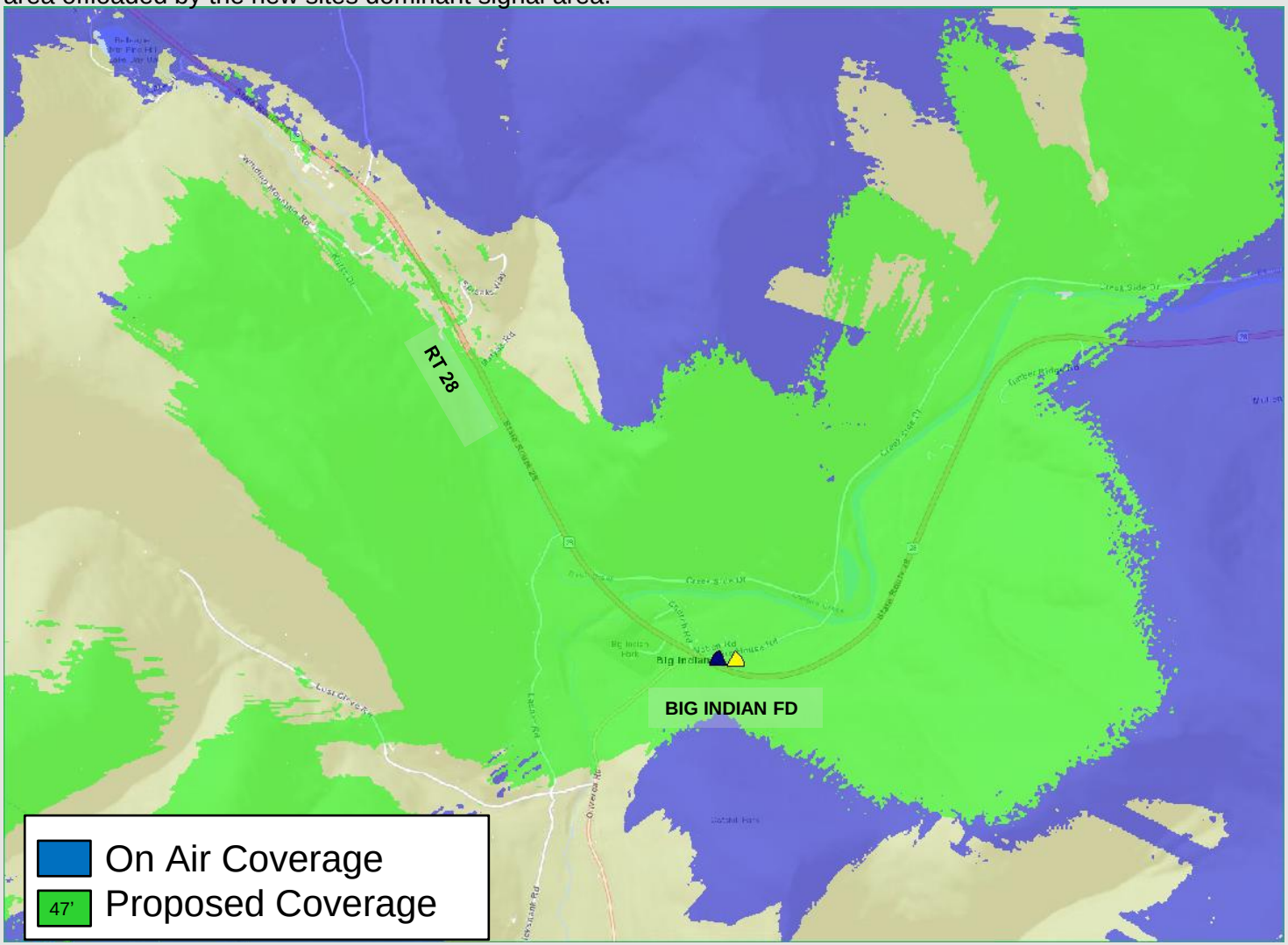
Proposed Low Band (700/850MHz) Best Server -105dBm RSRP

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 adds the footprint of the proposed **Big Indian FD** site with a 47' ACL coverage in green. The green best server footprint provides improved coverage and capacity throughout the identified significant gap area. This will improve service to users in the green area.

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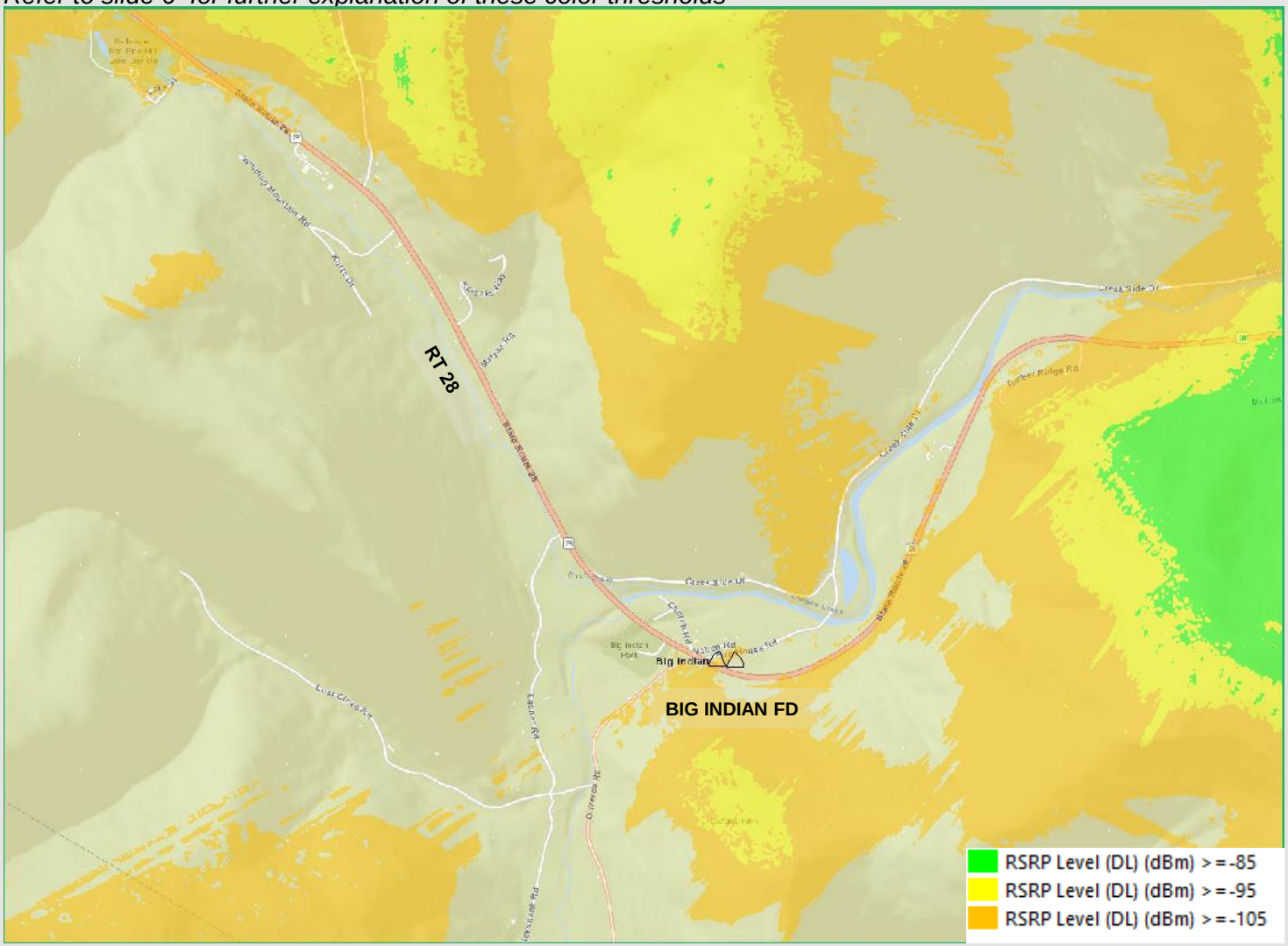
Existing Low Band (700/850MHz) Coverage (signal strength)

This coverage map shows how weak the RF conditions are in portions of the Town of **Shandaken** and surrounding area.
Refer to slide 6 for further explanation of these color thresholds



The map above represents low band signal strength coverage from existing sites. While low band generally serves this project area it is subject to overloading as shown in the capacity slides. This overloading in part is due to gaps in adequate and reliable mid band coverage as shown in the following slides. Network densification is needed to resolve these coverage and capacity issues.

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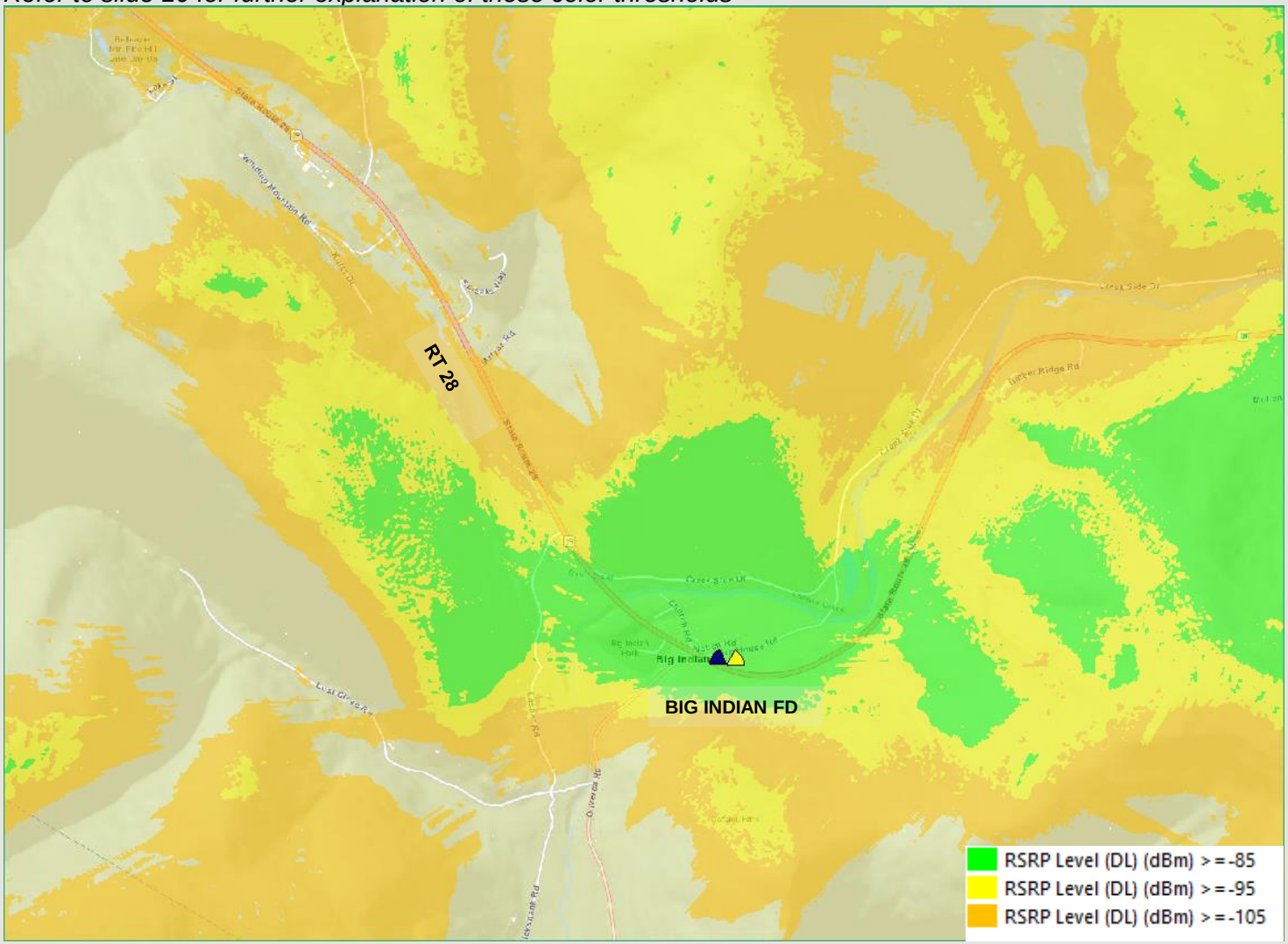
Proposed Low Band (700/850MHz) Coverage (signal strength)

This coverage map shows how improved the RF conditions will be in portions of the Town of **Parma** and surrounding area.
Refer to slide 10 for further explanation of these color thresholds



The map above adds low band of the **Big Indian** site at 47' ACL to the existing coverage map. The significantly improved signal strength corresponds to improved coverage and capacity throughout the identified significant gap areas. This will help to resolve the coverage and capacity issues impacting portions of the Town of **Shandaken**.

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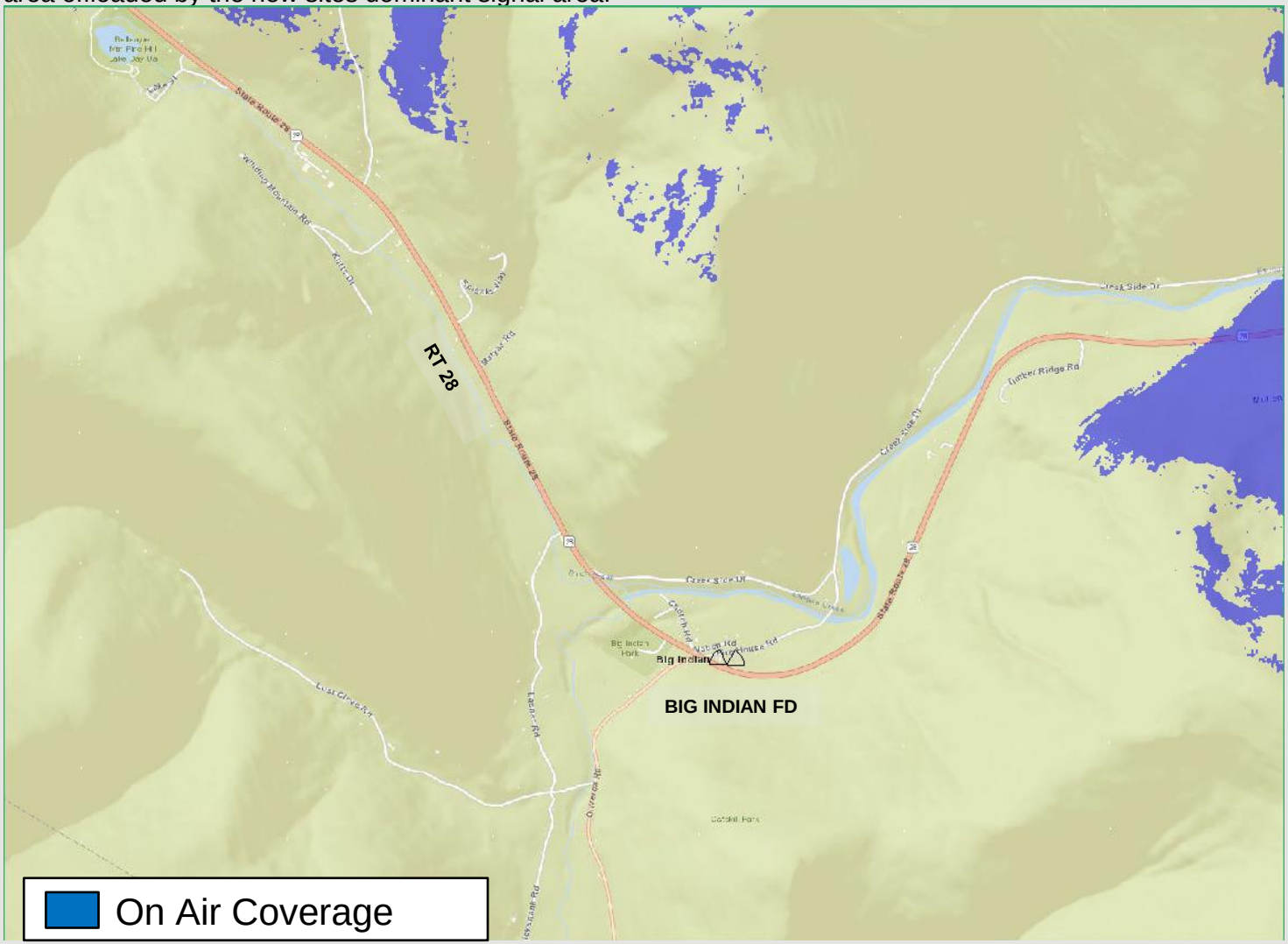
Existing Mid Band (AWS/PCS/C-Band) Best Server -105dBm RSRP

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 coverage from existing sites. Blue coverage is from other on air (Mid Band) sites. Notice the lack of signal throughout the **Big Indian FD** project area. This reveals several sites that are stretching their mid band coverage capabilities which results with unacceptable coverage and performance.

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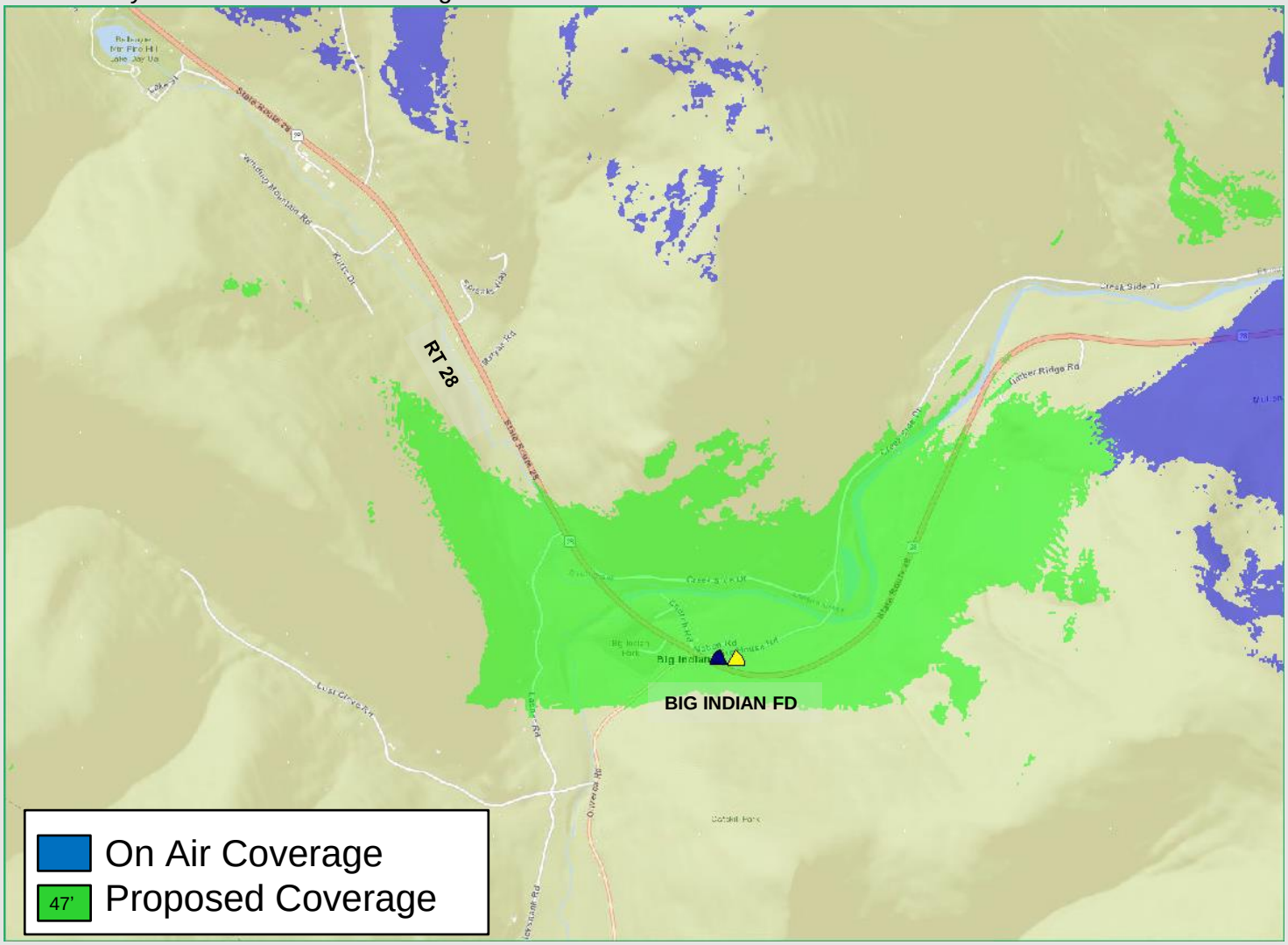
Proposed Mid Band (AWS/PCS/C-Band) Best Server -105dBm RSRP

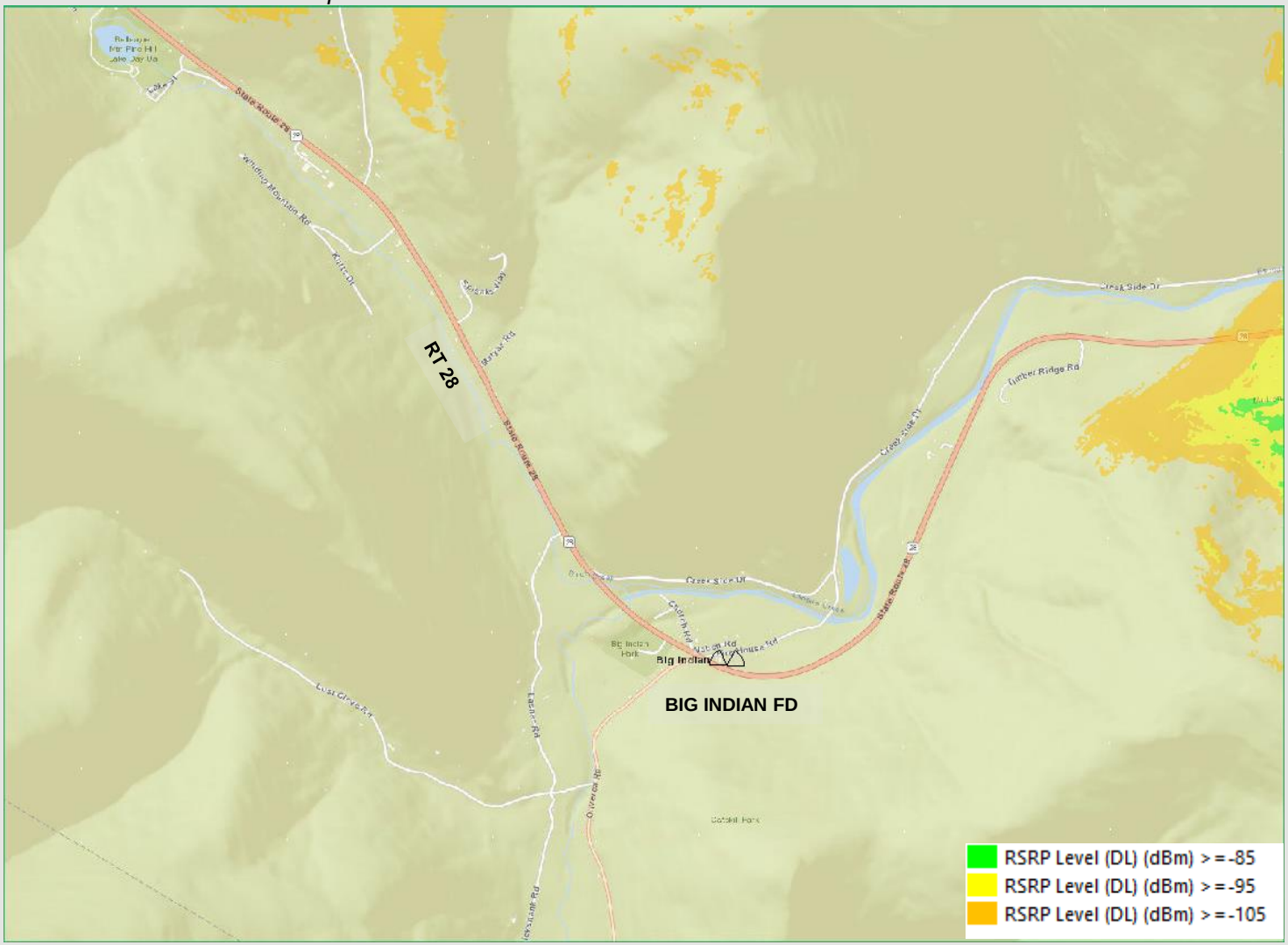
Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.



The map above adds the mid band footprint of the proposed **Big Indian FD** site with a 47' ACL in green. The green best server footprint provides improved coverage and capacity throughout the identified significant gap area. This will improve service to users in the green area.

Existing Mid Band (AWS/PCS/C-Band) Coverage (signal strength)

This coverage map shows how weak the RF conditions are in portions of the Town of **Shandaken** and surrounding area.
Refer to slide 6 for further explanation of these color thresholds



The map above represents mid band coverage from existing sites. This mid band signal is very weak to non existent throughout the project area. Additional mid band network densification is required to resolve these conditions. Notice the large orange and blank coverage areas near the proposed **Big Indian FD** site that are subject to variable coverage conditions including fading and seasonality gaps.

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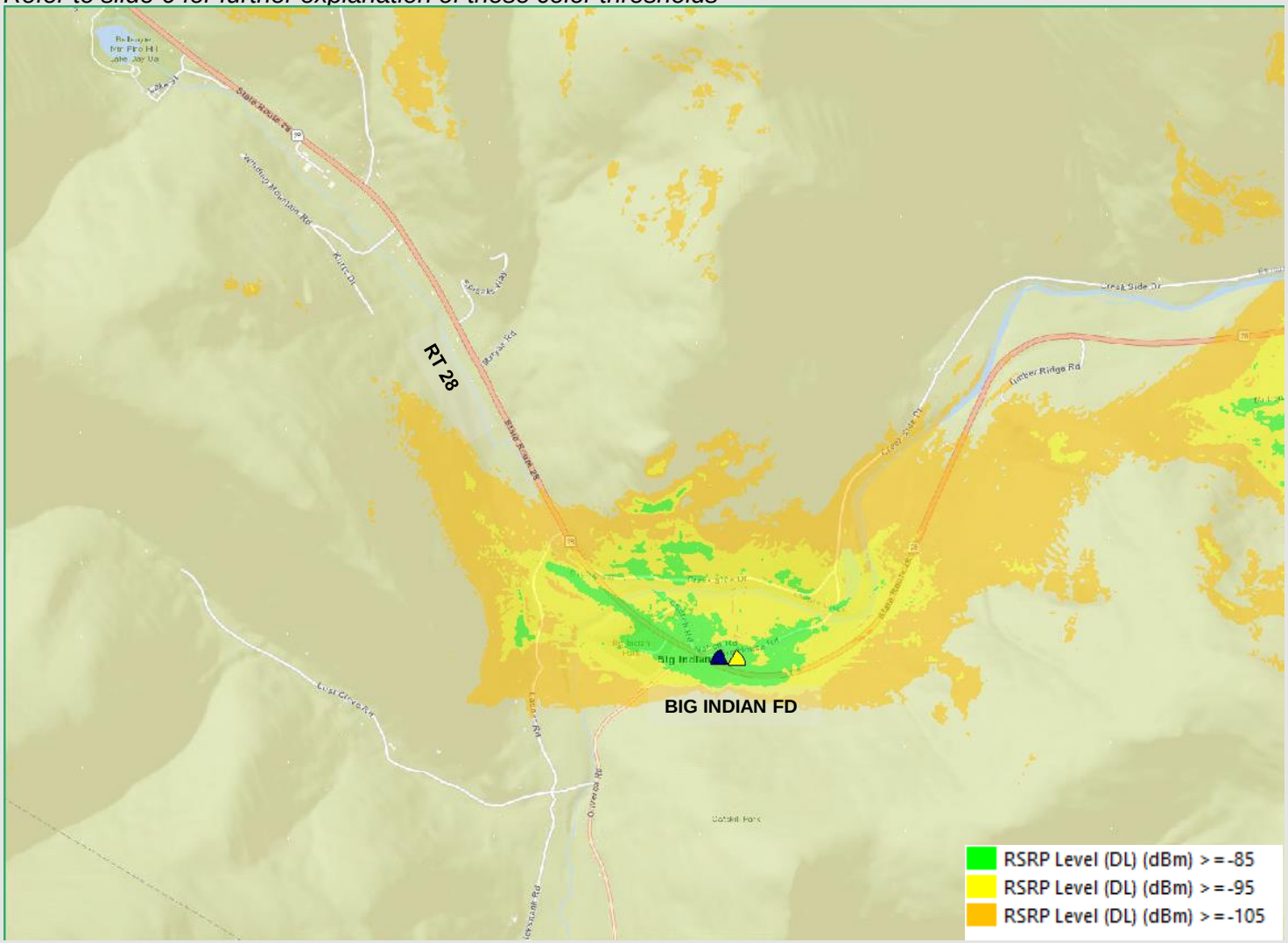
Proposed Mid Band (AWS/PCS/C-Band) Coverage (signal strength)

This coverage map shows how improved the RF conditions will be in portions of the Town of **Shandaken** and surrounding area.
Refer to slide 6 for further explanation of these color thresholds



The map above adds mid band of the **Big Indian FD** site at 47' ACL to the existing coverage map. The significantly improved signal strength corresponds to improved coverage and capacity throughout the identified significant gap areas. This will help to resolve the coverage and capacity issues impacting portions of the Town of **Shandaken**.

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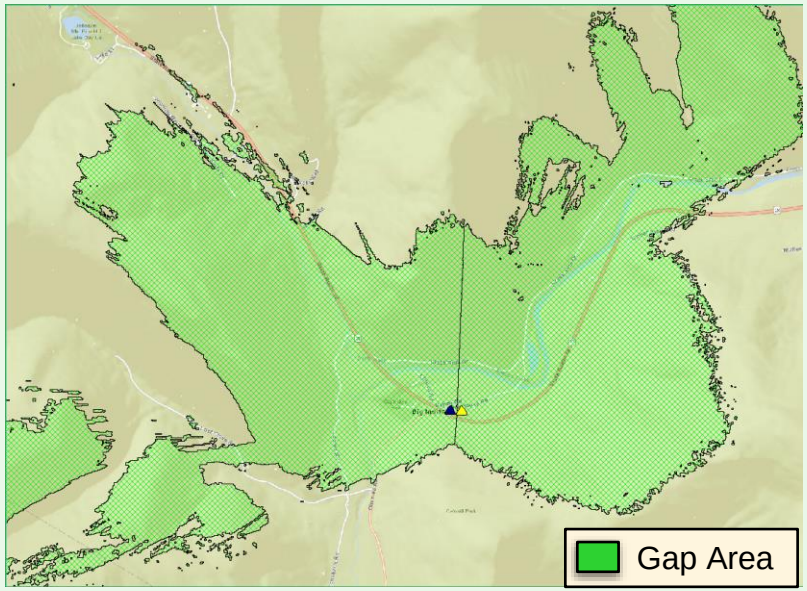
RF Justification Summary



The proposed site resolves the substantial and significant gaps in coverage and capacity impacting this portion of the **Town of Shandaken.** These gaps are shown above: The green shaded area represent the gaps in coverage and capacity that the proposed **Big Indian FD** site with a 47' ACL will resolve.

The network was analyzed to determine whether there is sufficient **RF coverage and capacity** in the **Town of Shandaken.** It was determined that there are significant gaps in adequate LTE service for Verizon Wireless in the Low and Mid Band LTE frequencies. 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.

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 site will satisfy the coverage and capacity needs of Verizon Wireless and users on it's network in these portions of the **Town of Shandaken** and this project area. The proposed location depicted herein satisfies the identified service gaps and is proposed at the minimum height necessary for adequate and reliable service.

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