Napa County Fiber Infrastructure Engineering Assessment Report

Prepared for:
Napa County, California
CEO's Office

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Executive Summary

Background

This report is based on information obtained by Magellan Advisors to assess the telecommunications infrastructure located within Napa County, California and assess the system damages from the 2017 Northern California wildfires. Magellan was retained by Napa County to conduct a study of the broadband network assets within the County limits that would identify specific network owners and their respective network locations. The purpose of the study was to determine the extent to which the network was damaged during the fire events in 2017, the current state of the repairs on the network, and assess the overall quality of the network. The findings contained within this report will be shared with Napa County.

Methodology

Magellan was able to locate specific network infrastructure by researching various online resources, compiling GIS data provided by some of the project stakeholders and soliciting information from network owners and service providers. Once the available infrastructure was mapped, coverage areas were identified, mapped and prioritized. Magellan deployed a field team to help fill in the infrastructure gaps and provide a more refined broadband assessment.

Results

By overlaying the 2017 fire perimeters on the mapped network and conducting the field study of assumed routes, Magellan was able to ascertain the extent of the network damaged by the fires, assess the overall quality of the network and identify locations where the infrastructure could use additional support in order to assist the county's future recovery efforts.

Key Findings

- Primary service providers and network owners were identified as AT&T and Comcast.
- An estimated 30% of network infrastructure sustained fire damage in the 2017 fires.

- Most repairs made can be classified as system replacements and not necessarily system upgrades.
- Linear network architecture can limit resiliency and redundancy.
- Aerial deployment is the primary means of transmission.
    - Lower installation and repair costs
    - Increased exposure to the elements
    - General upkeep is required by network owners within the right-of-ways and utility easements to maintain the network
    - Pole overloading can inhibit network expansion

County Data and Information

Napa County, California is 789 square miles of land located north of the San Pablo Bay situated between the State Capital of Sacramento and San Francisco. Nestled between the Mayacamas Mountains to the north and west and the Vaca Range to the east, Napa Valley is 30 miles in length and at most 5 miles wide and is home to some of the world's most renowned vineyards and wineries. Due to Napa County's ideal location and proximity to the Pacific Ocean, the region maintains a dry, Mediterranean climate. The combination of soil quality, unique topology, and climate are all factors that contribute to the classification of Napa Valley as a predominant American Viticultural Area.

In 2017, Napa County boasted an estimated population of over 140,000 people within the county limits with many of its citizens residing in the incorporated areas of American Canyon, Calistoga, St. Helena, Yountville, and the County Seat, City of Napa. While the primary industry in Napa County is centered around agricultural, manufacturing, service, and tourism sectors stemming from their world class vineyards, the largest employers are in the Health Care and Social Services.

Main transportation infrastructure provide access to Napa County citizens and visitors alike. Highway 29 and the Silverado Trail run north and south along the interior of the county. Highways 128, 12, and 121 assist those travelling east and west and continuing to neighboring counties. These major

roadways can also be considered as the some of the primary pathways for telecommunication infrastructure.

Project Overview

The North Bay Wildfires of October 2017 in Napa County and surrounding areas have cast a spotlight on the crucial importance of broadband communications infrastructure, particularly as it supports public safety communications. During the fire events, those communications virtually came to a standstill. While some communication was strategically stopped by service providers as a preventative measure, many areas lost service completely due to damaged infrastructure.

In the 4th quarter of 2018, Napa County hired Magellan Advisors to complete the initial assessment as it relates to current broadband infrastructure and services located within the county. This report will present the approach that was taken by Magellan Advisors to determine broadband network ownership throughout the county, assess the damage that the 2017 wildfires had on the network infrastructure, determine the current condition of the damaged infrastructure, and provide an overall assessment of the quality of the existing network throughout the county.

This information has been gathered and is listed in this broadband assessment in further detail. A variety of Geographical Informational System (GIS) technologies were utilized to map available data in order to create a high-level network foundation and identify unserved or underserved areas. GIS data from the 2017 fires was collected and mapped as an additional layer creating fire perimeters over the network foundation. Network operators and service providers were contacted to provide further information specific to their own networks, however limitations arose when this proprietary information was requested. Magellan Advisors sourced local permitting agencies for information that could be useful in determining areas that sustained damage from the fire. Magellan established the critical pathways located in the county. Officials were contracted to conduct three Ground Truth Tests in over 100 field locations, one for each Sprint, T-Mobile, and Verizon wireless service providers to locate wireless areas deemed as either

served, underserved, or unserved based on the CPUC Speed Standards. Field locations were chosen based on feedback from county officials. Speed tests were employed at the respective locations in order to validate advertised speeds. The data collected from those Ground Truth tests and established critical pathways assisted in the creation of priority areas that would be the primary focus for this assessment. Those identified priority areas have been outlined in magenta in Figure 1 below: Browns Valley, American Canyon, Wild Horse Valley Road, Rim Rock, Monticello, Oakville, St. Helena, Pope Valley, and Calistoga. This map was developed to lay out specific priority zones within our GIS database and serve as a preliminary basis for continued research.

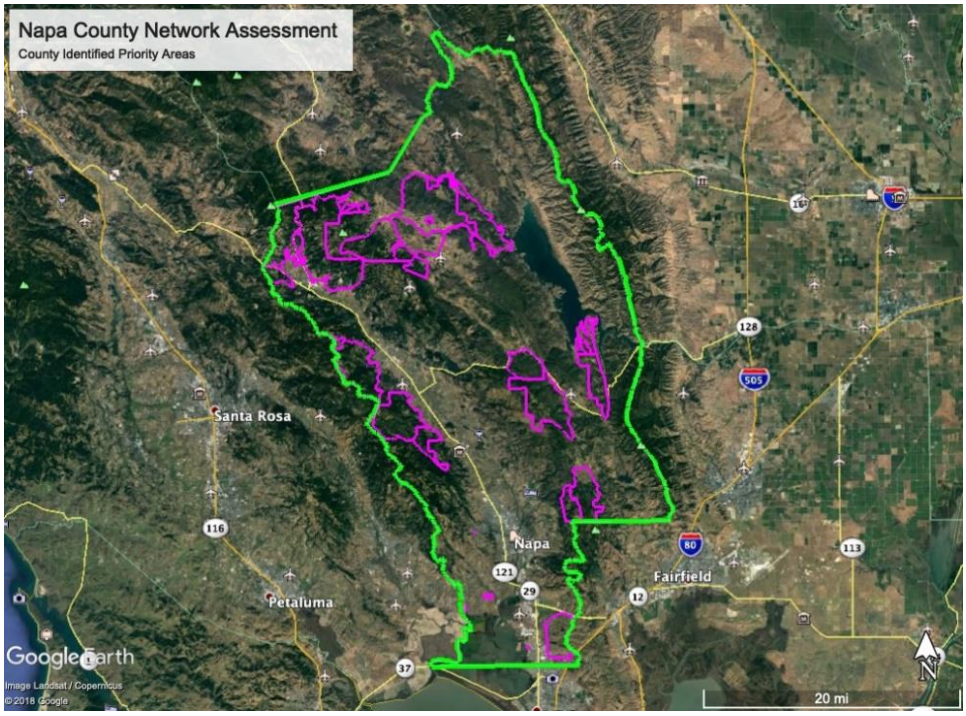


Figure 1

The critical pathways were defined as backbone routes that served as the major internal hub, connecting the cities within Napa County as well as those mountain overpasses connecting Napa County to its neighboring counties.

After the foundation was established, Magellan Advisors deployed a team to meet with County officials and conduct a field survey of the existing network infrastructure assets within the identified priority zones and document damaged infrastructure from the previous years' fire event. Figure 2 identifies specific points of interest that field personnel evaluated in greater detail to help establish the network within those established priority areas. These locations were selected based on accessibility and proximity to priority areas.

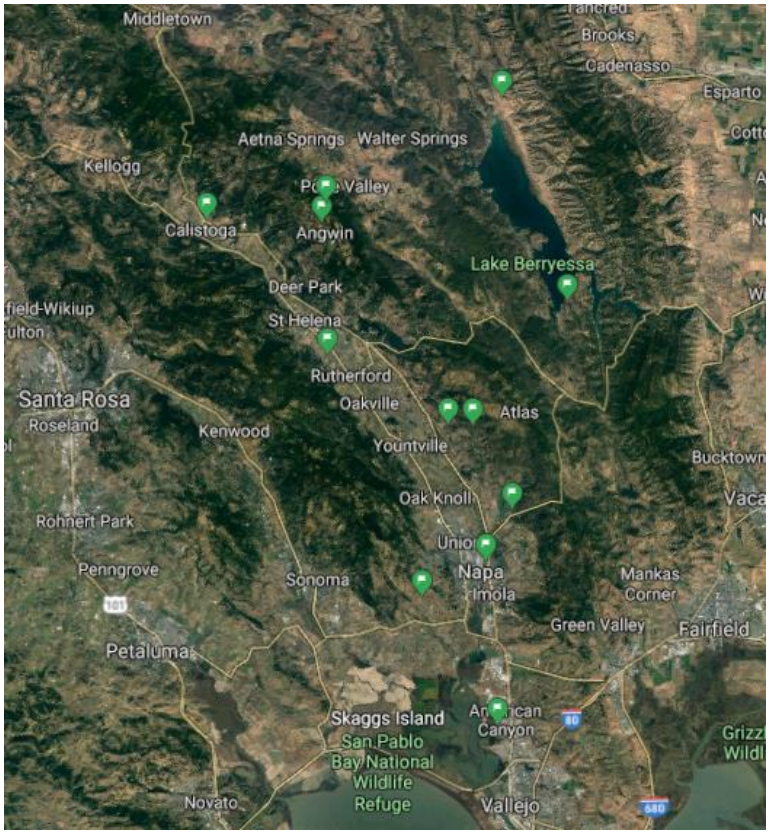


Figure 2

In addition to the mapped data, statistical information was compiled to provide a further understanding of the network infrastructure. This data was available within the public domain in the form a general market analysis, as a result of studies and surveys conducted by the North Bay/North Coast Broadband Consortium, and by written requests to network owners and service providers.

Using this mixed method approach to the data collection process, Magellan Advisors was able to draw significant conclusions surrounding the damage sustained by the network in October 2017 and ultimately, the overall condition of the existing network infrastructure. The combined quantitative and inferential data in this assessment will serve as a baseline for Napa County to further analyze and make recommendations

for the improvement of broadband services, enhance network redundancy efforts, and maintain a reliable network within the county limits.

Methodology

Magellan deployed several research methods to better understand the broadband network infrastructure located within Napa County. The purpose of these efforts was to identify, with as much accuracy as possible, where network facilities are located, what type of infrastructure is in the market, and what service providers use this infrastructure. Once these network facilities were identified, this information acted as the base layer of information to engage the service providers and network owners, and to review areas containing fire damaged facilities and identify areas with a high likelihood of contact or exposure to the fires. The methods and procedures that were used to compile this information have been outlined in significant detail within this section.

Data Requisition

The initial step was to gather information from the County in the form of a data request. Magellan requested data in support of the development for reporting on the broadband infrastructure and the impact the 2017 fires had on these facilities. The following information was requested from Napa County:

1. Any records of past permitting that might identify network owners within the County.
2. Any records from the County that would indicate network ownership to include any mapping, lists, or contact information for existing networks.
3. Records of any as-builts or construction plans that Napa County may have from permitting applications or plans provided to the County in any manner.
4. Any detailed information on names, dates, and locations and any GIS shapefiles containing data on the fires.
5. All GIS shape files and information on existing telecom and broadband networks to include the following information:

- Cell Tower Sites
- Pole Line Data
- Property Lines
- Right-of-Ways
- Roadway Center Lines
- Existing Utilities
- Power Meter Information
- City/County Limits

In addition to the GIS data request and information listed above, the County was also requested to provide any and all data or information that would be considered relevant to this report.

The next step in the process was to identify all network owners and service providers located within Napa County. Information was gathered by sourcing existing web subscription services for fiber locating websites, searching on-line databases for service availability within the county, initiating contact with service providers in the area, establishing contractor knowledge of working service areas and continuing service availability checks through service provider portals.

Once the network owners could be established, service providers utilizing that infrastructure were able to be identified. In order to collect the necessary network information, it was important for Magellan to communicate with both the network owners and service providers. This step was essential to glean specific information regarding the location and type of network infrastructure in particular areas of study. This would include the locations of the types of transmission mediums whether it be copper or fiber-based, as well as identification of any infrastructure that supports broadband deployment within the county. All wireline, fiber, cell, radio and satellite based broadband technologies were included in this requisition. These individual requests to network owners and service providers included an introduction of Magellan Advisors, a brief overview of the project and why the requests were being made, followed by the actual request for data.

The specific data request was to share any GIS-based network mapping. If GIS-based mapping was not available, Google Earth based .kmz formats were requested, and if neither of these types of files were available, PDF copies or any paper copy of high-level network information was requested to allow Magellan the ability to digitize the information. In addition to this, the request also asked for statistics on how their networks were impacted by the fires, including restoration, replacement and repair statistics.

After reaching out to network owners and service providers, challenges were identified that proved to be difficult for service providers to release proprietary information for the assessment. These challenges primarily revolved around the topic concerning sharing network information with 3rd parties. Magellan received mixed responses to the data request. While some network owners provided detailed statistics without mapping, some responded with high level mapping of facility locations and other owners remained altogether unresponsive.

Magellan thoroughly reviewed all data collected from the County, network owners and service providers in detail. Although several cell site, radio and microwave tower locations were provided, mapping for most of the wireline networks for both copper and fiber routing was not provided due to network security concerns. It was then determined that there was not enough hard data provided for Magellan Advisors to complete a full and accurate assessment of the broadband infrastructure solely on the information provided by 3rd parties.

Approach

Knowing that manually verifying locations of every cable located within the county was not a realistic approach to the mapping process, Magellan needed an approach to complete the mapping of network facilities in order to bridge the gap of provided network information and actual field facilities. For service offerings and locations of residential and commercial wireline-based network facilities, our approach was modified from mapping exact locations of cabling, to providing map layers of where specific services are offered combined with their respective speeds of operation. In using this approach, Magellan was able to draw service area boundaries and infer the

type of service being offered within those regions by connecting download and upload speeds with either copper or fiber-based services. Copper and fiber-based network availability information was then added into our GIS data, which is represented by color-coded "buffer" areas, spanning several hundred feet from the addressed street centerline representing service availability in those locations. Varying colors represent the collection of identified network owner type of service provided, copper or fiber.

These determined copper and fiber-based color-coded regions were then imported into our GIS mapping systems. This data was then imported into separate layers within the software program. More layers were added to represent other significant data that had previously been collected; to include County limits, roadways, fire burn perimeters, priority area boundaries, fire damaged property assessment data, cell, microwave, radio tower location layers, and other network information. Long haul and back haul network information, deemed as critical pathways within the county, was included to provide a more comprehensive map of the broadband infrastructure within the county. This new, comprehensive view provided an in-depth perspective on infrastructure and its relation to the 2017 fire perimeters in Napa County. Magellan determined that this approach would provide much of the information needed to complete the broadband assessment of the county as described in the task request.

Field Verification

Although manually verifying all network facilities was not a realistic approach, a review of the initial GIS base maps identified several areas that needed field verification in order to provide the most comprehensive report on the broadband infrastructure in the county. These areas included any locations where available services offered were questionable, all areas previously determined as priority zones, all areas located within the fire limits, and some of the more rural areas, specifically the Northeastern portions of the county. Other areas that were manually verified included portions of the county where data was currently unavailable and routes that could be deemed as critical pathways in, out, and through the county.

The result of this data collection and comprehensive approach gave us the information to complete the following assessment of broadband facilities and services located within Napa County, and how those facilities and services were impacted by the 2017 fires.

Critical Pathways

There are several critical infrastructure pathways located throughout Napa County. A critical pathway, for the sake of this report, can be defined as a main arterial convergence route for infrastructure. The main line routes act as the “trunk” to the various laterals and branches of smaller distribution cables off the mainline to service the surrounding distribution equipment and customers. Critical pathways can vary greatly depending on the type of infrastructure, network architecture, chosen routes, and network owners. For that reason, identifying critical pathways and, subsequently, the nature of those pathways can be a bit subjective. Cell towers, network services, back haul/long haul circuits, and residential/commercial distribution services are typically routed back to mainline copper and fiber-optic cabling known as feeder or backbone cabling. With technology and broadband advancements, these mainline routes typically use fiber-optic cabling as the preferred transmission medium for the critical data routes. Most outside plant cabling routes are installed in the road right-of-ways or public utility easements and are either installed in the aerial environment utilizing utility poles or in the underground environment utilizing buried conduit or direct buried cable.

Critical pathways within Napa County should include the pathways located along the main thoroughfares as well as the feeds in and out of the county. These utility corridors include those along the roads, as well as utility easements that do not follow roadways. These critical pathway easements are typically aerial routes crossing the mountains on the Eastern and Western borders of the county. The map in Figure 3 shows some main critical pathways for servicing Napa County.

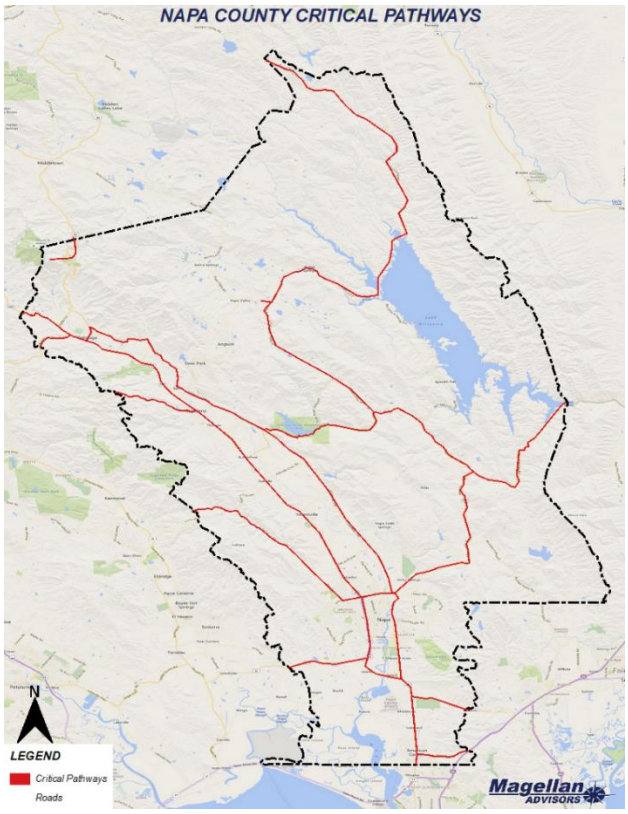


Figure 3

Service Provider Data

Through our research, we have identified 19 service providers that offer residential and/or commercial services within Napa County:

AT&T	Comcast Business	DigitalPath.net
GTT	HughesNet (Sat)	Internet Free Planet
Level 3	MegaPath	NetFortis
Sonic	TPX Communications	Utility Telecom
Valley Internet	Verizon Business	Vista Broadband
Windstream Business	Winters Broadband	Xfinity
XO		

Offered services vary greatly between providers and are limited in certain areas. From a high-level overview, most of the copper and fiber-based residential and commercial services are available by the service providers as outlined below. Although there are service options available utilizing cellular, satellite and wireline services, much of the county's copper and fiber-based infrastructure is owned by AT&T and Comcast. HughesNet provides service in limited areas of the county utilizing satellite transmission. Other entities provide wireless transmission, while some providers are utilizing dark fiber lease options from the network owners to provide a 3rd party service.

Magellan performed a general market analysis of the service provider availability by collecting coverage areas and service speeds per zip code within Napa County. This information is provided for commercial parcels in Figure 4, residential properties in Figure 5, and some general consumer accessibility information for Napa County in Figure 6 below.

Service Provider Coverage (Napa County – Commercial)

Percent Coverage/ Speed (Mbps)	94503 American Canyon	94508 Angwin	94515 Calistoga	94558 Napa	94559 Napa	94567 Pope Valley	94573 Rutherford	94574 Saint Helena	94576 Deer Park	94599 Yountville
AT&T DSL	100%/ 75				100%/ 75					
AT&T Fiber	1.9%/ 1000				0.9%/ 1000					
AT&T Internet		100%/ 18	100%/ 25	100%/ 75		100%/ 5		100%/ 50	24.8%/ 3	100%/ 18
Comcast Business	96.2%/ 987	72.6%/ 987	67.7%/ 987	77%/ 987	49.9%/ 987			76.9%/ 987	100%/ 987	95.4%/ 987
DigitalPath.net			27.4%/ 10							
GTT	14.7%/ 4		38.9%/ 6	44.5%/ 9	3.1%/ 8			8.2%/ 6		
Internet Free Planet	100%/ 10	100%/ 10	100%/ 10	100%/ 10	100%/ 10	100%/ 10	100%/ 6	100%/ 10		100%/ 10

Level 3	3.4%/ 100							0.9%/ 45		26.4%/ 45
Megapath	13.2%/ 12		3.5%/ 3	4.3%/ 12				7.4%/ 12		
Netfortris										5.9%/ 1.5
Sonic				29.2%/ 12	27.4%/ 12	100%/ 12		34.3%/ 12	48%/ 12	13.5%/ 12
TPX Comm	21.2%/ 100	2.8%/ 3	61.3%/ 100	48.1%/ 100	4.8%/ 50		100%/ 6	70.4%/ 100		52.4%/ 100
Utility Telecom			0.5%/ 100			49.6%/ 100		19%/ 100	27.2%/ 100	
Verizon Business			15.1%/3	0.3%/ 11				1.7%/ 1.5		
Vista Broadband	85.2%/ unk	85.2%/ Unk		100%/ Unk	100%/ unk	100%/ Unk	100%/ unk	100%/ Unk	100%/ unk	100%/ unk
Windstream Business	3.2%/ 10			1.1%/ 20	0.5%/ 3			1.0%/ 1.5		5.9%/ 1.5
Winters Broadband	100%/ 29	100%/ 29	76%/29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29
XO			0.3%/ 20							

Figure 4

Service Provider Coverage (Napa County – Residential)

Percent Coverage/ Speed (Mbps)	94503 American Canyon	94508 Angwin	94515 Calistoga	94558 Napa	94559 Napa	94567 Pope Valley	94573 Rutherford	94574 Saint Helena	94576 Deer Park	94599 Yountville
AT&T Fiber	2.5%/ 1000				6.6%/ 1000					
AT&T Internet	94%/ 75	89.2%/ 18	89.8%/ 25	95.9%/ 75	98.7%/ 75	6.6%/5		92%/ 50	12.8%/ 3	75.3%/ 18
HughesNet	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25	100%/ 25
Internet Free Planet	51.6%/ 10	76.4% 10	59.8%/ 10	98.6%/ 10	91.7%/ 10	100%/10	98.9%/ 6	27.5%/ 10		93.4%/ 10
Sonic				9.5%/ 100	34.1% 100	6.6%/ 100		55.2%/ 100	32.9%/ 100	40.9%/ 100
Valley Internet	100%/ 10	100%/ 10		100%/ 50	100%/ 50	69.5%/ 5	100%/ 6	100%/ 10	100%/ 6	100%/ 6

Winters Broadband	100%/ 29	100%/ 29	82.7%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29	100%/ 29
Xfinity	93.8%/ 987	8.1%/ 987	85.5%/ 987	92.3%/ 987	96%/ 987			92.2%/ 987	100%/ 987	69.7%/ 987

Figure 5

Service Provider Coverage General Statistics

	94503 American Canyon	94508 Angwin	94515 Calistoga	94558 Napa	94559 Napa	94567 Pope Valley	94573 Rutherford	94574 Saint Helena	94576 Deer Park	94599 Yountville
% of consumers who only have access to 1 or fewer wired internet providers	6.7%	29.7%	16.5%	8%	8%	100%		11.5%	87.2%	31%
% of residents who are severely limited in wired broadband choices							100%			

6,000 Napa County residents do not have access to wired internet
10,000 Napa County residents do not have access to 25 Mbps wired Broadband

Figure 6

All data was retrieved from a collection of on-line resources: BroadbandNow.com, InMyArea.com, BroadbandMap.fcc.gov within the time period in which this general market analysis was conducted (November - December 2018). It should be taken into consideration that this data was collected as reported by a 3rd party and could reflect a variance between actual coverage and reported coverage.

In addition to service provider coverage information above, Napa County provided the following data sourced from the California Public Utilities Commission from December 2017 reflecting data speeds available layered and 3 separate maps.

The map in Figure 7 indicates areas where fixed broadband speeds of 6 Mbps (Megabits per second) download, 1 Mbps upload are available. As indicated by the map, much of the county experiences broadband speeds within this range, minus a few scattered pockets of underserved or unserved areas.

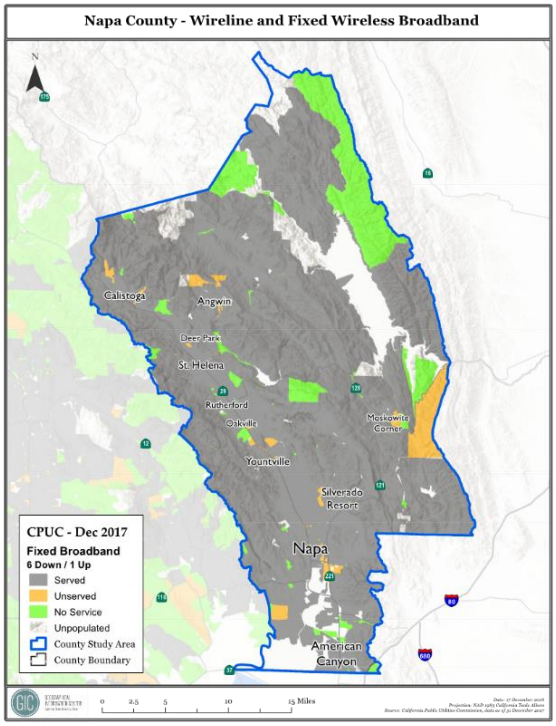


Figure 7

The map in Figure 8 indicates areas of coverage with speeds of 25 Mbps down and 3 Mbps up. It should be noted that the more densely populated areas are covered by providers offering these internet speeds. Large portions of the county in the East and smaller pockets along the Western County border continue to be underserved with these broadband capabilities. Currently, these speeds are classified by the FCC and the CPUC as the benchmark download and upload standards for fixed broadband services. Reports indicate that the state of California does in fact fall within this range, experiencing an average download speed of 25.7 Mbps.

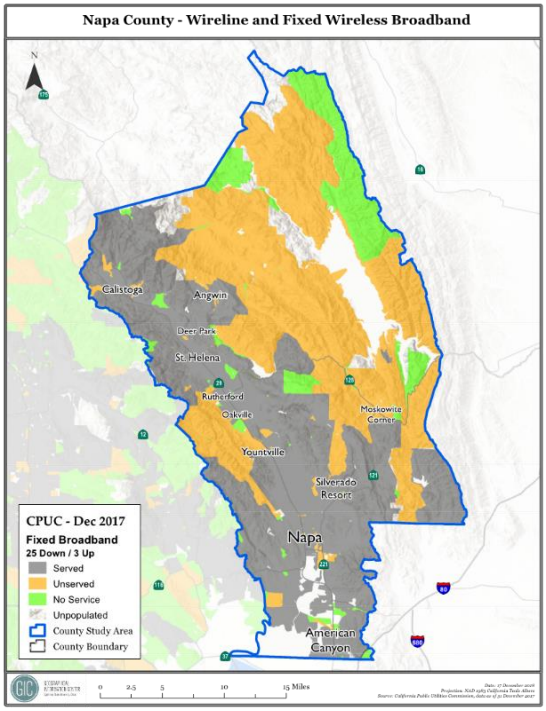


Figure 8

Finally, the map in Figure 9 indicates areas of the county where fixed broadband speeds are available at 100 Mbps down and 20 Mbps up. These service speeds are limited to the more densely populated area of the county to include American Canyon, the City of Napa, and the areas heading North toward Yountville, St. Helena and Calistoga.

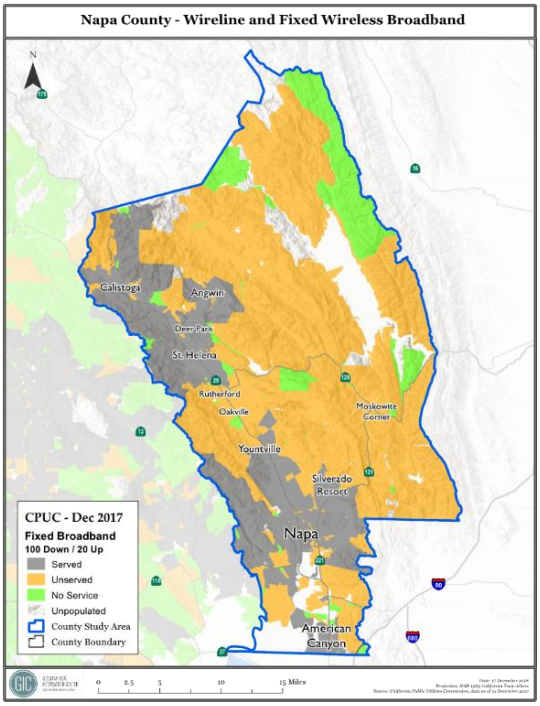


Figure 9

Long Haul and Back Haul Fiber

In addition to the service providers and network owners providing residential and commercial broadband services, there exist a small number of network owners (Zayo Fiber - Green, Crown Castle - Red, AT&T Long Distance - Blue) that provide back haul transport services for the carriers as well as transport services for towers, small cell deployments, and critical trunk transport pathways. These routes are displayed in Figure 10 represented by three fiber-optic based transport cables.

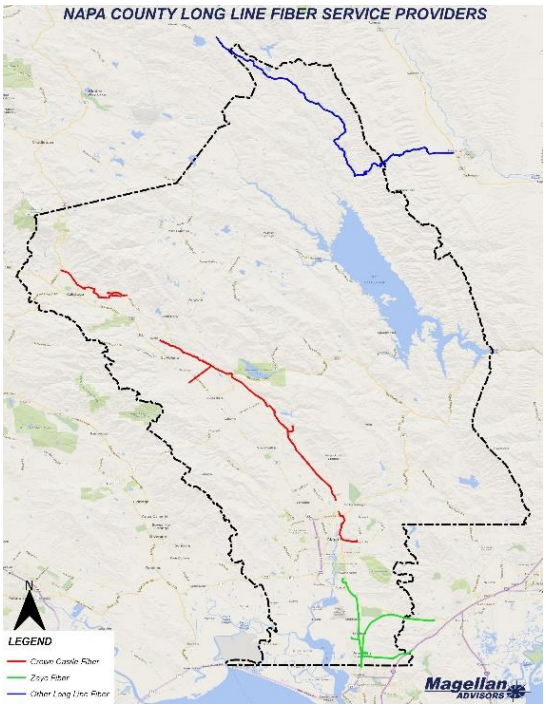


Figure 10

Tower Information

Cellular and wireless network equipment are widely considered valuable broadband network infrastructure. These assets include all identified cellular towers, small cell locations, FM radio towers, as well as TV and microwave towers. **There is a common misconception that "wireless" communications do not need cabling to work. Cellular data is only wireless from the end user to the cell site. Once at the cell site, the data is then converted to wireline-based data and transmitted over fiber-optic cabling.** This can result in critical cellular equipment and sites going off-line due to any fiber damage sustained by transport cables to and from cell locations. There exists a high density of wireless equipment and tower locations in the more populated regions of the county, as indicated in Figure 11. These tower locations tend to follow major county roadways such as St. Helena Highway. Outside of the county's major thoroughfares, Blue Ridge Road is another prime location for placement of wireless towers as they follow the topographical landscape connecting Napa County to nearby Vacaville.

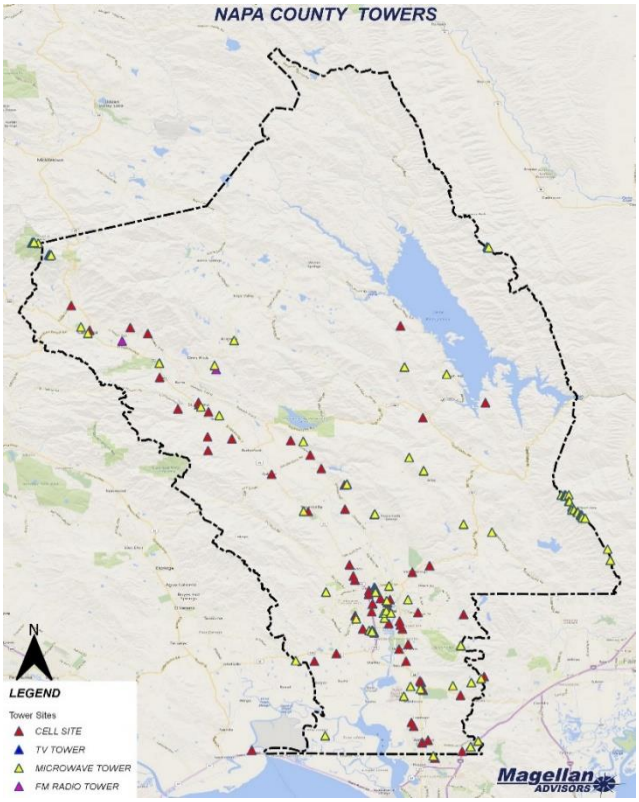


Figure 11

Network Owners and Services

One of the larger tasks of this assessment was to identify and map the location of wireline-based networks within Napa County. As described in the methodology portion of this report, most of the network owners did not

provide mapping to support this broadband assessment. The methods used to collect network data included identifying areas of service and corresponding network speeds. Determining availability of services would determine location and type of network infrastructure. Once this information was established, GIS-based maps were created with data layered to obtain a visual model of the network in Napa County. It was confirmed that these models were consistent with other data sets provided by the County and available through sources found within the public domain.

The following generated model shows the majority of copper and fiber-optic based network infrastructure located within Napa County is owned by AT&T. The AT&T copper and fiber-based locations have been identified in Figure 12.

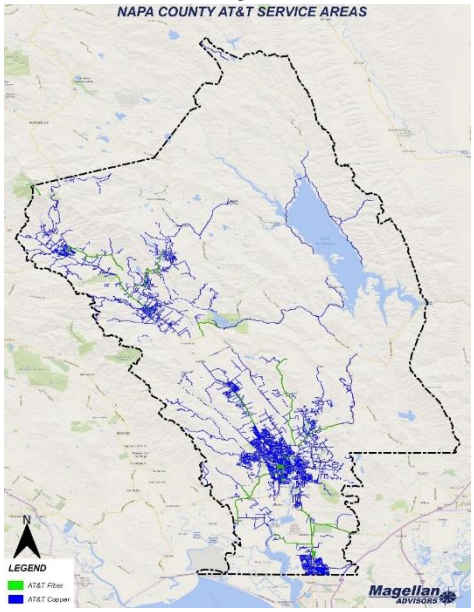


Figure 12

Utilizing the same mapping methods as mentioned above, another layer was created to represent the layer of Comcast network data. Figure 13 indicates the locations of Comcast facilities and when compared to the service area maps provided by Comcast, the maps are consistent once again validating the data collection methods used to map the network infrastructure.

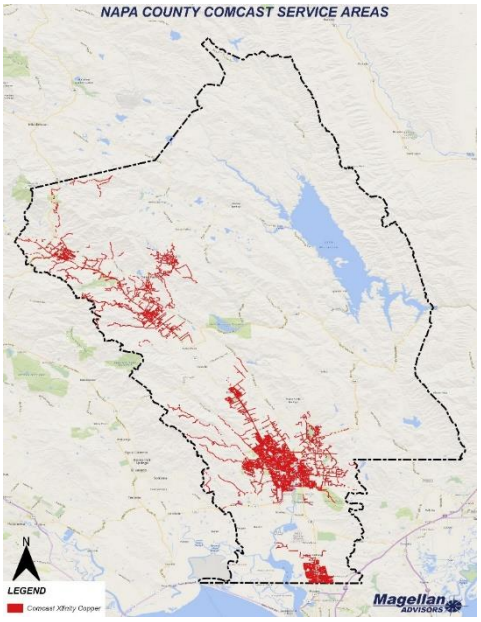


Figure 13

Although AT&T and Comcast own most of the wireline-based network facilities within the county, additional smaller fiber-optic based network facilities were identified. Those locations were mapped and merged with the previous layers to establish a more comprehensive model of existing network facilities as shown in Figure 14.

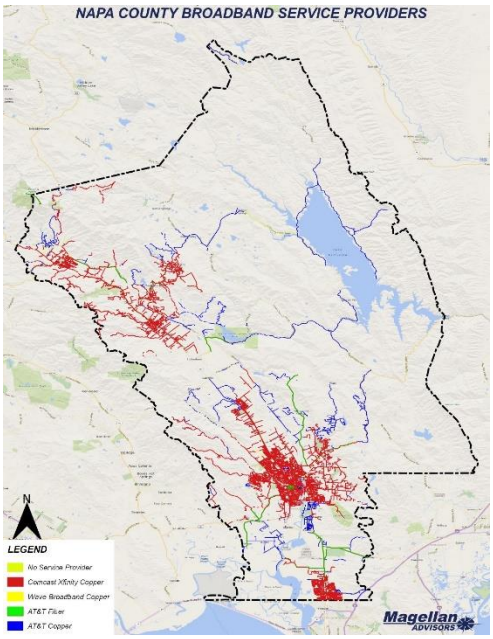


Figure 14

2017 Fire Information and Damage Assessment

During the fall of 2017, Northern California was hit with multiple, concurrent wildfires. Napa County was in the direct path of several devastating fires during that time. The NUNS Fires consumed the Western portion of the county, the Atlas Fire covered the South-Eastern portion, while the Tubbs Fire was concentrated within the Northern region of Napa County. Altogether, and across multiple county boundaries, these fires burned 144,987 acres of land, damaging or destroying nearly 8,000 structures; directly affecting approximately 19,000 households located within these fire perimeters. Collectively, the county's more rural landscape sustained the most damage during these North Bay Wildfires.

The North Bay/North Coast Broadband Consortium (April 2018) initiated a survey to illicit public feedback on telecommunication services as they relate to emergency response programs. Responses were received from approximately 2,000 residents (less than 2% of the county population). Results indicated that approximately 67% of respondents experienced some level of landline outage, 86% experienced cellular outages in some capacity, and over 71% of those responding to the survey reported that their internet

service was down to some extent during the fire event. With regards to AT&T landline service provided to the county, 100% of residents from Deer Park who participated in this survey experienced a loss to their landline service, while 71% of Angwin respondents and 68% of Yountville respondents reported landline losses. Comcast customers who responded to the survey reported similar landline outages. 100% of Angwin respondents lost landline service, 78% of Calistoga respondents reported landline outages, and 83% of Yountville respondents indicated that their landline services were down during the 2017 Firestorm. These results begin to paint a picture over the widespread nature of coverage losses within the county. It was also reported that while most of these outages were due to communications infrastructure being damaged by the fires, some service providers elected to take consumers offline as a preventative measure to maintain the overall integrity of the network (Press Democrat, 10/10/2017). Initial reports indicate that 340 cell towers were damaged by the fire (Napa Valley Register, 11/21/2018), however, it was unclear if these reports are isolated just to Napa County or a combined Napa, Sonoma, Marin, and Mendocino counties.

Due to the terrain located within the fire perimeters, much of the infrastructure is aerial cable installed in the communication space of the utility right-of-ways. It can be assumed that any aerial cables in the direct path of these fires, sustained considerable damage. It can also be assumed that those damaged cables would need to be repaired or replaced in order to bring services back online.

In our communication with network owners, it was reported several tower locations were damaged as well as isolated network damage to the Comcast network specifically along the following streets within the county: California Boulevard, Mustang Road, Burning Tree Court, Chaparral Circle, Tamarack Drive, Deer Hollow, Castle Oaks, Green Briar Circle, Stone Mountain Circle, West Gate Drive, Oak Leaf Way, Silverado Resort, Olive Hill Lane, and Mt. George Avenue. AT&T also reported restoration efforts in the Soda Canyon, Monticello, and Atlas Peak areas. These reports indicate damage to aerial and underground copper and fiber-optic cable as well as pedestals that required replacement. In addition to the specific locations of damage reported above, we can estimate overall network

infrastructure exposed to the fires to estimate overall damage using GIS-based mapping and data collected.

In Figure 15 below, previously provided infrastructure maps have been overlaid with fire perimeters to indicate the extent of network damage sustained through the 2017 fires. This model creates a more distinct visual representation of how and where the network infrastructure was impacted by the fires. The damage assessment includes all network infrastructure including utility poles, aerial and underground cabling, tower locations, and supporting infrastructure.

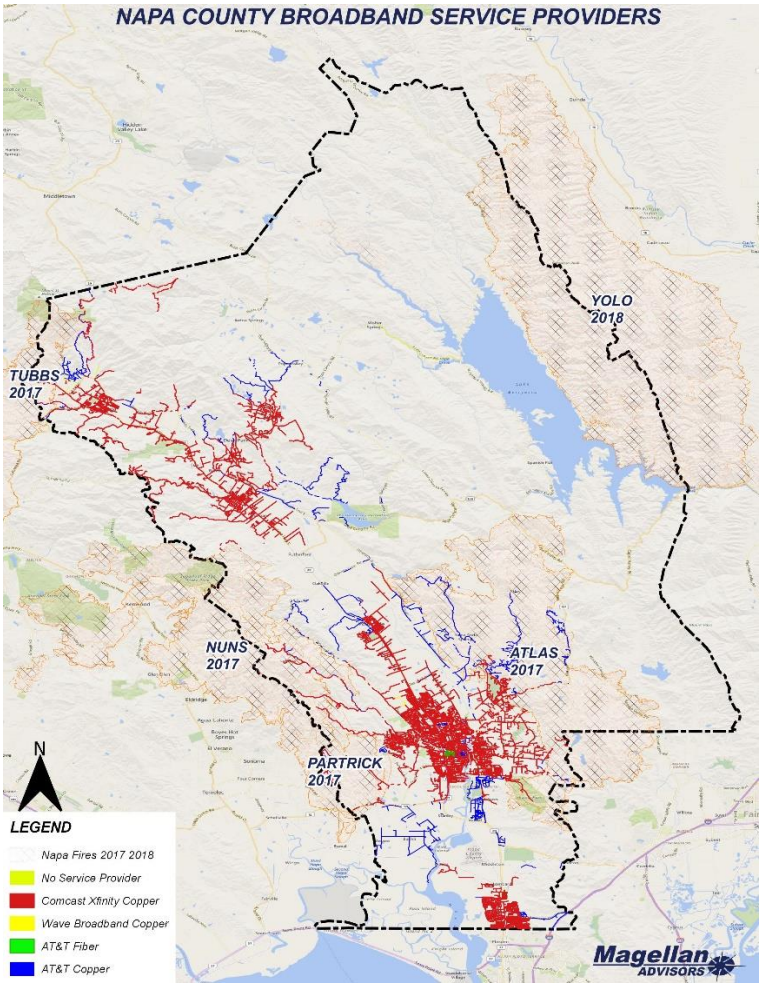


Figure 15

Magellan has identified over 213 total miles of copper and fiber-based cabling that was exposed to the fire limits. Of this footage, we have compiled the following breakdown of the data:

Underground long lines fiber = 56,009 feet
Aerial transport fiber = 8,123 feet
Service provider #1 copper-based network = 633,847 feet
Service provider #2 copper-based network = 368,674 feet
Aerial fiber-based network = 55,501 feet

In speaking with the network owners, it was determined that approximately 62.5 miles of damaged cable was either repaired or replaced along with several surface mounted service terminals, distribution equipment cabinets, and hundreds of utility poles.

Magellan does not believe that the 11 mile underground long-distance fiber sustained any fire damage. Based on data reported by the network owners, an estimated 30% of the network infrastructure within the fire limits was damaged in the fires. This damage includes both cable and supporting infrastructure. In addition, at least 21 tower locations were subject to equipment and tower damage, however cable damage significantly increased the number of tower locations that were indirectly impacted due to connectivity loss. This low number when compared to the initial report of 340 damaged towers indicates that multiple counties were taken into consideration in the publication and would also suggest that multiple carriers are being served by single towers, creating possible duplicate reporting of the total number of damaged towers. Field verification also showed burn damage to the utility poles (Figure 16),

Figure 16

including those deemed structurally sound by the providers and those that needed to be replaced.

Taking into consideration industry standard pricing, the assumptions outlined, data collected in the field and provided directly from the network owners, Magellan has established the following estimate of damaged broadband assets in the 2017 fires.

An estimated total of 25,000’ of fiber-optic based network infrastructure was damaged.

An estimated total of 300,000’ of copper-based network infrastructure was damaged.

An estimated 21 tower locations were damaged, although it is estimated a larger number of sites were impacted due to loss of cabling connectivity.

Utilizing the following composite rates for removal/replacement cost based on standard industry rates for installation:

Aerial copper network infrastructure = composite rate of $8/ft
Aerial fiber network infrastructure = composite rate of $6/ft
Tower locations = estimated $100k repair cost per site.

Combined total for costs to repair/replace damaged infrastructure is estimated at $4.65 million

It is also estimated that the majority of repairs to bring network infrastructure back online was replaced with technologies similar to the damaged infrastructure. Although AT&T does report that some damaged copper cable sections were replaced with fiber optic cable in certain neighborhoods of Soda Canyon, Monticello, and Atlas Peak. Most restoration efforts included sections of damaged cables that were replaced and spliced or cutover to remove only the damaged sections of the cables. Due to the critical timing of bringing these facilities back online, it is expected that very little infrastructure, aside from the new fiber optic installation reported above, was

upgraded to a different technology than what was currently in place before the fires.

Wireless service was restored by the providers by bringing in mobile cell tower facilities (Cell-On-Wheels (COWs) and Cell-On-Light-Trucks (COLTs)) while restoration to the permanent structures was taking place. Generators were also brought in to provide backup power, as needed. It is believed all restoration to network infrastructure has been completed.

Summary and Assessment of Overall Quality

The broadband assets located throughout Napa County paint a visual picture that represents broadband availability, quality, and resiliency within Napa County as it relates to broadband infrastructure.

Network asset densities and service areas are consistent with the population densities, which is to be expected for a served area. As with any area, the network architecture and layout are unique to the county as network owners have deployed equipment and transmission mediums within the municipal right-of-ways and public and private utility easements. These network assets were put in place to serve residential and commercial customers, provide transport services for critical circuits, connect community anchors, and provide broadband services throughout county.

Although it appears that there are sufficient network assets covering the critical routes and densely populated areas running north and south through the center of the county, there are some challenges in certain areas of the county that may contribute to limited broadband deployment technologies. These limitations include wireline and wireless services.

These limitations can be summarized and attributed to overall deployment costs. The county topology and pockets of population densities play significant factors in the location of broadband services deployed within the county. To service the county, providers will target the areas where the cost to build is reasonable and customer densities are maximized, thus following a financially sound business model. The network mapping provided in this

report supports this statement. Eastern and Western portions of the county are covered by rocky, mountainous terrain which makes for an expensive option to build for incoming network owners. Low population densities also deter network owners from investing in broadband deployment within these regions.

Since tower locations tend to be predicated on altitude, there are number of towers that have been installed in the more remote locations on the Eastern and Western peaks located near the county borders. Due to their remote locations and terrain, most tower facilities are supported with transport cables placed on utility poles and installed in the aerial environment. There is a significant cost savings to install these transport cables in the aerial environment as opposed to buried infrastructure in the rocky terrain. The major disadvantage to this type of installation, specifically for this report, is the exposure of this cable to the fires. Most underground infrastructure was spared from fire damage. Some of the damage was limited to service pedestals, distribution and surfaced mounted equipment cabinets, and supporting equipment mounted above the ground. A significant amount of the exposed aerial cable was damaged or destroyed to include the utility poles they were placed on.

As a result, when investigating the network asset mapping provided in this assessment, all network assets seem to be heavily designed to be linear, focusing on the North to South routes through the center of the county in support of densely populated communities. This linear network design can limit the resiliency and redundancy of a network. Network architecture arranged in this linear point to point layout provides minimal diverse pathway options. Optimal network configuration would be heavily fiber optic-based

and in a ring-type configuration in order to have the ability to provide redundant services to priority locations.

Another item worth noting that was seen during field verification, was the condition of the existing aerial assets as it relates to pole loading and maintenance. Service providers typically enter into a leasing agreement with pole owners before attaching their infrastructure. While performing a pole loading analysis is not necessarily a legal requirement, this analysis is used to determine the overall structural integrity of the vertical asset and all corresponding attachments. The load bearing strength of the pole and the volume of attachments can adversely affect any pole loading analysis. Overloaded poles endure more stress over time and are more prone to failure, primarily during extreme weather conditions. There were a significant number of poles seen in the field that could be deemed as overloaded and may not pass a pole loading analysis due the amount, type, and size of the current cables attached to the poles. This may be due to restoration efforts to redeploy new cables as quickly as possible. However, with most of the restoration efforts reporting to be complete, this does not appear to be a temporary issue. Due to the current loading of these poles, this could discourage future expansion as adding additional cable to these poles could result in additional make-ready costs to upsize poles, or to coordinate efforts or adjust existing pole attachment to accommodate any new cables.

Magellan also identified several areas in the remote Eastern portions of the county in the easements and right-of-ways along the Western shores of Lake Berryessa where fallen trees, low cabling, missing lashing, and general maintenance on the aerial infrastructure seems to be needed. This type of maintenance can have direct impact on network downtime and reliability.

Although the county does not have direct jurisdiction or responsibility over maintaining the utility poles, the utility owners are obligated to maintain their facilities located in public right-of-ways. Right-of-way encroachment permits are typically required when installing new facilities that will interfere with the public right-of-way, depending on the rules and regulations of the authority having jurisdiction over any specific road right-of-way. The current Napa

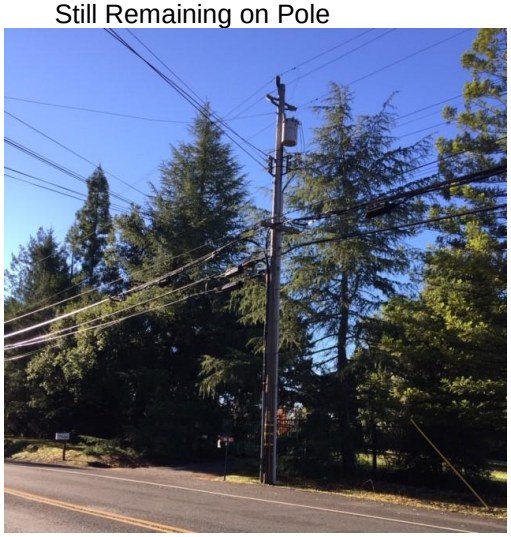
County right-of-way encroachment permitting process does list general permit regulations that require the permittee to hold the county harmless in any claims of liability as a consequence of the issuance of the encroachment permit. The permittee is also responsible for all costs incurred by the county, relative to the permittee's activities under said permit. In addition, general regulations also require that all facilities permitted must adhere to County Codes Title 12 Roads and Vehicles and the Roads and Street Standards. The existing county general regulations also require the utility owners to maintain the proposed installations for 1 year, as well as move or adjust facilities in the event that a county sponsored project conflicts with the permittee's facilities.

In summary, our broadband assessment of Napa County identified a significant amount of aerial infrastructure as opposed to underground infrastructure in the remote and rural locations of the county due to the rocky terrain. These aerial routes result in more critical pathways and circuits that are exposed to fire prone areas. A considerable number of aerial facilities with pole loading concerns exist along more of the critical pathways through the centralized sections of the county were also observed possibly impacting future expansion and creating potential connectivity issues.

Retired Copper Cable Infrastructure

Heavily Loaded Pole

Still Remaining on Pole



Heavily Loaded Pole

Low Hanging Cable and Tree Limb Overhang

Leaning Pole

Example of Heavily Loaded Pole

About Magellan

Magellan Advisors is the industry's leading broadband consulting firm, providing broadband planning and implementation services for public utilities, government organizations and service providers across the United States and internationally. We assist providers of all types leverage their

strengths to plan, deploy and manage next-generation broadband networks, enabling their communities to thrive in the digital economy. We believe that broadband is a critical element to achieving these goals and our services position public and private organizations with effective strategies to expand broadband, customized to their individual needs.

Our combination of unmatched broadband, telecom, business and operational experience creates actionable strategies that organizations use to deploy competitive networks nationwide. We have led the planning, funding, construction and management of over 50 fiber to the premise networks passing over 1 million homes and connecting more than 1,000 schools, hospitals, government offices and community organizations. Our work has resulted in over $1 billion in new broadband investments nationwide. Magellan has helped more communities successfully plan, implement and manage broadband networks than any other firm in the market.

Appendix A

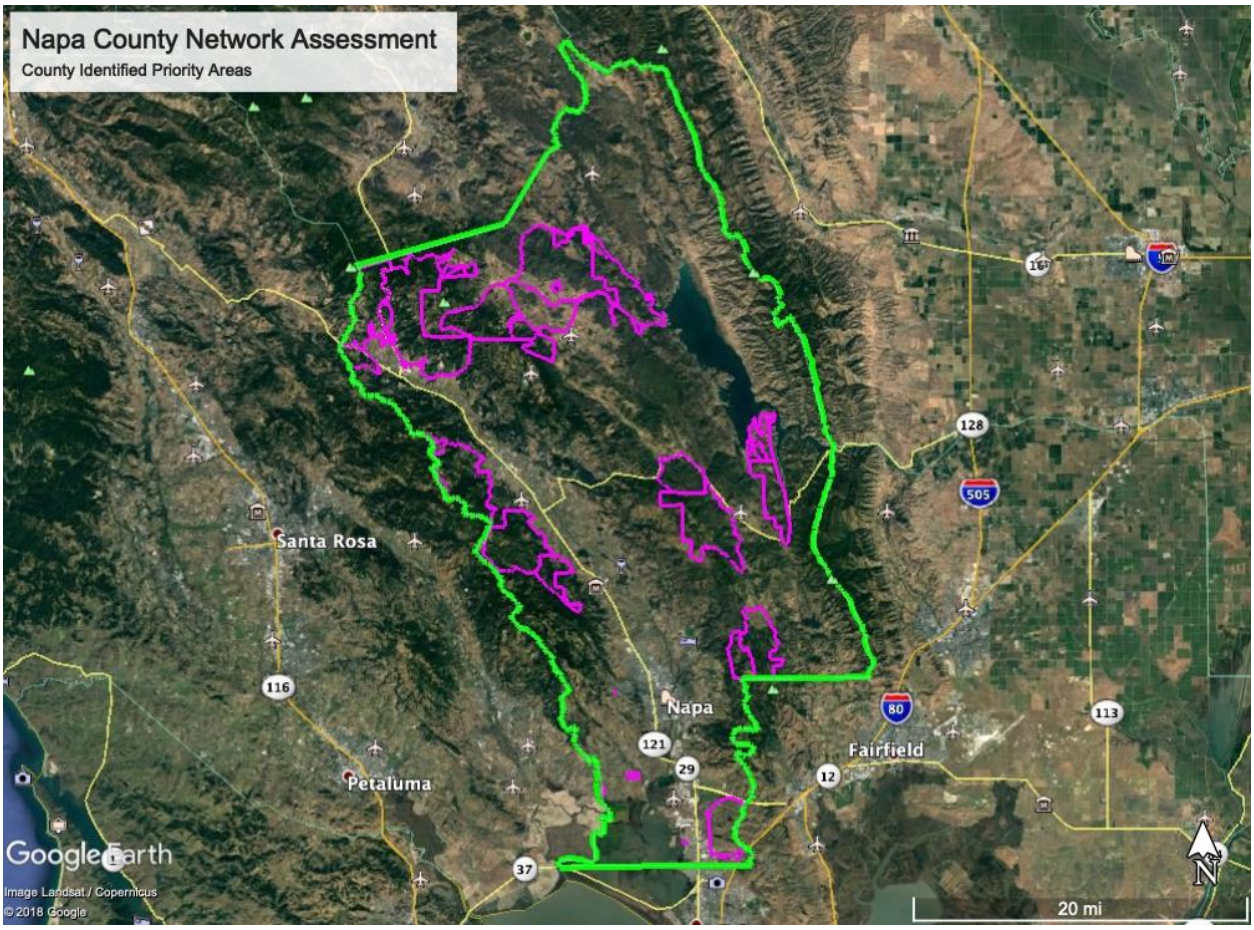


Figure 1

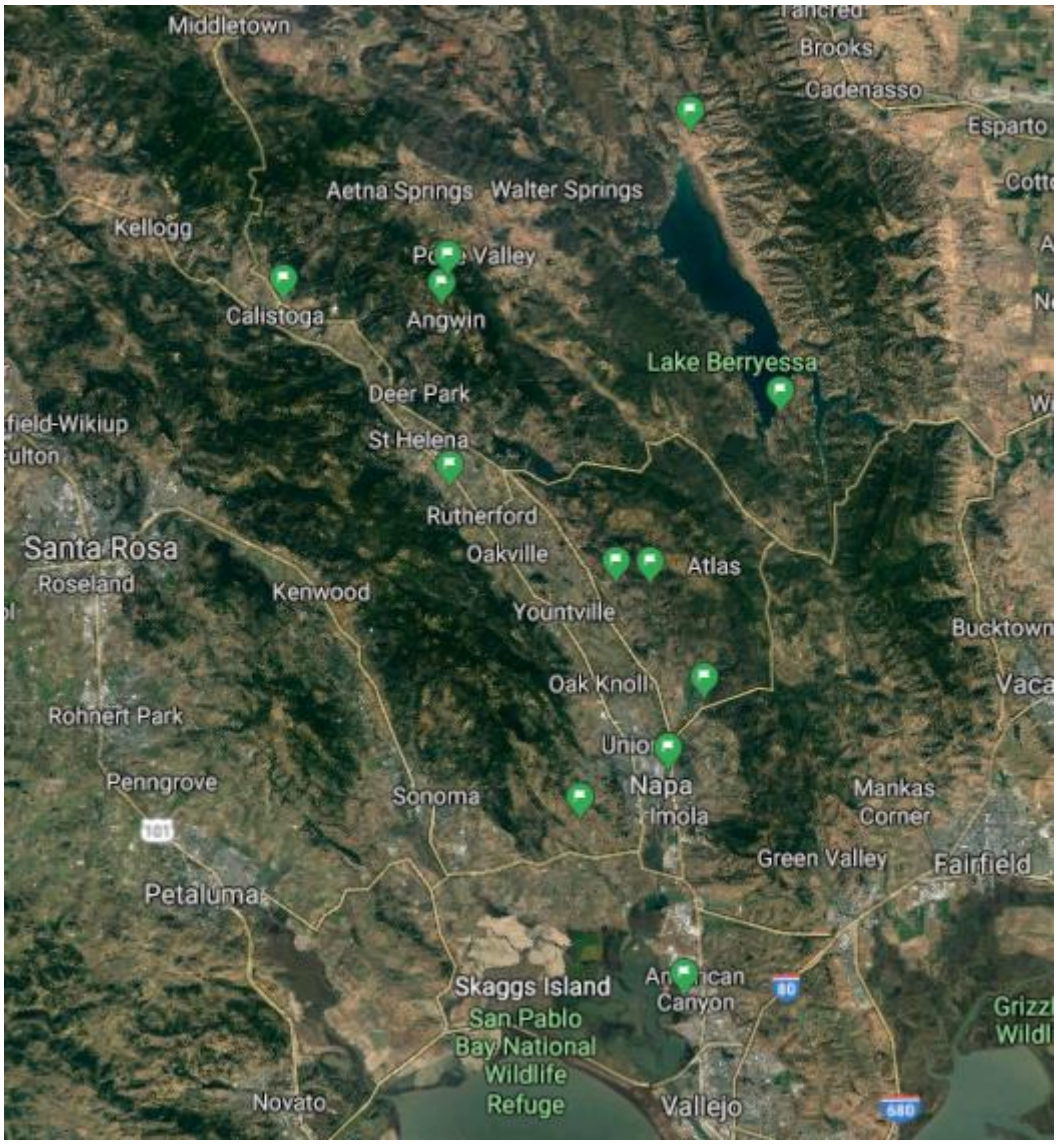

Middletown
Brooks
Cadenasso
Esparto
Aetna Springs
Walter Springs
Kellogg
Calistoga
Angwin
Lake Berryessa
Deer Park
St Helena
Rutherford
Santa Rosa
Roseland
Kenwood
Oakville
Atlas
Yountville
Oak Knoll
Rohnert Park
Penngrove
Sonoma
Napa
Imola
Mankas Corner
Green Valley
Fairfield
Petaluma
Skaggs Island
San Pablo Bay National Wildlife Refuge
Canyon
Novato
Vallejo
101
80
680

Figure 2

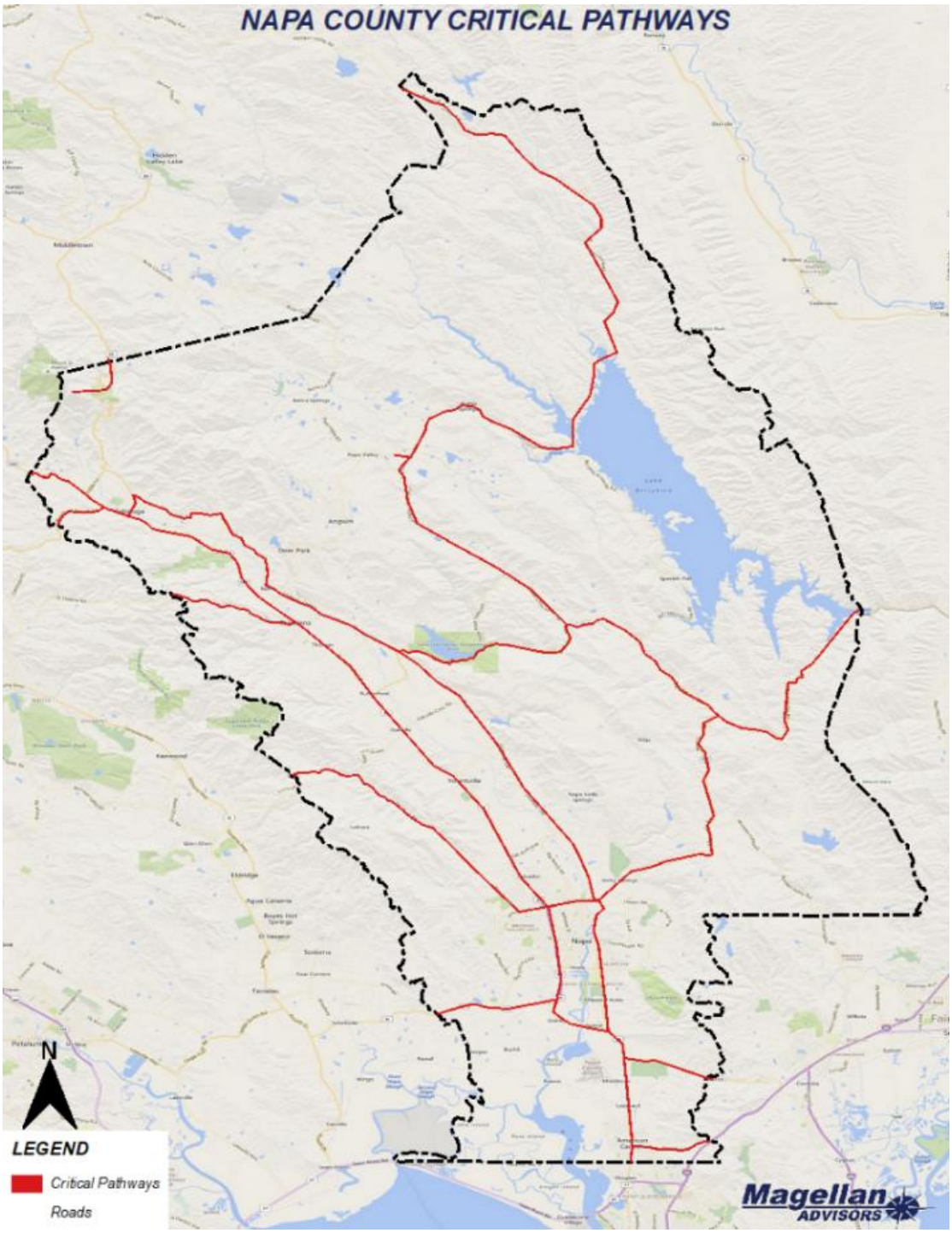

NAPA COUNTY CRITICAL PATHWAYS
N
LEGEND
Critical Pathways
Roads
Magellan ADVISORS

Figure 3

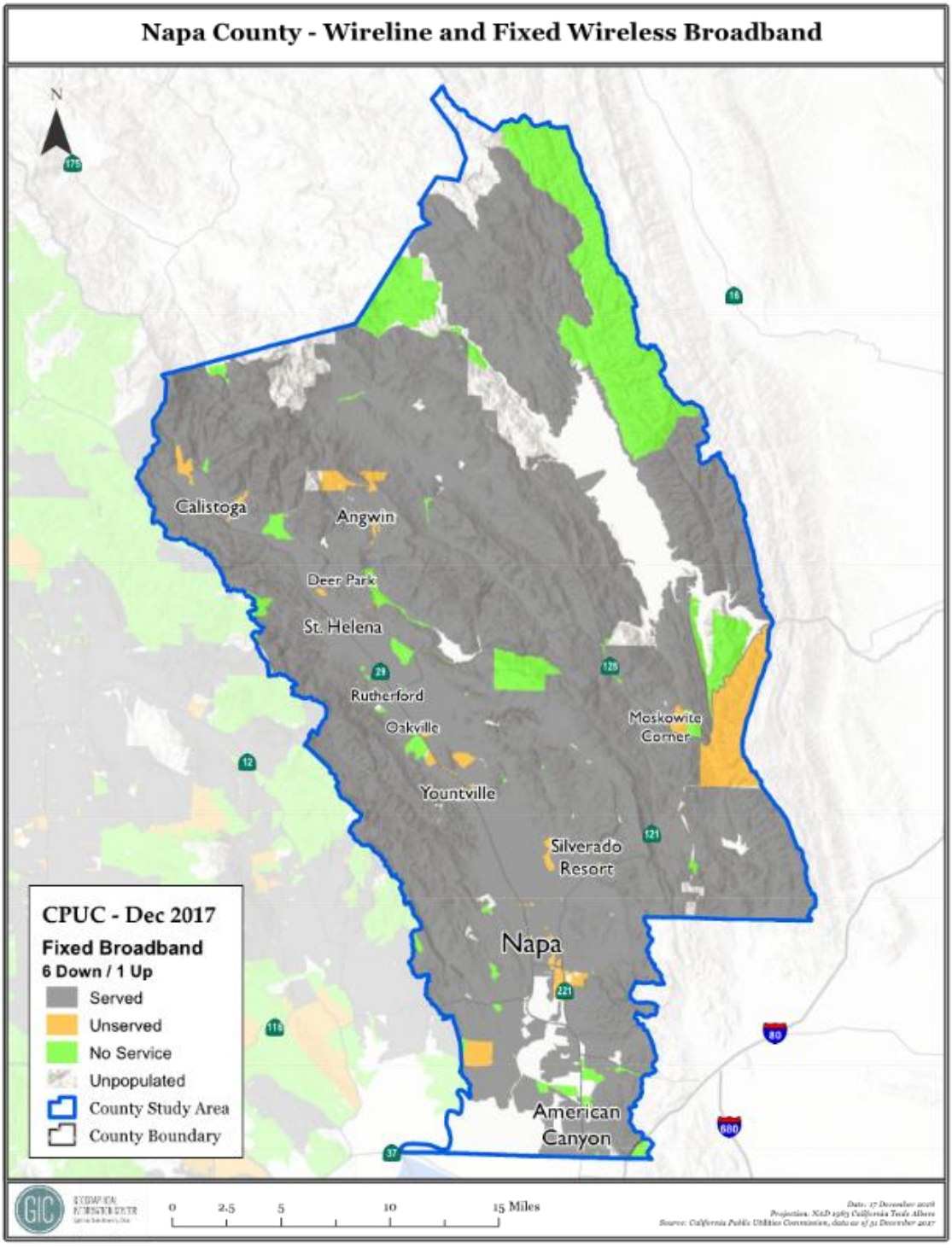

Napa County - Wireline and Fixed Wireless Broadband
N
Calistoga
Angwin
Deer Park
St. Helena
Rutherford
Oakville
Yountville
Moskowite Corner
Silverado Resort
Napa
American Canyon
CPUC - Dec 2017
Fixed Broadband
6 Down / 1 Up
Served
Unserved
No Service
Unpopulated
County Study Area
County Boundary
0 2.5 5 10 15 Miles

Figure 7

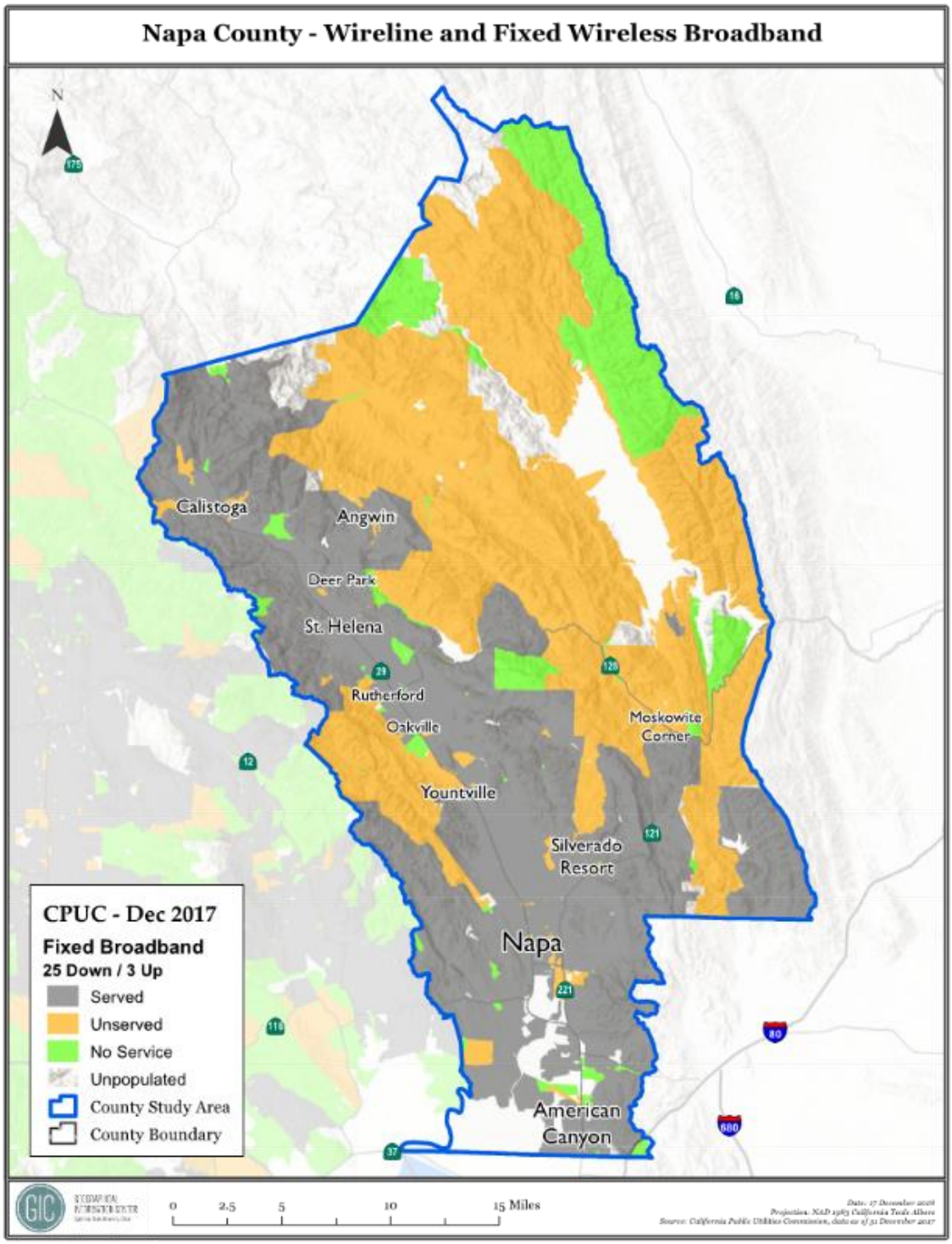

Napa County - Wireline and Fixed Wireless Broadband
N
Calistoga
Angwin
Deer Park
St. Helena
Rutherford
Oakville
Yountville
Moskowite Corner
Silverado Resort
Napa
American Canyon
CPUC - Dec 2017
Fixed Broadband
25 Down / 3 Up
Served
Unserved
No Service
Unpopulated
County Study Area
County Boundary
0 2.5 5 10 15 Miles

Figure 8

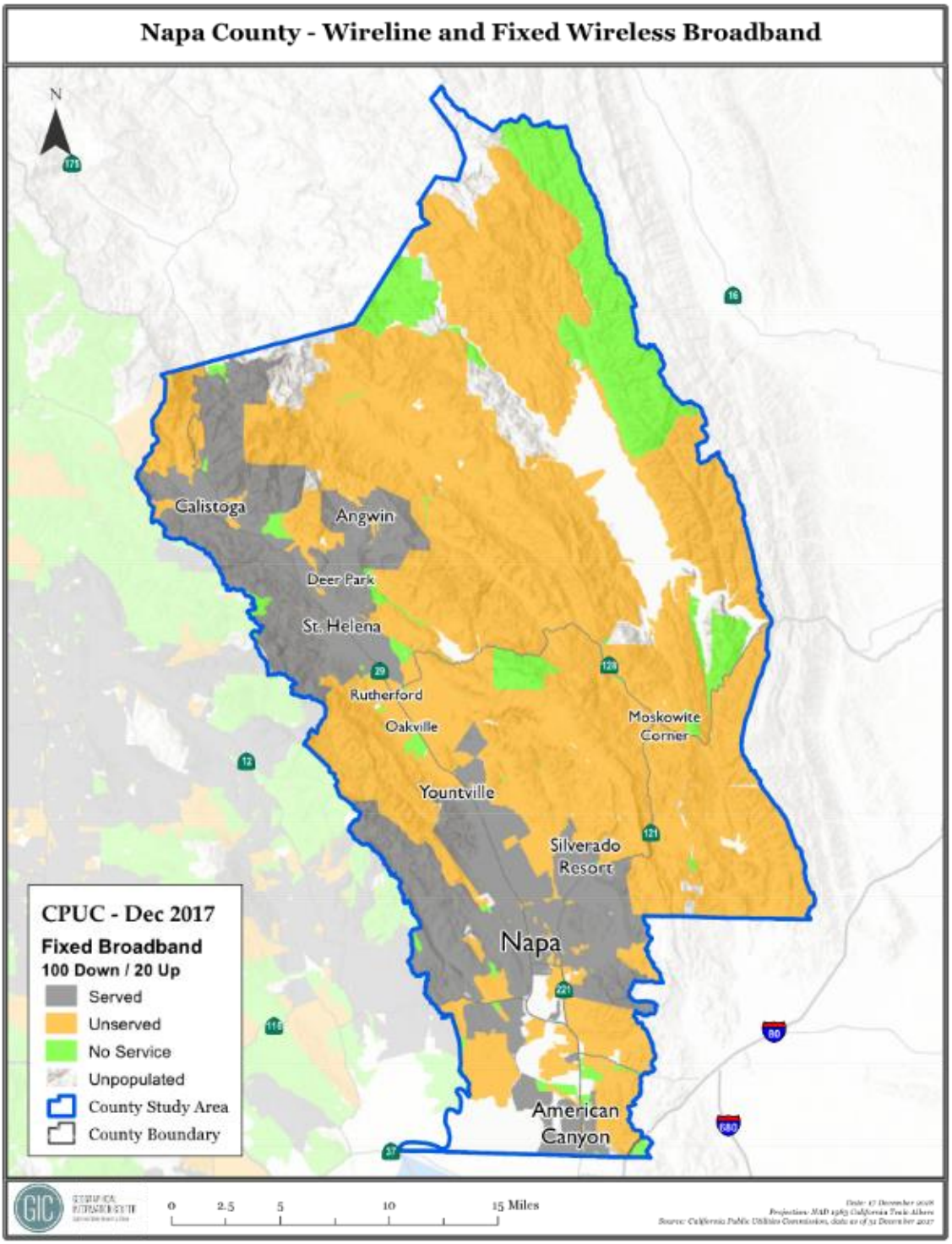

Napa County - Wireline and Fixed Wireless Broadband
N
Calistoga
Angwin
Deer Park
St. Helena
Rutherford
Oakville
Yountville
Moskowite Corner
Silverado Resort
Napa
American Canyon
CPUC - Dec 2017
Fixed Broadband
100 Down / 20 Up
Served
Unserved
No Service
Unpopulated
County Study Area
County Boundary
0 2.5 5 10 15 Miles

Figure 9

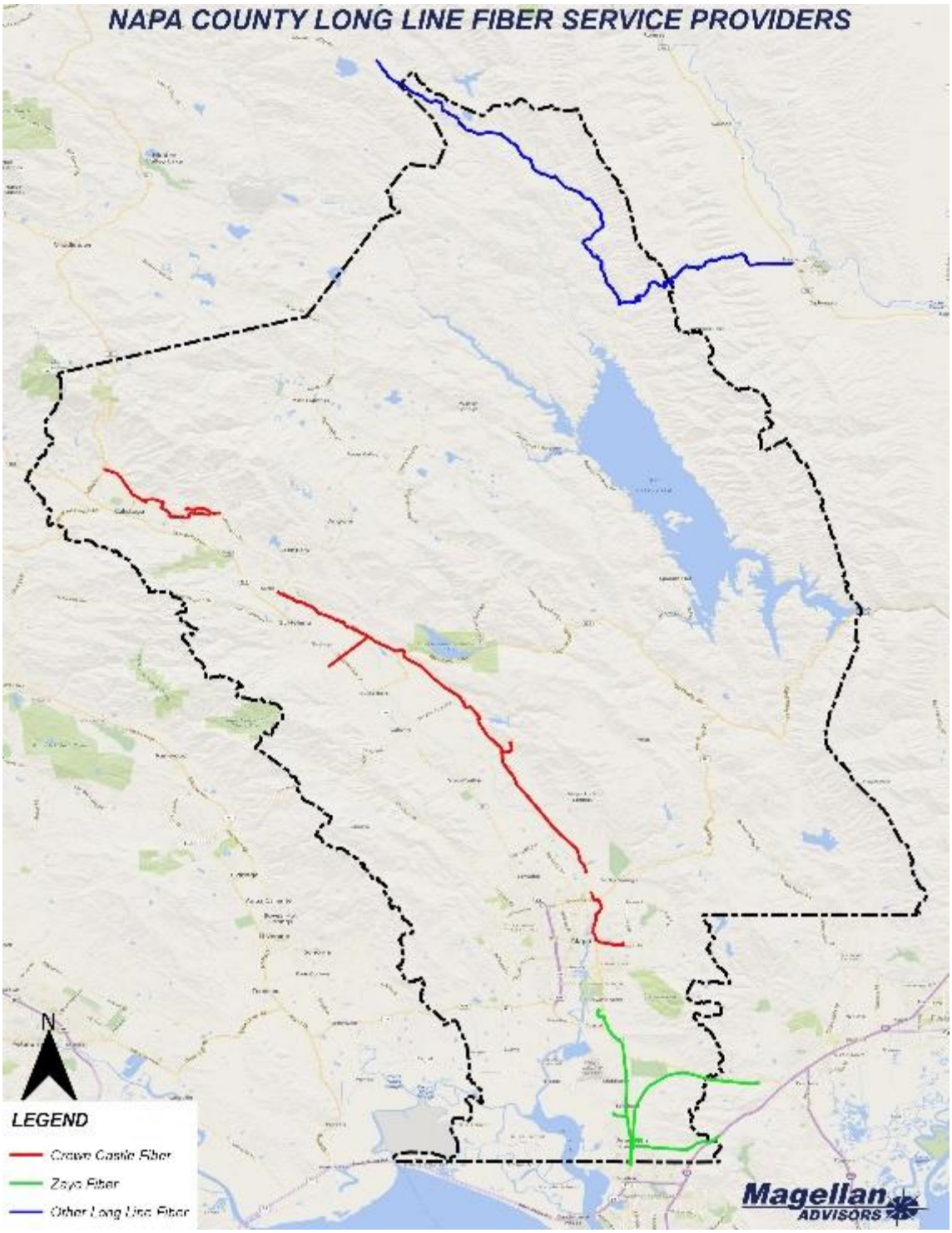

NAPA COUNTY LONG LINE FIBER SERVICE PROVIDERS
N
LEGEND
Crown Castle Fiber
Zayo Fiber
Other Long Line Fiber
Magellan ADVISORS

Figure 10

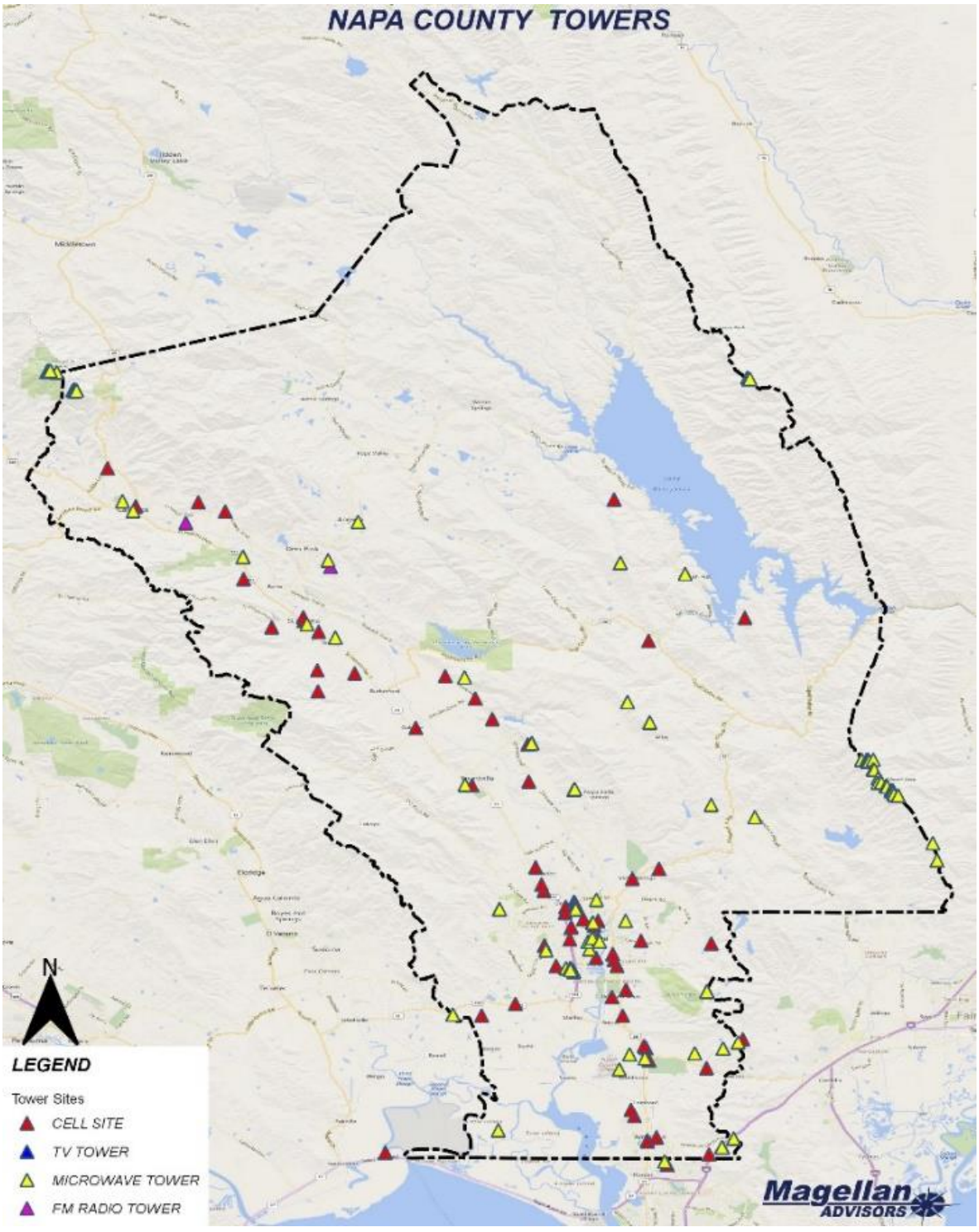

NAPA COUNTY TOWERS
N
LEGEND
Tower Sites
CELL SITE
TV TOWER
MICROWAVE TOWER
FM RADIO TOWER
Magellan ADVISORS

Figure 11

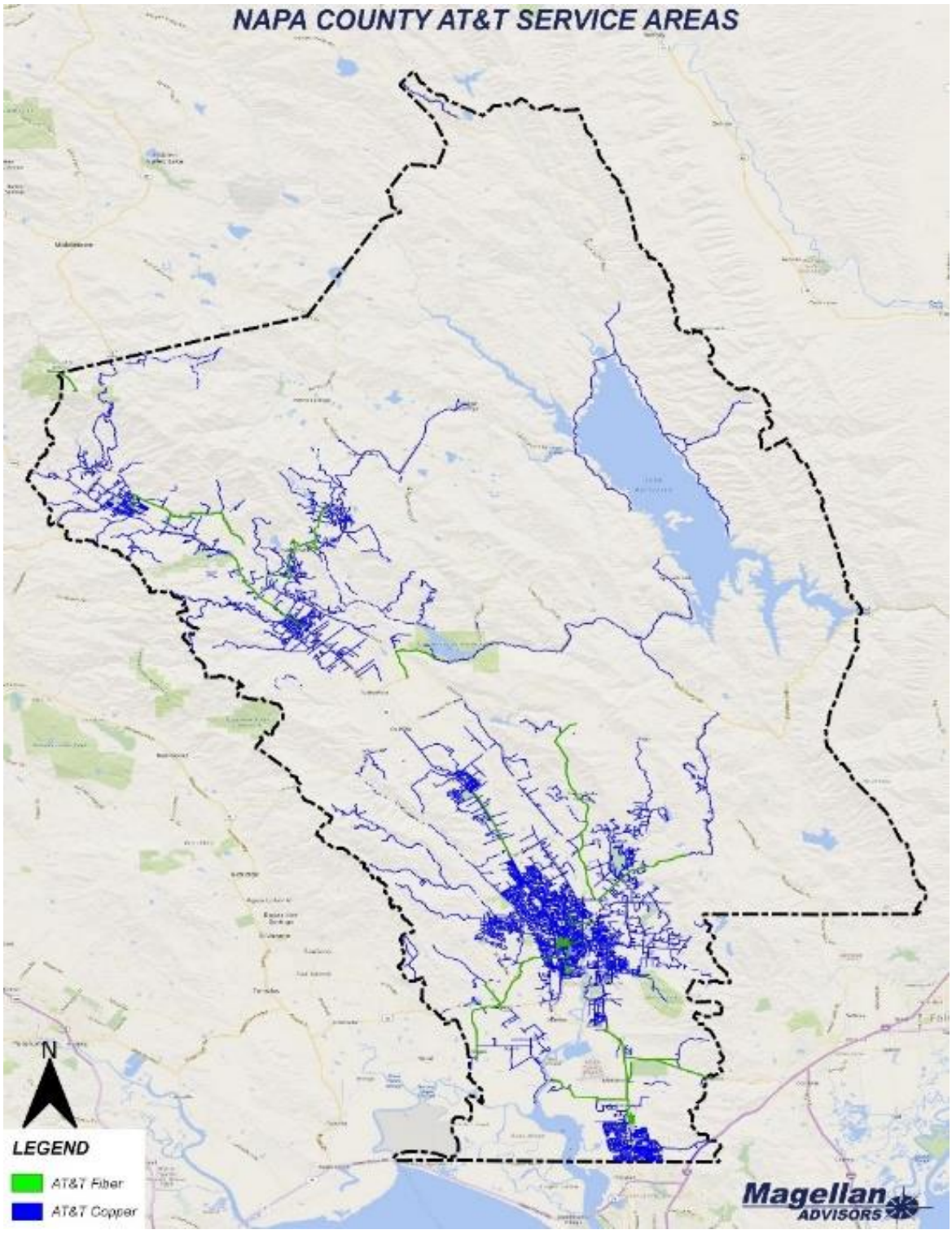

NAPA COUNTY AT&T SERVICE AREAS
N
LEGEND
AT&T Fiber
AT&T Copper
Magellan ADVISORS

Figure 12

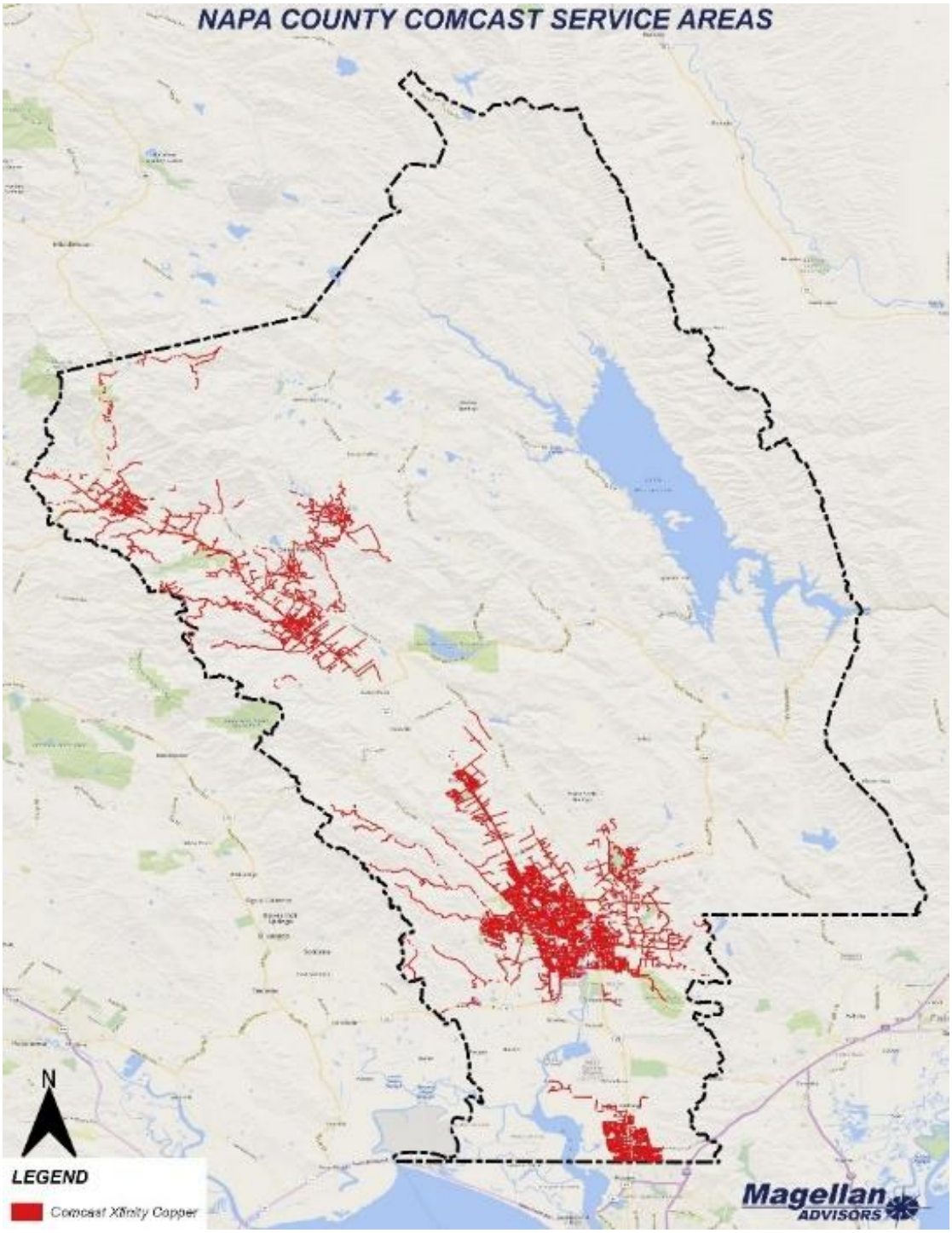

NAPA COUNTY COMCAST SERVICE AREAS
N
LEGEND
Comcast Xfinity Copper
Magellan ADVISORS

Figure 13

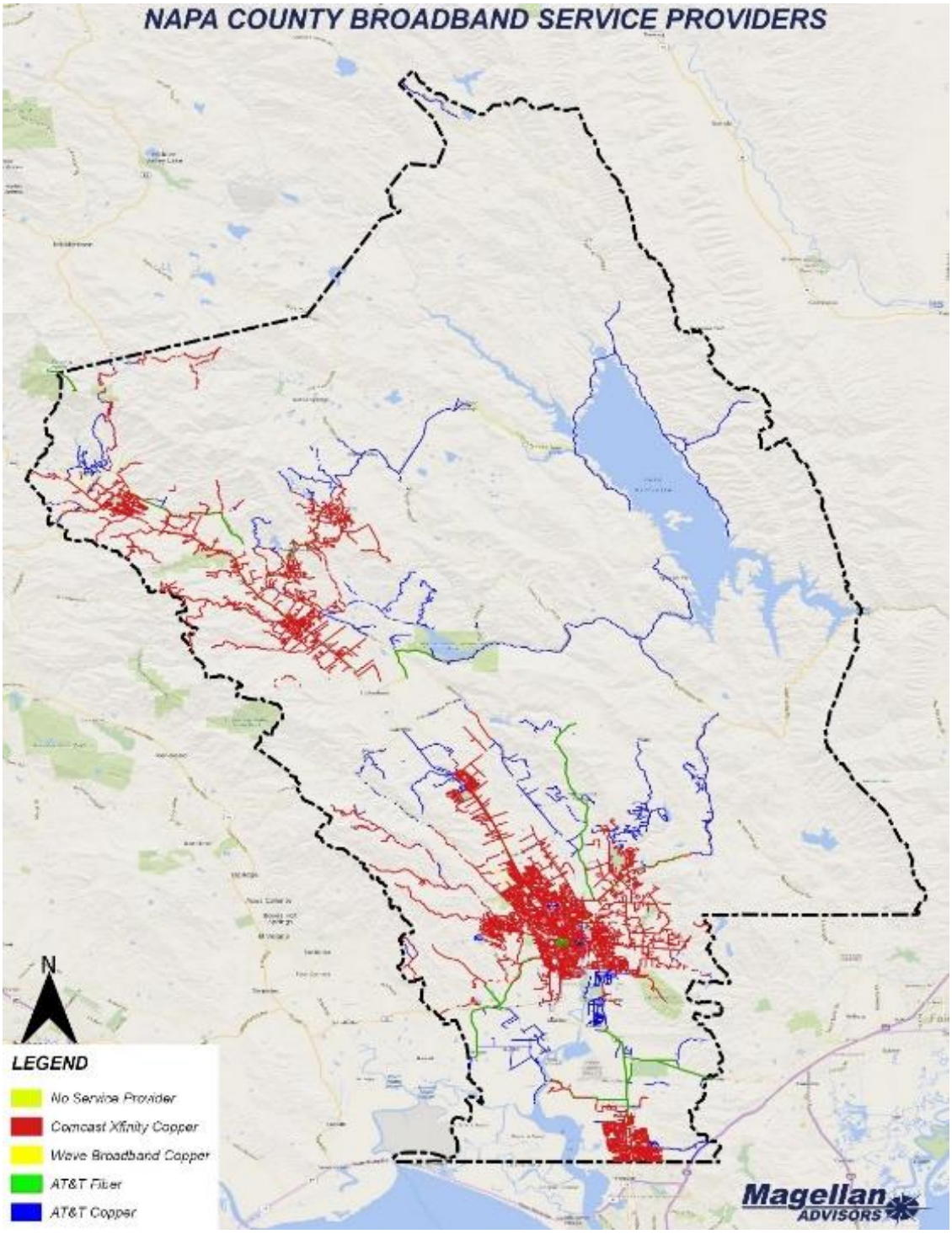

NAPA COUNTY BROADBAND SERVICE PROVIDERS
N
LEGEND
No Service Provider
Comcast Xfinity Copper
Wave Broadband Copper
AT&T Fiber
AT&T Copper
Magellan ADVISORS

Figure 14

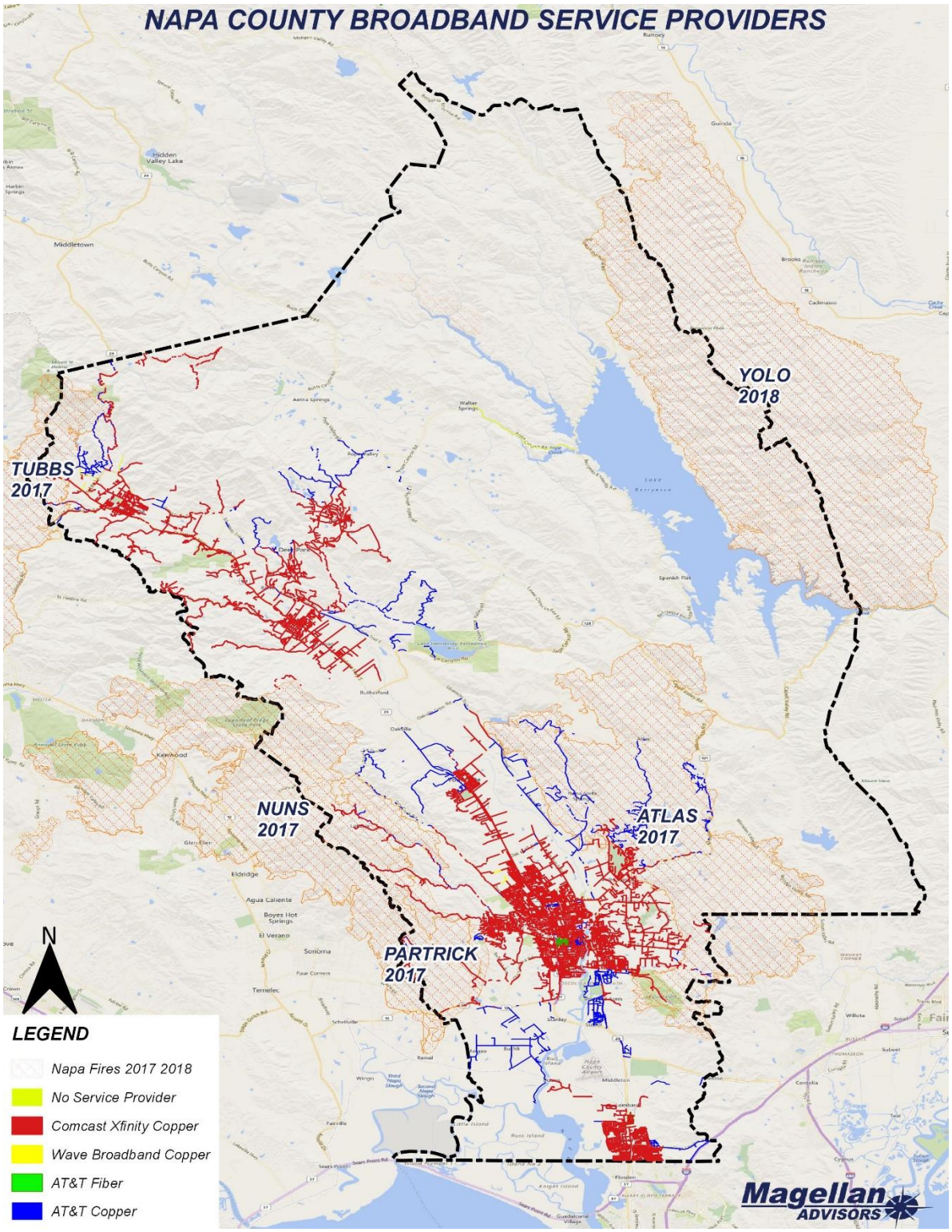

NAPA COUNTY BROADBAND SERVICE PROVIDERS
TUBBS 2017
NUNS 2017
ATLAS 2017
PARTRICK 2017
YOLO 2018
N
LEGEND
Napa Fires 2017 2018
No Service Provider
Comcast Xfinity Copper
Wave Broadband Copper
AT&T Fiber
AT&T Copper
Magellan ADVISORS

Figure 15