



Independent Radio Frequency Report
Regarding a proposed
Wireless Communications Facility For
T-Mobile

Site ID: NJ07320

13 Vanderhoof Court

Vernon Township, New
Jersey Sussex County

Prepared

By

Pier Con Solutions, LLC
June 13, 2019

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I. PURPOSE AND SCOPE

PierCon Solutions LLC, an engineering firm specializing in wireless communications, performed an independent analysis regarding the radiofrequency engineering aspects of the proposal by Diamond Communications to construct a new tower on behalf of T-Mobile to operate a wireless telecommunications facility on 13 Vanderhoof Court, Vernon Township, New Jersey (Block 141, Lot 12.02).

PierCon Solutions prepared for this analysis by obtaining applicable engineering data from T-Mobile, reviewing drive test data and propagation, topographical maps, considering the potential for alternative site locations, and considering relevant portions of the Township's ordinance for a wireless telecommunications facility.

The following report describes the results of this analysis. The report results from a thorough independent study and analysis from a radiofrequency engineering perspective of the applicant's proposal considering Vernon Township's stated zoning goals and restrictions. It includes responses to specific sections of Vernon Township's Land Development ordinance, specifically addressing those provisions outlined in **Ordinance Subsection 330-187** for Personal Wireless Telecommunication Towers, Equipment, and Facilities. Exhibits prepared by PierCon Solutions LLC, referenced in this report are included in the Appendix.

II. GENERAL OVERVIEW

T-Mobile is a commercial wireless communications service provider licensed by the Federal Communications Commission (FCC) to provide personal wireless service in various frequency bands throughout the state of New Jersey. The frequency bands to which T-Mobile is licensed for are the 600, 700, 1900, and 2100 MHz frequency bands. The wireless telecommunications facility proposed in this application is to provide coverage for personal wireless services for voice and data in the form of technologies such as Third Generation (3G) data (speeds of 500Kbit/sec to 1000 Kbit/sec) and (4G) LTE data (4 Mbit/sec to 10 Mbit/sec).

In the T-Mobile network, the 700 MHz frequency band is reserved for a small 5 MHz LTE channel (4G), the 600 MHz and 1900 MHz frequency band is reserved for a medium 10 MHz LTE channel, and the 2100 MHz frequency band is reserved for a large 20 MHz LTE channel and a small 5 MHz UMTS (3G) channel.

In order for T-Mobile to support existing legacy customers as well as transition to the latest 4G LTE service T-Mobile must operate their frequency bands on multiple technologies. Therefore, based upon spectrum allocation, T-Mobile operates both 3G UMTS and 4G LTE services on their 2100 MHz frequency band; and only 4G LTE service on their 600, 700 & 1900 MHz bands. All 4G LTE services provide access to voice calls with a technology called Voice over LTE (VoLTE).

A wireless base station facility communicates with each user's mobile handset through a pair of wireless frequencies. The operation of a commercial wireless communications system is dependent upon an intermeshed network of wireless communication facilities – often called base stations or cell sites. Each wireless communications facility is designed to use low transmit power and provide a limited broadcast range. In order to provide seamless communications, it is essential that the radio coverage from each facility overlaps with adjacent facilities. This design factor allows users to engage in uninterrupted wireless telephone conversations and remain connected as they move across a geographic region. A gap in coverage exists when the wireless user cannot reliably initiate, receive, or continue telephone conversations or establish a data session on the wireless network.

The area of coverage an individual wireless telecommunications facility can provide for is affected by its antenna height and transmitter power. Generally, the optimum antenna height for a wireless communication facility is between 100 and 200 feet AGL (Above Ground Level) in areas that consist of dense trees and rolling hills. Height requirements are also influenced by mean ground elevation at the site, the wireless carrier's coverage objective, and expected user traffic.

III. DESIGN OBJECTIVES

The design objective for each wireless communications carrier is to provide seamless, ubiquitous, and reliable wireless service to their users, in accordance with the Wireless Communications and Public Safety Act of 1991. T-Mobile's design objectives are consistent with these goals. T-Mobile achieves this design objective by designing their network to supply signal levels sufficient enough to support reliable in-vehicle and in-building communications. Today's wireless systems, like T-Mobile', provide enhanced communications beyond the initial expectations for voice communication along roadways. The demand to provide in-building communications, voice and data communications, and enhanced E-911 access is a paramount requirement in today's wireless systems. T-Mobile's design objectives are consistent with this goal.

Designing a wireless telecommunications network involves balancing the need for coverage and capacity. Coverage is the ability of each site to provide reliable signal to the network of expected users. Capacity is the ability of the site to support simultaneous user traffic. This design balance is accomplished through an analysis of demographics, terrain, and long-term planning. Initially, system design focuses on providing wide-area coverage, particularly targeting the major highways and roads in an area. As the wireless communications system matures, the carrier's focus changes to increasing their ability to support anticipated volume of user traffic, as well as providing coverage to additional locations in the area, such as business and residential districts.

In order to adequately provide reliable wireless service to Vernon Township, the design threshold for reliable service must be defined. The design threshold is a reference to signal strength and varies depending on the physical characteristics of the area under analysis. T-Mobile defines the reliable coverage boundary of an LTE site using a value of Reference Signal Received Power (RSRP). This value is derived from industry standard definitions of LTE receiver sensitivity and data throughput, along with statistically quantifiable variations in the physical surroundings. This threshold takes into account additional losses associated with the location of the user; such as on-street, in-vehicle or in-building. The scan data and drive test coverage analyses for Vernon Township, presented herein, are for services based upon a suburban in-building standard with a corresponding RSRP of -97 dBm and in-vehicle standard with a corresponding RSRP of -114dBm. The suburban in-building standard encompasses most wood framed structures such as single-family homes.

Currently, T-Mobile desires to remedy significant gaps in wireless service in Vernon Township. A coverage gap exists for the residential homes along sections of State Highway 94 and County Highway 517 as well as businesses such as Mountain Creek Resort, the Appalachian Hotel, the Mountain Creek Water Park and the Minerals Resort and Spa. This is T-Mobile's Target Area. T-Mobiles gap in service exists for all four (4) LTE frequency bands, the 600MHz, 700 MHz, 1900 MHz and 2100 MHz.

IV. DRIVE TEST METHODOGY

A independent CW (continuous wave) test was performed on March 29, 2019 by ATEC Wirless and a Scan drive test was performed by T-Mobile on May 10th, 2019. Scan drive tests are a means to evaluate existing coverage and CW tests are a means to determine the minimum height for a proposed facility.

Scan Test are used to produce maps (“Drive Test Maps”), which demonstrate actual signal levels along roadways that are traveled by specially equipped scan test vehicles. In a drive test, the signals from the surrounding on-air sites (LTE) are collected by a receive antenna mounted to the roof of the drive test vehicle. The data collected by the receive antenna is then processed by computer equipment within the drive test vehicle. The coordinates and signal strength of each collection point is recorded by the computer equipment and ultimately depicted on a Drive Test Map. Literally thousands of data points are collected during a drive test over the roadways driven by the drive test vehicle to ensure that a complete and statistically relevant number of data points can be evaluated.

The scan test consisted of collecting thousands of data points in the vicinity of the NJ07320, the proposed site, and surrounding roadways. A multiband receiver, capable of measuring signals from the 700, 1900, and 2100 MHz frequency bands, was used to collect data points through the use of a magnetic mounted antenna and GPS device on the outside of the vehicle. The recording software is also capable of measuring LTE Technologies. The drive test software was used to collect the data on a laptop computer while the vehicle was moving.

The CW test also consisted of collecting thousands of data points in the vicinity of the proposed site and surrounding roadways. A multiband received was utilized to measure the CW signal from a magnetic mounted antenna located on the roof of the vehicle.

Since the CW testing was performed during the time of year with minimal foliage, the test results will be the best-case scenario. No account has been taken for losses due to dense foliage that will be present during the spring through fall season. CW test factor was involved providing an equivalent RSRP signal level from the measured RSSI level in the CW test. RSRP signals are the standard reference signals for LTE networks. By performing these calculations, the Scan Drive Test can be compared with the CW Test data for the proposed site, to evaluate the coverage gaps filled at the proposed heights.

V. T-MOBILE’S GAP IN SERVICE

The T-Mobile network, in the area surrounding the subject site, consists of (3) three existing wireless communications facilities located in Vernon Township. NJ07198, NJ07300A and NJ07289A are existing facilities that currently provide service to the area surrounding the proposed site. Since the 600MHz and 700 MHz are close in frequency coverage will be similar and the same is true for the 1900Mhz and 2100Mhz. A map of these facilities can be seen in Exhibit A and Exhibit E, where existing reliable 4G LTE coverage is

shown for the 700MHz and 1900/2100 MHz respectively with Scan data. In addition, T-Mobile has an approved site, NJ07327 which is currently not on air. A prediction analysis has been provided for NJ07327 with the scan data in Exhibits A-1 and E-1, in order to demonstrate a comprehensive view of existing and approved coverage within Vernon Township. Below is an inventory of T-Mobile's existing and approved wireless facilities.

Site ID	Address	Antenna Height	Structure Type
NJ07198	200 Route 94	35ft	building
NJ07300A	2 Chamonix Drive	40ft	building
NJ07289A	101 Tower Lane	127ft	Lattice Tower
NJ07327	9 Sussex Road	82ft	Tower

Attached hereto as Exhibit A is a Scan drive Map, which represents T-Mobile's existing areas of reliable 4G LTE 700 MHz wireless coverage from existing sites surrounding the proposed Site. The areas of green represent reliable 4G LTE coverage at a RSRP level of greater than or equal to -97 dBm, which represents T-Mobile's design criteria for reliable 4G LTE in-building residential coverage and the areas of yellow represent reliable 4G LTE coverage at a RSRP level of greater than or equal to -114 dBm, which represents T-Mobile's design criteria for reliable 4G LTE in-vehicle coverage. The areas of grey are unreliable and no data points indicate no LTE signal was recorded. It is important to note that NJ07300 and NJ07198 only have the high band frequency, 1900/2100 4G LTE. The equipment space allows only a small cabinet that cannot support the low band (600 MHz /700 MHz) or a full macro type of facility.

A coverage gap exists when existing facilities do not provide adequate signal strength to reliably serve the user. As one can see from Exhibit A and A-1, the 700MHz frequency band, there is a in building coverage gap in LTE service in the following areas:

- Edsall Drive (.6mi)
- McAfee Glenwood Rd (greater than 1.2 mi)
- Macpeek Road (.9 mi)
- McAfee Vernon Road (State Hwy 94) (1.7 mi)
- Sand Hill (.5 mi)
- Vernon Warwick Road (.37 mi)
- Vernon Crossing Road (.3 mi)
- All Cedar Ter
- All Valley Ter

In Exhibit E, T-Mobile's higher frequency band 2100 MHz is more adversely affected by the dense foliage and challenging terrain than the 700 MHz. Exhibit E and E-1 demonstrate that T-Mobile has a gap in reliable 4G LTE 2100 MHz wireless coverage that is significant. The in-building suburban coverage gap in 4G LTE service is significantly large within Vernon Township and cannot be filled by a single proposed wireless facility. However, for this application, the primary objective is near the surrounding residential and major businesses of the target area mention in Section III. The gap in the 2100 MHz are in the following areas:

- State Highway 94 from Sand Hill Road to Vernon Warwick Road (1.6 mi)

- All of Valley Terrace
- All of Cedar Terrace

Based on the coverage gaps mentioned above, it is clear a significant gap in service exists for T-Mobile in the Township of Vernon.

In order to remedy the gap in service T-Mobile contracted with Diamond Communications to locate and develop a facility that will provide reliable service as well as work within T-Mobile's existing network of facilities. To determine a suitable location, the facility first must work within T-Mobile's technical geometric grid plan design, taking into account the location of existing sites, existing coverage signal, coverage quality and capacity. Additional technical considerations include the topography, which in this case includes very challenging terrain, and demographics such as business centers, residential areas where people work, play and live.

The location of the subject site at 13 Vanderhoof Court meets this requirement as the site placement demonstrates reasonable placement with respect to the existing T-Mobile facilities and target area. In addition, in accordance with Township of Vernon zoning ordinance, wireless communication facilities are prohibited within all residential zones as well as Conservation District, Agri-Eco Tourism, and Mountain Conservation zones. The proposed facility is located in the C-3 zone which meets this guideline and is near the Target Area to fill the gap and provide 4G LTE in building service.

Thus, T-Mobile is proposing to install a new wireless facility at 13 Vanderhoof Court in Vernon Township. This location is in close proximity to the gap along State Route 94 and near the major businesses such as the Mountain Creek Ski resort and others previously mentioned but further away from residential areas. It is important to note that the change in elevation between the proposed facility location and the ski lodge is approximately 100ft.

In order to determine the minimum height necessary, ATEC conducted a CW test on behalf of T-Mobile at the proposed location at three (3) heights: 180ft, 140ft and 80ft (as per the ordinance maximum height). Please see Exhibits B, C, D for the drive test at 700 MHz and F, G, H for 2100 MHz. Based upon the drive test, the minimum height is determined to be between the 180ft and 140ft height. A minimum height of 160ft would allow for collocation of 2 carrier with 10ft separation. In addition, Exhibits B-1, C-1, D-1, F-1, G-1 and H-1, the propagation from the approved site NJ07327 has been added to represent the additional coverage provided from the approved wireless facility and the proposed together. As seen in Exhibits B, the following gaps will be alleviated:

700 MHz:

180ft In building coverage

- McAfee Glenwood Rd (.6 mi)
- Macpeek Road (.6 mi)
- McAfee Vernon Road (State Hwy 94) (1.4 mi)
- Sand Hill (all)
- All Cedar Ter
- All Valley Ter

However, at 140ft shown in Exhibit C, State Highway 94, Sand Hill Road and Macpeek Road begin to lose in building coverage due to the dense foliage, terrain and distance. For this reason, 160ft is chosen as the minimum height. At 80ft, shown in Exhibit D, significant gaps occur along State Highway 94 for both in building and in vehicle coverage.

As seen in Exhibits F, the following gaps will be alleviated:

2100 MHz:

180ft - In building coverage

- State Route 94 (.5 mi)

180ft - In vehicle coverage

- State Route 94 (.7 mi)
- All of Valley Terrace
- All of Cedar Terrace

In-building and in vehicle 2100 MHz 4G LTE coverage gaps remain in the residential area to the north, west, south west and east of the proposed Site. As previously mentioned, the entire gap in coverage for T-Mobile includes a very large significant area in the high band frequency. Therefore, more than one site will be required to provide seamless reliable coverage to the entire Township of Vernon. In Exhibit G, at antenna centerline of 140ft, the loss of in building on State Highway 94 compared to 180ft is less but minimal. At 80ft, there is no in building coverage along Ste Highway 94 and no in vehicle coverage on Cedar Terrace and Valley Terrace.

VI. RESPONSES TO REQUIREMENTS OF WIRELESS ORDINANCE

PierCon's responses to the radiofrequency engineering aspects of Vernon Township's Land Use Ordinance, regarding Wireless Telecommunications Technology, are addressed in the paragraphs to follow. Each relevant provision of the Ordinance is followed by PierCon's response from a radiofrequency engineering perspective in italics. Exhibits prepared by PierCon and referenced in this section are included in the Appendix.

Pursuant to Subsection 330-187(D)(1)(a)[1] Location priorities first being Existing lawful structures which include existing buildings or structures owned by the Township of Vernon. T-Mobile's site acquisition found no existing buildings or structures of sufficient height owned by the Township of Vernon within or near the Target Area. The closest municipal property to the target area was the Vernon Township Ambulance Squad Inc. located at 3 Balwin Drive approximately .4 miles east of the proposed location. It is further away from the target area. The structure on this property is below the tree line and would not cover the target area. A new structure would be required and this location is closer to residential houses than the

proposed location, therefore this was not a viable option.

Pursuant to Subsection 330-187(D)(1)(a)[2], Location priorities first being Existing lawful structures which include existing wireline systems, such as conventional cable or telephone wires, located along major traffic corridors in non-residential zones within the Township. There are no existing wireline systems or telephone wires of sufficient height along State Route 94 that T-Mobile can collocate on to provide in-building service to the residential and commercial areas described in Section V due to the topography and tall dense tree foliage.

Pursuant to Subsection 330-187(D)(1)(a)[3], Location priorities first being Existing lawful structures which include existing wireline systems, such as conventional cable or telephone wires, located within the public right-of-way of any state or county road within the Township, There are no existing wire line systems or telephone wires of sufficient height along State Route 94 or public right or way where T-Mobile can collocate on to provide in-building service to the residential and commercial areas described in Section III and V, due to the topography and tall dense tree foliage. According to T-Mobile's site acquisition, transmission towers were not available as T-Mobile could not obtain a ground lease from Mountain Creek. Several attempts were made and were unresponsive.

Pursuant to Subsection 330-187(D)(1)(a)[4], Location priority first being existing lawful structures which include the consent of the property owner, personal wireless telecommunications facilities may be placed on or in an existing lawful structure in any zone. As, previously stated, Site acquisition found no existing structures of sufficient height in or near the target area that could meet the coverage objective. The transmission tower across from the Appalachian Hotel did not have additional space above the current carrier and other transmission towers were not available as T-Mobile could not obtain a ground lease as previously stated.

Pursuant to Subsection 330-187(D)(1)(b), Location priority second being antennas on existing towers. T-Mobile identified a transmission tower, in close proximity to the Target Area, located across the street from the Appalachian Hotel, approximately .23 miles south west of the Subject Site location. This transmission tower currently has a wireless facility located on it, but no additional space to collocate and would require that an extension be constructed. Further investigation revealed two additional transmission towers further from the Subject site, but closer to the Target Area near the Mountain Creek Ski resort. As formerly mentioned, T-Mobile attempted to pursue a lease agreement on the transmission towers with Mountain Creek however T-Mobile's requests to discuss options with Mountain Creek received no response.

Pursuant to Subsection 330-187(D)(1)(c), Location priority third being new tower construction. T-Mobile's subject site at 13 Vanderhoof Court falls under this category. Currently, the proposed tower height for the new facility is 160 feet, with T-Mobile's antenna centerline of 156ft. Per Ordinance Section 330-187 (D)(1)(C)[1][c], the maximum tower height allowed is 80 feet. However, the area surrounding the proposed facility is located at a elevation of 477ft. Some of the surrounding residential areas requiring inbuilding coverage are at higher ground elevations up to 800 ft. In order for a telecommunications facility to work properly, there needs to be a substantial height difference between the antennas and any obstructing object. The average tree height in these residential areas is approximately 60 to 80 feet, in addition to the Appalachian hotel which obstructs line of sight to a portion of the area to the south west. In order to reach some of the residential areas, businesses and ski slopes which are more than 200ft higher in elevation, the proposed facility must be able to have line of sight to the top of these hilly areas. Therefore, placing the antennas at 80 feet is too low and close to the tree line and would not adequately fill the coverage gap, further requiring additional wireless facilities in other zones which are more residential as well as offering no future collocation. Please see Exhibit D and Exhibit H for the drive test of the proposed facility at 80ft for the 700 MHz and 2100 MHz.

The drive test demonstrates significantly less coverage will be provided at this height. This is due to the terrain and foliage. As previously mentioned, the proposed location is at an elevation of 477ft, whereas State Highway 94 near the Ski lodge is approximately 577ft. The proposed location requires 100ft just to be at the same elevation as State Highway 94. Please see Exhibit I and J for the proposed facility at 160ft for the 700 MHz and 2100 MHz frequency band respectively. Based on the drive test results of 180ft and 140ft, 160ft would allow for 2 carriers to collocate with 10ft separation thereby providing similar coverage footprints at 160ft, 150ft and 140ft.

Pursuant to Subsection 330-187(D)(2) Prohibited areas, T-Mobile's proposed location is not in a residential zone or any of the prohibited areas and is located in the C-3 zone.

Pursuant to Subsection 330-187(D)(3)(h) RF Radiation. Please refer to the submitted "Evaluation of the Radiofrequency Environment in the Vicinity of the Proposed T-Mobile Wireless Facility NJ07320" for an emissions report. To summarize, the proposed facility will be in compliance with all New Jersey and Federal emissions standards.

Pursuant to Subsection 330-187(D)(3)(j)[1] Site location analysis of how the proposed location of the wireless telecommunications tower, facility, or equipment related to the objective of providing full wireless communications services within the Vernon Township area at the same time full services is provided by the applicant and by other providers of wireless telecommunications services within the Vernon Township area. As discussed in Section V, there is a significant suburban in-building 4G LTE gap in the 600,700,1900 and 2100 MHz frequency band in the area near the proposed location. Currently, there is unreliable service in the area that cannot be remedied by the existing T-Mobile facilities. By placing a new facility at 13 Vanderhoof Court, T-Mobile will address the substantial gaps in coverage. Doing so will also help provide seamless and ubiquitous service within Vernon Township.

Pursuant to Subsection 330-187(D)(3)(j)[2] Site location analysis how the proposed location of the wireless telecommunications tower, facility and equipment relates to the location of any existing towers, facilities or antennas within or near the Vernon Township area. Please see Exhibit A and Exhibit E which shows existing coverage T-Mobile Wireless Facilities near the proposed location. Exhibits A1 and E1 have been added to include the approved facility coverage from NJ07327. The nearest existing T-Mobile facility to the proposed facility is the NJ07300 facility which is located approximately 1.12 miles to the south west of the proposed. This facility is 40ft, too low to provide service to the areas previously mentioned. T-Mobile's existing site NJ07289A is 127ft on an elevation of 1400 ft. This facility provides most of the coverage to Vernon Township, however due to the high elevation, this site does not have line of site into sections of the valley. Therefore, these facilities do not provide sufficient coverage to all of Vernon Township. As previously mentioned, an existing transmission tower with a wireless carrier was identified with insufficient space to collocate in addition T-Mobile was not able to obtain a lease agreement with respect to other transmission towers in the nearby area.

Pursuant to Subsection 330-187(D)(3)(j)[3] Site location analysis how the proposed location of the wireless telecommunications tower, facilities and equipment relates to the anticipated need for additional towers, facilities or equipment within and near the Vernon Township area by the applicant and by other providers of wireless telecommunications services within the Vernon Township area. The proposed location will help provide much needed coverage for the populated areas in the western part of the Township. However, T-Mobile acknowledges that additional facilities may be needed in the eastern portion of Vernon Township.

Pursuant to Subsection 330-187(D)(3)(j)[4] Site location analysis how the proposed location of the wireless telecommunications tower, facilities and equipment relate to the objective and goal of maintaining concealed or reduced tower height with groups of towers within closer proximity to one another rather than isolated taller towers with many users at greater tower heights at random locations throughout the Township. Per Section 330-187 (D)(1)(C)[1][c] the maximum height is 80ft which is too low to cover due to the drastic changes in ground elevation and dense tree foliage. This height does not allow the overlap in coverage to T-Mobile's existing facility NJ07300A and would require more wireless facilities in the residential areas. NJ07300 and NJ07198 are low height wireless facilities near State Highway 94. As one can see, these low wireless facilities do not adequately provide coverage into the residential areas. As previously mentioned, most of the coverage is from the tower at 101 Tower Lane, NJ07289A.

VII. Conclusion

PierCon Solutions' analysis of T-Mobile's existing network coverage indicates that a significant gap in wireless exists within Vernon Township. The application by T-Mobile proposes to construct a new 160' tower at 13 Vanderhoof within the Vernon Substation. The proposed installation will alleviate the specified coverage deficiencies and provide reliable LTE 4G service to the area. It is clear from the CW test that 80ft is too low, however drive test determined 160ft is the minimum height necessary to achieve adequate coverage within the target area and allow for collocation of 2 additional carriers.

PierCon performed a thorough review of the wireless code and has addressed each section to which a response from a radiofrequency engineering perspective was applicable. The operation of this facility will enable T-Mobile to provide reliable wireless service to Vernon Township area and to remedy the identified service gaps. After performing our independent radiofrequency analysis, PierCon Solutions concludes that this facility is essential to T-Mobile's network design for Vernon Township. PierCon recommends that the Township's Zoning Board of Adjustment acts in favor of T-Mobile's proposal. Without the proposed facility, T-Mobile will be materially inhibited from providing its services.

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06/13/2019

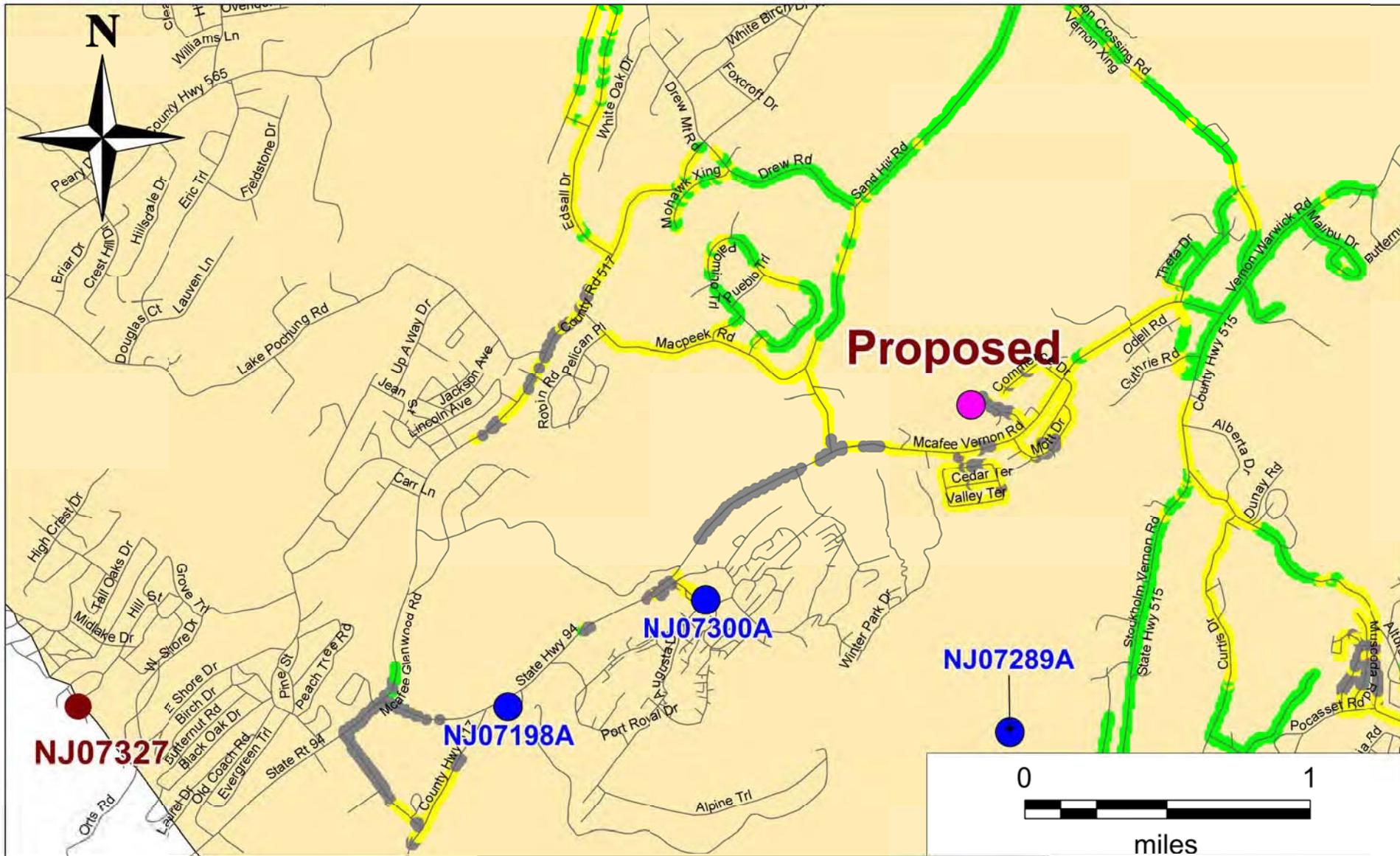
VIII. APPENDIX

- **-Exhibit A – Existing T-Mobile 700 MHz LTE Scan Data**
- **-Exhibit A1 – T-Mobile Approved NJ07327 700 MHz Coverage & Existing T-Mobile 700 MHz LTE Coverage Scan Data**
- **-Exhibit B – Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 180ft**
- **-Exhibit B1 – T-Mobile Approved NJ07327 700 MHz Coverage & Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 180ft**
- **-Exhibit C – Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 140ft**
- **-Exhibit C1 – T-Mobile Approved NJ07327 700 MHz Coverage & Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 140ft**
- **-Exhibit D – Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 80ft**
- **-Exhibit D1 – T-Mobile Approved NJ07327 700 MHz Coverage & Proposed T-Mobile 700 MHz LTE Coverage Drive Test at 80ft**

- **-Exhibit E – Existing T-Mobile 2100 MHz LTE Coverage Scan Data**
- **-Exhibit E1 – T-Mobile Approved NJ07327 2100 MHz Coverage & Existing T-Mobile 2100 MHz LTE Coverage Scan Data**
- **-Exhibit F – Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 180ft**
- **-Exhibit F 1 – T-Mobile Approved NJ07327 2100 MHz Coverage & Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 180ft**
- **-Exhibit G – Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 140ft**
- **-Exhibit G1 – T-Mobile Approved NJ07327 2100 MHz Coverage & Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 140ft**
- **-Exhibit H – Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 80ft**
- **-Exhibit H1 – T-Mobile Approved NJ07327 2100 MHz Coverage & Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 80ft**

- **-Exhibit I – Proposed T-Mobile 700 MHz LTE Coverage Drive test at 160ft**
- **-Exhibit I1 – T-Mobile Approved NJ07327 700 MHz Coverage & Proposed T-Mobile 700 MHz LTE Coverage Drive test at 160ft**

- **-Exhibit J – Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 160ft**
- **-Exhibit J1 – T-Mobile Approved NJ07327 2100 MHz Coverage & Proposed T-Mobile 2100 MHz LTE Coverage Drive test at 160ft**



NJ07327

NJ07300A

NJ07198A

NJ07289A

NJ07320

T-Mobile Existing 700 MHz

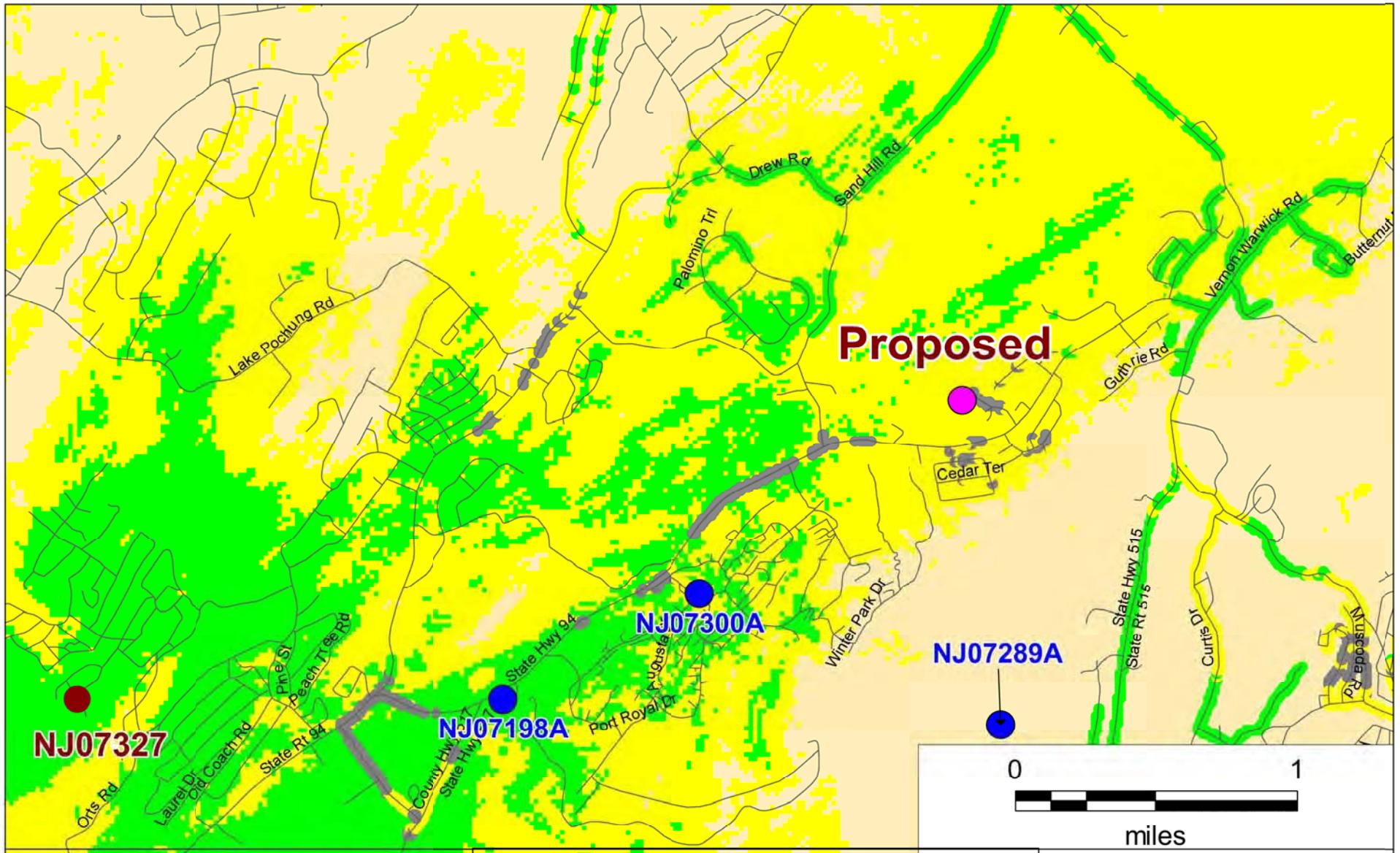
Scan Data
13 Vanderhoof Court
Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township

PierCon Solutions LLC
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T-Mobile

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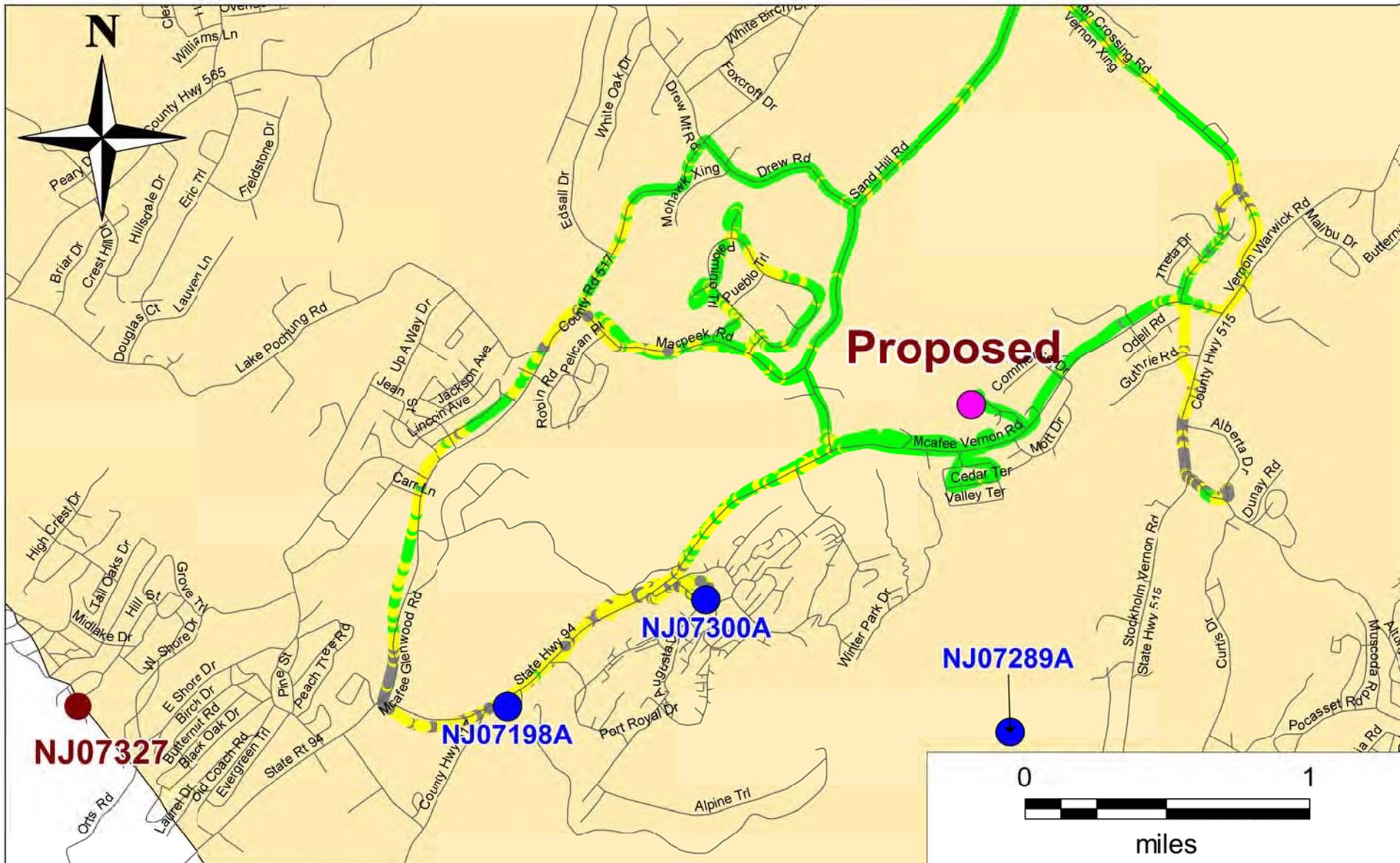


NJ07320
 T-Mobile Approved NJ07327 700 MHz
 Coverage & Existing 700 MHz
 Scan Data
 13 Vanderhoof Court
 Vernon Township, NJ 07462

	Proposed Site		Vernon_Township
	Existing Site		Approved T-Mobile Sites
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	Reliable In Vehicle Coverage (≥ -114 dBm RSRP)		
	Unreliable Service		


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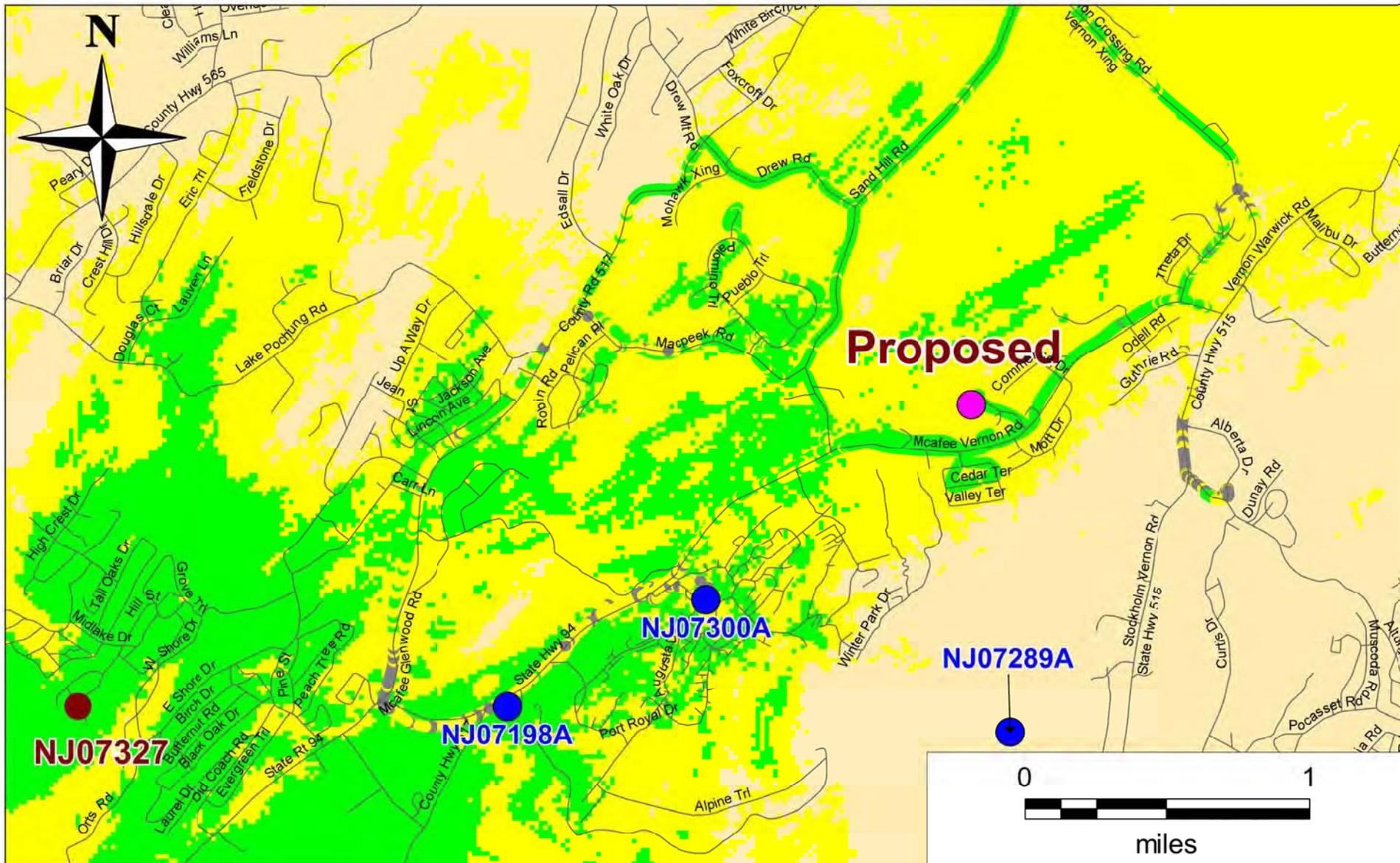
NJ07320

T-Mobile Proposed 700 MHz
 Drive Test @ 180ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Vernon_Township
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
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NJ07320

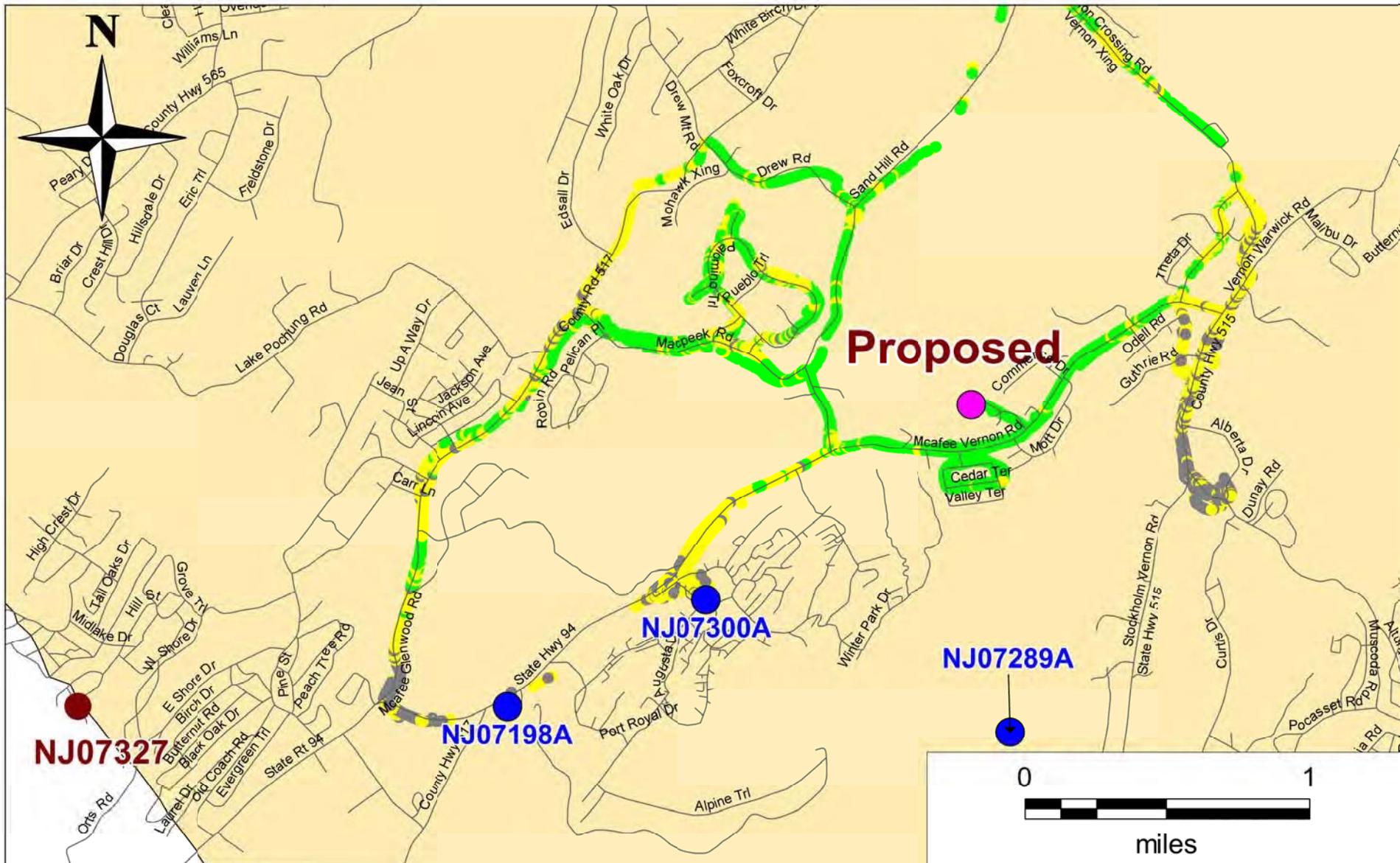
T-Mobile Approved NJ07327 700 MHz
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 Vernon Township, NJ 07462

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- Unreliable Service
- Vernon_Township

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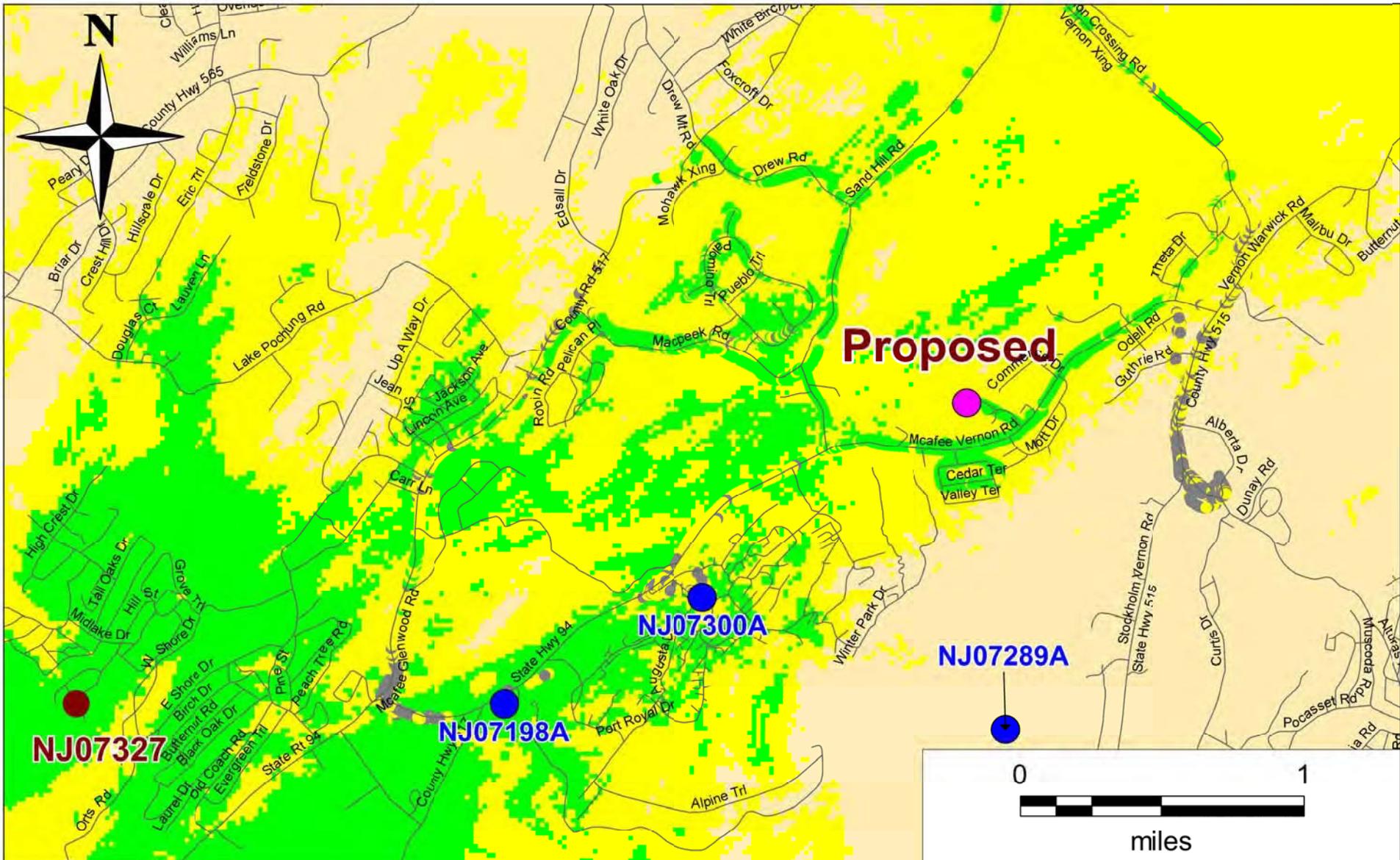
NJ07320

T-Mobile Proposed 700 MHz
Drive Test @ 140ft
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Vernon Township, NJ 07462

- Proposed Site
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- Vernon_Township
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service

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Prepared By: PierCon Solutions LLC
6/12/2019



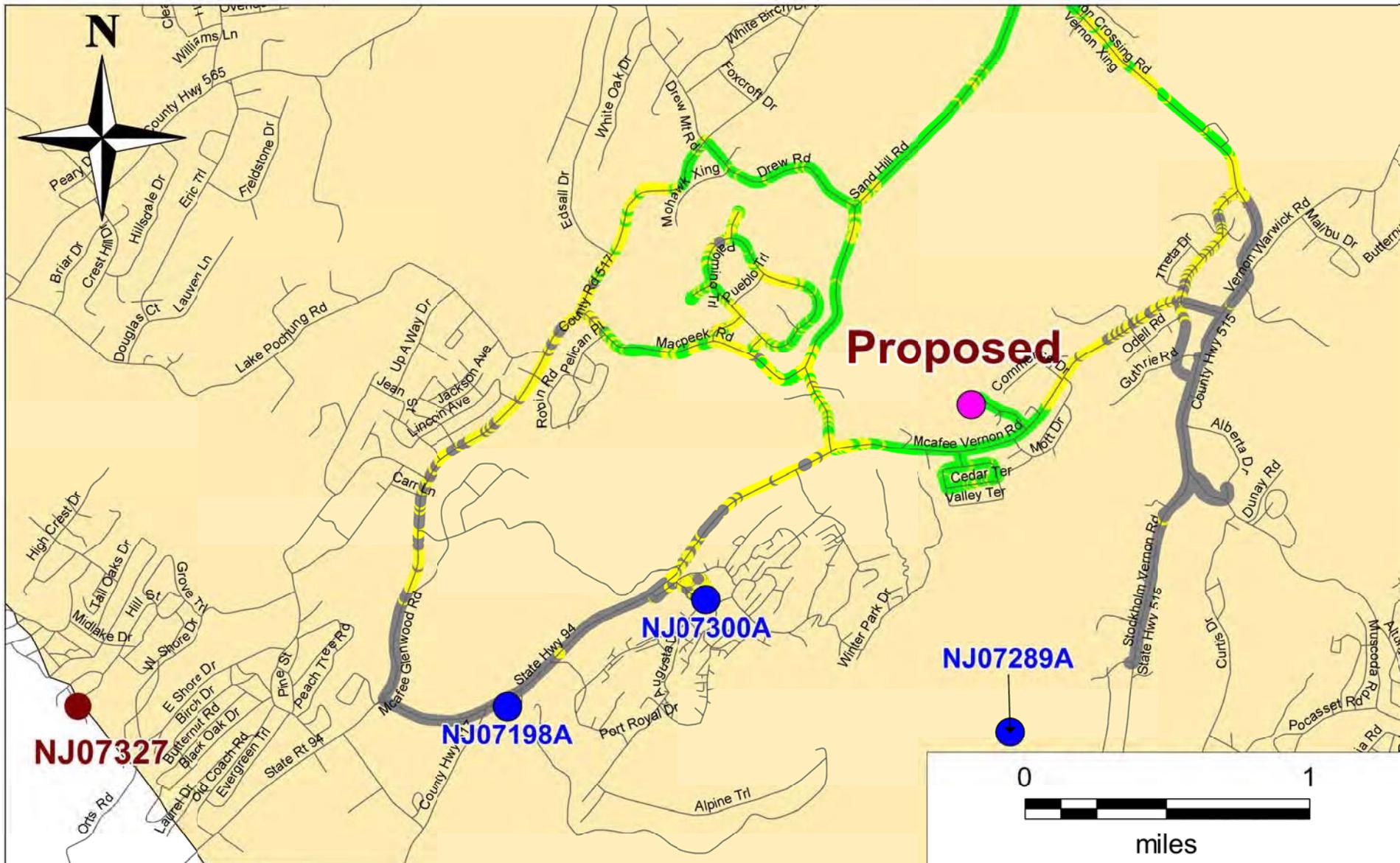
NJ07320
 T-Mobile Approved NJ07327 700 MHz Coverage & Proposed 700 MHz Drive Test at 140ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

 Proposed Site	 Vernon_Township
 Existing Site	 Approved T-Mobile Sites
 Reliable In Building Coverage (>= -97 dBm RSRP)	
 Reliable In Vehicle Coverage (>= -114 dBm RSRP)	
 Unreliable Service	


 Specialists in Wireless Systems



Prepared By: PierCon Solutions LLC
 6/12/2019

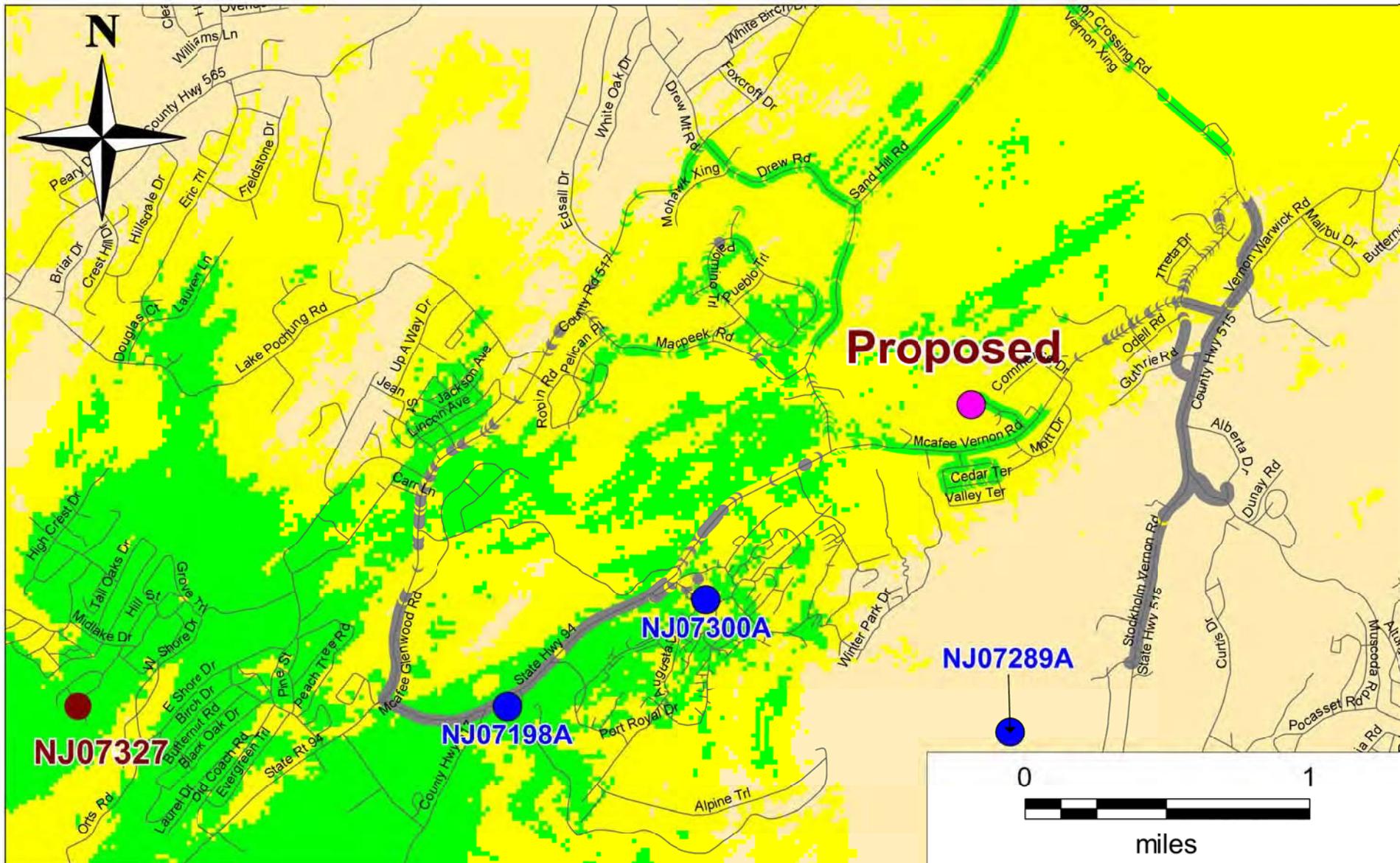


NJ07320
 T-Mobile Proposed 700 MHz
 Drive Test @ 80ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township

PierCon Solutions
 Specialists in Wireless Systems

Prepared By: PierCon Solutions LLC
 6/12/2019



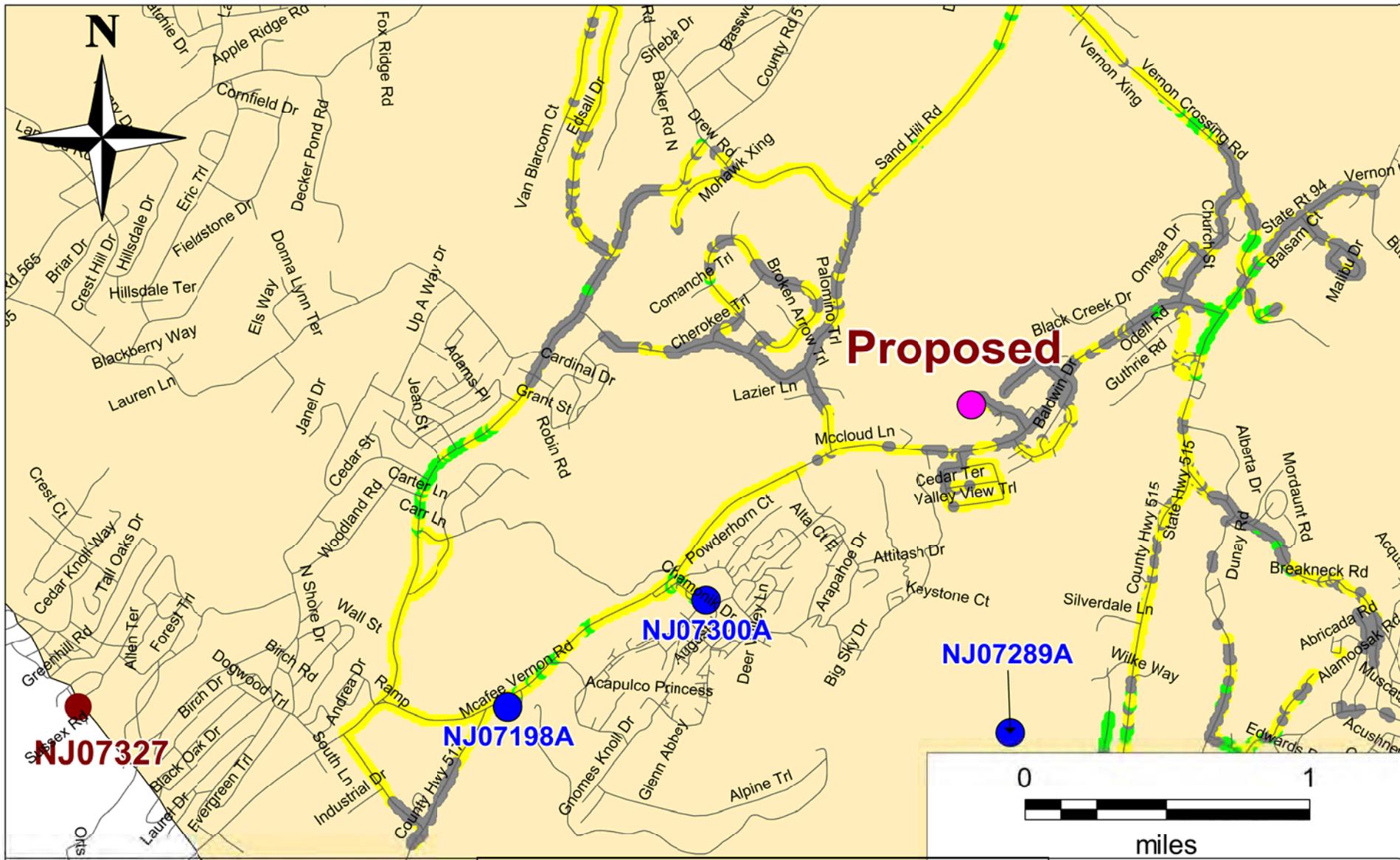
NJ07320

T-Mobile Approved NJ07327 700 MHz
 Coverage & Proposed 700 MHz
 Drive Test at 80ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

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- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township



Prepared By: PierCon Solutions LLC
 6/12/2019



Proposed

NJ07300A

NJ07289A

NJ07327

NJ07198A

NJ07320

T-Mobile Existing 2100 MHz

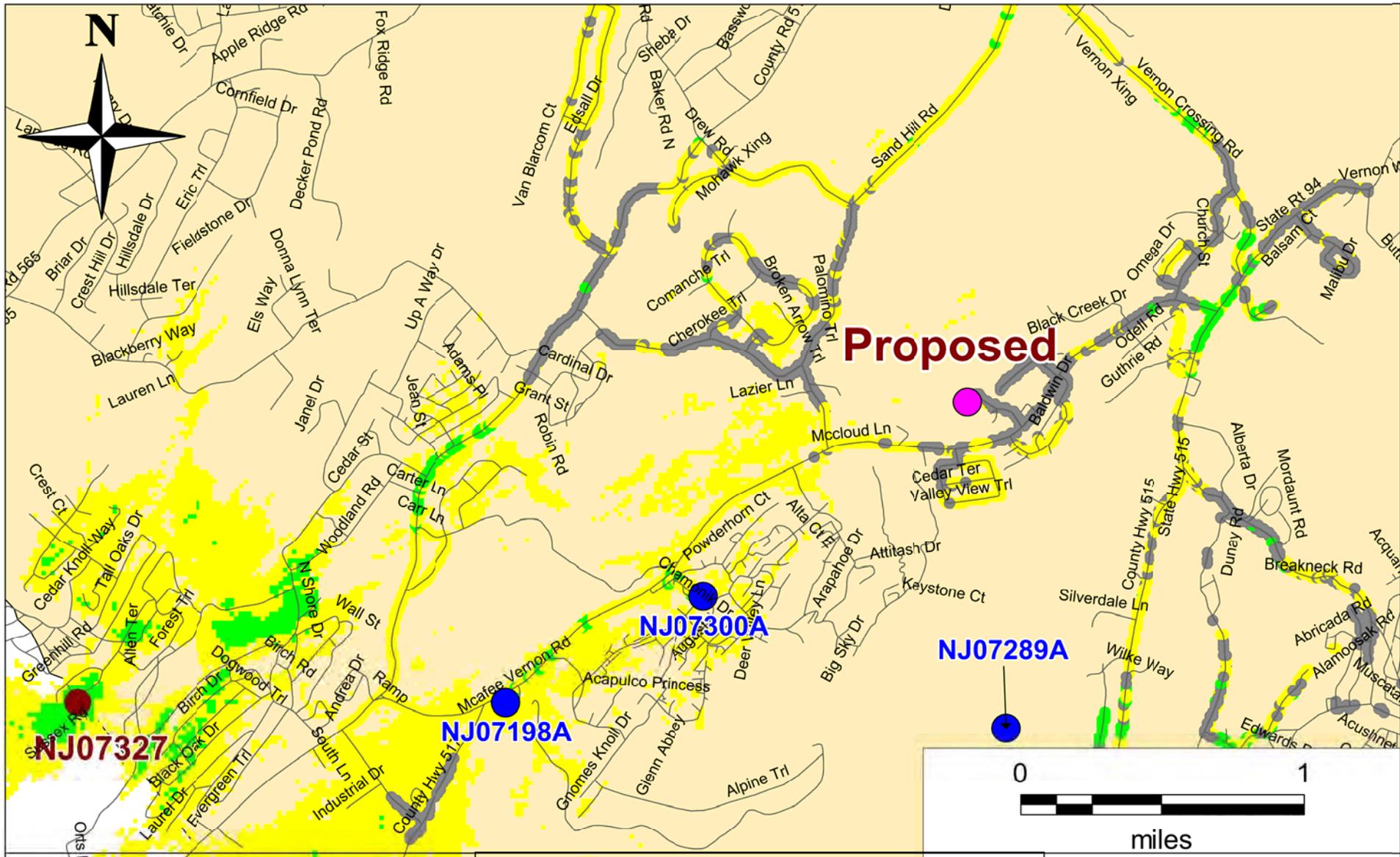
Scan Data
13 Vanderhoof Court
Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township

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T-Mobile

Prepared By: PierCon Solutions LLC
6/12/2019



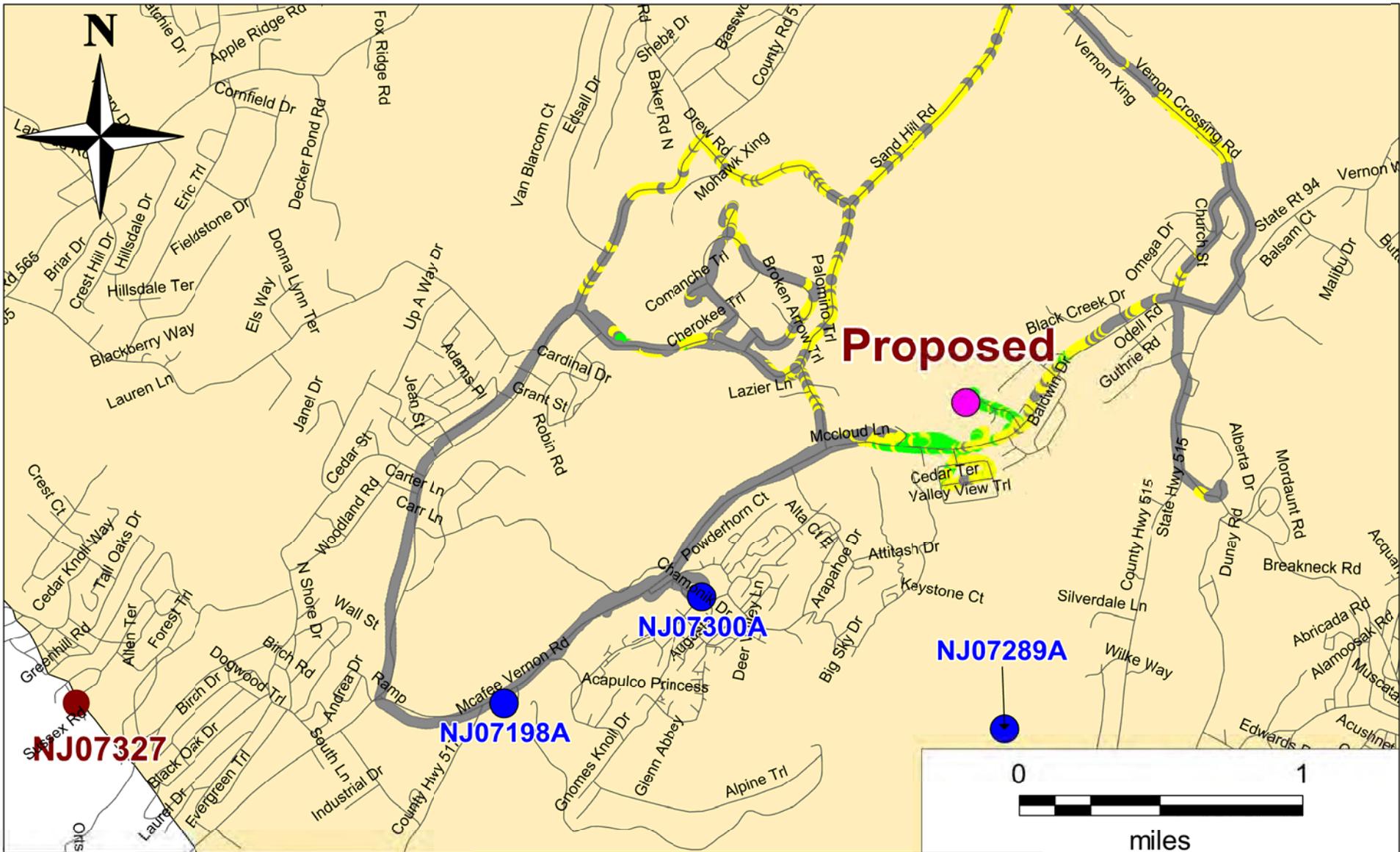
NJ07320
 T-Mobile Approved NJ07327
 2100 MHz Coverage
 & Existing 2100 MHz
 Scan Data
 13 Vanderhoof Court
 Vernon Township, NJ 07462

	Proposed Site		Vernon_Township
	Existing Site		Approved T-Mobile Sites
	Reliable In Building Coverage (≥ -97 dBm RSRP)		
	Reliable In Vehicle Coverage (≥ -114 dBm RSRP)		
	Unreliable Service		


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Prepared By: PierCon Solutions LLC
 6/12/2019



Proposed

NJ07327

NJ07300A

NJ07198A

NJ07289A

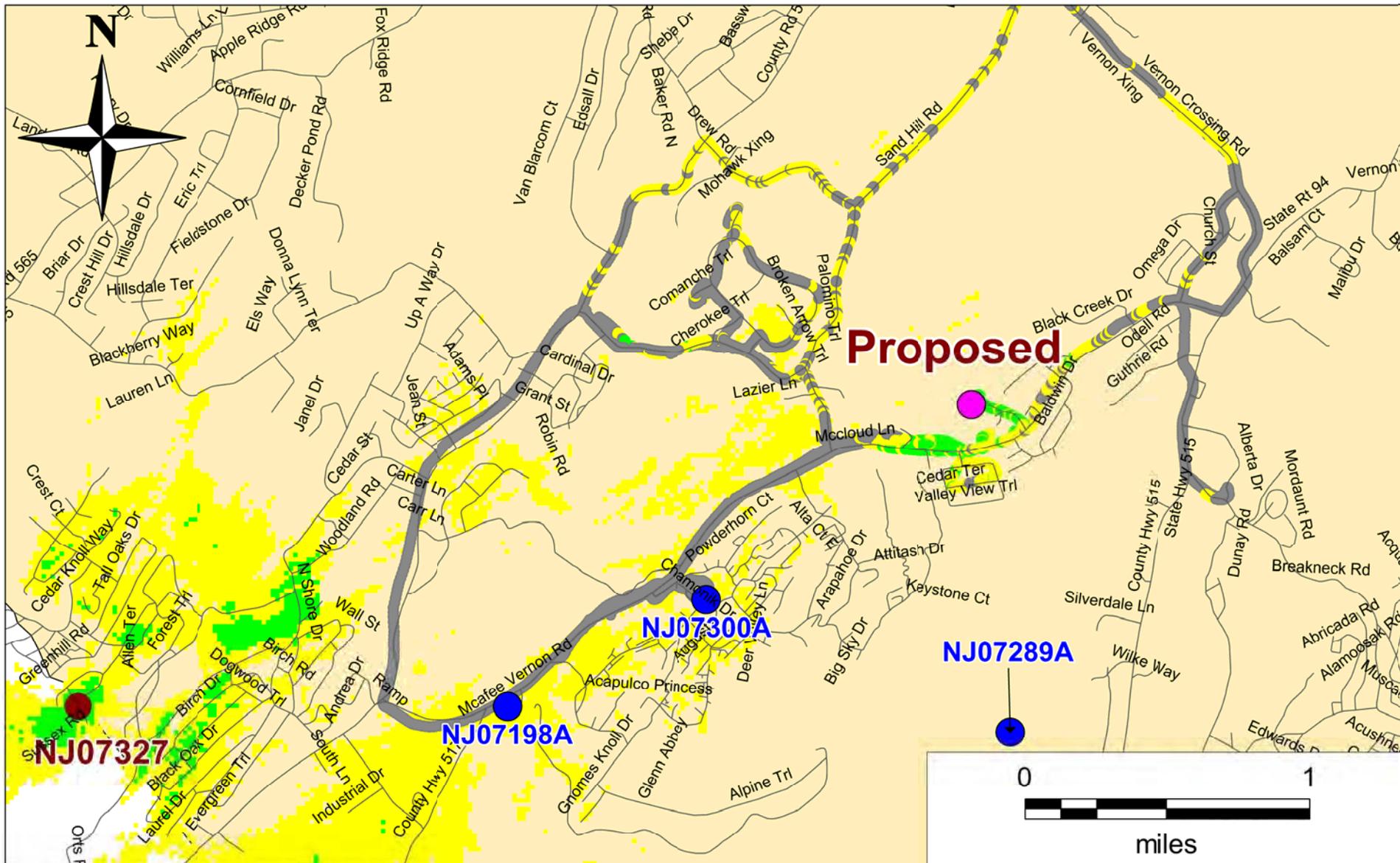
NJ07320

T-Mobile Proposed 2100 MHz
 Drive Test @ 180ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Vernon_Township
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
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Prepared By: PierCon Solutions LLC
 5/15/2019



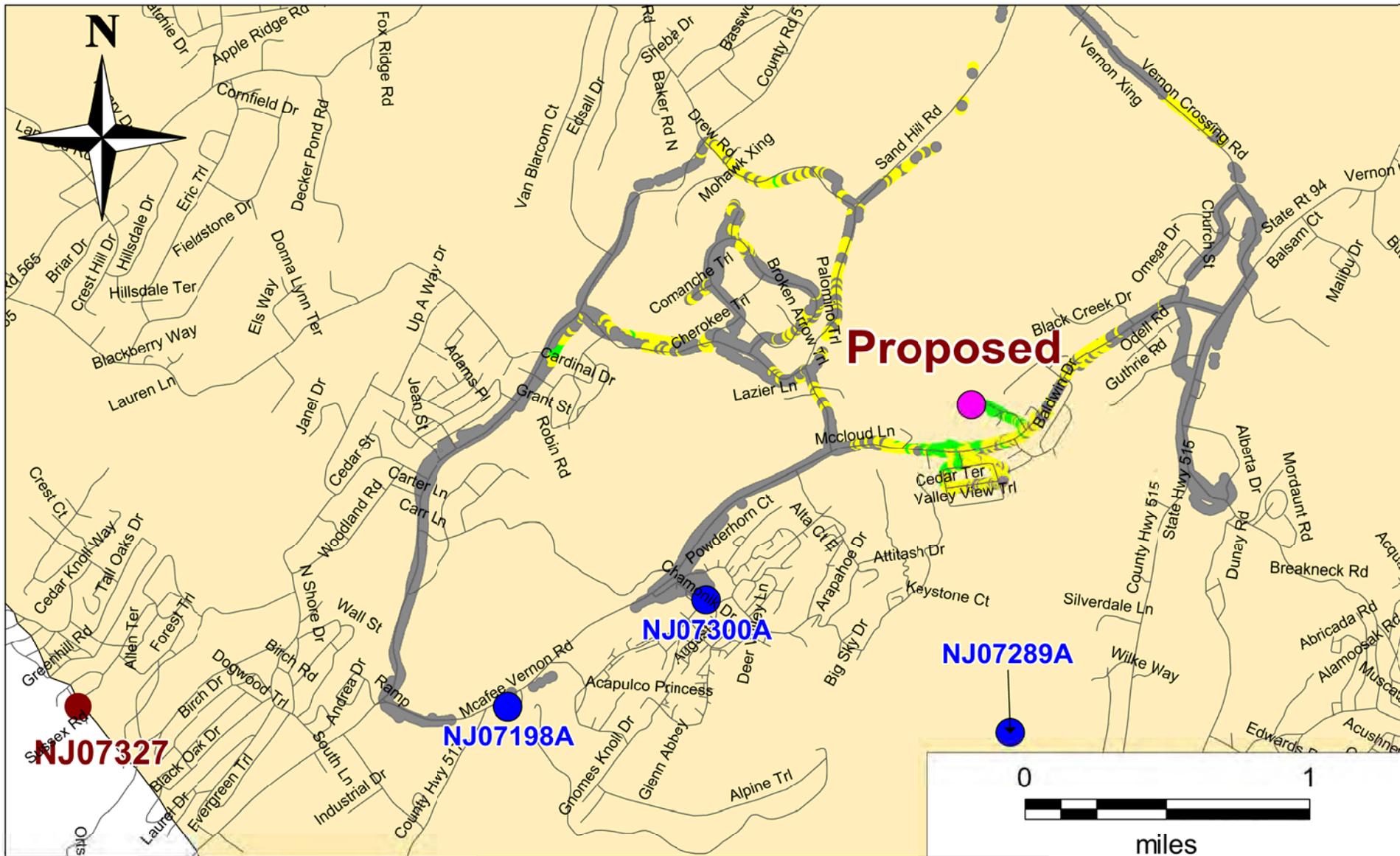
NJ07320
 T-Mobile Approved NJ07327 2100 MHz
 Coverage & Proposed 2100 MHz
 Drive Test at 180ft
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 Vernon Township, NJ 07462

 Proposed Site	 Vernon_Township
 Existing Site	 Approved T-Mobile Sites
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 Reliable In Vehicle Coverage (≥ -114 dBm RSRP)	
 Unreliable Service	


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 6/12/2019



Proposed

NJ07327

NJ07300A

NJ07198A

NJ07289A

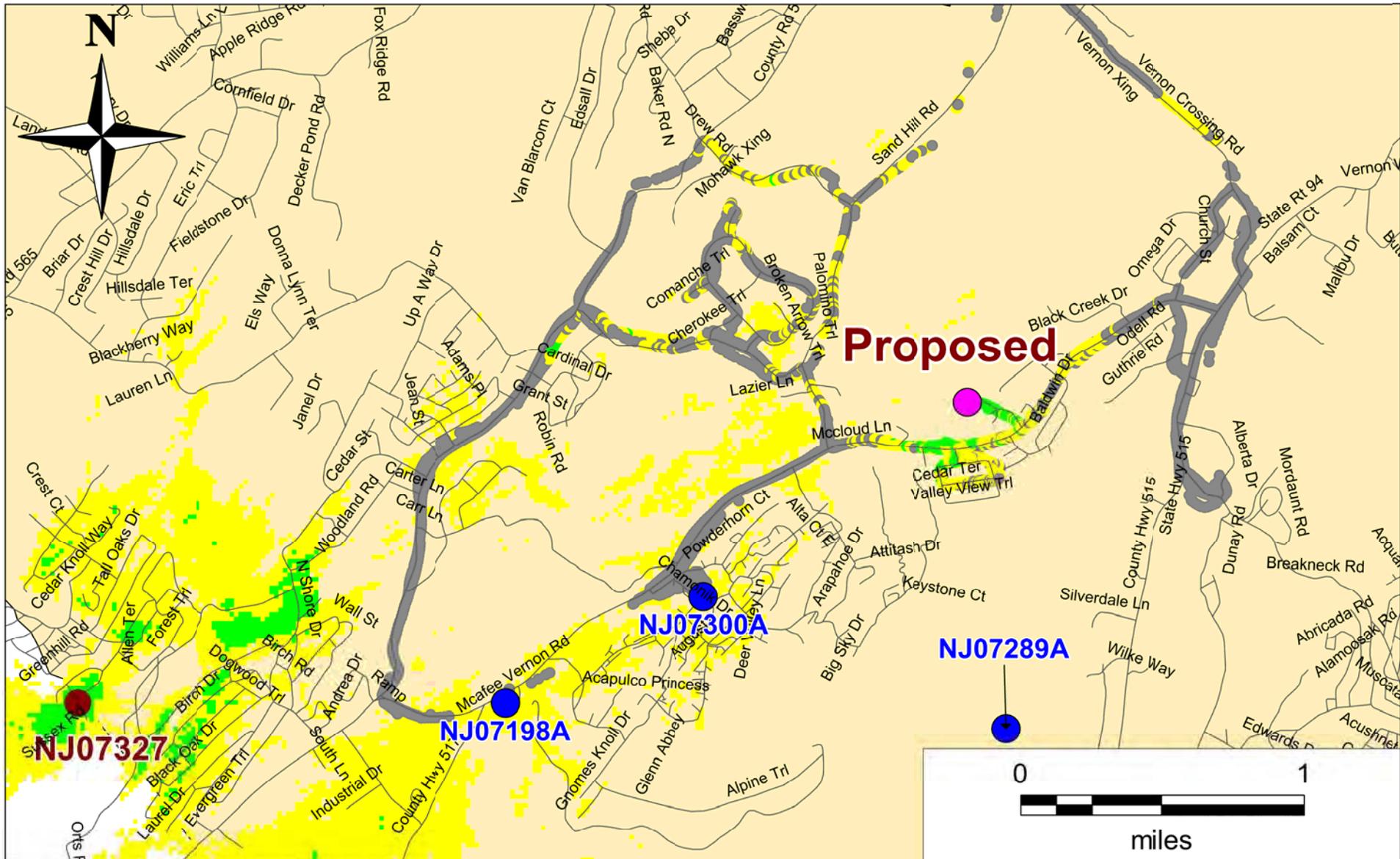
NJ07320

T-Mobile Proposed 2100 MHz
 Drive Test @ 140ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township



Prepared By: PierCon Solutions LLC
 5/15/2019



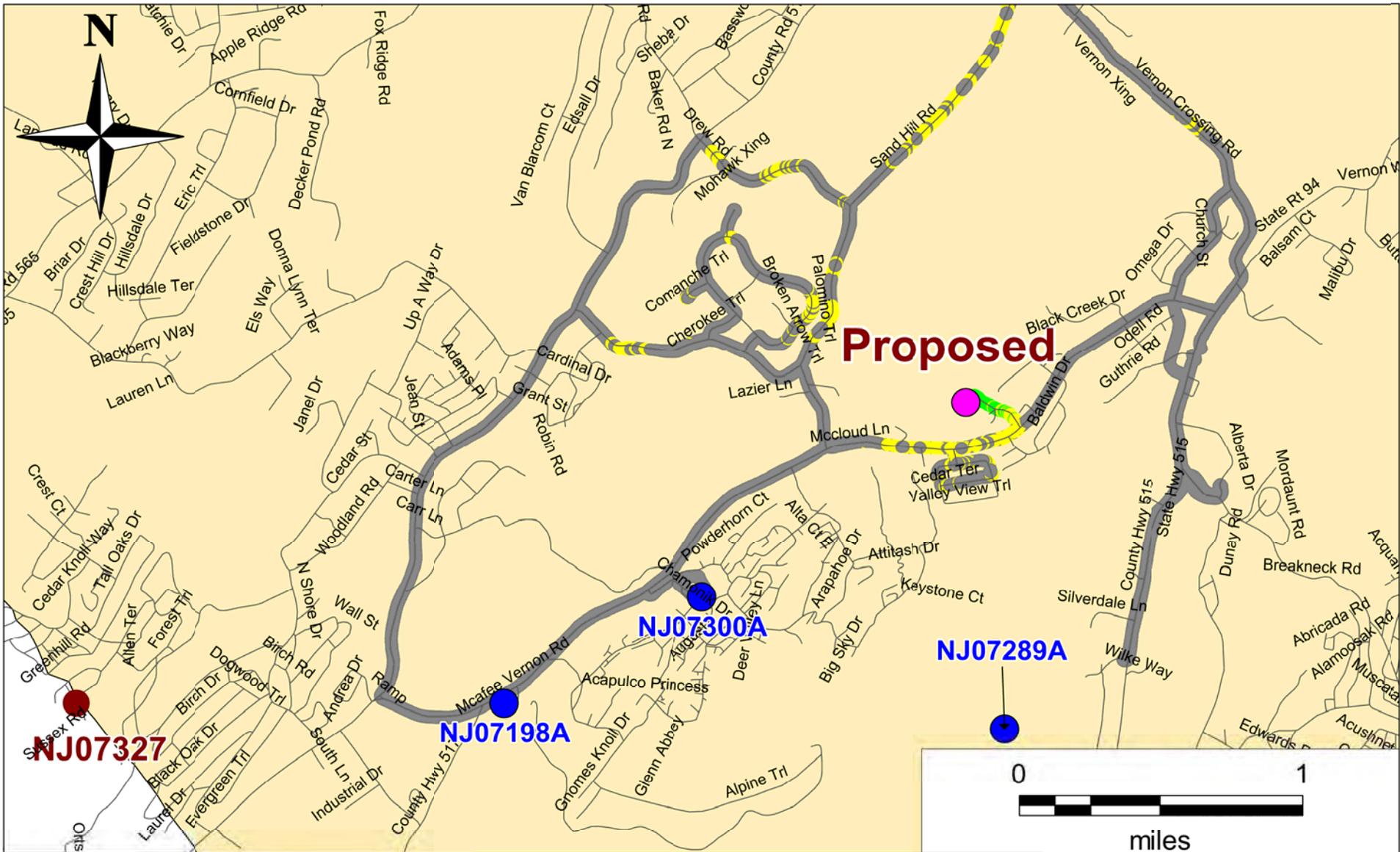
NJ07320
 T-Mobile Approved NJ07327 2100 MHz
 Coverage & Proposed 2100 MHz
 Drive Test at 140ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

 Proposed Site	 Vernon_Township
 Existing Site	 Approved T-Mobile Sites
 Reliable In Building Coverage (>=-97 dBm RSRP)	
 Reliable In Vehicle Coverage (>=-114 dBm RSRP)	
 Unreliable Service	


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 6/12/2019



Proposed

NJ07327

NJ07300A

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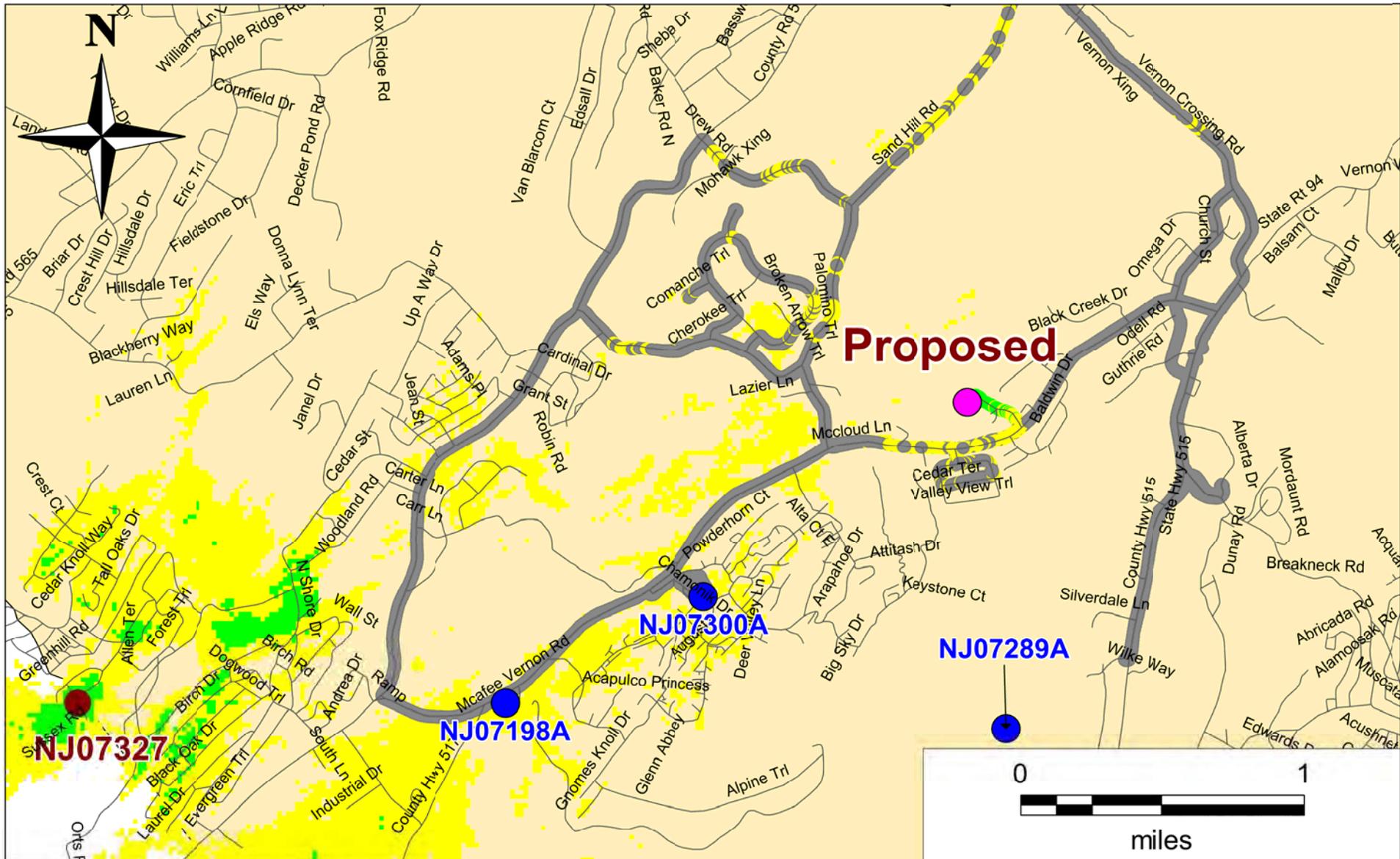
NJ07320

T-Mobile Proposed 2100 MHz
 Drive Test @ 80ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Approved T-Mobile Sites
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 5/15/2019



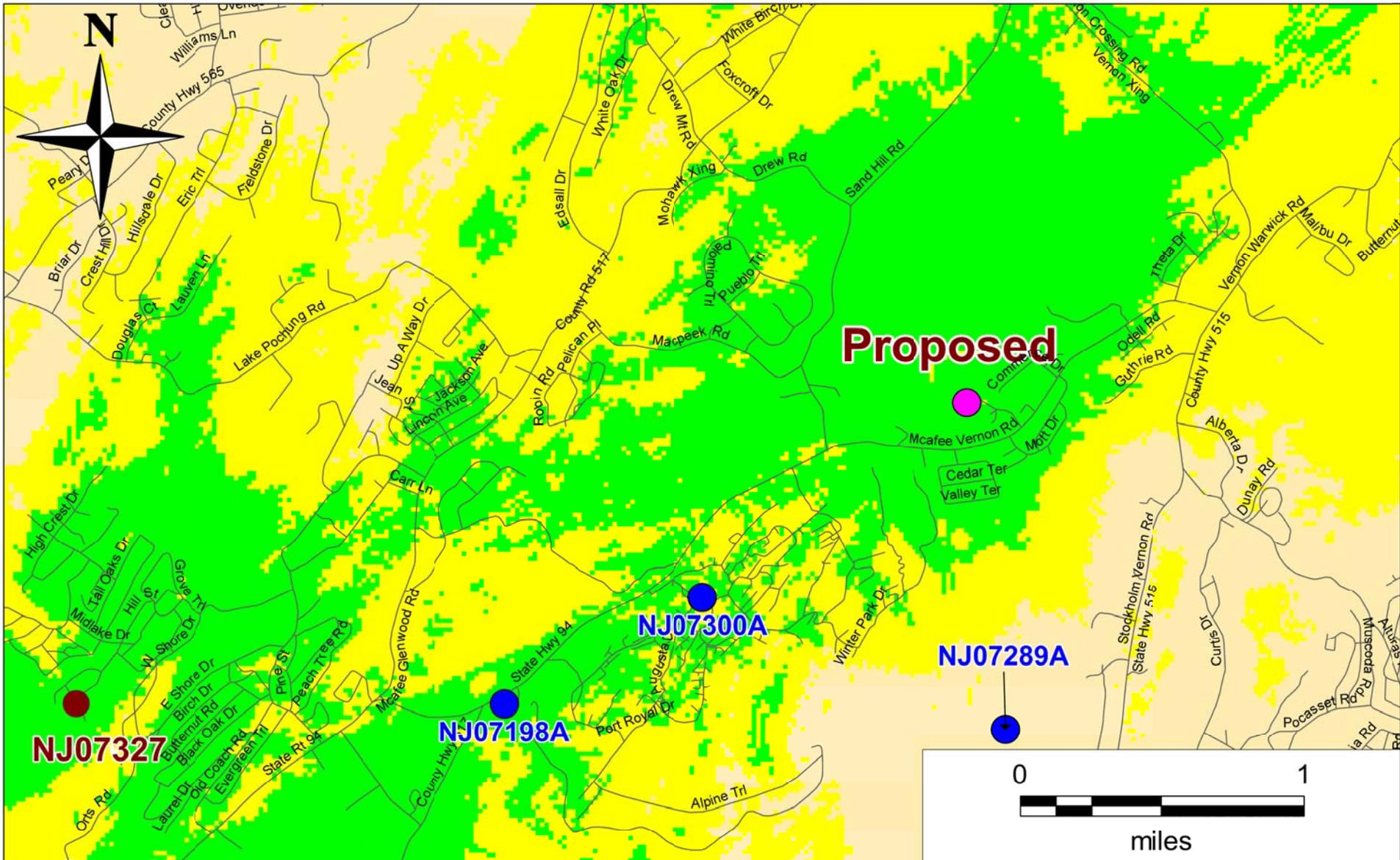
NJ07320
 T-Mobile Approved NJ07327 2100 MHz
 Coverage & Proposed 2100 MHz
 Drive Test at 80ft
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 6/12/2019



NJ07320

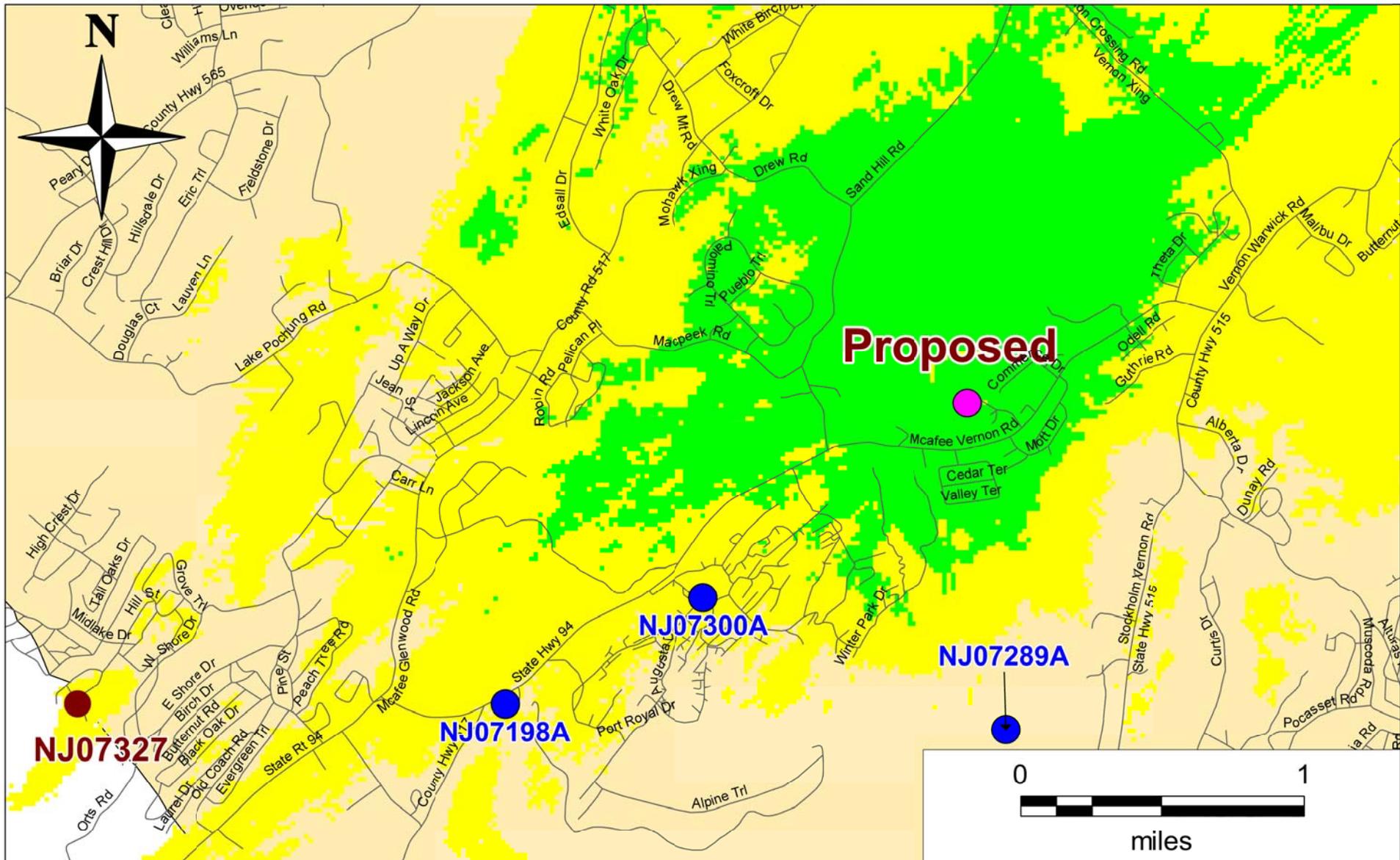
T-Mobile Approved NJ07327 700 MHz
 Coverage with Proposed 700 MHz
 coverage at 160ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township
- Approved T-Mobile Sites

 **PierCon Solutions LLC**
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 6/12/2019



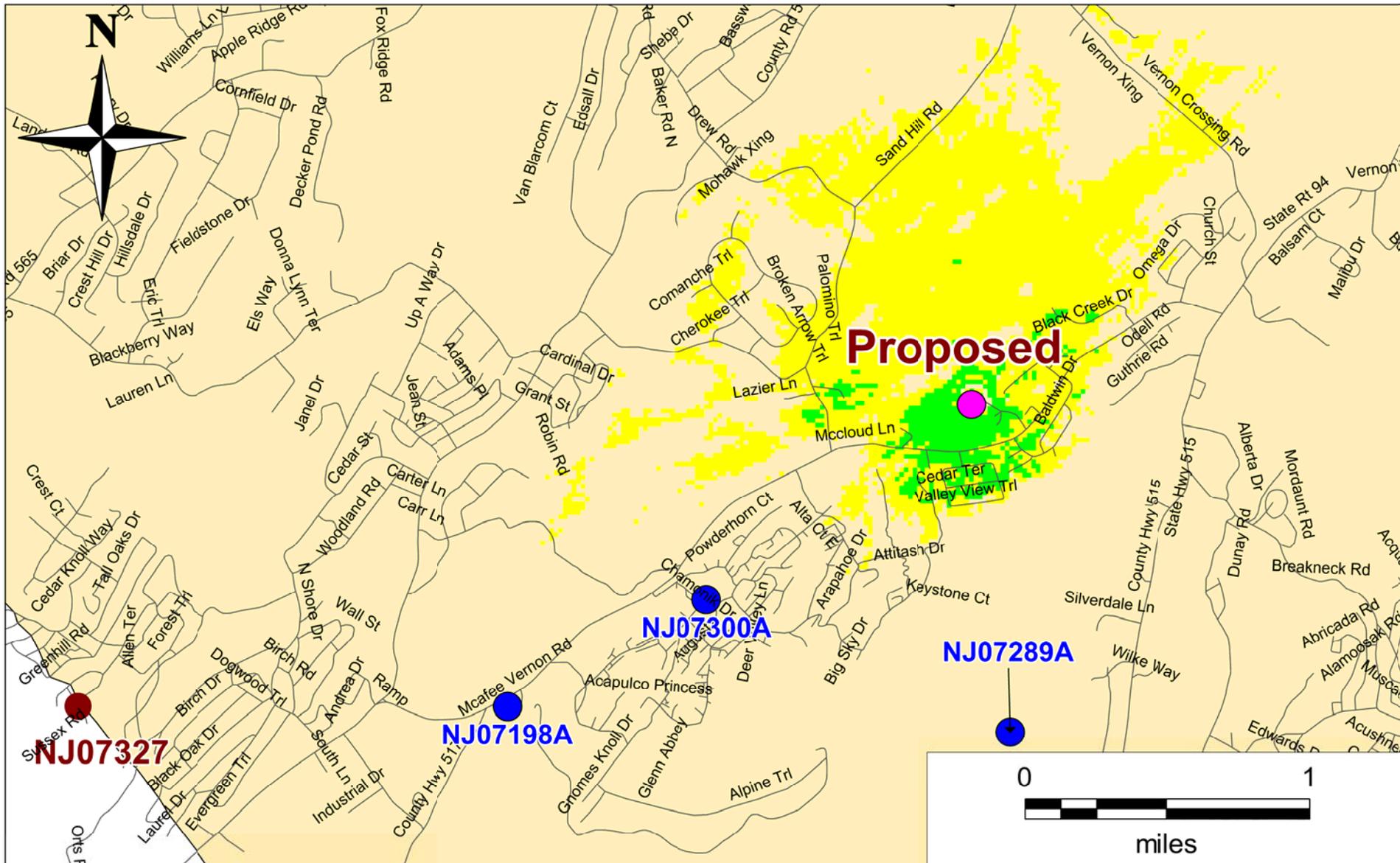
NJ07320

T-Mobile Proposed 700 MHz coverage at 160ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
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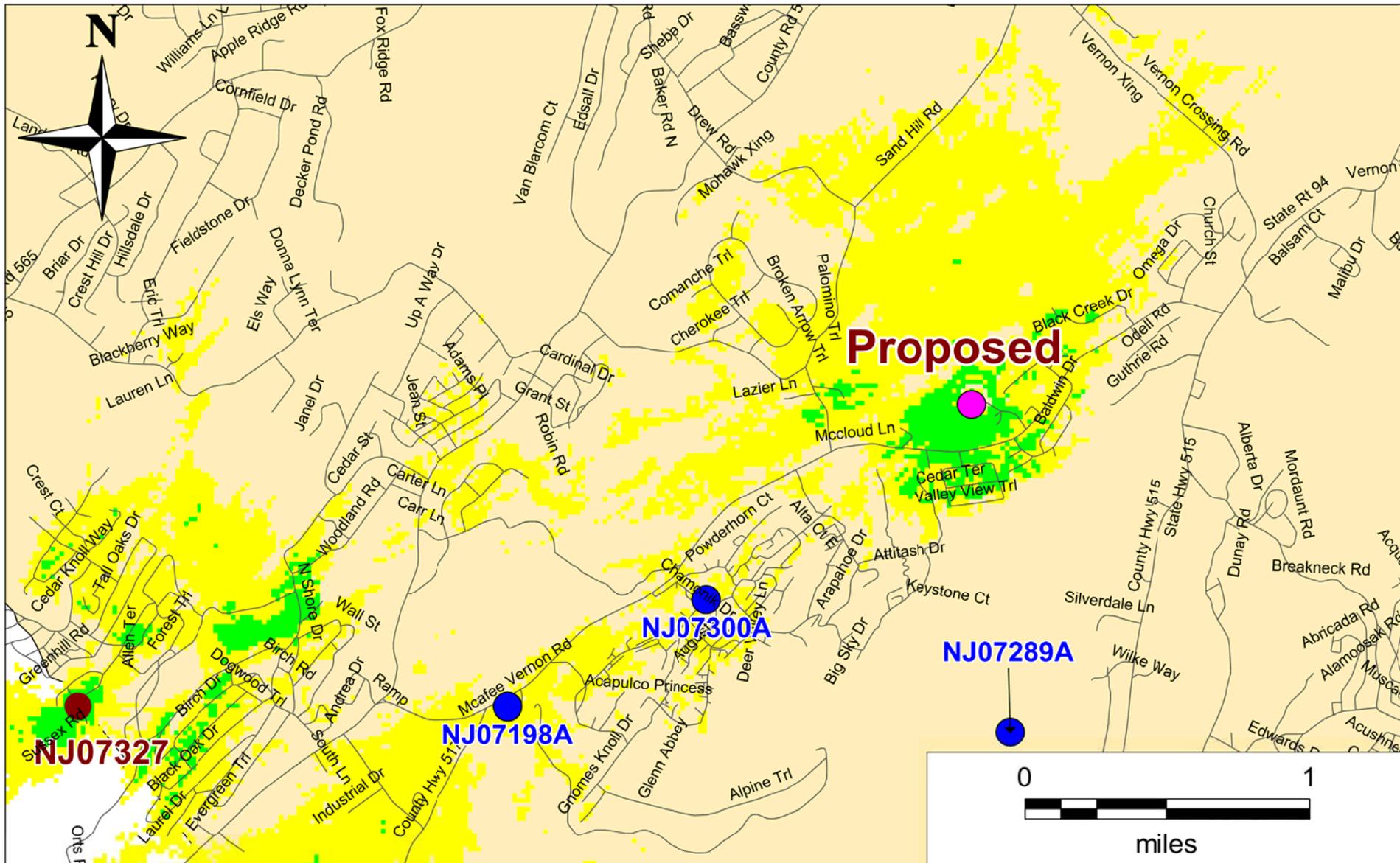
NJ07320

T-Mobile Proposed 2100 MHz coverage at 160ft
 13 Vanderhoof Court
 Vernon Township, NJ 07462

- Proposed Site
- Existing Site
- Reliable In Building Coverage (≥ -97 dBm RSRP)
- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
- Unreliable Service
- Vernon_Township
- Approved T-Mobile Sites

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Specialists in Wireless Systems

Prepared By: PierCon Solutions LLC
 6/12/2019



NJ07320

T-Mobile Approved NJ07327 2100 MHz
with Proposed 2100 MHz
coverage at 160ft
13 Vanderhoof Court
Vernon Township, NJ 07462

- Proposed Site
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- Reliable In Vehicle Coverage (≥ -114 dBm RSRP)
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