

Independent Radio Frequency Report
Regarding a Proposed
Wireless Communications Facility For
T-Mobile Northeast, LLC

**Site ID:
“NJCLT56A”**

PSE&G Steel Tower
#12/4

Long Hill Road

Long Hill, NJ

Morris County

By

Pier Con Solutions, LLC
January 4, 2021

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1 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 T-Mobile Northeast, LLC to construct and operate a temporary wireless telecommunications facility consisting of 9 antennas (3 per sector) in the PSE&G right of way which is also the site of the existing PSE7G tower #12/4 on Long Hill Road, Long Hill, NJ (aka, "NJ06097E").

The purpose of this proposed site known as (NJCLT56A) for T-Mobile is to temporarily replace an existing site (NJ06097E) T-Mobile located on a PSE&G transmission tower approximately 780 feet to the West. This PSE&G transmission tower which supports T-Mobile has been ordered to be removed to allow PSE&G to replace the row of transmission towers. Once this transmission tower is taken down, the T-Mobile network will experience a significant gap in service in the local area. In an attempt to avoid this significant gap in service, T-Mobile is proposing to install a temporary 100-foot ballast mounted tower in the PSE&G right of way property.

In preparation for conducting this analysis, PierCon Solutions obtained applicable engineering data from T-Mobile and considered whether best suited a location from an RF perspective since wireless communication facilities are prohibited throughout the Township.

The following report results from a thorough independent study and analysis (from a radiofrequency engineering perspective) of the applicant's proposal in consideration of the Township of Long Hill's restrictions. Exhibits referenced in this report can be found in the Appendix.

2 GENERAL OVERVIEW

T-Mobile's network FCC frequency holdings include 1900 MHz, 2100 MHz, and 700 MHz ,600MHz, 2500 MHz for LTE.

Each frequency band has different performance characteristics for both coverage and capacity. From a coverage perspective, the lower frequency bands (600/700 MHz) cover a greater distance and are less attenuated by trees and terrain, while the higher frequency bands (1900/2100/2500 MHz) cover a lesser distance and are more attenuated by trees and terrain. From a coverage perspective if the 700 MHz frequency band demonstrates a gap in coverage then all higher frequency bands (1900 MHz, 2100 MHz, 2500 MHz) will demonstrate greater gaps in coverage. For simplicity, coverage demonstrations at 700MHz for low band and 1900 MHz for high band will be shown. Additional exhibits for the remaining frequencies can be provided upon request.

3 DESIGN OBJECTIVES

T-Mobile have established service and performance goals to provide reliable wireless services across all of its FCC licensed frequency bands and technologies. T-Mobile's service and performance goals include providing adequate coverage and capacity for voice and data services, preparing to provide future services, and otherwise improving service capabilities.

The service goals established by the wireless carriers are designed to provide all customers with a positive wireless voice and data experience. Simply put, a positive wireless experience includes the customer connecting to the network on the first try, staying connected throughout the session, and the customer ending the session when ready. For positive experiences with data connections (e.g., internet browsing) the speed is as fast as the technology allows. Unreliable service, meaning service levels that do not meet T-Mobile's service and performance goals, causes a negative experience: customers cannot place calls when they want to; when they are connected, voice call quality does not meet customer expectations; or, the call simply drops off (disconnects) without notice. A negative data experience is not instantaneous, is much slower than consumers expect and demand, or the connection is never established.

Unreliable service that fails to meet the wireless carrier's service and performance goals, which include voice and/or data services, can occur if there is: (i) a lack of reliable signal, including poor signal quality; and/or (ii) a lack of system capacity, or in terms of LTE, insufficient throughput, for any of T-Mobile's services and across all of their licensed frequency bands. Providing quality in-building voice and data services, with sufficient system capacity and high-speed data rates, is critical to their customers and is essential to their ability to compete effectively with its functionally equivalent competitors in a fair and balanced legal and regulatory environment.

In order to adequately provide reliable wireless service to the Township of Long Hill, and surrounding area, the design threshold for reliable service must be defined. The reliable coverage boundary of an LTE site uses 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 propagation coverage analyses presented herein, are for services based upon a suburban in-building standard with a corresponding RSRP of -97dBm for T-Mobile and -114dBm for in-vehicle threshold. The suburban in-building standard encompasses most wood framed structures such as single-family homes. Stronger signal levels may be required in other locations and environments where higher density buildings and/or population densities are located.

4 RADIO FREQUENCY ENGINEERING ACTIVITIES PERFORMED

In the course of the analysis described in this report, PierCon engineers performed the following tasks:

- Reviewed USGS Topographical Maps of the Township of Long Hill and surrounding areas.
- Performed an engineering site analysis; reviewing terrain and tree line.
- Reviewed the location and design of adjacent wireless communications facilities
- Reviewed Radio Frequency coverage maps, the RF design and objective within and surrounding the Township of Long Hill

5 COVERAGE PROPAGATION ANALYSIS

T-Mobile's main technology deployed is LTE and is the relevant standard in which to design to. PierCon Solutions evaluated T-Mobile's (1900MHz) and (700MHz) frequency bands through propagation analysis in order to demonstrate the high frequency band and low frequency band coverage analysis.

Documentary evidence regarding the need for the proposed telecommunications facility at the proposed location was obtained by PierCon Solutions from Asset propagation tool for T-Mobile similar to other propagation tools used by Verizon Wireless, AT&T, Sprint, and many other service providers throughout the world. The technical specifications for this application and existing T-Mobile sites provided was used to produce these propagation coverage maps

indicating the locations where reliable service is being provided by T-Mobile wireless communications facilities. Please find attached, in the appendix, exhibits for T-Mobile.

5.1 T-Mobile Coverage

Currently, T-Mobile has deployed only the 1900MHz at the existing facility. T-Mobile has not been able to upgrade the facility with the other frequency bands due to PSE&G. T-Mobile's surrounding sites already have other frequency bands such as the 2100MHz which offers more capacity with its larger bandwidth and the 700MHz which offers a much larger footprint in coverage. Together, the frequency bands allow T-Mobile network to function more efficiently having more coverage from the low band frequency and more capacity from high band frequencies to support user's demand for data services.

After the removal of existing site NJ06097E, the remaining network of sites for T-Mobile will have a gap in coverage for the FCC licensed frequency band of 1900 MHz for T-Mobile. T-Mobile has been unable to upgrade the existing PSEG site for the other frequency bands due to the transmission tower's need of maintenance. There will be a benefit to the Township of Long Valley with the addition of the low band frequency for T-Mobile customers due to its larger coverage footprint.

To define the gaps in coverage, PierCon analyzed the propagation of the 1900MHz and 700MHz. For a graphical view of this coverage analysis, please refer to the following exhibits in the Appendix:

- Exhibit A – Existing Coverage 1900 MHz
- Exhibit B - Existing Coverage (without NJ06097E) 1900 MHz
- Exhibit C - Existing + Proposed Coverage (without NJ06097E) 1900 MHz
- Exhibit D – Existing Coverage 700 MHz
- Exhibit E – Existing + Proposed Coverage 700 MHz

In these exhibits, blue dots represent the existing site locations and the pink dot represents the proposed site location. The brown dot refers to the site to be decommissioned and removed by PSE&G during their maintenance. The green shaded area represents locations where the T-Mobile network achieves enough LTE signal strength to provide in-building coverage. The yellow shaded area represents locations where the T-Mobile network achieves in-vehicle LTE coverage only and not sufficient strength to provide adequate inbuilding service.

1900 MHz Coverage

Exhibit A represents the LTE 1900 MHz existing coverage. Exhibit B represents the LTE coverage lost to the Township area, due to the decommissioning of NJ06097E. The impact is significant and includes the following area bounded by Whitebridge Road to Mountain Ave (North to South) and Morristown Rd to Bridge Avenue (West to East):

In vehicle coverage:

- 1.7 Mi on Whitebridge Road
- 2 mi on New Vernon Road

Residential Coverage:

- 2.3 mi on Meyersville Road from Jodi Ln to Long Hill Road
- 1 mi on Long Hill Road from Mitchell Road

- 1 mi on Springfield Road (State Route 512)
- .8 mi on Park Avenue
- 1.5 mi on Mountain Avenue

Figure 1– Google Map Image of the area within the Township of Long Hill at risk of losing reliable service

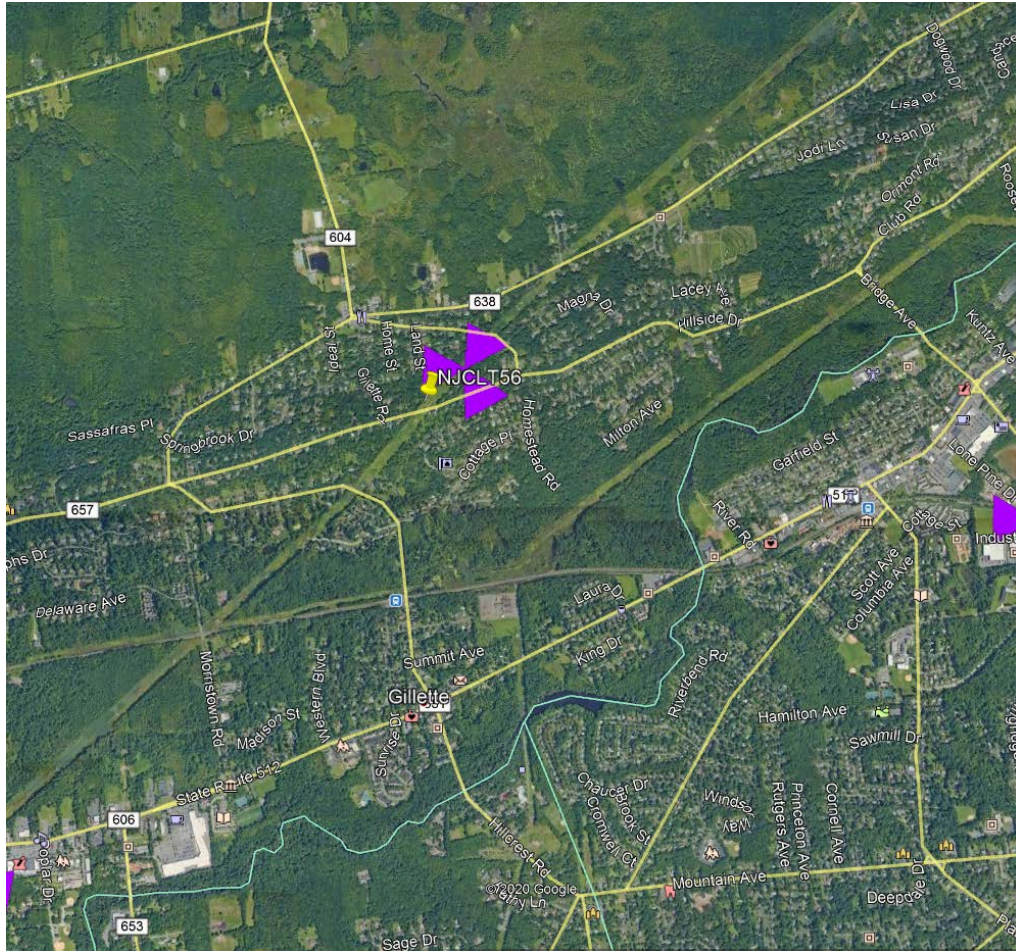


Exhibit C shows the coverage from the proposed site (NJCLT56A). The proposed site is approximately 780ft west of the existing and has a lower antenna centerline of 95ft from the existing center line of 130ft. It is important to note that although the temporary location is further west and 35ft lower in height. The ground elevation difference between the two locations is approximately 40ft. The proposed ground elevation is approximately 40ft higher than the existing, making the antenna rad centers similar. Due to the shift in location further west, one would expect coverage to be shifted in the westward direction.

This temp site fills most of the coverage from the existing NJ06097E site and provides additional coverage to the west filling in an existing gap near Morristown Road. The temp site provides more coverage north due to the higher elevation but falls short to the south reaching southern portion of Mountain Avenue and along the valley easterly along Meyersville Road.

The additional new inbuilding coverage includes the following:

- .42 sq mi residential area between Morristown Avenue and Mountain Ave.

- 1 mi section along New Vernon Road

700MHz Coverage

Exhibit D represents T-Mobiles existing 700MHz coverage. Exhibit D shows T-Mobile currently has a gap in coverage which is significant and extends from the intersection of Pleasant Palins Road and Whitehill Road to the southern portion of Mountain Avenue.

As mentioned, there currently exists no low band frequency at the existing site due to T-Mobile inability to upgrade on the PSE&G tower. The 700MHz will help fill in areas where 1900 MHz is unable to reach, due to its characteristic of the higher frequency.

The proposed temporary site (NJCLT56A) is designed to have the low band 700 MHz which adds coverage, improving wireless service to the Township of Long Hill. Please see Exhibit E for the Existing and Proposed Coverage at 700 MHz for the coverage improved area. The coverage gap is filled at the low band frequency.

It is important to note, the LTE 2100MHz frequency band provides the largest 20 MHz of bandwidth for T-Mobile. The lower frequency bands, 700 MHz and 600 MHz provide smaller bandwidths which can result in slower data throughput speeds. Therefore, the 20MHz service is capable of providing approximately 4 times the capacity to the network and much higher data throughput speeds. The proposed temporary site is important to T-Mobile's Network to assist in maintaining adequate data service to residents and workers in the Township of Long Hill as well as providing improved wireless coverage and reliability.

6 CONCLUSION

PierCon Solutions' analysis of T-Mobile's existing network indicates that a significant gap in wireless service exists (due to the loss of existing site NJ06097E within the Township of Long Hill. The application by T-Mobile proposes to construct a temporary new wireless telecommunications facility in the PSE&G Right of Way which is an ideal location from an RF perspective. The proposed installation will alleviate the coverage deficiencies due to the decommissioning of their existing site and provide improved reliable service to and around Long Hill Road for nearby businesses and residents in the interim.

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.

After performing the independent radiofrequency analysis, PierCon Solutions concludes that this facility is essential to T-Mobile's network design for the Township of Long Hill.

Report Prepared by:

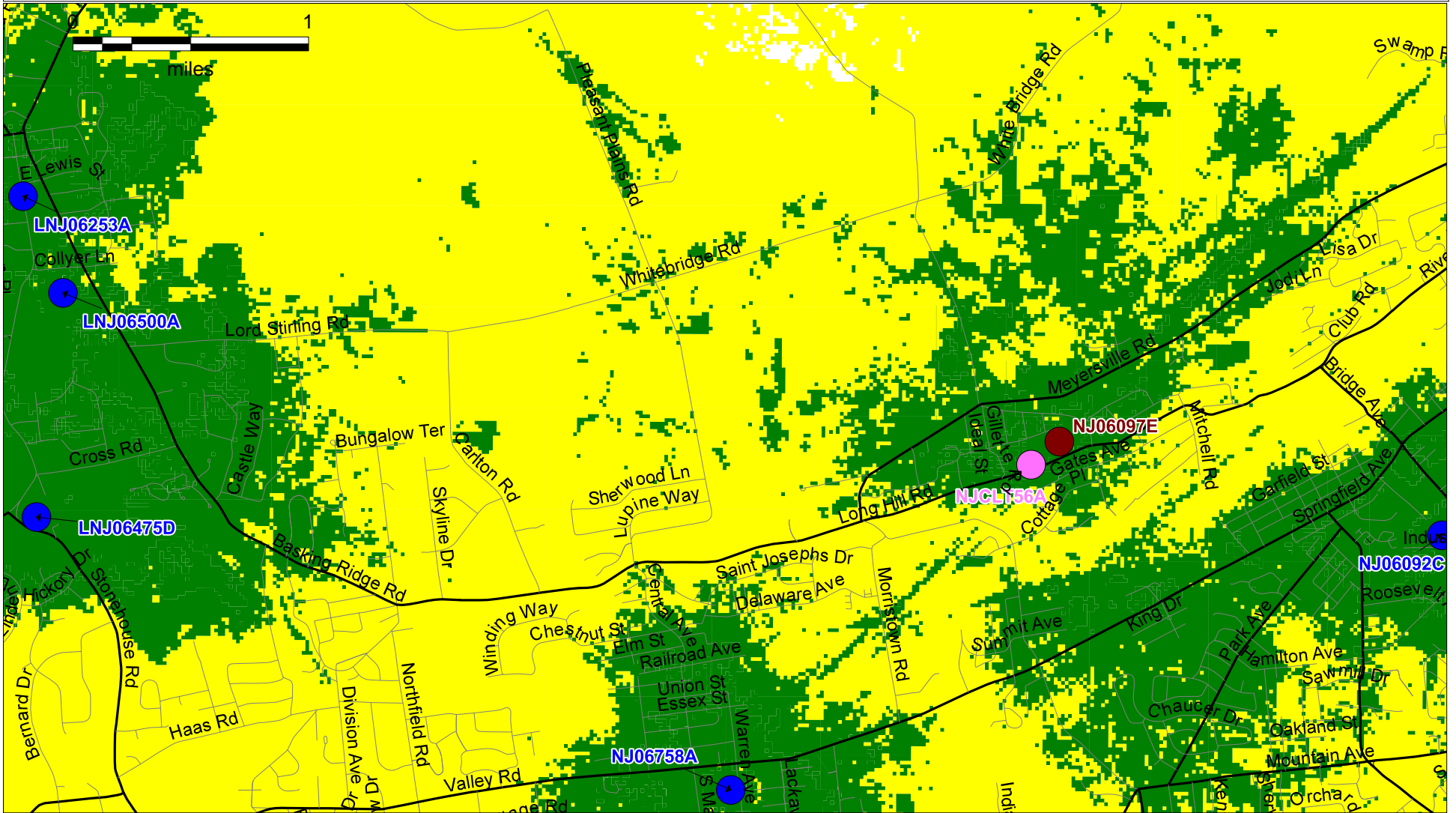


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7 APPENDIX - EXHIBITS

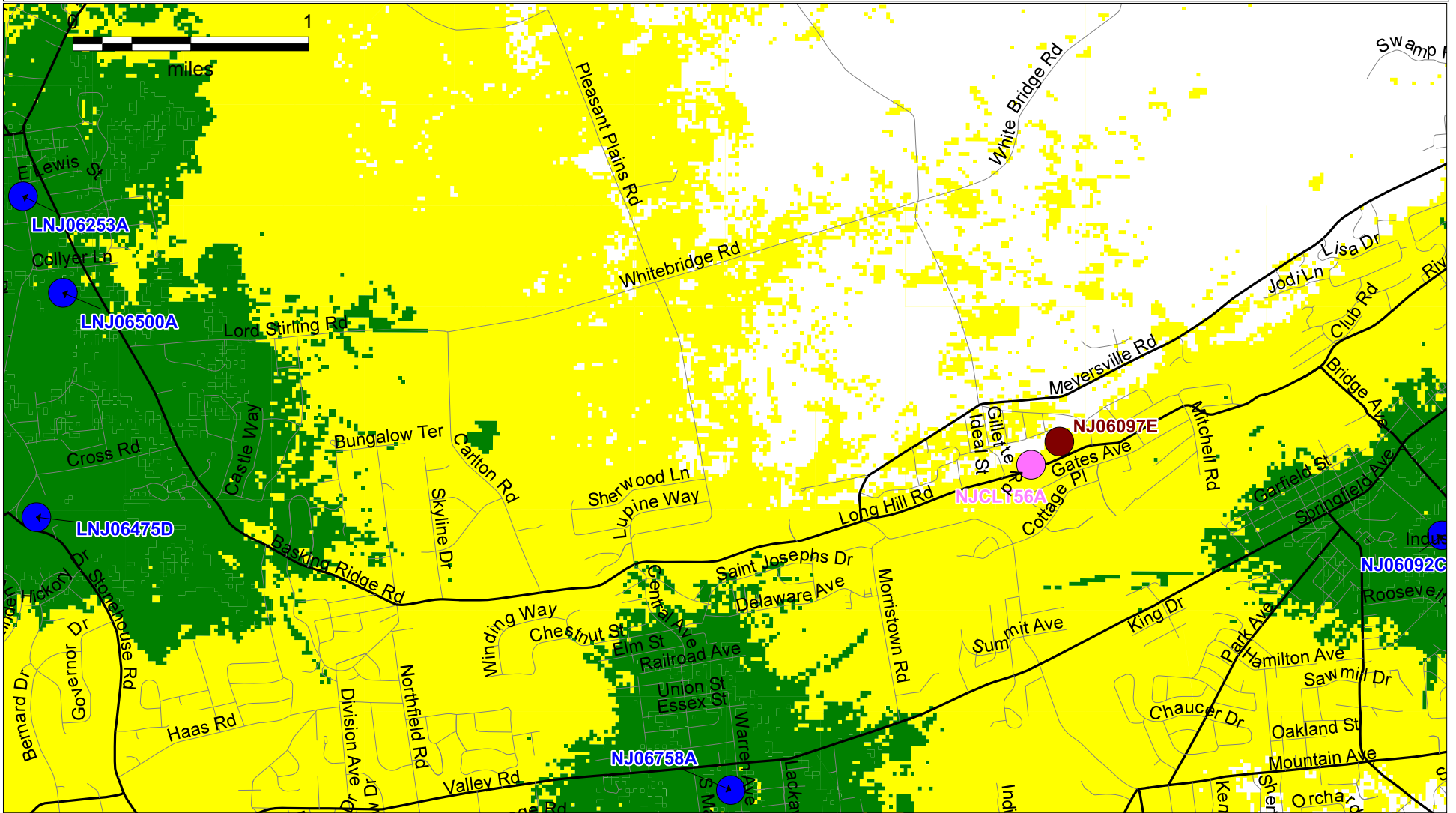
- *Exhibit A – T-Mobile Existing Coverage 1900 MHz*
- *Exhibit B – T-Mobile Existing 1900 MHz LTE Coverage Without NJ06097E*
- *Exhibit C – T-Mobile Existing 1900 MHz LTE Coverage with Proposed NJCLT56*
- *Exhibit D – T-Mobile Existing Coverage 700 MHz*
- *Exhibit E – T-Mobile Existing + Proposed Coverage 700 MHz*

T-Mobile Existing 1900 MHz LTE Coverage



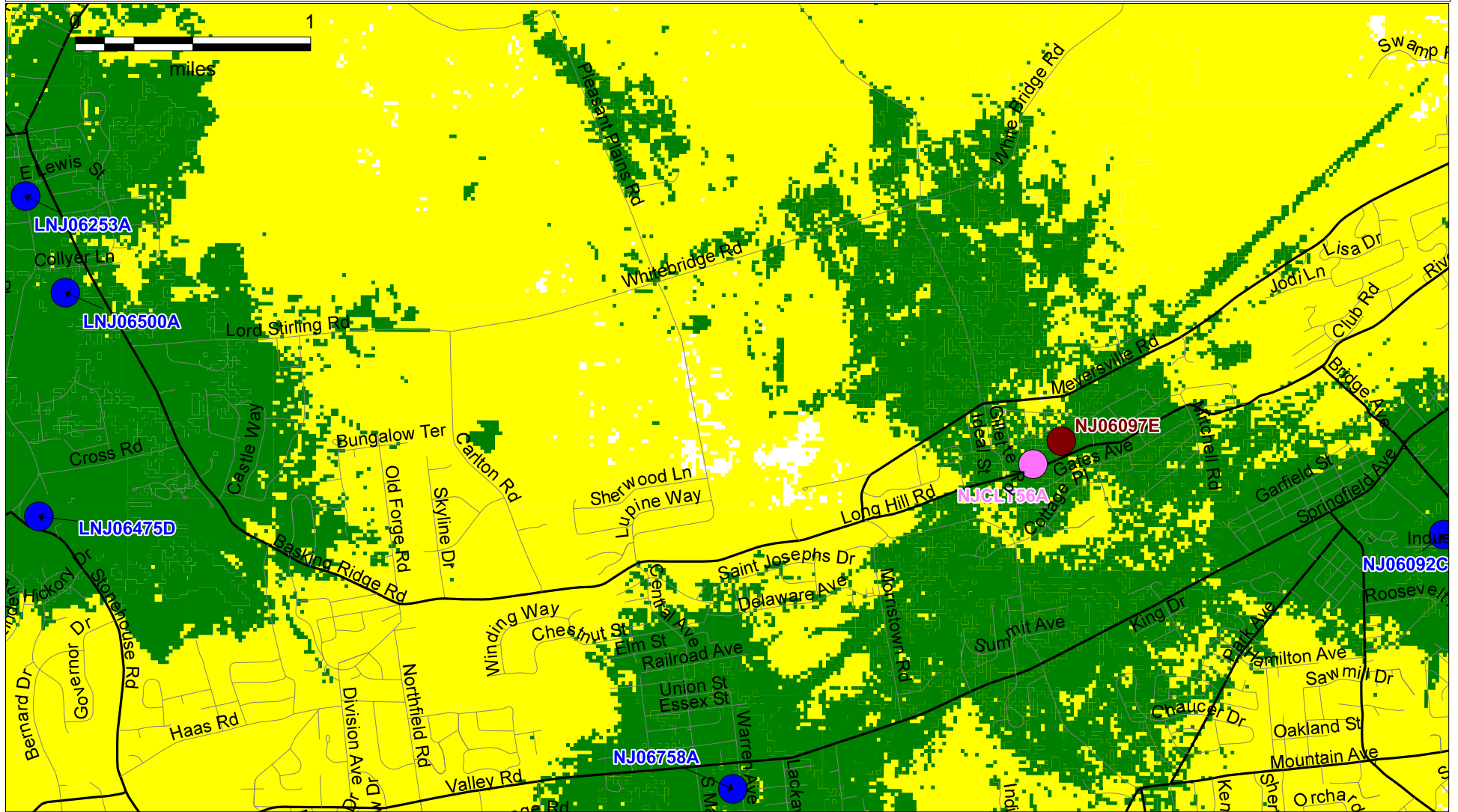
- Existing Macro On Air Site
- Existing On Air Macro Site to be Decommissioned
- Proposed Temporary Macro Site
- Inbuilding Service
- Invehicle Service

T-Mobile Existing 1900 MHz LTE Coverage Without NJ06097E



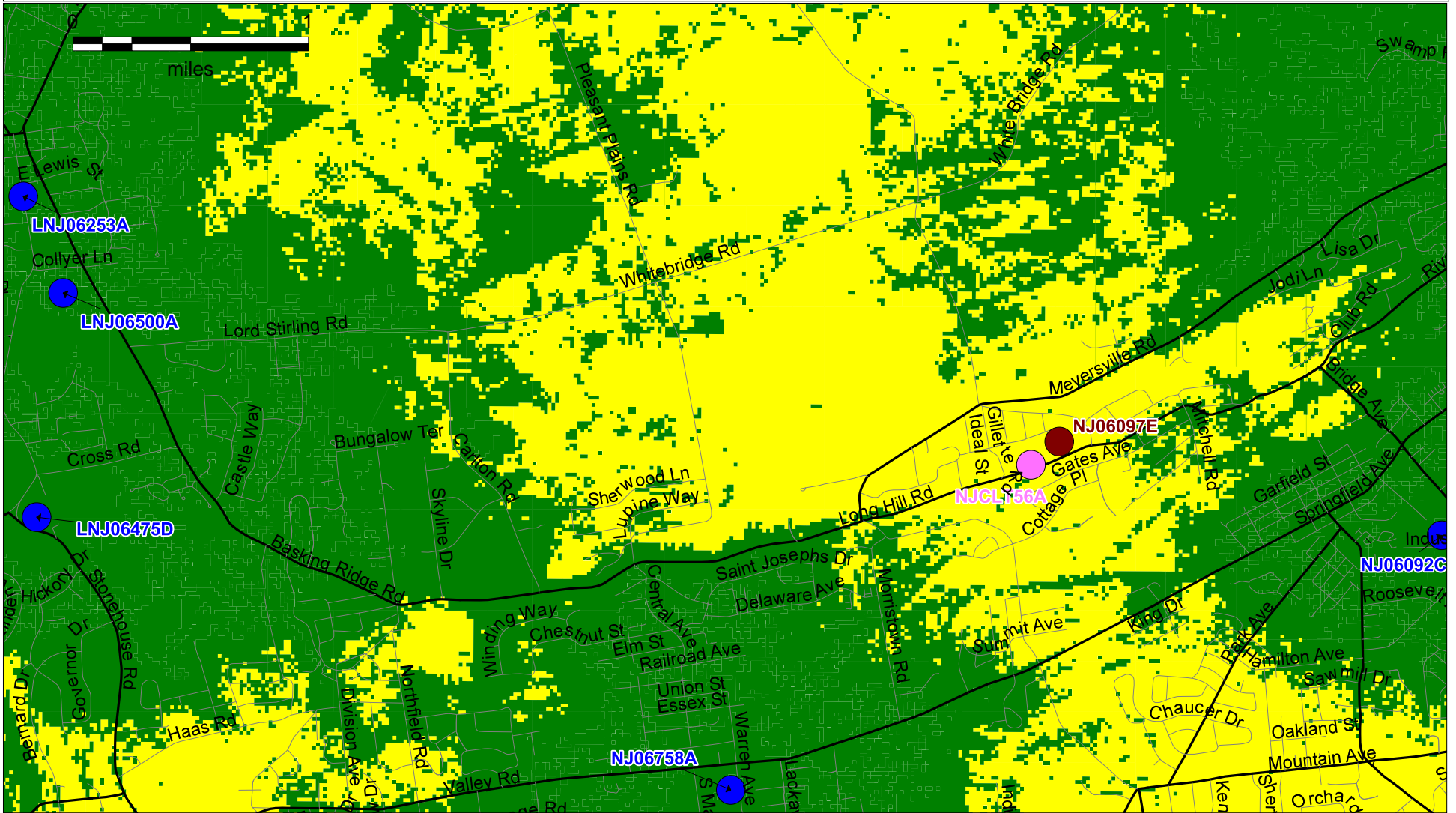
- Existing Macro On Air Site
- Existing On Air Macro Site to be Decommisioned
- Proposed Temporary Macro Site
- Inbuilding Service
- Invehicle Service

T-Mobile Existing 1900 MHz LTE Coverage with Proposed NJCLT56



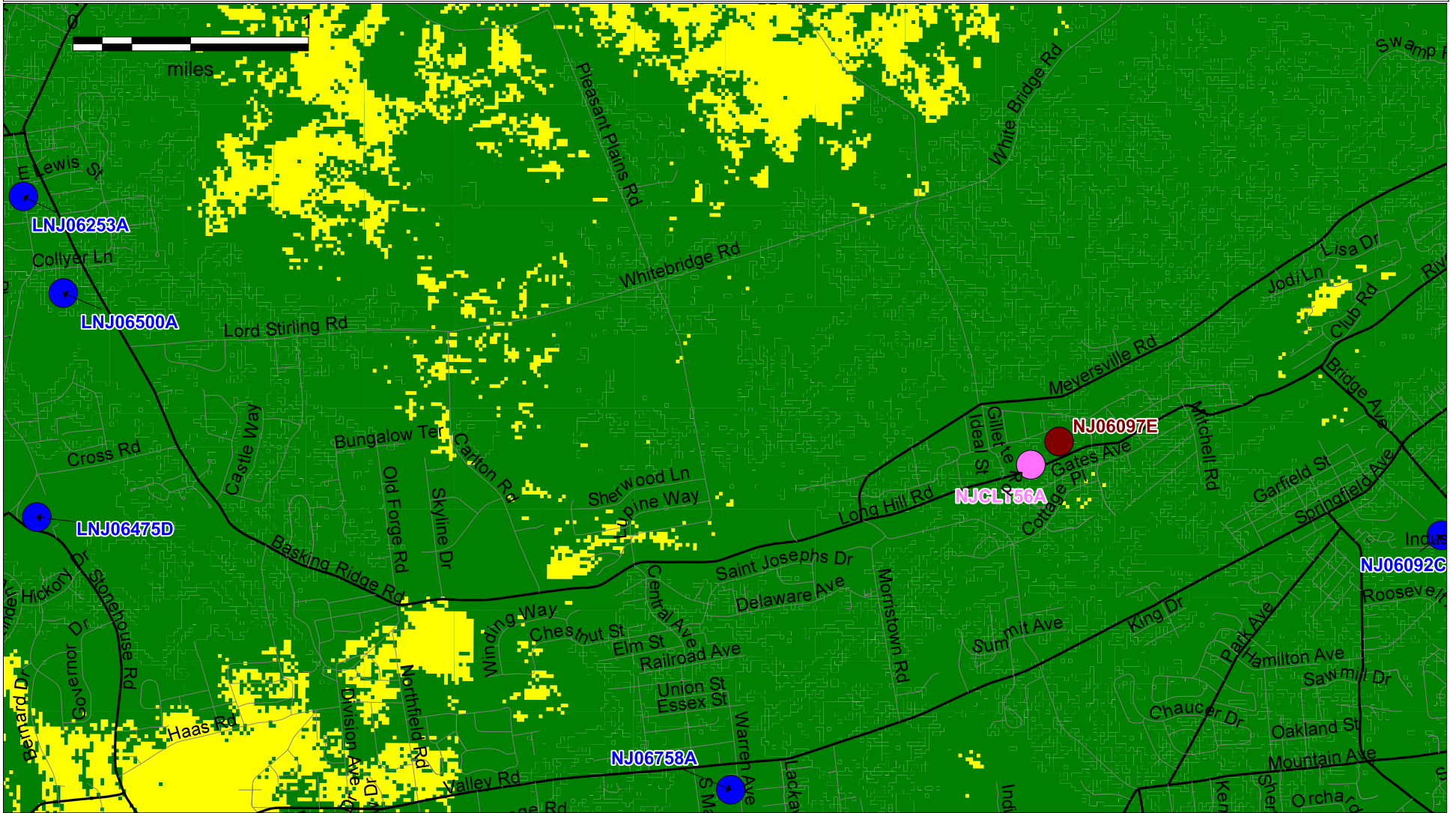
- Existing Macro On Air Site
- Existing On Air Macro Site to be Decommissioned
- Proposed Temporary Macro Site
- Inbuilding Service
- Invehicle Service

T-Mobile Existing 700 MHz LTE Coverage



- Existing Macro On Air Site
- Existing On Air Macro Site to be Decommissioned
- Proposed Temporary Macro Site
- Inbuilding Service
- Invehicle Service

T-Mobile Existing 700 MHz LTE Coverage with Proposed NJCLT56



- Existing Macro On Air Site
- Existing On Air Macro Site to be Decommissioned
- Proposed Temporary Macro Site
- Inbuilding Service
- Invehicle Service