Doña Ana County Broadband Feasibility Study

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Broadband Feasibility Study

DOÑA ANA COUNTY, NM

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1. Executive Summary

Doña Ana County faces the same issues as many other rural communities throughout the country. Overall connectivity is lacking in Doña Ana County both in terms of access and affordability. Doña Ana County exhibits slow connections, lack of access outside the city, in more rural areas of the County, and fiber infrastructure that is only available at certain locations and not equally accessible nor affordable to residential, business and anchor institutions. Abundant, affordable, fast internet access via reliable, redundant, and resilient infrastructure will accelerate economic development, enable improvement and innovation, and provide numerous benefits to residents.

METHODOLOGY

The County selected Magellan Advisors to determine the feasibility of providing broadband to under-served areas.[1] To this end, we interviewed key stakeholder representatives about their current connectivity, goals, and plans. We also considered results of a *State of New Mexico* survey on its community about broadband. Public and shared assets were assessed for connectivity requirements and usefulness in deploying broadband. Research into current broadband offerings provided insights about supply that we cross-reference to other data from the state and federal agencies. All this input is boiled down to broadband needs and opportunities.

Costs and funding define feasibility of meeting needs with opportunities. We created a conceptual network design for broadband in under-served areas to identify the major components and costs. Various technologies were considered for the design, and it includes wired and wireless broadband connections. Costs for infrastructure components are based on vendor prices for equipment and materials and prevailing local wages for labor, which are built into Magellan Advisors' proprietary financial model.

We used available data on businesses and households in Doña Ana County to estimate revenue potential with these designs. We then estimated the associated operating expenses. The study includes a thorough review of funding options. This

[1] The Federal Reserve Bank of Dallas supported Magellan Advisors' work with Doña Ana County through its Advancing Digital Inclusion initiative.

information enables the County and its partners to decide where to focus broadband development, the scale of that development, and what role each partner might play.

FINDINGS

A key issue for Doña Ana County continues to be the lack of access to quality and affordable broadband for residents outside the city limits. Many don't get the speeds and reliability they need to work from home or access online education and telehealth. Stakeholders are eager for connections and competition. Magellan's discussions with Doña Ana County community leaders revealed that the County's rural areas are being left behind compared to urban areas. There appear to be numerous gaps in the city that incumbent providers said they will fill.

Price seems to be the greatest source of dissatisfaction among residents and small businesses with broadband, followed by speed and quality. The quickest (1-3 years), and surest way to deliver abundant and affordable broadband to the vast majority of the County is for the County leadership to directly invest via a public-private partnership, which was initiated at the time of this report. A business model that develops infrastructure to be accessed and used by private partners to expand affordable and high-performance broadband solutions is both feasible and likely to sustainably address broadband issues. This type of partnership will leverage the strengths and abilities of both the public and private sectors to combine their efforts on delivering abundant and affordable broadband.

Due to the economics of broadband delivery, it is virtually impossible for a private provider to take on the role of closing the digital divide without public governmental help. For more than 100 years, Doña Ana County has delivered critical infrastructures that helped move the community forward and built a solid base and environment to help the community grow and thrive. Broadband is just another form of critical infrastructure that the County can participate in that will move the greater Doña Ana County community forward into the digital future for many years to come.

There are a range of broadband business models from policy-only through full retail. Most involve some form of network infrastructure. The minimum role the County might actively play is to build network assets for private providers to use under a lease or revenue-sharing arrangement. Lighting the network to provide wholesale transport requires additional investments in equipment. Retail services require access infrastructure to customer premises, which can be the most costly portion of the network. Our conceptual design included 1,331 route miles of fiber, 188 of which comprised a backbone for wired and wireless broadband, and 14 radio access

network antenna sites. We considered three options for developing this infrastructure to determine costs, coverage, and revenue potential:

1. Aerial fiber and radio access network focused on under-served areas
2. Underground fiber and radio access network focused on under-served areas
3. Full aerial fiber and radio access network for all areas

Option 2 has the best long-term costs even though the capital expense was the high. We estimate it would cost $40.6M to construct, versus $15.2M and $53.6M for options 1 and 3, respectively. The revenue potential is $5.9M for options 1 and 2. The $30.2M revenue potential of option 3 is offset by its higher capital expenses, which could be multiplied by any financing costs, and operating expenses. Revenues were estimated from data about business and residential addresses based on market prices for service and typical take rates.

Federal funding, flowing directly to the County and through the state, is available for pandemic relief and infrastructure. There are on-going programs that fund broadband planning and development. The County is already applying this funding per this report and this study positions it for additional funding to be “shovel-ready”. The State of New Mexico may supplement these funds with assets and assistance. These sources are described in detail in this report.

The County should seek private investment in broadband as economic development, much like an industrial park. The County can capitalize on federal and private funding to generate revenue by leasing or providing infrastructure to providers for a revenue share. This income could then fund additional broadband development with other revenue or via debt, particularly to meet internal and specific external demands. Broadband development in many communities aligns and even combines private and public investments. It is not clear how this might work in New Mexico due to state regulations.

RECOMMENDATIONS

Magellan Advisors recommends Doña Ana County build on current initiatives to develop a county-wide fiber optic backbone. Capitalize on current funding availability but plan to build incrementally over the long term. Build underground to boost resilience and minimize maintenance costs. Target investment to the areas with greatest need based on specific stakeholder requirements. It is beyond the scope of this study to specify locations, but the Las Cruces airport and Santa Teresa border crossing are key areas as are the Colonias. Extending network to those areas as well as community centers, schools, and towers included in the conceptual design should effectively reach all county residents.

Elements of a public-private partnership recommended by Magellan are based on assumptions that lead to the financial analysis and recommendations in this report:

- The County wants control of its collective digital future and robust, economical connectivity for all its facilities.
- The County and other local governments are willing to lead efforts to build a mission critical network infrastructure that will:
    - Provide wireless and fiber-based broadband to home and businesses across the County especially for the low- and moderate-income residents, and in the rural parts of the County.
    - Connect County facilities and anchor institutions.
- The County does not desire to be a retail operator but does desire to control and own key portions of the network.

The County should seek private partners to provide certain elements of the network, such as customer premises equipment, retail services, and network maintenance and operations. The private partners should provide all services including internet access for retail customers and possibly bulk IP for the County and city networks to use. Be clear about relationships with providers and other stakeholders. They may be customers or partners, depending on what they are expected to contribute and what they expect to receive in return. The County can act as a catalyst for private investment and avoid competitive situations. Magellan Advisors recommend these next steps:

1. Establish a fund for broadband development
2. Formalize the business model and establish a Broadband Authority
3. Set objectives and metrics for digital inclusion impacts
4. Determine development priorities and phasing
5. Identify specific assets that might be used to develop the network
6. Design and develop the network infrastructure

2. Introduction

Residents of Doña Ana County face essentially the same broadband issues as many other communities throughout the country. Broadband is deployed to maximize return on private investment, which excludes high cost in low-income areas, especially the rural and urban core. This means fast, reliable connectivity is not available nor affordable to everyone in the County. Internet access in many areas is via cellular, DSL, or satellite, which do not provide the speeds and reliability that many need to work from home or to access online education and telehealth.

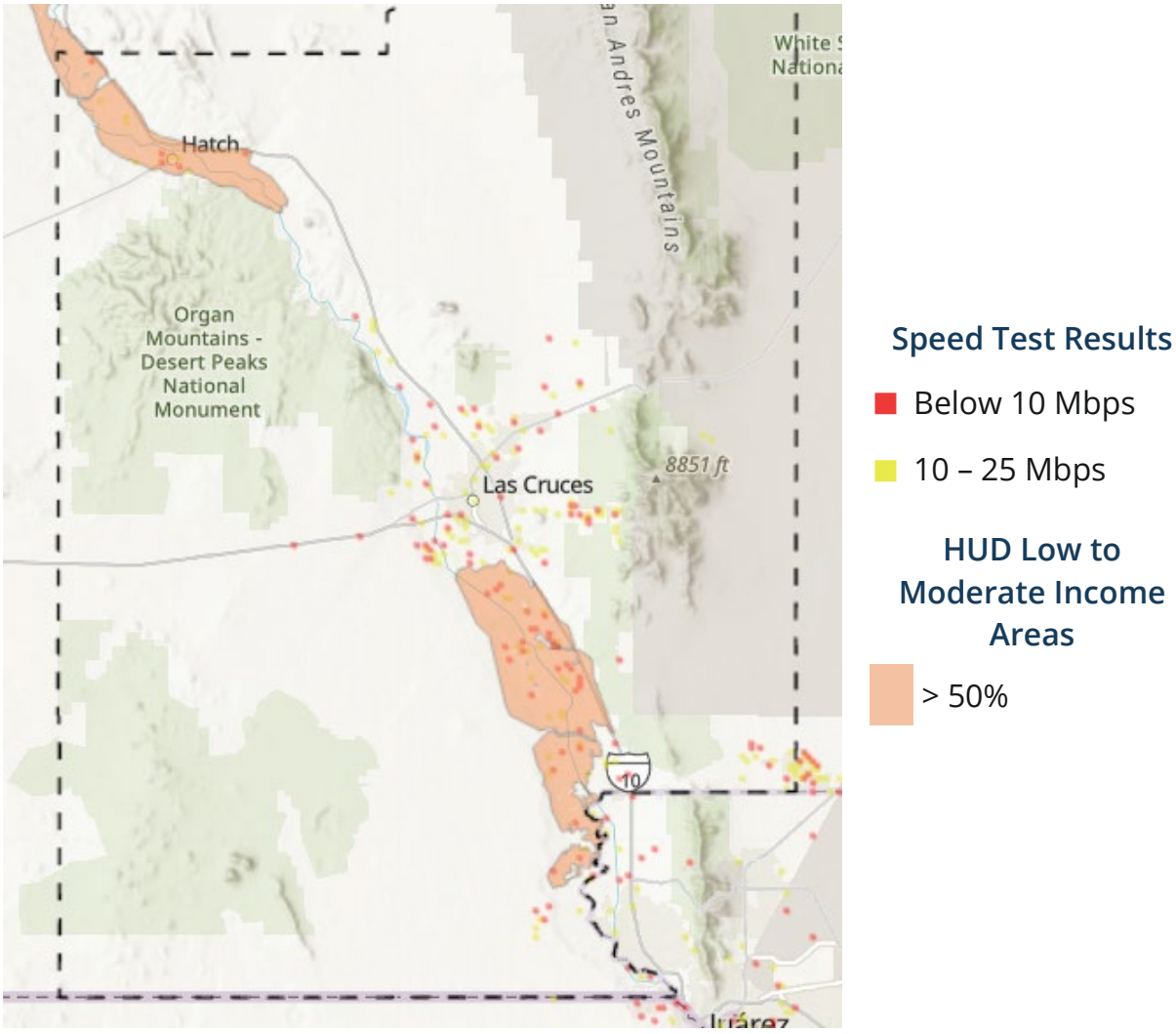

Figure 1. The Broadband Problem: Digital Exclusion in Doña Ana County

Data shows that Doña Ana County's under-served areas are dispersed throughout the area, extending beyond lower income urban areas, generally west of the Rio Grande. Figure 1 and Figure 2 illustrate this problem. Doña Ana County is at a

disadvantage being on the wrong side the digital divide relative to communities that have invested in their broadband infrastructure. Slow connections, high costs, and limited infrastructure means many families, businesses, and institutions in Doña Ana County are left in this divide.

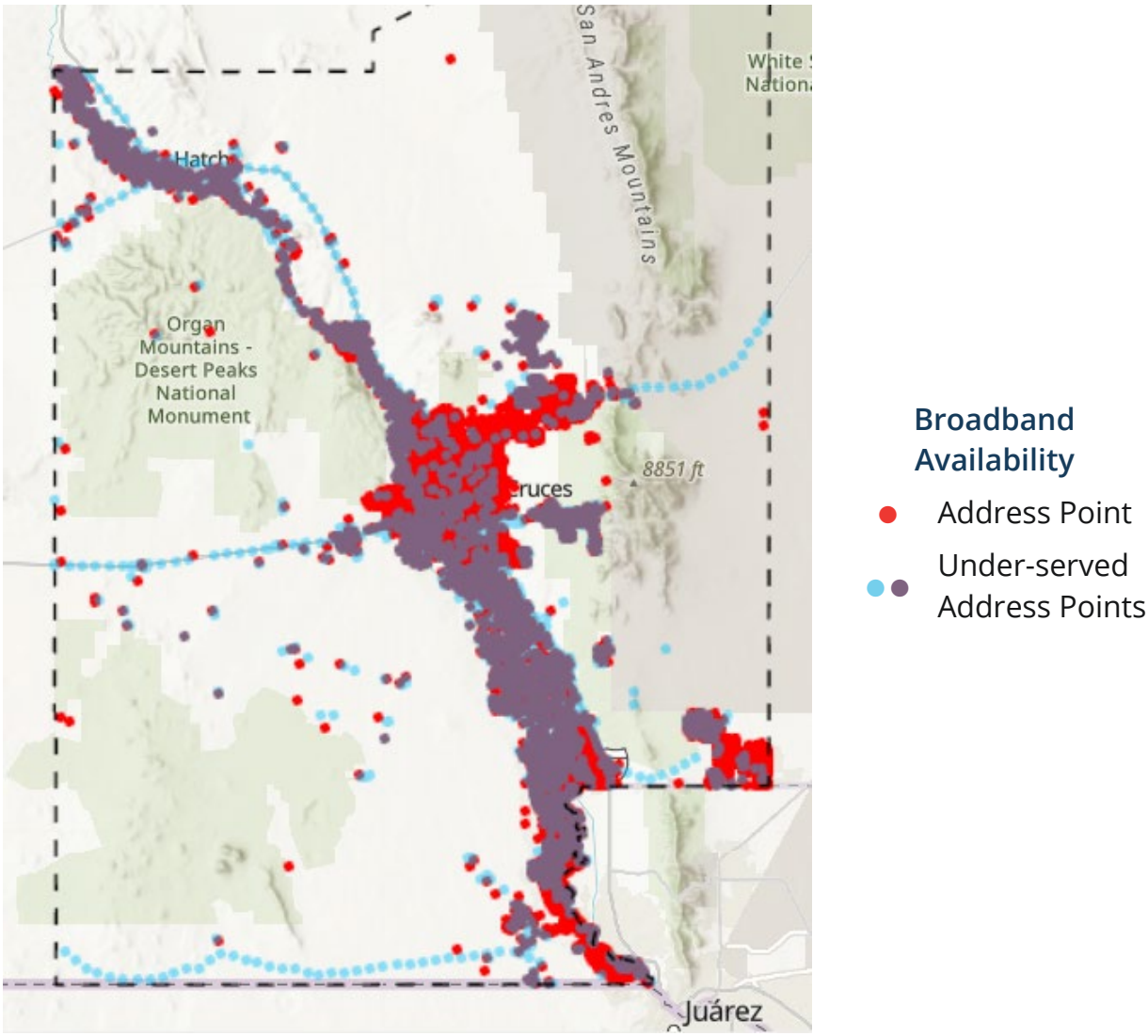

Figure 2. Under-served Address Points in Doña Ana County

Federal data published as "Indicators of Broadband Need" by the National Telecommunications and Information Administration (NTIA) show some areas of need in Doña Ana County. The NTIA areas of need generally don't overlap state-identified under-served areas, as shown in Figure 3, and miss large swaths of the county, including key sites. A more detailed view shows the areas of need have very few premises within them.

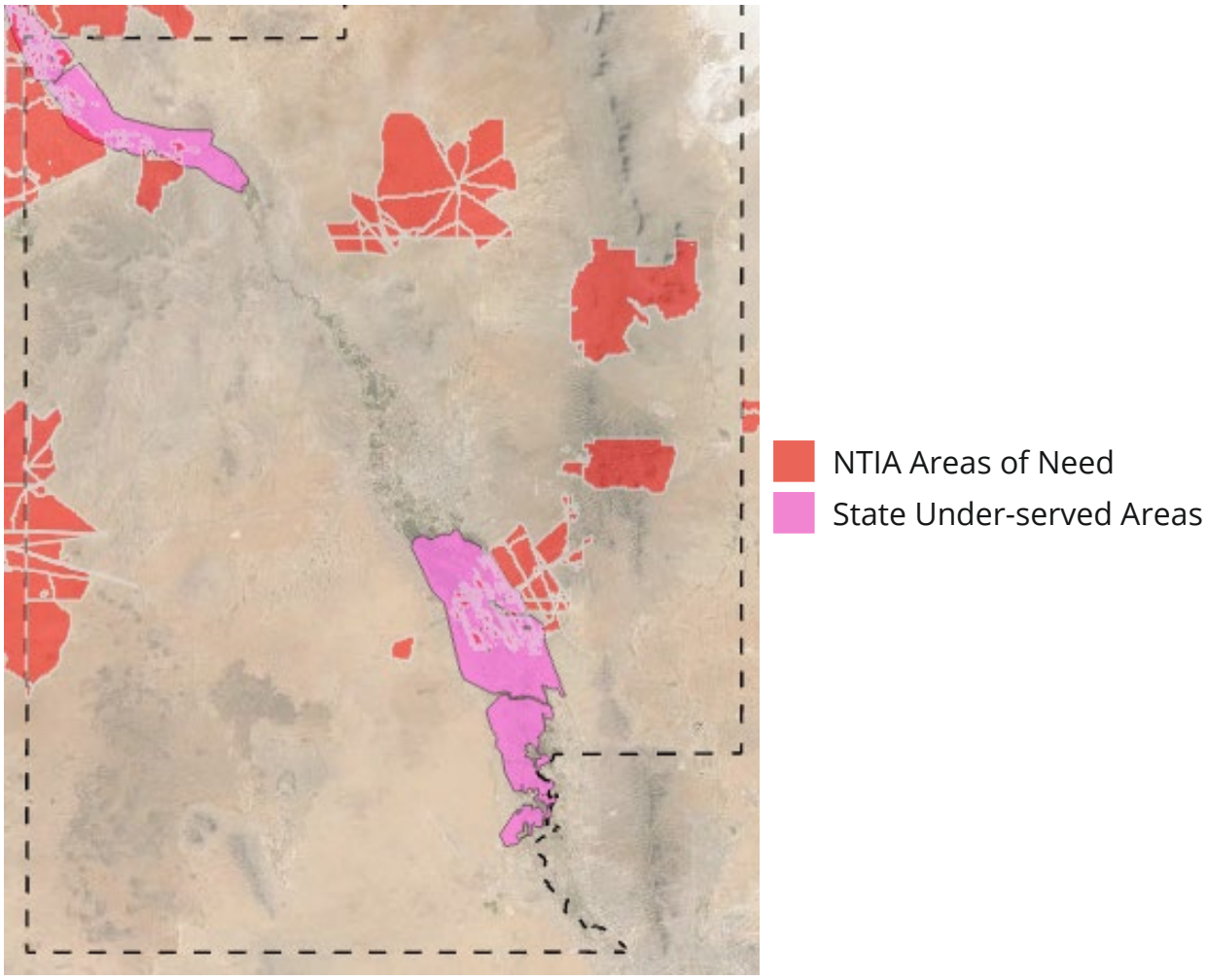

Figure 3. NTIA Areas of Broadband Need and State-identified Under-served Areas

Most of the unserved areas simply don't have anyone to be served. They cover fields and other undeveloped land. Addresses in un-served areas are adjacent under-served areas, apparently just beyond the end of the broadband line. Some un-served addresses, as shown in Figure 4, are in areas surrounded by "under-served" areas and close to "fully served" addresses. To serve the unserved premises, it would be necessary to build through fully served areas and past under-served areas. On one level, one has to wonder why providers haven't closed these gaps already. On another level it would not make business sense to serve *only* un-served areas. Any new provider would want to pick up as much business as possible on the way to reaching addresses no current provider serves.

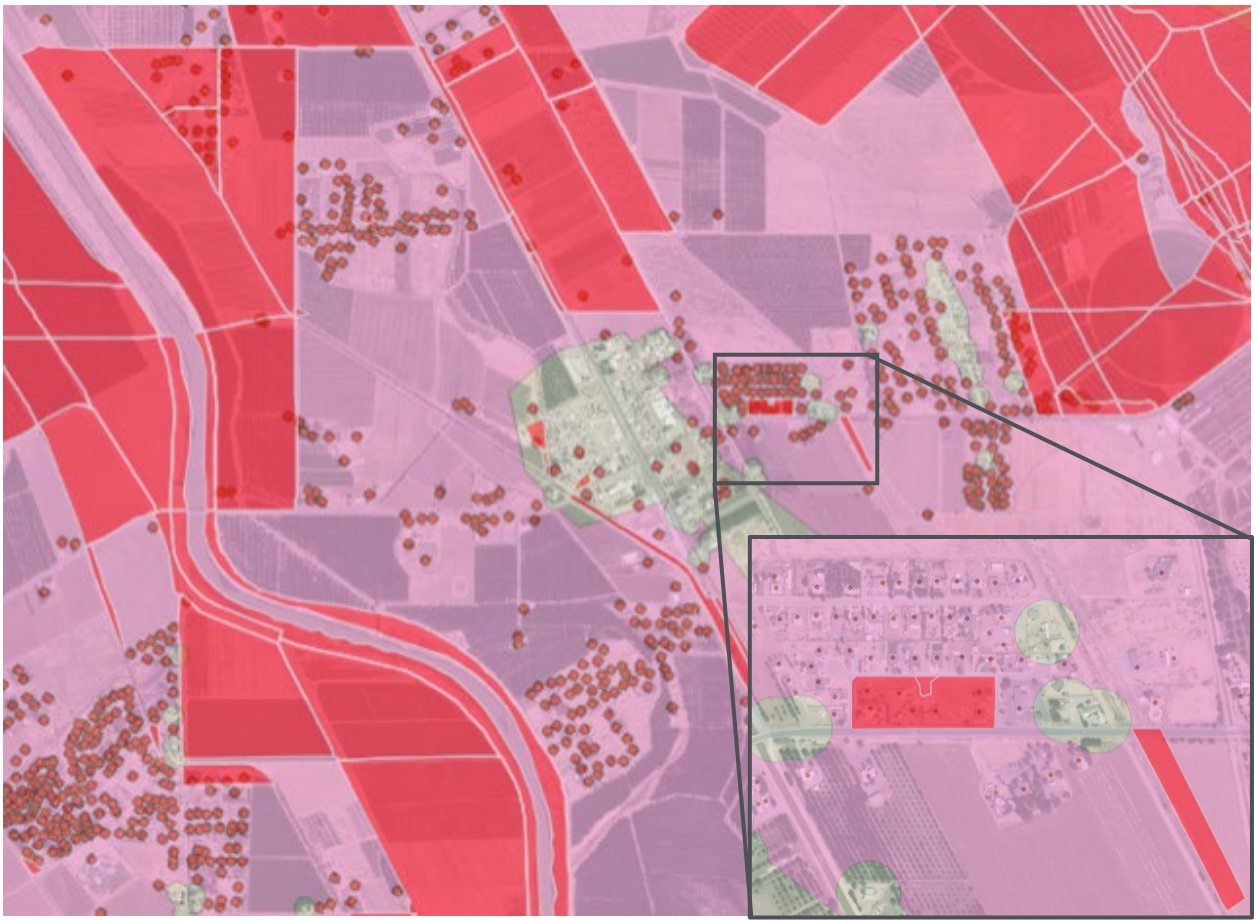

Figure 4. Detailed Views of Un- and Under-served Areas in Mesquite, NM

Stakeholders are eager for more options and better prices. A range of public and private organizations across the country have developed fiber and wireless broadband service offerings. If Doña Ana County and the City of Las Cruces want this type of investment, they must first invest internally. The key issue is how to take control of the County's own broadband destiny.

- *Broadband allows communities to expand their markets.*
  With broadband technology, communities can leverage their local resources and legacy industries to compete in the global economy.
- *Broadband enables industry clusters.*
  Broadband supports the "multiplier effect" by facilitating communication and data-sharing between inter-related businesses and institutions. Strong industry clusters spur innovation and local growth.
- *Broadband helps ensure that the workforce is qualified for regional jobs.*
  Broadband facilitates specific training opportunities, tailoring workforce skills trainings to help meet the requirements of the regional economy.

- *Broadband promotes "smart" regional development.*
  Integrating broadband into regional infrastructure ensures that planning efforts will accommodate and meet the region's needs.
- *Broadband enhances quality of place.*
  Broadband improves all aspects of a region's ecosystem, from healthcare, education, to public safety. Higher living standards attract and retain residents, giving them more reason to invest in their communities.

After careful analyses and based on Magellan Advisors' work with more than 400 communities, we have determined the quickest (1-3 years), surest way to deliver abundant and affordable broadband to under-served areas of the County is community investment - the Doña Ana community must invest in itself to get better broadband-related opportunities. Leveraging the community investment will increase private investment. Magellan's team recommends Doña Ana County to form a public-private partnership using the model described in this plan to build infrastructure for private providers to offer affordable, fast and reliable broadband.

It is virtually impossible for a private provider to close the digital divide without public governmental help due to the cost of building the basic infrastructure. Investing a portion of ARP funds will make it practical for new providers to enter the market. Fees paid by the providers to use the network creates a revenue stream to provide devices, support, and training to make full use of broadband. The outcomes are, but not limited to better education, health, and incomes, which lead to lower social costs and a bigger tax base, that then paves a way for lower taxes and better services.

This type of partnership builds the strengths of both the public and private Doña Ana to deliver abundant and affordable broadband. For more than one hundred years the City of Las Cruces and Doña Ana County have developed and managed critical infrastructure for the community to grow and thrive. Regulatory barriers, specifically the "anti-donation" clause in New Mexico's state constitution, must be addressed. Today's digital economy requires new infrastructure for everyone. Broadband is just another way for the community to invest in itself. This plan identifies how to do this in a way that will pay dividends for many years to come.

ASSUMPTIONS AND GOALS

Elements of a public-private partnership recommended by Magellan are based on some simple assumptions about and general goals of Doña Ana County:

1. The County wants to control their community's destiny, attract private investment, and ensure that investment aligns with community needs and public priorities.

- Direct ownership of infrastructure is the most effective way to achieve these goals because it enables the public to literally say where the investment should go.
- The focus of the County's effort is digital inclusion for residents in under-served areas.

2. The County needs a carrier-class, hybrid fiber-radio broadband network to:
   - Connect County facilities and anchor institutions, and support essential services.
   - Provide wireless and fiber services to the home and businesses, especially those in under-served, low- and moderate-income areas.
   - Generate revenue to support programs for residents and local businesses to get the skills and technologies necessary to prosper in today's economy.
3. The County wants to attract more investment from more private companies, particularly internet service providers and other technology companies.
4. The County does not wish to be a retail operator but is willing to fund and own network infrastructure if it generates direct benefits to taxpayers.
5. While the County has invested ARP funds and is likely to receive additional infrastructure funds, it does not have the capacity to develop and manage a wholesale broadband network, and it has limited capacity to run digital inclusion programs and work with providers.

This plan is designed to accommodate a variety of partners. The City of Las Cruces and/or Doña Ana County could fund and own all the network infrastructure described in the plan. Private Doña Ana companies could build and own at least part of the infrastructure. The plan is based on two simple realities: (a) owners control assets and (b) companies invest in communities that invest in themselves.

The value of networks is determined by the number of connections and the geographic area covered. This plan focuses on Doña Ana County, including the City of Las Cruces. The return on the County's investment, in terms of additional investment, impacts, and revenue, can be greatly increased by extending the network across the region. We assume the County does not want to fund or own infrastructure outside their boundaries but does want to maximize the return on their investment. This plan could easily be expanded and scaled to cover more area with additional investors.

ACHIEVING DIGITAL INCLUSION

Digital inclusion is having the abilities and resources to access online content and participate in online activities. It enables fundamental improvements in businesses processes, often referred to as "digital transformation," as well as profound changes in personal life. Processes and products can be translated into software to make them more efficient, flexible, and usable and useful, and, therefore, more valuable, presuming people can access and use them. Generally, this involves increasing knowledge and skills and substituting technology for labor. It requires a whole suite, or "stack," of technology components, illustrated in Figure 5.

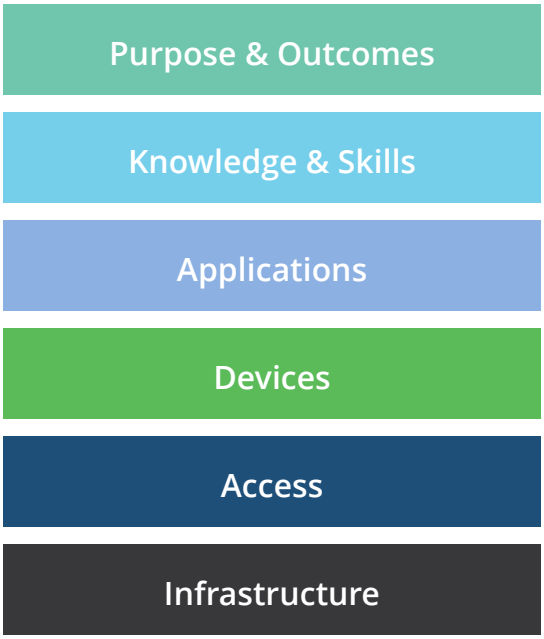

Figure 5. The Tech Stack

Each component, or layer, of the tech stack provides key functions for the layers above and below. For example, network access requires infrastructure and devices require access. Functionality is constrained from the bottom up so should be driven from the top down. The type of infrastructure should be determined by the type of access required, not vice-versa.

Ideally, purpose and intended outcomes should be clearly defined before other components of the tech stack. In reality, components at the top of the stack are limited by lower layers. The knowledge and skills required are often determined by the available applications, which are in turn determined by the available devices, etc.

There are two keys for achieving digital inclusion. The first is to define the current, default stack and the ideal, planned stack. These should be touchstones to guide digital development efforts as well as rubrics for assessing it. The second key is resources, including a sustainable source of revenue to enable digital inclusion. Technology is getting cheaper and easier, but it is not free or self-evident. Digital development requires money and time. Generally, the lower layers of the stack require relatively more financial capital while the upper levels require more human capital.

Technology companies want to invest in digitally inclusive places with solid, complete technology stacks. This means communities, private companies, government

agencies and even individuals must invest in their tech stacks. An initial infusion of capital can be critical as a catalyst to kick start this process.

3. Needs and Opportunities

The foundation of any broadband plan is a clear, comprehensive understanding of unmet requirements for connectivity and programs or resources that might enable development. Needs and opportunities define what is practically feasible and meaningful. Magellan Advisors gathered information via interviews with key local stakeholders and from a survey conducted by the State of New Mexico.

STAKEHOLDER INPUT

With the support of County personnel, Magellan Advisors conducted seven discussion groups with 50 representatives of organizations with a stake in broadband and other forms of digital connectivity.[2] Most of these related to essential services, including education, public safety, and utilities. Community and economic development were discussion groups. There was a discussion with a group of network service providers. This section summarizes the connectivity needs and opportunities identified in those discussions. All content in this section comes directly from stakeholder representatives. This information is not the opinion of Magellan Advisors, the Federal Reserve Bank of Dallas, or Doña Ana County.

Cities and Towns

Many residents lack tools to get online, even though it is virtually required in today's technology-dependent world. Schooling has been virtual. Medical appointments have gone to telehealth. Local government activities such as the juvenile justice program have largely gone online. The area's agricultural economy has embraced automation and has been increasing its needs for workforce with technical skills, which people could develop online if they had better access. Transportation was an issue even before the pandemic made everything go virtual. The key for most County citizens' success is a mix of in-person and online capabilities. Social interaction is helpful, but some are able to participate more if they do not have to go in-person. For example, this capability has increased registration in city programs.

Basic access is an issue particularly in older, lower income areas. Consistent internet is an issue, in both lack of capacity and affordability. A relatively high percentage of residents are distressed. There are a number of senior citizens and single parents with living with their children who are currently in school. Today connections do not have the capacity that will enable families with multiple members to perform various

[2] See Appendix 1 for a list of participating organizations.

essential tasks. Small businesses have reported issues with connections, and connection services in industrial areas have limited capacity.

Local governments have taken some actions to improve access options. The City of Las Cruces, for example, has done a lot of initiatives to increase connectivity in their parks. One of the parks near Mesquite Historic District had Wi-Fi which provides access for the public. Some relatively rural areas of the County, known as Colonias, where a lot of agricultural workers live, develop their economy but without enough planning. They do not have basic local government services or an infrastructure that could allow for several options for connection services.

Community and Economic Development

The area's rural character is a key factor for broadband as well as community and economic development. It is spread out enough that fiber could be prohibitively expensive to deploy, especially in the Colonias where there are few public rights-of-way. Most community and economic assets are generally along the Rio Grande River, in the Mesilla Valley—from Garfield in the north to Sunland Park in the south—but a few are not. The Las Cruces International Airport, adjacent West Mesa Industrial Park, and the Santa Teresa Port of Entry are all several miles west of the river. The area's abundant agricultural assets are primarily in the valley. The eastern portion of the County has numerous outdoor recreation sites but is largely unpopulated, beyond White Sands, as is the southwest portion of the County.

Connectivity is important for modernization of agriculture to operate machinery, for value-added processing, and as a means of monitoring resources. The Arrowhead Center and Technology Incubator at New Mexico State University (NMSU), just south of Las Cruces, had some focus on "*ag-tech*". Many of the agriculture workers and businesses owners cannot access resources like this due to limited connectivity. Interviewees had just recently heard from small businesses about this issue. It was noted that education for business leaders was important, helping them operate and sell online, along with workforce upskilling. Many agriculture workers live in the Colonias with few options for internet services, although there are fixed wireless companies operating in the southern portion of the County.

A recent survey of businesses identified issues with limited capacity in the West Mesa industrial park, which is focused on value-added agriculture and aerospace (it is 70 miles from Spaceport America in Truth or Consequences, NM). The lack of connectivity capacity and options can be an issue when recruiting businesses, and there were three "hot prospects" for recruitment. There were 19 businesses in the area with upload and download speeds that are so slow that people had to go home

to get on to their Zoom calls. Redundancy is an issue because businesses rely on the internet. Santa Teresa has similar issues as its industry, although companies in West Mesa have more technical jobs and are giving workers more flexibility on their work locations. Planned commercial development at the exit near the airport will create more demand for broadband in the area. Regularly scheduled passenger service to the airport, which has been proposed, would likely increase demand, too.

Work on a recent grant application revealed the County's broadband to be spotty, especially in rural areas. New value-added agricultural industry, particularly cannabis, is going to be rural. Santa Teresa is a largely rural, sparsely populated area but has a lot of connectivity needs because of the industrial location of businesses around the border. Many companies were headquartered somewhere else and use various cloud applications. Some were using point-to-point microwave radios for connectivity. There are a couple of corporate campuses and cellular towers that could use improved connectivity. Prospects asked about water, power, and internet. U.S. Customs is installing a new scanning system that will centralize processing, which will require excellent connectivity.

Overall, Las Cruces and other more urban areas have been seeing a lot of sustained growth. Most of the residential development is to the east of Las Cruces, and commercial development is along the highway and major streets, particularly east of Roadrunner Parkway. A large mixed-use development was planned on East Lohman, and the majority is for a city-owned property adjacent to Mountain View Medical Center. There is also a major, healthcare anchor, mixed use development planned in Anthony, at the site of the closed Dos Lagos golf course, between I-10 and Anthony Dr, south of Ohara Rd.

Education

The schools generally have good connectivity due to e-Rate subsidies. The Gadsden and Hatch school districts have multi-Gbps connections at district offices and most schools. The Doña Ana Community College (DACC) has somewhat slower connections, especially at sites outside Las Cruces. NMSU is connected via the Rio Grande Optical Network (RGON) to the Albuquerque GigaPop and provides 10 Gbps and 1 Gbps connections to sites on campus. All have effectively ubiquitous, up-to-date Wi-Fi in buildings and on campus. There had been substantial growth in numbers of devices and other connectivity demands for all educational institutions.

The big issue is their students' access when not in school. While this was especially an issue during the pandemic, educators expected distance learning or online education to be common practice going forward. Gadsden has 13,000 students, at

least 5,000 have no internet, and others were getting less than 10 Mbps for as much as $100/month. Twenty-five percent of school families in Hatch have internet and only half of those have reliable internet. “How do we get more students to the finish line?” one educator asked, then answered herself, “Technology is more critical to us and our students than ever before.” Many students left the educational system because of poor internet access at home. Connectivity outside schools was also a problem for the faculty and staff.

Educational institutions in Doña Ana expanded their Wi-Fi coverage to the parking lots and other areas outside the school so students could have more access. NMSU was considering using EduRoam[3] to provide off-campus connectivity for students. The schools were already working toward providing devices to all students. DACC gave out iPads to impacted students. Schools gave numerous cellular Wi-Fi hotspots to students without home internet, typically one per student because that is all that a hotspot could handle. Schools have internet sites in every little community, many without much business driving investment. It is not just rural students that need remote access and support but also the school faculty.

Emergency Services

Emergency services really need broadband anywhere there are people assigned for command and control, coordination, etc. This means they need broadband everywhere because they cannot predict where there is going to be an incident. Responders need to be able to pull up plans, maps, and other information right at the incident sites. Dispatching and 911 operations for all of Doña Ana are provided by Mesilla Valley Regional Dispatch Authority (MVRDA). They recently upgraded to broadband and have Wi-Fi inside and outside their offices. MVRDA would like to have high-speed connections in other locations. They are upgrading 911 to accommodate remote operations, particularly hot sites at the State Police and university. The fairgrounds will be a major, all-hazards shelter. Community centers are important locations for first responders and public health. MVRDA and other agencies need the ability to go mostly anywhere they have to put dispatchers on-site for major incidents.

City of Las Cruces Fire Department stations were all connected via a combination of Century Link broadband, city fiber, and microwave. Their vehicles had mobile data terminals (MDTs, which are laptop computers) and Verizon cards. Some had routers for using multiple connections. They experienced coverage issues with cellular as

[3] EduRoam (https://eduroam.org/) provides connectivity to thousands of hotspots for universities, research institutes, and schools across more than 100 countries.

well as Wi-Fi connections which interfere with getting geographic data and maps via computer-aided dispatch (CAD). Doña Ana County Fire and Emergency Services have similar connectivity issues over a larger and more rural area.

First responders do not have good connections in all County buildings, particularly in community centers. Vaccination pods in various parts of the County were using 4G routers to support eight tablets. There were connection issues whenever the rain falls or the wind blows. They are sometimes so slow that emergency operations staff often cannot even log in. There are not a lot of options for high-speed connectivity, especially in rural areas, which have issues every day. FirstNet has not provided a solution, as it does not have adequate coverage in rural areas and dead spots indoors.

Public safety will be relying even more on broadband in the future. Emergency Operations are moving to an online platform, Web EOC, and must work on a daily basis with neighboring counties and states. The Dispatch team is focused on NG-911 as the state is building out the network for all the telephone systems, etc., to be upgraded. They were expecting to have the ability to accommodate live video from 911 callers. Reporting, telemedicine, and crisis intervention are performed by responders in the field. Community centers are planned to be telehealth locations, for behavioral and mental health, as well as locations for first responders. They will need greater backhaul capacity as well as broader, more consistent coverage. The university police have backhaul via RGON and it would be good if the State Education Network (SEN) could similarly accommodate other public safety.

Public Works, Transportation, and Utilities

Public works, including road construction and traffic management, are handled by the cities and the County. Doña Ana County provides wastewater to unincorporated and rural areas. El Paso Electric Company serves most of the County. There are six water authorities or districts serving the County. Two utility providers participated in discussion about needs and opportunities in these sectors. This input was supplemented by State of New Mexico Department of Transportation (DoT) late in the project. The DoT has limited fiber assets in the area, needs connectivity between "fiber islands," has flexible access/use permitting, and was working on statewide Dig Once policies.

The Camino Real Regional Utility Authority Department (CRRUA) was formed via a joint power agreement between the City of Sunland Park and the County, and is considered a municipal utility, and self-regulated. It serves 7,200, mainly residential but some commercial and industrial (particularly in unincorporated areas on the

mesa) customers in Sunland Park and Santa Teresa along the national and state border with water and wastewater. In the City of Sunland Park alone, CRRUA was turning up 20 new customers per month. It had 14 wells, 3 sewage treatments, 3 arsenic treatment plants and another on the way. New subdivisions were driving expansions, which they workout with developers before they build. CRRUA was developing its SCADA to meet increasing needs and had implemented radio-read residential meters, which was gradually replacing with AMI.[4] It uses Verizon for monitoring major commercial and industrial customers. There were portions of its territory where conduit was being installed for gas and telecom.

El Paso Electric (EPE), a public utility privately held by the Infrastructure Investment Fund (IIF), distributes, generates, and transmits power in southern New Mexico and west Texas from a variety of energy sources including nuclear, natural gas, solar, and wind. It has operational technology deployed with several sub stations all the way up to Hatch along the Rio Grande. It was modernizing its SCADA and seeking regulatory approval for AMI, after which it will go through a planning process. It would most likely use cellular-based AMI with mesh and cellular backhaul. It has some backbone fiber, mostly on transmission systems, but primarily uses carrier and some cellular to route data to multiple centers in the El Paso area. It also uses carrier-based private LTE for mobile communications.

EPE had on-going, unmet connectivity needs, was continually adding infrastructure that needed connectivity, and was using its own infrastructure for connectivity for internal, operational purporses. EPE preferred to own the backbone for bulk electric use and was tentatively interested in data support for AMI. There were locations where EPE could use dark fiber if it was available. Generally, the utility was becoming far more data-intensive but was very focused on operations to comply with regulations. The EPE representative noted that they were always interested in better infrastructure/ backbone because that is critical to attracting big electricity users. “The more customers are digitally savvy, the better for EPE because people can better use the online tools the utility provides”. Every utility wants to have balanced loads to bring peaks down but keep the base up, and broadband can help with that.

Service Providers

The incumbent service providers—Charter (formerly Spectrum), Comcast, and Lumen (formerly CenturyLink)—have good connectivity in Doña Ana—but had some

[4] SCADA stands for supervisory control and data acquisition and AMI is advanced metering infrastructure, which are information systems that acquire data from geographically distributed production and distribution infrastructure and consumer meters, respectively.

service gaps. They felt it was better to fill gaps than have a new provider overlay fiber in an area and looked at funding from federal government for this purpose. Charter has participated in FCC's Rural Digital Opportunities Fund (RDOF) to deploy fiber to the home in Anthony and Sunland Park by mid 2022. Comcast was working on a project to fill gaps in Las Cruces and considered providing 10 Gbps access.

There were multiple other providers working to provide "middle mile" solutions and fill gaps, particularly for rural areas. Several of them explicitly noted no intention to move into well-served metro areas and willingness to extend reach into Doña Ana County in partnership with other providers. Two of these were fiber-based, independent network services companies, one was a former independent telephone company based in a nearby community, one was a wireless internet service provider, and one a local, independent cable company. All were actively building out in the County, variously throughout the Rio Grande Valley.

5G to residential sites may be problematic because an area must be densely populated to be cost effective. The range for gigabit speeds is very limited with 5G service. Edge computing would only be deployed to communities with excess disposable income. Distributed millimeter-wave wireless was suggested as a better technology for high bandwidth to end-users in more sparsely populated areas. Citizens Broadband Radio Service (CBRS) frequencies were seen as a resource that could be used to successfully provide wireless broadband.

Providers needed more information and support. Letters of support from local officials and public agencies were critical. Hooking up 300 customers a day requires a lot of coordination. Provision of last mile services requires many employees. The State of New Mexico maps, generated from data provided by the providers, were not necessarily current or complete. In addition to accurate coverage maps, a middle mile network map is needed. Providers should share information on middle mile capacity available.

They also saw issues for consumers. Some customers had higher bandwidth services available but didn't want to pay the cost of the plan. Subsidies were identified as a possible solution. If subsidies don't cover full cost of the discount, some providers would not be able to economically participate. Spectrum offered a low-cost broadband option called Internet Assist for $17 a month for people with Social Security income or whose children receive a free school lunch. LifeLine program offered discounts to provide devices for low-income families.

The providers noted challenges in finding qualified workers in the southwest New Mexico area. People were retiring. Companies were making major changes that helped recruitment. Educational programs were seen as important. One participant

recalled that Sierra County offered community courses like "Intro to computers," which boosted demand and workforce. Another worked with community colleges and universities to provide internships and establish STEM programs to get high school kids interested.

COMMUNITY SURVEYS

The State of New Mexico Department of Information Technology (DoIT) surveyed residents of Doña Ana County over the fourth quarter of 2021 with assistance of various community organizations to assess broadband availability, costs, and performance, as well as training needs. This sub-section summarizes results of that survey.[5] Of the over 3,000 survey responses, 1,475 had some form of internet access and 1,553[6] did not. Of those with internet, speed test results were:

- 54% below 25 Mbps download and 3 Mbps upload,
- 37% above 25 Mbps download and 3 Mbps upload but below 100 Mbps download and 20 Mbps upload, and
- 8.5 % above 100 Mbps download and 20 Mbps upload.
- 38% characterized their internet as inadequate

The most common type of primary internet connection was cable, reported by 36% of respondents. Sixteen percent had DSL[7] and nearly a quarter had fixed wireless. Only 3% had fiber broadband. Nearly half of those with internet paid between $50 and $100 per month for the service. About one-fifth each paid less than $50 or over $100 per month. Respondents had a range of performance issues:

- 50.17% had slow or inconsistent Internet
- 2.61% experienced outages that lasted several hours a day
- 3.43% reported outages for a day or more
- 22% respondents limited usage due to data caps

The most common uses of internet were for household (97%), entertainment (96%), and social purposes 95%. Over three-quarters of respondents reported using internet for education, and just under three-quarters used if for civic activities and telehealth. Two-thirds had business uses. Half of respondents reported negative

[5] For detailed analysis, see "Doña Ana Report Broadband Survey Program," located online at https://www.donaanabroadband.com/survey-report.html.

[6] Many responses from non-broadband households were collected by Promotores (Community Health Workers) with Empowerment Congress of Doña Ana County.

[7] Digital subscriber line using twisted pair copper wire.

work impacts, one-third felt negative impacts on schoolwork, and over a quarter of respondents experienced negative health impacts due to poor internet access.

Among respondents without internet, 74% identified price as the most significant barrier and 24% indicated that internet service was not available where they live. Lack of availability was a major barrier for 10% of respondents. Providers' requirement for a credit check, a required deposit, or the need for a contract were also impediments to getting access. While 45% said they would consider getting Internet if barriers were removed, 21% did not want home internet.

- 27% accessed the Internet at a relative's or friend's house.
- 13% used the library to access the Internet.
- Respondents also accessed the internet at school, work, community centers, senior centers, local businesses, and public hotspots.

CONCLUSIONS

While Doña Ana County nominally has three major ISPs, only one—the telephone company—offers services in most of the County and a second—one of the cable companies—offers services only in more affluent, densely populated areas. Persons with lower incomes and of non-White ethnicity are relatively unlikely to have internet access. The major barrier is cost, followed by lack of service. A substantial portion of the community doesn't see the benefits: Of 1,553 respondents with NO Internet, less than half (691) indicated they would consider getting Internet if barriers were removed. Lack of devices and knowledge about the internet seemed to be issues as much as high costs and limited availability of internet services.

Commercial and industrial areas, particularly outside the valley, have limited infrastructure and services, which limits their attractiveness to prospects. Key industries, particularly agriculture, transportation/warehousing, and utilities, increasingly require pervasive connectivity, which means local businesses and the region as a whole is at a disadvantage due to limited broadband. Multiple small, independent providers are interested in entering the market but simply can't justify the capital required to expand into the area.

4. Asset Assessment

The subject of this study is how to deliver abundant and affordable broadband to under-served areas of the County. Market-driven private broadband development has bypassed them. Federal and state programs are unlikely and tend to be out of step with local needs and opportunities. There aren't many options for closing these gaps other than community action. Well-managed local public investment can generate financial, operational, and quality of life benefits for the community, and lead to increased private investment.

A public-private partnership can be an effective and economical way to build infrastructure for affordable, fast, and reliable broadband. The County can best achieve this purpose by leveraging its current assets and requirements for connectivity. The utility of a network is determined by the number of devices, sites, or users it connects, and the geographic area covered. Therefore, this assessment focuses on identifying the full range of Doña Ana County assets related to deploying or using networks.

All information analyzed came from County documents or personnel and secondary sources of information about Doña Ana. Magellan's staff conducted video conference calls during November and December 2021 to interview and discuss the broadband and connectivity needs of cities and agencies within the County. Our team conferenced with eight (8) groups over a three-week period to learn about the County's current connectivity, gaps, and future projected needs. The County provided extensive geographic information (GIS) on its assets and other documentation. We have analyzed this data, researched the area, and reviewed published plans for the County. We also met with several telecommunication company representatives and have since had follow-up discussions with those and other companies' representatives.

Doña Ana County has extensive and evolving connectivity requirements. Digital connectivity is essential to the County's future. Numerous regional, state, and federal entities have assets in the area, all of which are likely to have similar requirements. Aligning County investment with key local stakeholders can be a highly effective means to drive and guide private investment, including in communications infrastructure.

COUNTY ASSETS

Doña Ana County has over 800 employees at 86 locations and a total of 130 facilities at 104 sites (addresses, some located adjacent to others), broken down by type in Table 1. The County Assessor, Clerk, Manager, Probate Judge, Sheriff and Treasurer, most of which are included under "Miscellaneous," are located at the Doña Ana County Government Center, in western Las Cruces. The Southern New Mexico State Fair and Rodeo, the property for which is owned by the County, is located 11 miles east of the Government Center. The County's International Jetport at Santa Teresa is 42 miles to the south near the border crossing in Santa Teresa.

Table 1. Number of Doña Ana County facilities by type

Type of Facility	Number
Utilities	38
Parks And Recreation	24
Fire	21
Miscellaneous	21
Community Center	13
Health	5
Detention	3
Sheriff	3
Airport	1
Fairgrounds	1

Between community centers, fire stations, parks, and utilities, Doña Ana County's assets span the Rio Grande Valley to the very northern and southern ends. The utility sites, which are wastewater lift stations but include four treatment plants and multiple pumps, are the most numerous. Parks and recreation facilities are quite varied, from ten ball parks to a gazebo. The County's community centers are just that, and function as meeting and service delivery points for the community. Several are located adjacent to fire stations. The "miscellaneous" type of facility includes animal control, the courts, library, and visitor center, as well as the Government Center. The County shares its Emergency Operations Center, which is located three miles east of the County Government Center, with the City of Las Cruces.

Financially stable, the County's two major sources of revenue are Property Taxes and Gross Receipts Tax (GRT). All told, the County has 89,840 land parcels. The regional utility authority has an enterprise fund. As noted above, the County provides wastewater through most of the populated, unincorporated area. Other funding sources include Fees and Services and grant revenue.

Network Assets

Doña Ana County has a very limited amount of inter-building fiber. The City of Las Cruces owns fiber for interconnecting municipal sites, public safety radio towers, and traffic signal controls. Data on the extent of these assets was not readily available for this study. City officials indicated interest in the Doña Ana broadband initiative but did not offer use of any assets for deploying broadband. There are about 50 active radio towers in the County that are approximately 200 or more feet tall,[8] 20 of which are owned by American Tower, and one in Santa Teresa owned by the Mesilla Valley Regional Dispatch Authority (MVRDA). There are another 150 cell sites on smaller towers around the County.

Network Infrastructure Initiatives

At the writing of this report there are three evolving network infrastructure initiatives in Doña Ana. The Gadsden School District was considering a wireless broadband network to serve about 7,000 homes for approximately a $35 million investment. The biggest challenge was how to deploy and manage it properly. For example, the valley around the schools is filled with orchards so line of sight can be a problem. The district had identified at least one vendor with solutions to minimize such issues. Backhaul connections was also a noted challenge, especially for rural areas.

The New Mexico Public School Facilities Authority (PSFA), which connected 840 schools statewide to fiber, was creating a State Education Network (SEN) to connect school sites regionally and aggregate broadband demand to drive investment. SEN would run through the Rio Grande Valley, have a hub at NMSU and extend to the University of Texas in El Paso. Preliminary cost estimate was for wholesale 10 Gbps dedicated internet access to be $3,000 per month. Such services are limited to designated education and research institutions but infrastructure for SEN could be leveraged to develop similar service offerings for other entities.

Local fiber to SEN hubs will need to be developed separately. PSFA would provide network management and cybersecurity for SEN and could build private LTE networks in places private services will never be available, but it does not include local infrastructure. They were taking a phased approach starting with the most interested districts. Local governments will need to play a lead role because they know the needs and can provide many details and dependencies. University involvement was dependent on funding and staff capacity, but SEN was seen as an

[8] Data includes shorter towers that are deemed by the FCC to be a "physical obstruction" to flight paths for nearby airports.

opportunity for higher education to provide leadership necessary to collaborate and increase digital inclusion.

A private company has proposed to co-build a fiber route between Hatch and Radium Springs for the County. The County would get 28 linear miles of two conduits, one with a 96-strand fiber cable, along with access to four strands of existing privately-owned fiber to the County's new tower in Salem, for $4 million. The new fiber would terminate at the Radium Springs Community Center with a lateral to the Fire Station and at an unspecified meet-point location in Hatch. The company would be responsible for maintenance, including break-fix for the County. The County or other entity would be responsible for any equipment lighting the network and operations. There was an alternate proposal to extend the backbone fiber to the County Government Center in Las Cruces for $7.6 million.

Other Community Assets

There are five incorporated municipalities in Doña Ana County and 12 Census designated but unincorporated places, as well as 37 designated Colonias. Colonias are rural communities with a population of twenty-five thousand or less, located within 150 miles of the US-Mexico border, established before 1990, and certified by a state board. There is a special state fund for housing, water, and other infrastructure in these areas. Las Cruces, with over 111,000 population, is the largest city. Anthony, with just under 10,000 population, is the second largest and is part of the El Paso Metropolitan Statistical Area, which has over 950,000 residents.

Doña Ana County is home to New Mexico State University (NMSU), and the University of Texas at El Paso is just over the state line. NMSU's 900-acre main campus is located south of Las Cruces, surrounded by the city, at the intersection of interstates 10 and 25. NMSU has five other locations across the state, 12 research and science centers, and extension offices in all 33 New Mexico counties. Doña Ana Community College has six sites, all in the County: three in Las Cruces, including a Workforce Center, one in Anthony, another in Sunland Park, and a Learning Center in Chaparral.

There are three school districts in the County and a total of 78 school sites, including charter and private schools. All educational institutions have abundant connectivity on and to their sites, as discussed in the "Education" subsection, above. At least one (Gadsden) is considering building public network infrastructure to provide home internet access for students.

Table 2. Schools in Doña Ana County

District	Sites
Las Cruces	43

Private	9
Charter	3
Hatch	5
Gadsden	27

As noted elsewhere, the County is served by multiple utility districts, including a County water/wastewater authority and a private power company. The City of Las Cruces operates an international passenger airport. The federal government has major operations at the border, specifically the Santa Teresa Port of Entry, and at White Sands Missile Range (Holloman Air Force Base), which covers most of the northeastern County. None of these entities have network assets to speak of, and areas where they are located appear to have major network infrastructure gaps.

PRIVATE NETWORK ASSETS

Multiple companies have network assets in or near Doña Ana County. Most of these are long-haul fiber, as shown in Figure 6, which interconnects providers' points of presence (POPs) with effectively no physical access in between. Companies that have "metro" fiber, which has access at key locations on the routes, are illustrated in Figure 7. Much of both the long-haul and metro fiber networks follow routes to the south of Doña Ana to El Paso.

Figure 6. Long-haul Fiber Routes Through Doña Ana County

Most long-haul routes run west from Las Cruces, particularly CenturyLink (Lumen), redIT, and Zayo, to Phoenix. As discussed elsewhere, CenturyLink's parent company recently rebranded as Lumen, and relegated CenturyLink to retail services. The long-haul fiber belongs to Lumen, which would provide any enterprise, wholesale backhaul, long-haul or middle-mile services. Lumen and Zayo seem to share a fiber route north to Albuquerque, paralleling a route owned by T-Mobile (formerly Sprint). RedIT and Zayo are both independent, international enterprise network companies. Zayo is the larger of the two, with fiber network extending throughout North and South America, to Asia and Europe. RedIT's network assets are primarily in Mexico and Central America as well as the southwestern United States.

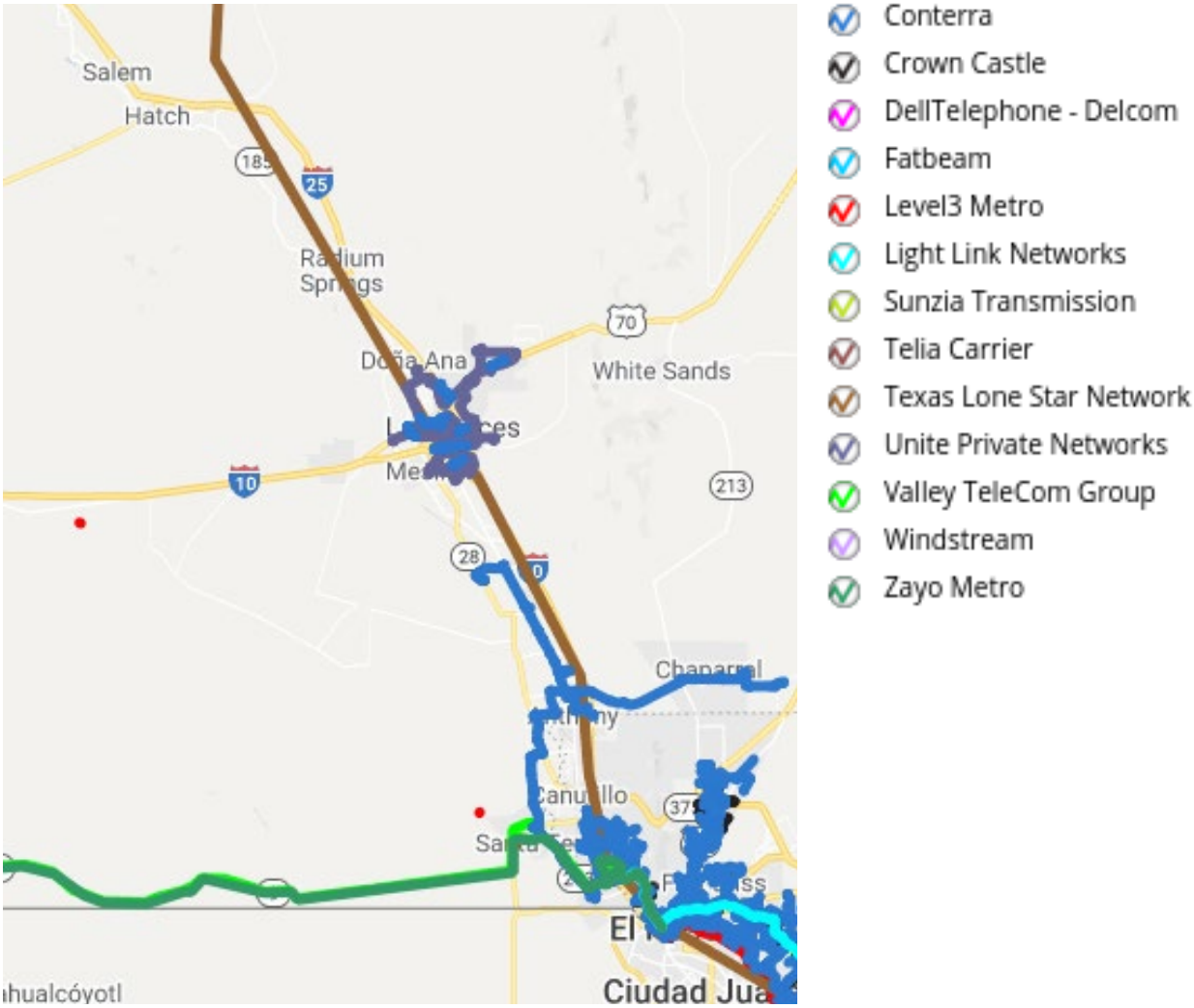

Figure 7. Metro Fiber Networks in the Doña Ana County Area

The middle-mile assets are more concentrated in the El Paso area. Unite Private Networks has extensive infrastructure in Las Cruces. Conterra has multiple short fiber segments in the Las Cruces area, primarily for interconnecting towers, along with extensive local network in El Paso that runs through Sunland Park, through Anthony, to Chaparral and Vado. Crown Castle has numerous towers in Las Cruces but no fiber, although it has long-haul and some middle-mile infrastructure in El Paso. The Texas Lone Star Network, a consortium of 41 independent rural telecom companies, has a fiber route through and point-of-presence in both Las Cruces and El Paso. Zayo and Valley TeleCom appear to share middle-mile fiber along State Route 9, through Santa Teresa and Sunland Park and into El Paso.

5. Broadband Market Analysis

Traditional cable and telephone companies generally do not share locations of their local network infrastructure. These assets are used for either customized "enterprise" services or standardized "mass market" services. Mass market services are typically divided between "business" and "residential" services. Therefore, we assess local assets in terms of providers' standard, mass market services, specifically broadband internet access.

For the purposes of this analysis, "broadband" is defined as minimum speeds currently specified by the Federal Communications Commission (FCC). The FCC defines "broadband" as a minimum of 25 megabits per second (Mbps) download speed, and 3 Mbps upload speed (or 25/3.) While still the "official" definition, it is generally not considered adequate. California and Washington have set 100/20 the new standard. Gigabit speeds (1 Gbps = 1,000 Mbps) are the gold standard for retail broadband. In practice, the public concept of broadband is defined by practical use.

Identical download and upload speeds are termed "symmetric". In most cases, download speeds far exceed upload speeds (i.e., "asymmetric"), and typically only download speeds are advertised. As businesses and consumers publish increasing amounts of data-rich web content (videos, photographs, and other social media), today's "slower" upload speeds will adversely affect the overall user experience; thus, demand for faster upload speeds and symmetric services will accelerate.

Three companies—Comcast (Xfinity), CenturyLink (Lumen), and Spectrum—offered retail broadband services in Doña Ana County, with limited areas served. We gathered information about offerings directly from the providers, via their websites and other means.[9] Residences in the zip codes examined for Las Cruces and Anthony appear to have the best coverage options, with available speeds of 100/10 from the telephone company or better from a cable company. Offerings to these areas are summarized in Tables 3 through 5[10] on the next page.

Monthly recurring cost (MRC) of service ranges from $50.00 (CenturyLink) to $74.99 (Spectrum Internet) for residential plans. The fastest residential offering was Spectrum Internet Gig 940/35 service, which costs $134.99 per month. The most expensive service was Comcast Business Internet Gig 940/35 service for businesses,

[9] This information does not necessarily mean current customers get these prices or services. Providers may not change existing contracts or simply not fulfill offers.

[10] As of October 2021. Current prices may vary. Offering does not necessarily mean a service is available at a particular location.

at $354.99 per month. The residential, retail median monthly recurring costs per Mbps for these offerings was $0.26.

Table 3. Comcast's Published Residential Internet Service Offerings in Las Cruces, NM

Package	Speed[11]	MRC[12]	MRC per Mbps[13]	Notes
Xfinity Connect	50/5	$60.00	$1.09	Discount available for 1st year
Xfinity Fast	300/10	$80.00	$0.26	Discount available for 1st year
Business Internet 35	35/5	$69.95	$1.75	2-year contract
Business Internet 100	100/15	$143.44	$1.25	2-year contract
Business Internet 200	200/20	$149.99	$0.68	2-year contract
Business Internet 300	300/30	$179.99	$0.55	2-year contract
Business Internet 600	600/35	$254.99	$0.40	2-year contract
Business Internet 1 Gig	940/35	$354.99	$0.36	2-year contract

The services that are available at specific locations can be quite different than what is generally advertised by the providers. We randomly selected ten (10) residential locations and ten (10) business locations to assess availability. Many residential areas outside of Las Cruces are served only by satellite providers or low speed DSL connections.

Table 4. Spectrum's Published Residential Internet Service Offerings in Anthony, NM

Package	Speed	MRC	MRC per Mbps	Notes
Spectrum Internet	200/10	$74.99	$0.36	Discount available for 1st year
Spectrum Internet Ultra	400/20	$94.99	$0.23	Discount available for 1st year
Spectrum Internet Gig	940/35	$134.99	$0.14	Discount available for 1st year

[11] Speeds are in megabits per second (Mbps) download over megabits per second upload. Cited in this section are those advertised by providers and should be considered maximum possible speeds. Actual speeds are likely to be lower.

[12] MRC is "monthly recurring cost." Cost presented here is at the time of our research (October 2021) and does not include any discounts.

[13] This metric is the MRC divided by the total aggregate throughput, downstream plus upstream.

Package	Speed	MRC	MRC per Mbps	Notes
Spectrum Business 200 Mbps Internet	200/10	$64.99	$0.31	
Spectrum Business 600 Mbps Internet	600/35	$114.99	$0.18	

Comcast serves areas in and around Las Cruces. Spectrum serves southern Doña Ana County, particularly Anthony, and the El Paso region. The two "cable companies" do not compete head-to-head, instead serving separate, non-overlapping areas. CenturyLink nominally services the entire area but has limited offerings and availability is practically limited.

Table 5. CenturyLink Published Broadband Offerings in Doña Ana County

Package	Speed	MRC	MRC per Mbps	Notes
CenturyLink Internet 40	40/3	$50.00	$1.16	Requires paperless billing & installation fee
CenturyLink Internet 100	100/10	$50.00	$0.45	Requires paperless billing & installation fee

While business class internet service was found to be available at some commercial addresses examined beyond Las Cruces, including addresses in La Mesa and Mesilla Park, it must be noted that provider reported business class internet was available to less than 50% of analyzed business locations, indicating that additional business development reliant upon broadband services may be limited.

6. Business Model

The critical considerations for selecting a model are shown in Figure 8 8. Generally, it seems that the competitive environment in Doña Ana County is limited to the big telecom duopoly common in most places. One telephone company—CenturyLink/Lumen—serves the County and only one of two cable companies—Comcast and Spectrum—serve most population centers. Community needs are substantial, many of them unmet, and growing. Costs are generally high and there are gaps in service availability scattered throughout the County although most acute in the colonias and rural areas.

Figure 8. Considerations for a broadband business model

While Doña Ana County has a capable IT staff, they do not have the capabilities needed to operate a broadband enterprise. At the same time, the County has substantial operational requirements many of which are only minimally met by current connectivity. It is clear from stakeholder input that the County is not in this boat alone; many other organizations in the County have unmet connectivity requirements. Everyone has the general requirement for increased digital inclusion for economic development, education, healthcare, and improved quality of life, particularly for disadvantaged areas and people.

The County has committed substantial financial resources from the American Rescue Plan Act (ARPA) for broadband and economic resilience. The state is administering more of these funds, some of which will be allocated to network infrastructure. More funding has been allocated to broadband in the Infrastructure Investment and Jobs Act. There are also huge amounts of private capital pouring into broadband. Funding is not the issue it has been in the past but additional capacity is required to apply for and manage these funds.

Risk aversity of key decision makers is a critical consideration in broadband not so much for the infrastructure itself—deployed fiber generally has strong long-term value as a real asset. Instead, risk comes from uncertainty about trade-off with other infrastructure and programs that need investment and about who will use the broadband infrastructure in the short term. The County will certainly reduce its recurring costs for connectivity as soon as its deployed. It will eliminate cost and

infrastructure barriers to new network-dependent applications or services, but that's a relatively ill-defined, future benefit.

If multiple private companies and other institutions literally buy into the network, a broadband enterprise could generate short-term capital investment and revenue, depending on how the business is structured. A broadband enterprise could generate revenue from services, too. As illustrated in Figure 9, the amount of investment involved increases with service offerings. The risk of buy-in depends on exactly where the infrastructure is deployed but also the level of effort put into selling physical connections and services. The County has relatively little capacity and doesn't have the culture for marketing and operating a broadband network.

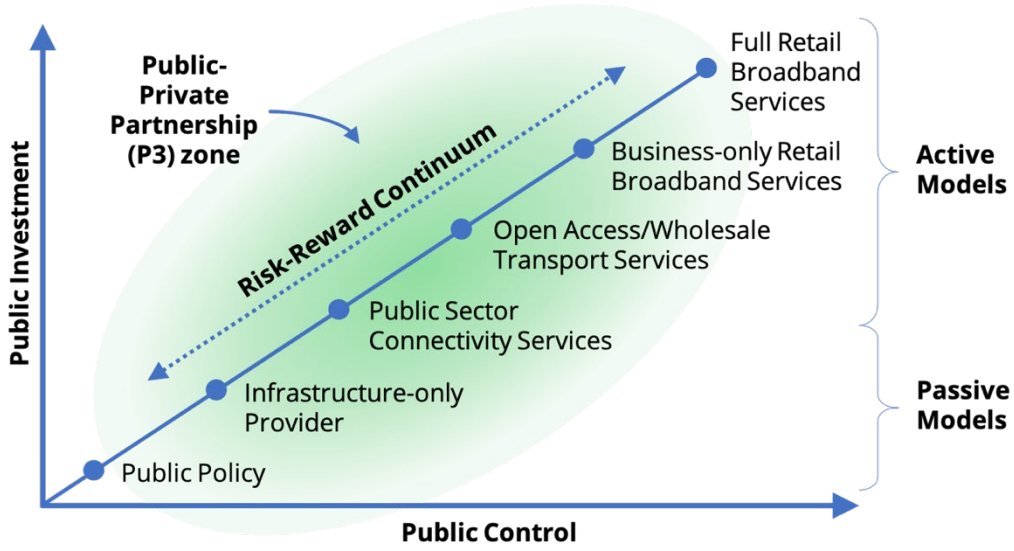

Figure 9. Broadband business models compared

Given the considerations above, the business model Magellan Advisors recommends (illustrated in Figure 10) involves the County investing in and owning critical local network infrastructure. Whether this would be only "middle-mile" backbone or distribution and access infrastructure should be based on public priorities. Ideally, the City of Las Cruces and other cities and local institutions would co-invest with the County. An independent public corporation—an authority, district, or similar—may be established to manage and market the infrastructure as an integrated system. Additional data gathering and analysis—as well as decisions about priorities by public officials—will be necessary to more narrowly focus any such efforts.

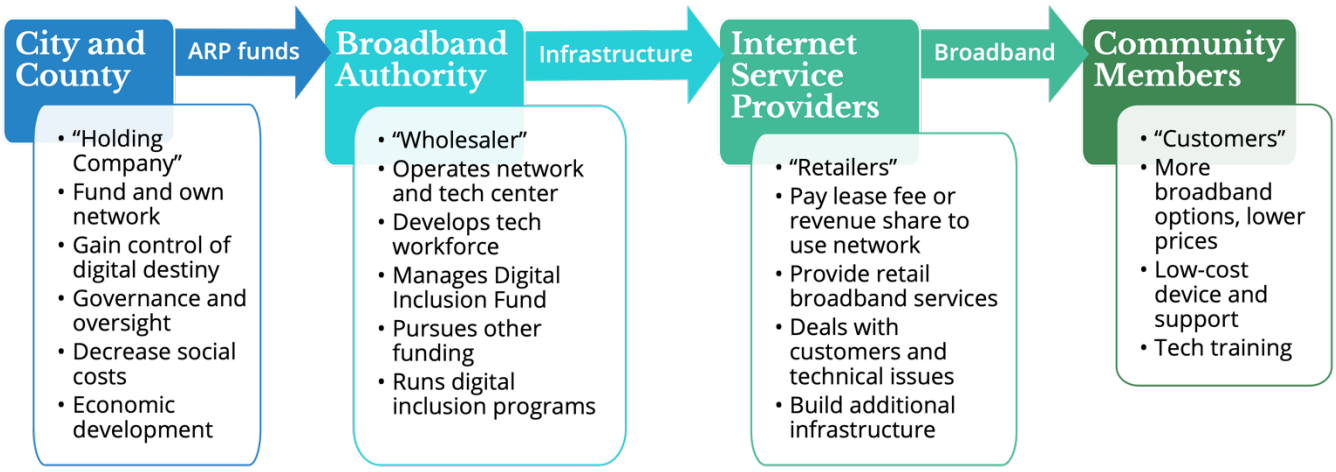

Figure 10. The Doña Ana Digital Inclusion Business Model

Private network service providers and major institutions would be customers for this enterprise, which we will refer to as the Doña Ana Broadband Authority (DABA). The authority would be responsible for capitalizing on the infrastructure to achieve public priorities and directly benefit taxpayers. DABA would provide redundant, high-capacity connections for local government and utility sites, backhaul and feeder capacity for private ISPs, and public Wi-Fi.

We recommend the Authority focus investment toward Colonias[14] and other areas with low- to moderate-income families, illustrated in Figure 1. Health and social service non-profits locations and small businesses areas are also appropriate target areas. Generally, DABA can focus on backbone infrastructure through and to these areas, along with programs to increase technology adoption.

DABA would not provide retail broadband services or manage consumers accounts. Private ISPs would provide customer connections, customer premise equipment, technical support to fix problems, and operational systems. The ISPs will have the opportunity to invest in additional infrastructure to extend their services, particularly more affluent areas that are outside the focus of this plan. Portions of the Authority's operations, particularly network maintenance and repairs, may be outsourced to an ISP or other party.

[14] The Colonias have been the topic of extensive planning. See https://www.vivadonaana.org/colonia.php for more information about these areas.

IMPLEMENTING THE MODEL

We recommend that the Broadband Authority be incubated inside an existing non-profit with members of the Doña Ana Broadband Committee as interim board members. This allows the initiative to launch very quickly with adequate capacity and a solid organizational foundation for long-term success. The incubating organization would ideally have a regional scope and a track record of managing locally focused projects. The regional scope enables the Authority to mobilize more resources and make the initiative more attractive to customers (ISPs) and partners. Experience with local projects ensures full accountability to the County. Initial opinion of the County's legal counsel indicates such an approach is viable and commensurate with state legislation but may require deed restrictions.[15]

A strong board ensures the Broadband Authority has lean operations with minimal overhead. Excess revenue generated by the network goes into a Digital Inclusion Fund, controlled by the Broadband Authority with oversight from its board and County officials. We recommend the fund be focused on ensuring digital inclusion: subsidizing connections for low-income families with elderly and school age members, providing devices for digitally disadvantaged persons, and assisting small business with digital transformation and workforce reskilling. This not only empowers people to participate in the digital economy, but also drives demand and increases ability to pay for broadband services.

Table 6. Division of Responsibilities between Broadband Authority and Retail Providers

Broadband Authority

- County WAN connections
- Digital Inclusion Fund and Programs
- Facilities and Data Center
- Feeder and Distribution Network
- Fiber drops to customer premises

Internet Services Provider through RFQ

- Billing and Provisioning
- Customer Premises Equipment
- Customer Service
- Network Operations
- Sales and Marketing

Responsibilities that might be Outsourced through RFP

- Construction Management
- Engineering Design
- Fiber Maintenance
- Access Network(s)

The conceptional network design ensures under-served areas will have access to true broadband directly via fiber or via radio access network with a high-capacity fiber backbone. The infrastructure will connect residences, institutions, and businesses to

[15] Input provided via email on July 12, 2022. Magellan Broadband, LLC, does not provide legal counsel. All tactics should be thoroughly reviewed by counsel prior to implementation.

the internet via ISPs that pay a fee for use of the network as outlined in the financial models. A retail ISP could assist with digital inclusion, do network maintenance and operations, or play other roles. A request for proposals (RFP) for these services should be issued along for a request for qualifications (RFQ) to use the network for retail broadband. Table 6 identifies how the responsibilities are divided.

OPERATIONAL REQUIREMENTS

A key characteristic of the infrastructure-only wholesale business model is relatively low overhead and operating costs. Payroll can account for 90% or more of on-going costs for a broadband enterprise. Equipment licenses, maintenance, refresh, and upgrades create recurring costs and large periodic costs. Management and marketing are much less for wholesale. Limiting operations to underground backbone also greatly reduces on-going costs.

Management and Marketing

Doña Ana County should plan to add a broadband director on day one. The director will need a part-time marketing manager by the end of year one. The director should have some experience with or knowledge of broadband and fiber but must have a strong understanding of facilities leasing and maintenance. The director will be responsible for overall organizational performance, focused on finances and governance.

The marketing manager would be responsible for identifying and managing lessees, so this person should know the community well and have basic knowledge of the broadband industry. The marketing manager may also work with wholesale customers to promote their internet services to the community. Doña Ana County should budget for marketing and other professional services as appropriate. We use $20,000 per year as an estimate for events, materials, and services, including research, social media, and web presence.

Table 7. Management and Marketing Staff

Position Title	Initial Fully Loaded Cost	Full-Time Equivalent Employees Year 1	Year 2	Year 3	Year 4+
Broadband Director	$249,000	1.0	1.0	1.0	1.0
Marketing Manager	$161,468	-	0.5	1.0	1.0

Operations and Maintenance

A network infrastructure manager should be hired on day one. This individual will be responsible for any customer adds, changes, or moves to the backbone. The Broadband Authority must purchase a fiber management system and should have a maintenance fund to cover repair costs. Costs for software vary greatly so we recommend budgeting approximately $75,000 for one-time costs with annual fees of 15%. Major maintenance or repair tasks—anything requiring excavation—may be contracted out or may be handled by Public Works. For the purpose of this analysis, we assume the County funds maintenance and repairs in lieu of network service charges or lease payments. Just to be conservative, we assume the Authority will need a dedicated full-time network engineer by year four.

Table 8. Operations and Maintenance Staffing

Position Title	Initial Fully Loaded Cost	Full-Time Equivalent Employees Year 1	Year 2	Year 3	Year 4+
Network Manager	$166,638	1.0	1.0	1.0	1.0
Network Engineer	$114,923	-	0.5	0.5	1.0
Maintenance Tech	$83,319	0.5	1	2	3

Other operating costs, beyond salaries, include facilities leases and maintenance. As discussed below, various equipment and systems are required for lit services, which generates additional operating costs. The Broadband Authority should budget approximately $450,000 to $500,000 per year for operating expenses.

7. Conceptual Network Design

A conceptual design is a means to estimate network costs and revenue potential for budgetary purposes as basis for strategic planning. It is a means of determining what would be required *in concept*, including infrastructure, to provide a set of services. The scope of this conceptual design is community anchor and County sites as well as under-served areas. Data for this design came from the State of New Mexico, as described in Introduction section (page 7, above). The question becomes who should pay for, operate, and maintain this infrastructure.

Doña Ana County will not provide retail broadband as a matter of policy. Therefore, its business options are to either lease dark fiber or operate an open access "wholesale" network. A dark fiber approach involves simply leasing out a real asset—strands of fiber-optic cable. Open access involves additional equipment, lighting the network, and providing wholesale services. Neither involves access infrastructure for retail broadband, which would also require major investments in equipment, facilities, and staff for operations and maintenance.

Some entity will need to build access infrastructure for underserved areas for any shared, public infrastructure to support digital inclusion. It is important for Doña Ana County leadership to understand the scale of investment required, even though they will not make it. Any public infrastructure should be considered as a catalyst for private investment, so capital expense of access infrastructure can be seen as a target. Magellan Advisors analyzed three options for the Broadband Authority to develop broadband network infrastructure to digitally include all of Doña Ana County:

1. Aerial fiber and radio access network for under-served areas
2. Underground fiber and radio access network for under-served areas
3. Aerial fiber and radio access network for all areas

The analysis involved creating a conceptual design for all three options. We used gigabit passive optical network (GPON) architecture, capable of connections up to 40 Gbps, for this design, with distribution nodes (GPON points of presence or PoPs), distribution fiber based on numbers of retail customer premises, and optional Active Ethernet for major users. The GPON was overlaid by a Citizens Broadband Radio Service (CBRS) radio access network (RAN) with 14 cell sites, five of which would be on new towers.[16] Both networks incorporate a 288-strand backbone. Figure 11 on page 42 illustrates the coverage and general location of the Doña Ana Broadband

[16] Cost estimates do not include land acquisition.

Network assets used to analyze the options. Costs for the design were estimated with Magellan Advisors' proprietary financial modeling systems using vendor-specified prices for materials and prevailing local wages for labor.

Under the wholesale, infrastructure-only business model, network service providers and major enterprises or institutions, including the County itself, are the customers. The broadband authority develops, maintains, and manages backbone infrastructure. Distribution and access infrastructure are generally handled by the wholesale customer. Customers use the backbone for their core and feeder networks and possibly as distribution infrastructure. The network will handle numerous wholesale customers, especially if it is carefully managed: A conduit can be leased to a single customer or, on the other extreme, portions of a backbone cable could be leased to hundreds of customers.

The design allows the network to be extended by others—community institutions and retail internet service providers—as they use the Broadband Authority infrastructure as part of their stack(s). A large, multi-site enterprise for example, could lease fiber strands and attach its own equipment. Or a provider could build fiber or radio access infrastructure in particular areas or locations, interconnected via the backbone. Conceptually, customers pay to connect their assets via the Broadband Authority. Lit services would make this much easier and valuable to most prospective customers but would require capital and operating expenditures. In this design, the physical network and facilities can be securely shared among multiple customers/users, controlled by the Broadband Authority. Whether it lights and operates any portion of the infrastructure should be based on local public priorities.

NETWORK ARCHITECTURE

The Broadband Authority network will be designed as a backbone for passive optical (PON) and active Ethernet. The basic requirements are to interconnect distributed customer access equipment and commercial data centers and retail ISPs. Fiber should be deployed in a ring topology to minimize impact of an equipment failure or fiber cut. The basic architecture is interconnecting rings—like a length of chain—of high-capacity fiber cable in underground conduit with access points (hand holes, pull boxes, vaults) at regular intervals.

The routes follow major thoroughfares, as well as some secondary streets where appropriate to complete a ring. There are a few spurs to water plants and wireless tower infrastructure. The rings can be grouped into phases for financial and practical purposes. The routes are designed to connect as many County and community assets as practical with this architecture. Therefore, the conceptual network design

is very extensive and intended to generate maximum cost estimates for budgeting and planning purposes.

Fiber Backbone

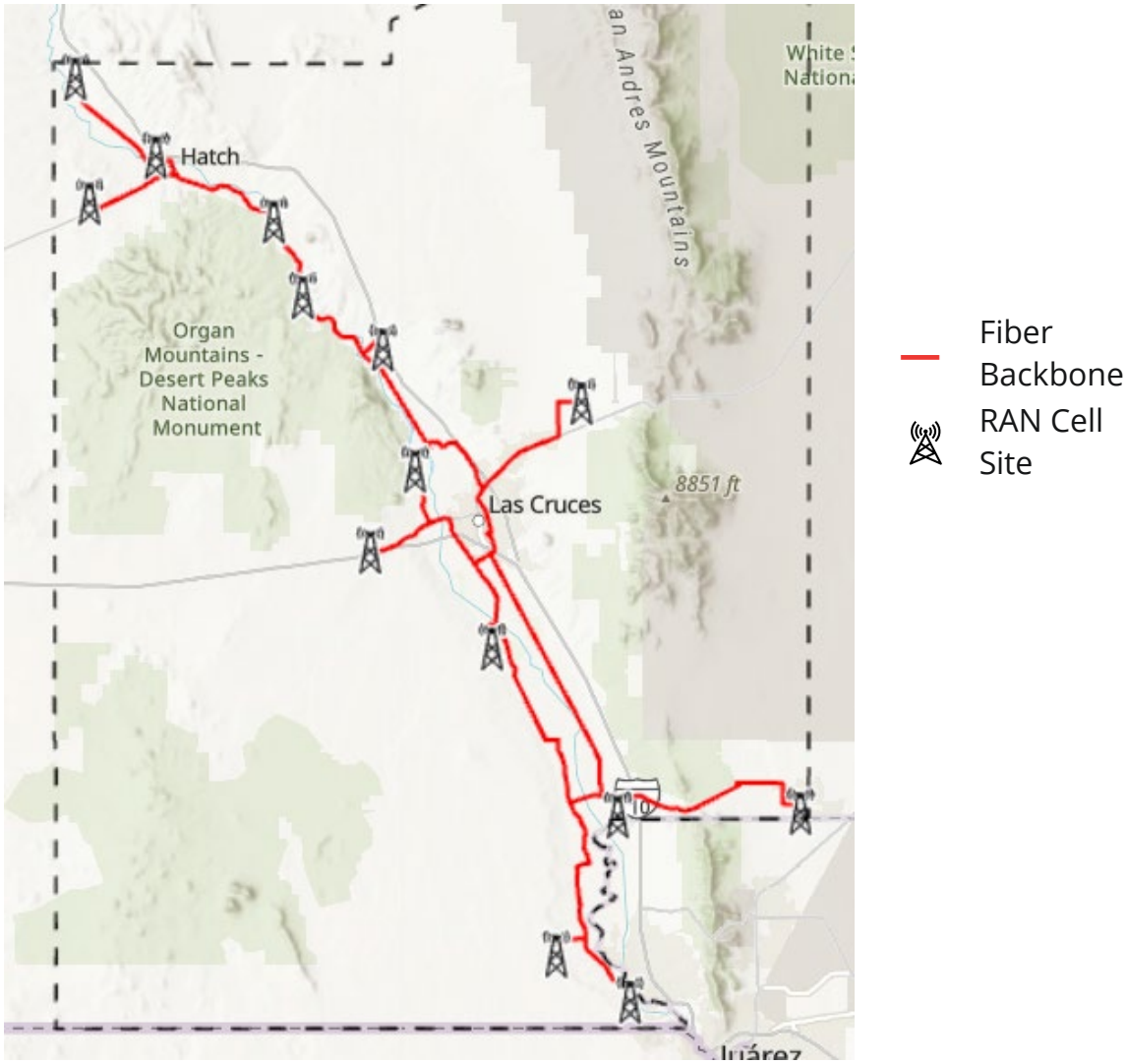

Figure 11. Doña Ana County Fiber Backbone Conceptual Design for Digital Inclusion, including Radio Access Network (RAN)[17] Cell Sites

The conceptual design requires "backbone" network infrastructure, illustrated in Figure 11, the purpose of which is to interconnect and support multiple other networks. Typically, broadband networks have a core network that forms a ring between a few key sites. Core sites contain the most powerful equipment to connect

[17] See "Radio Access Network model" subsection below for a full description and explanation.

the local network to the global network. They must be secure, with high reliability power, preferably centrally located. At least one, ideally two, sites must connect to high-capacity dedicated internet services, ideally via different providers with fiber following separate routes, for bulk IP.

Magellan Advisors recommends high strand-count (e.g., 288-strand) fiber cable for the backbone entirely underground because this approach is the most conservative design in terms of costing and risk avoidance. It also tends to be more aesthetically acceptable. Underground has a higher initial cost to build but may be less costly to maintain (although this varies by specific method: bore versus trench versus direct bury/micro-trench). The design includes two separate conduits ducts with shared access points (hand holes). We provide cost estimates for two 2-inch conduits; 4-inch conduits would cost substantially more as they cannot be installed by boring or plowing and must be trenched.

The backbone infrastructure can also be used to directly serve or enable services to customers. There are 29,060 locations within 2,500 feet of the backbone illustrated above. Most of these would require additional distribution infrastructure, as described below, but over 3,000 sites are within 500-foot “drop distance” of the backbone, including 114 anchor institution sites and 268 commercial sites, as detailed in Table 9.

Table 9. Prospective customers sites within 500 feet of backbone by type

Type	Count
Anchor Sites	
Church	10
Government	21
School	9
Utility	74
Sub-Total	114
Commercial Sites	
Agricultural	51
Support Industry	185
Basic Industry	6
Telecommunications	26
Sub-Total	268
Residential sites	2,770
Grand Total All Sites	**3,152**

Fiber Distribution Infrastructure

The backbone will traverse the utility service area to connect distributed customer access equipment, or hubs. Feeder lines, which are also typically deployed in rings, connect the core sites to distribution hubs. Distribution lines are branches from the hubs and access lines drop off the distribution lines—hence the term "fiber drops"—into customer premises. Major sites can be directly connected to the core. These lines are referred to as "laterals" rather than feeders. Radio access networks (RANs) may also be used as broadband distribution infrastructure, with cell sites as hubs. The 288 strands of fiber in one cable of backbone infrastructure may be used for a feeder network and/or laterals, as well as core network. The particular use of specific fiber strands is a matter of how they are spliced together and where they terminate.

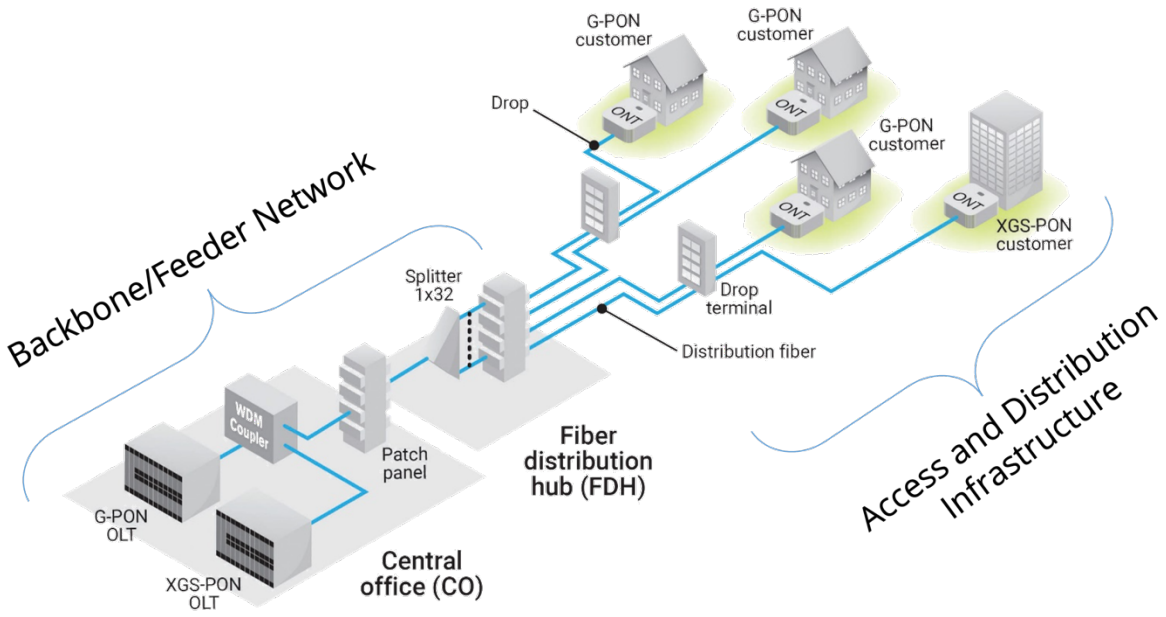

Figure 12. Passive Optical Network Structure Divided Between Backbone/Feeder Network for Wholesale and Access and Distribution Infrastructure for Retail

Under wholesale business models, the wholesale customer may own the distribution infrastructure, as shown in Figure 12. This includes deploying points of presence (POPs) throughout the service area at backbone hubs. The backbone network provides redundant feeder fiber connections to hubs. ISP POPs require powered cabinets, prefabricated shelters, or existing structures with sufficient space for equipment racks and other components. The conceptual network is designed to connect to retail ISPs at one or more locations across its service area and to accommodate internet connectivity via diverse routes to multiple upstream service providers for fault protection.

The County may provide some access infrastructure for lit services and internal purposes. The backbone routes cover many County assets and other systems, including traffic, surveillance cameras, Supervisory Control And Data Acquisition (SCADA), and Advanced Metering Infrastructure (AMI), saving operating costs and supporting increased functionality and operational benefits. The conceptual design accommodates connections to such assets and provides a basis for estimating costs to physically connect them to the backbone. See the Financial Analysis section, below, for a discussion of these components and estimated costs.

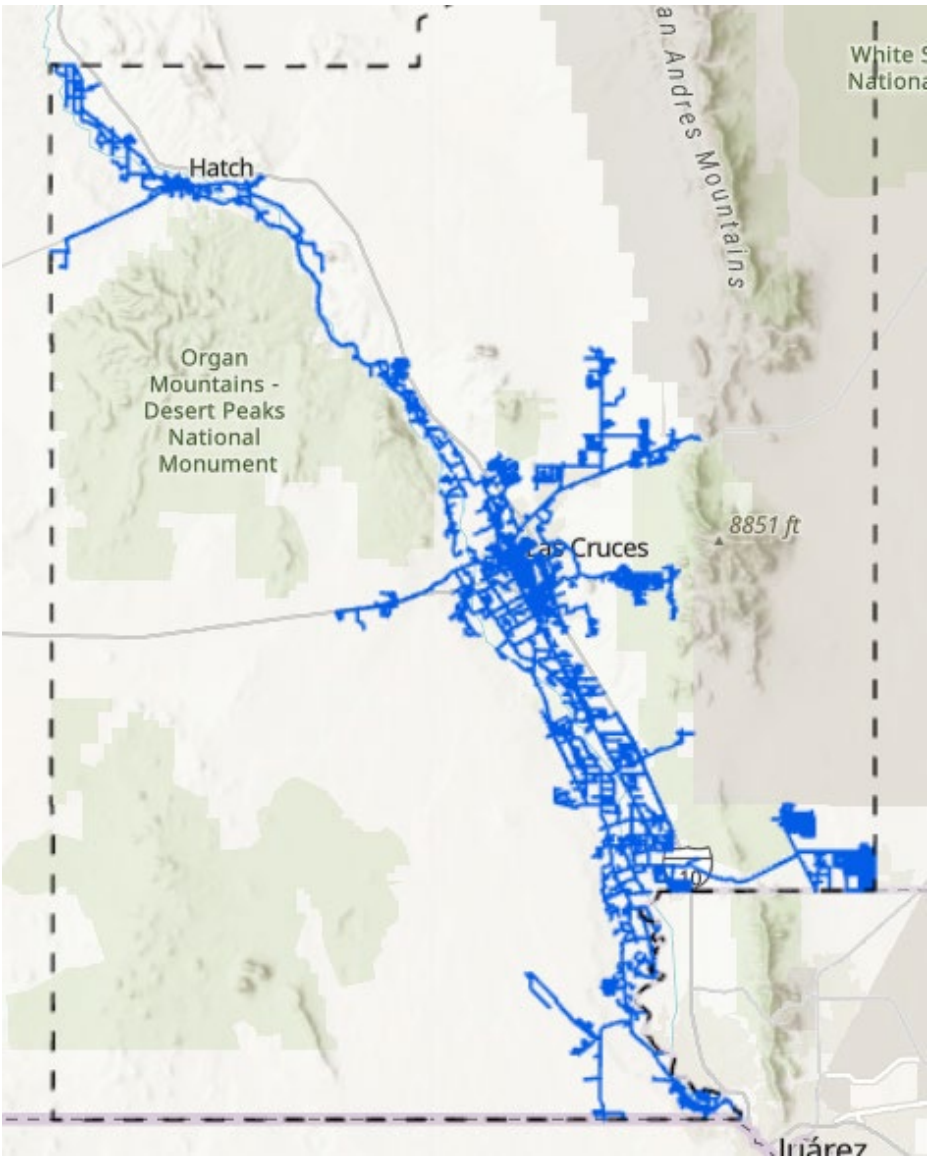

Figure 13. Doña Ana Fiber-to-the-Home Broadband Network Conceptual Design for Full Digital Inclusion

Feeder fiber extends from the POPs to neighborhoods and business districts, connecting OLT ports to passive splitters located in outdoor cabinet enclosures called fiber distribution hubs (FDHs), placed strategically throughout the service area. Splitters may also be located within the access POP itself. In areas where aerial fiber deployment may be used, FDHs may be placed aerially or transitioned from the aerial pole to a ground mounted FDH. Distribution fibers are sized based on the demand forecast and sizing of each enclosure to ensure that each service area is well equipped for both PON and Active Ethernet services. These details are set in the high-level design and engineering processes.

Distribution fiber, illustrated in Figure 12 on page 44 extends from the splitters in the FDHs to network access points (NAPs) which provide access to the individual fibers required for customer connections. NAPs may be attached to aerial strand, located in ground level pedestals or placed in underground vaults or hand holes located near the sidewalk or curb in residential neighborhoods or business districts. Fiber distribution to NAPs will be sized based on the service area density to provide service to between 8-12 premises per NAP.

Fiber Service Drops

Fiber drops connect from each NAP to the customer premise equipment that delivers broadband service. At the customer premise, the drop cable terminates in a protective "clamshell" enclosure attached to a home or building for storage of slack and connection to the home equipment. Drop fiber may be installed aerially or underground, typically for a flat fee. Providers may charge additional drop costs for special circumstances such as burying fiber through difficult landscapes or under driveways.

Network Equipment

The network equipment required to deliver broadband services to customers is comprised of several functional groups and multiple components within each group. Each functional group and a brief overview of how it is used to deliver service to the end customer follows below. Retail ISPs may operate a mix of access network consisting of both PON and Active Ethernet services. The diagram below demonstrates the functional components of the network and how customers connect to the network to receive services.

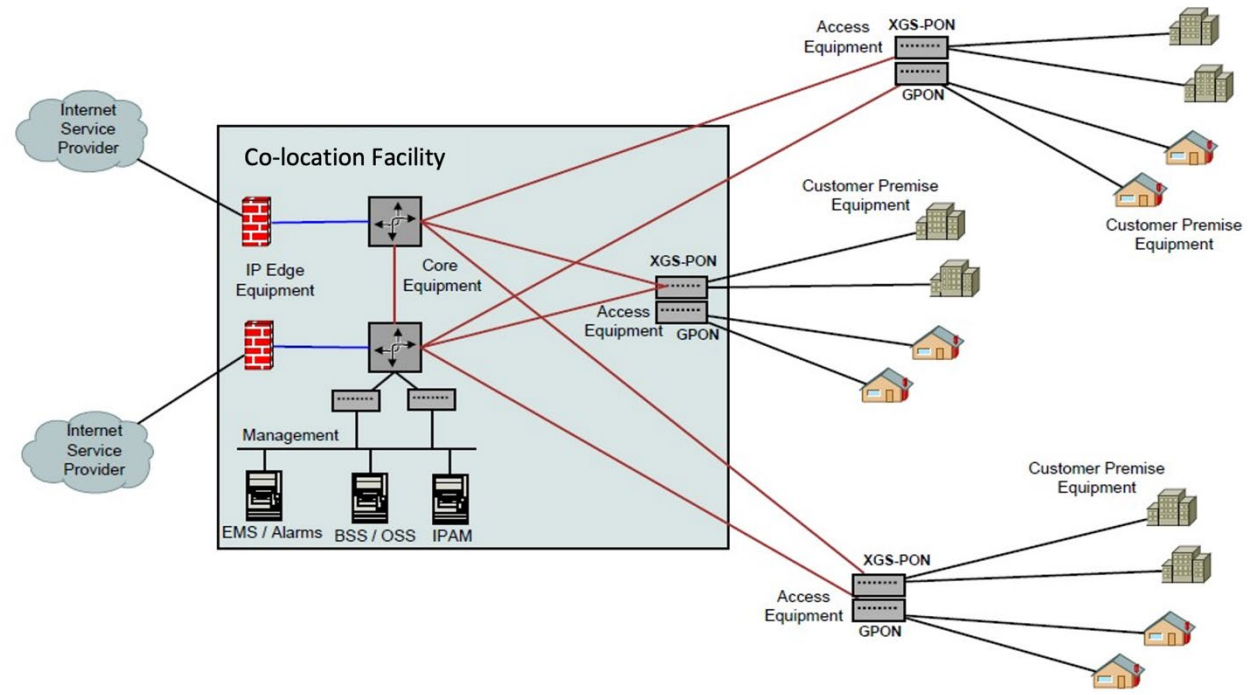

Figure 14. Passive Optical Network Broadband Model

Core Equipment

The core equipment aggregates traffic from all access equipment, connecting customers and routing their data to and from the IP edge equipment or other end-point destinations. Standard network protocols provide link redundancy and dynamic traffic re-routing in the event of an equipment failure or fiber cut. Core equipment can easily support thousands of customers and hundreds of gigabits of traffic throughput at deployment and will accommodate future system growth through the addition of service modules, optical interfaces, and/or software licenses. Figure 12 shows the key components and how they are integrated into a broadband system.

Optical Network Terminal

An Optical Network Unit (ONU), sometimes called an Optical Network Terminal (ONT), serves as the demarcation point between the retail ISP's fiber network and the router or firewall connecting to the customer's local area network (LAN). There are two general methods for installing ONTs. The first method involves mounting an outdoor rated ONT on an exterior wall of the structure and extending service wiring inside the premise. The second method involves extending the fiber into the premise and installing an indoor-rated ONU inside.

In either case, the ONT is typically installed somewhere near the fiber entrance and an AC power source. The ONT terminates the fiber based PON signals and provides customer access to their services through traditional copper interfaces. XGS-PON ONTs supporting greater than 1 Gbps data service may also support optical small form-factor pluggable (SFP) interfaces for connection to enterprise-class LAN equipment.

Internet Protocol Edge (IP Edge) Equipment

Separate from the core switches, the Broadband Authority should maintain an "internet perimeter." The internet perimeter will include internet routers and internet firewalls to be used to manage routing throughout the network. Firewalls will be utilized to protect critical back-office systems, including provisioning, network management, data storage, and other information. The Authority's two core switches will be interconnected to two internet routers providing redundancy for internet services in the event of a single interface or equipment failure. As mentioned above, the Authority should acquire bulk IP from at least two providers using diverse paths, one of which should be a Tier 1 provider.

Wireless Access Infrastructure

While the Broadband Authority would not deploy or operate radio access network or other wireless infrastructure under the model in this plan, it is important to consider this infrastructure in the design to accommodate cellular and fixed wireless ISPs and capitalize on the Broadband Authority's assets.

Wireless broadband can operate as mobile or fixed service. Although cellular connections can approach broadband speeds, mobile wireless broadband is still in its infancy, as discussed below. Fixed wireless can be used to connect remote locations or sparsely populated areas (see Figure 15 on page 50), where DSL or cable service would not be economically feasible, via long-range directional microwave antennas. As discussed below, most of these connections are built on proprietary technologies, although they generally extend Wi-Fi and similar standards.

Coverage and speed are an intrinsic trade-off for wireless technologies. The farther a signal travels, the less information it can carry. High frequency signals, which have inherently high capacity, travel shorter distances than lower frequency signals (at the same power level). Lower frequency signals cover terrain and penetrate physical objects more effectively than high frequency signals. Spectrum in the lower frequency ranges offer better non-line-of-sight solutions, whereas the higher spectrum ranges need a more line-of-sight solution. Line-of-sight requires the

transmitting antenna to be able to "see" the receiving antenna with limited trees and buildings in the way to be effective.

Terrain, then, plays an important role in the network design. Radio signals do not get over mountains or hills very well, nor does certain spectrum do very well in penetrating through buildings, foliage, or water, including rain and snow. The farther away the transmitter and the receiver are from each other, the less bandwidth is available. Transmitter sites need a means of connecting to the network, whether via fiber or microwave, to another site where it then transitions to a wireline fiber network. Fiber can be costly to install in remote locations. Electrical power, security and access are also considerations when locating appropriate tower sites. A propagation analysis to determine appropriate tower locations for Doña Ana's specific terrain would be part of a wireless high-level design to be conducted in the future.

Cellular Mobile Wireless

Mobile wireless connections operate from antennas on towers that create wireless cells across a geographic area. Connectivity is maintained as devices move from wireless cell to wireless cell. The base of each tower site is connected to other tower sites and the internet, optimally via fiber-optic cables. Today, 4G transmits data at around 12/5 Mbps.[18] With each new generation, more wireless applications become possible as more data can be carried across the airwaves.

5G networks operate multiple frequencies using millimeter wavelengths to offer anticipated download/upload speeds of 1 Gbps. The networks are designed to provide increased efficiencies while decreasing latency and to improve the performance of connected devices that define the Internet of Things (IoT), including autonomous vehicles, healthcare monitoring technologies, ultra-high-definition video, virtual reality, and many more applications ripe for development.

With limits in ROI and physics, the reality of 5G as the all-encompassing gigabit solution is beginning to fade. A mature 5G network will take time and continued investment by carriers. The information is speculative on when larger, national cities will begin to see 5G deployments, but if the investments in current infrastructure are any indicator, then areas like Doña Ana should expect a long wait.

[18] Several providers have announced they will discontinue 3G services in 2022.

Fixed Wireless

Fixed wireless services allow consumers to access the internet from a fixed point while stationary, and typically require an external antenna with direct line-of-sight between the distant wireless transmitter and the customer building-mounted receiver. Speeds are generally comparable to DSL and cable modem. These services have been offered using both licensed spectrum and unlicensed devices. To deliver a fixed wireless solution, providers need to consider:

- Available and appropriate spectrum – not all spectrum is created equal
- Tower locations and siting
- Terrain and other sources of interference
- Backhaul options
- Bandwidth requirements

Fixed wireless can be deployed as point-to-point (PtP) or point-to-multipoint (PtMP). PtP involves a one-to-one relationship between antennas at different locations. It is typically used for interconnecting sites, such as a headquarters or main buildings to a remote facility. Internet service providers typically use this approach for connecting to customer locations where they do not have wired infrastructure.

End-users typically use it as a backup or secondary connection or for non-critical sites because the connections have less capacity than fiber and are susceptible to environmental degradation from foliage, weather, and other factors. PtMP involves multiple users' antennas connecting to a single, central base station. The number of users can be into the hundreds of users. This model and infrastructure are very similar to cellular but with much more bandwidth and without the mobility.

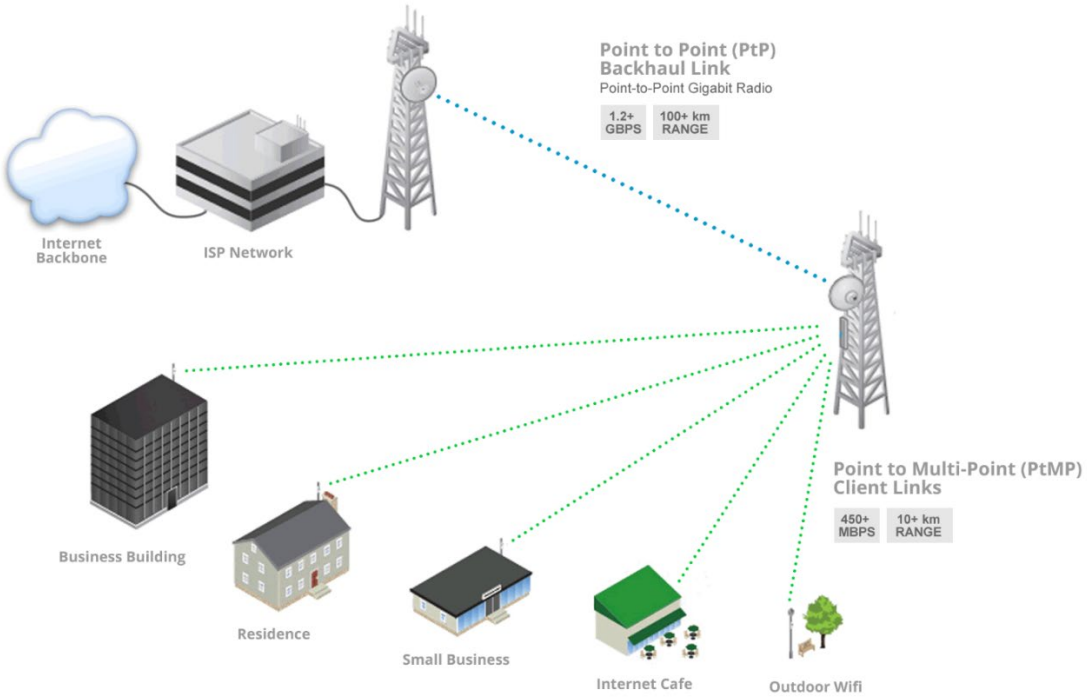

Figure 15. How Wireless Networks Connect Communities

As illustrated in Figure 15 above, PtP and PtMP are complementary technologies. PtP can be used to interconnect PtMP base stations as well as for remote sites (although fiber is preferable due to its capacity and reliability). The networks require Line of Sight (LOS) or near Line of Sight (nLOS) to operate. The systems utilize proprietary protocols and specialized devices to achieve the long ranges and high throughputs. Different vendors' products may not interoperate with each other.

Citizens' Broadband Radio Service (CBRS)

The FCC set aside the 3550-3700 MHz (3.5 GHz) spectrum in 2015 under a new, shared spectrum approach. There are three tiers of CBRS users, diagrammed in Figure 16. Current, incumbent, tier 1 spectrum users, which include US military, fixed satellite stations, and, for a limited time, wireless internet services providers (WISPs) are protected from interference by other users. Ten Priority Access Licenses (PAL) for 10 MHz channels between 3550 and 3650 MHz in each County were auctioned off by the FCC in July 2020. These licensees are protected from interference by other users but may not interfere with incumbent users. A licensee may aggregate up to four (4) PALs. Any portion of the spectrum may be used without a license for General Authorized Access (GAA), but this may not interfere with incumbent or PAL users.

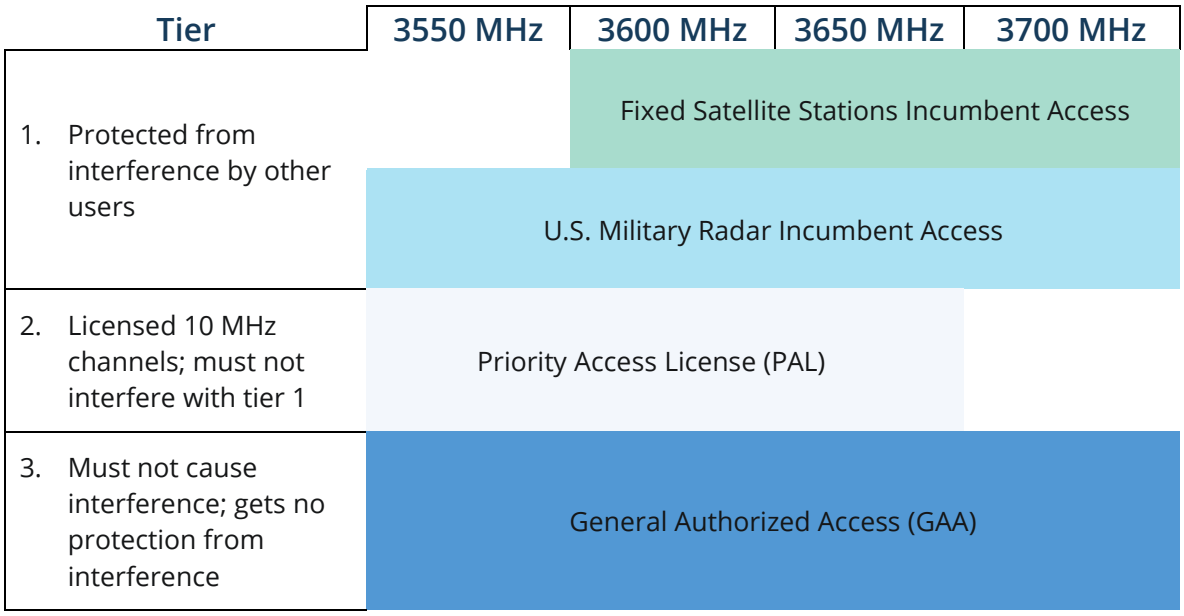

Figure 16. CBRS User Tiers

CBRS uses will be managed by a Spectrum Access System (SAS) with which all Citizen Broadband Service Device (CBSD) base stations must be registered. There are two classes of CBSD. Class A base stations, which can transmit at 1 watt of power are meant for smaller-scale indoor, enterprise, or campus use. Class B base stations can transmit at 50 watts giving them much greater range. Strategically placed radio signal sensors will ensure that uses do not interfere with each other, particularly military radar.

Another important characteristic of CBRS is the Long-Term Evolution (LTE) protocol commonly used with the spectrum. LTE is also used for 4G cellular data service, so it is widely implemented in user equipment. CBRS involves different spectrum, but some smartphones have antennas that operate in the CBRS bands. It is reasonably easy and economical to add CBRS/LTE to devices without changing their operating characteristics or systems. Therefore, there are few barriers to end user adoption.

The combination of CBRS/LTE in base stations and user equipment is a radio access network (RAN). A RAN has a network core (an Evolved Packet Core or EPC) that authenticates and authorizes user equipment and manages connections to multiple base stations. This allows for mobile roaming from base station to base station without loss of connectivity and makes RANs very secure. The downside of a CBRS/LTE RAN is that some entity must operate EPC and the SAS. These are relatively inexpensive services that can be purchased from vendors or run on private servers.

Low-Power Wide Area Networks (LPWAN)

Although not broadband, LPWAN technology should be considered in any network infrastructure plan. It is generally used to connect many small devices over a large geographic area. Water meter reading is a prime example of an LPWAN application. These are message-based networks, meaning end devices send small packets of information to an LPWAN gateway that then sends the data via a wired network to a monitoring or tracking software. Real-time control of the devices is very limited but other, similar technologies exist that allow for remote control.

There are numerous standards for LPWAN with varying degrees of openness. The proprietary technologies were first to develop and currently have the largest installed bases. The open standards for LPWAN are still evolving. The major open standards are extensions of other standards, specifically 5G and Wi-Fi. The costs and flexibility of open standard based systems tend to be much better than proprietary technologies, although proprietary technologies may perform better in the short-term.

Wi-Fi

Wi-Fi, originally termed "Wireless Fidelity", is an open standard that was developed to connect computers to a local area network (LAN) via unlicensed radio spectrum (the same frequencies used for cordless phones, garage door openers, and other non-network wireless devices). Generally, Wi-Fi is a PtMP technology: Wi-Fi access points connect multiple devices within limited range, typically no more than 150 feet indoors and up to 1,500 feet outdoors. There are multiple standards or versions of Wi-Fi. Some can provide up to 1 Gbps of throughput. Other new Wi-Fi standards are intended to cover large areas with minimal power requirements.

Wi-Fi coverage and speed depends on multiple factors such as buildings, foliage, and other physical barriers, interference from other spectrum users, radio spectrum used, transmission power, type of antenna(s), and weather. New versions of the Wi-Fi protocol operate at greater distances and/or speeds. It can be deployed PtP to interconnect sites and is being adapted for LPWAN applications.

Wi-Fi access points are often integrated into routers that interconnect the Wi-Fi network (also called a service set identifier or "SSID") to other networks, including a broadband connection to the internet. This is typically referred to as a "hotspot" or Wi-Fi zone. Multiple access points can be interconnected to each other as well as a router to cover a larger area. A Wi-Fi network can even be extended over multiple otherwise independent routers via a centralized server to create "community" Wi-Fi. The latest version, Wi-Fi 6, improves these functions as well as expands the spectrum and increases speeds for Wi-Fi connections.

Today, many organizations use Wi-Fi to provide wireless connectivity throughout a building or campus. Many cities and counties have deployed public Wi-Fi in zones that extend into parks, other public spaces, and even throughout the community. Wi-Fi hotspots are common at hotels, restaurants, and public buildings for public access, and are widely used in homes and businesses for private access. The conceptual network is designed to accommodate Wi-Fi as well as other wireless technologies but does not include them. While the Broadband authority could offer public Wi-Fi, we assume any such equipment would be provided separately by the County or other entity.

Radio Access Network model

To accommodate all the above forms of wireless connectivity, and thereby maximize the number, types, and value of wireless providers as customers, Magellan Advisors recommends Doña Ana County plan around the Radio Access Network (RAN) model, diagrammed in Figure 17 below. Under this model, the Broadband Authority would lease co-location facilities, fiber backbone, poles, towers, and other assets to private companies to deploy and operate RANs. The type of RAN depends on the equipment deployed. For this study we based cost estimates on CBRS gear from Telrad.

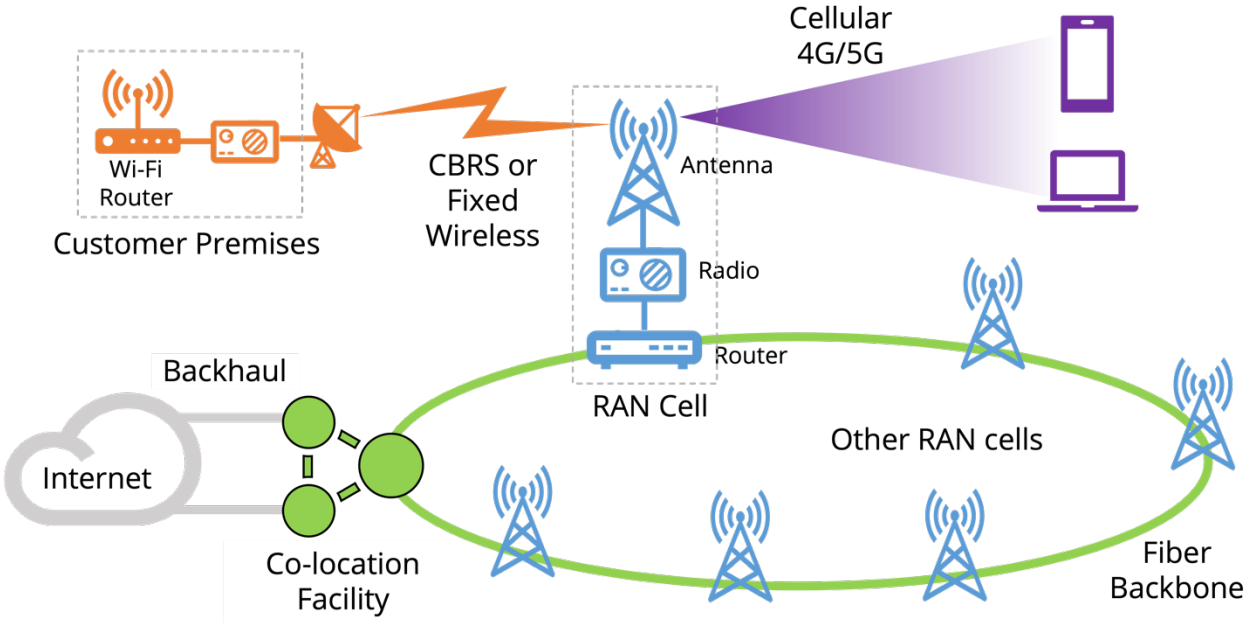

Figure 17. The Radio Access Network (RAN) Model

The key issue for the Broadband Authority is to develop County assets and facilities to accommodate RANs. The fiber backbone must route past poles and to towers. Poles will need to be assessed and possibly upgraded to support small cell infrastructure. Tower sites will need secure, multi-tenant huts for providers to deploy

their gear (these huts may also serve as fiber hubs, depending on the location). Providers may need the backbone to route to their central office and will definitely need interconnection to their regional/national networks.

RANs are much less costly that fiber networks. They are more flexible, too, but have much less capacity and lower reliability. Mounting facilities can be the largest cost for RAN because antennas need to be above the surrounding terrain. Aesthetics is also an important issue because, as boxes on poles and towers, cell sites are not particularly attractive. People want connectivity but may object to cells in their neighborhood. As listed below (with latitude and longitude) illustrated in Figure 18 on the next page, a RAN comprised of 14 cells, including nine existing towers and five new ones, would cover 97% of the underserved addresses (13,100 of 13,500) in the County.[19]

- Commercial, Chaparral (32.0086406, -106.3870384)
- Commercial, Hatch NM (32.684956, -107.1745651)
- Commercial, Hockett (32.6374358, -107.2557503)
- Commercial, Radium Springs (32.4871963, -106.8974058)
- Commercial, Santo Tomas (32.1785916, -106.7638311)
- Commercial, Sunland Park (31.8131025, -106.595375)
- Existing TWR, Microwave Drive (32.2784113, -106.9127708)
- New Site, Airport RD (31.8609735, -106.6854422)
- New Tower, Jamie Pl (32.361983, -106.8579517)
- New Tower, North Valley Dr (32.6186827, -107.0305892)
- New Tower, North Valley Road (32.5410068, -106.9952152)
- New, Garfield and EO55 (32.7654286, -107.272903)
- Private, Anthony (32.0050816, -106.6104014)
- Water Tank, 9250 El Centro Blvd (32.4320656, -106.654568)

Since RAN operators are among the Broadband Authority's prime customers, it should work to address cell site costs and issues and facilitate RAN development. Improving streetlight poles with fiber and working with TAFB to develop cell sites are two specific examples. The County may want to extend the network to reach all area cell sites.

[19] Cost and coverage estimates are based on Telrad CBRS equipment operating at 43 dBm EIRP using 20 MHz channels with 4x4 MIMO, -130 dBm minimum RSRP with a 6 dB noise figure, to 11.9 dBi antenna on the fixed wireless CPE at a 5 meter height.

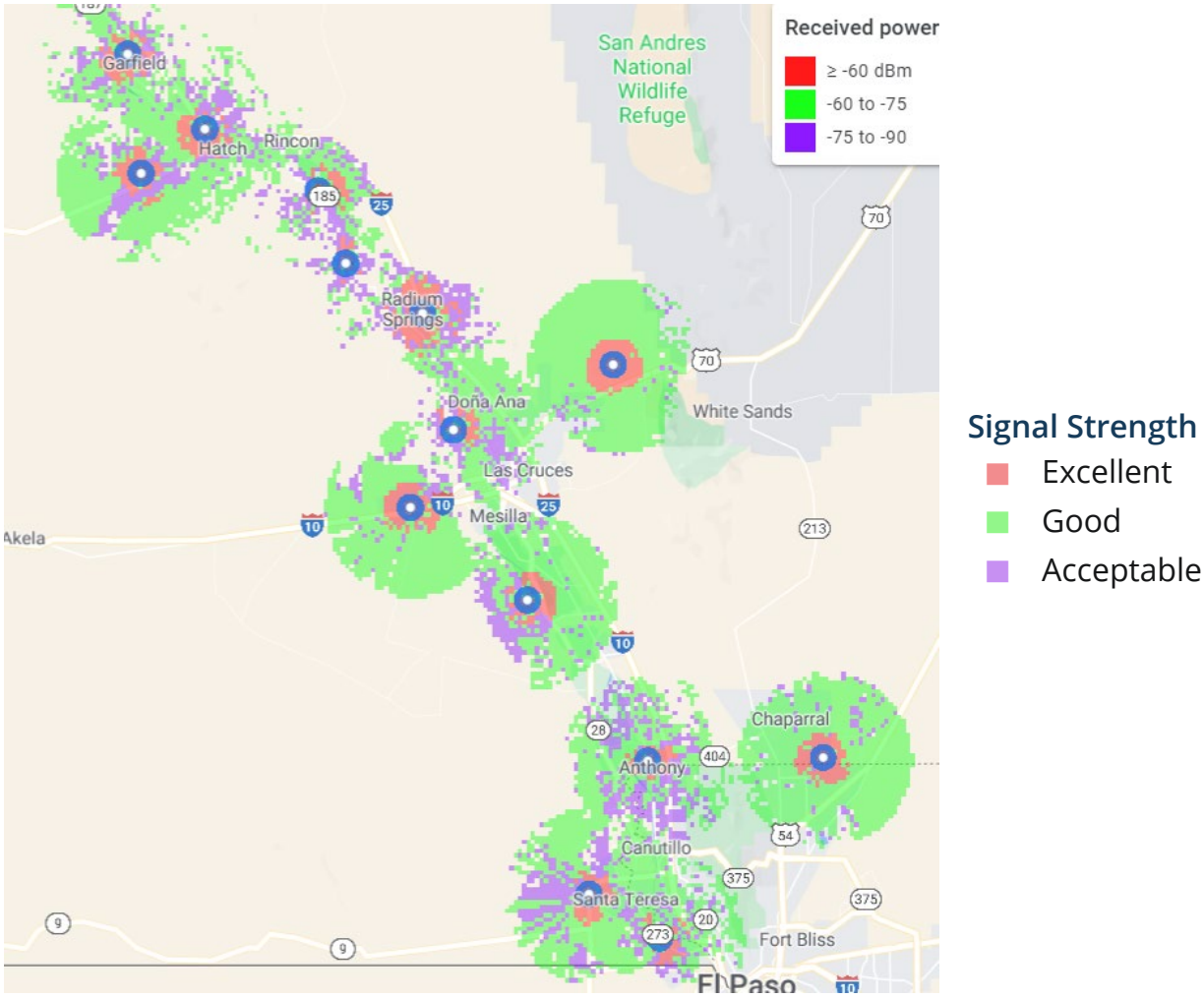

Figure 18. Doña Ana Wireless Broadband CBRS Radio Access Network Conceptual Design for Digital Inclusion

Co-Location Facility and Core Network

Modern, carrier-class networks are typically structured in a hierarchical manner, with a core network interconnecting a few key sites. Core network sites are key to operations and reliability as they feed major sites. The Authority will need a central office (CO), data center, or headend facility to provide an interconnection hub for retail ISPs. The CO will house core and edge equipment for ISPs serving customers within the area. Other carriers can be co-located in these sites so circuits and traffic can be connected and routed to the rest of the world.

Two of these sites, including the CO, should have dedicated internet access to different providers using separate network routes out of the area, ideally to both Albuquerque and El Paso. Equipment and facilities requirements are reasonably

modest, primarily separate, secure cages for providers and major network users to place equipment. This includes environmental controls and clean, reliable power. The Authority may add equipment to provide lit services, up to and including transport, edge processing, hosting, and other services, as appropriate. However, this functionality is beyond the scope of this design. Doña Ana County will need to identify prospective locations for a CO and co-location facilities.

8. Financial Analysis

As shown in Table 10, the primary differences between the three options from a coverage perspective are the fiber route miles and the estimated number of subscribers. All three options cover low-to-moderate income areas. Option 3 involves extending the fiber network into more affluent areas, which means ISPs using the network would be able to reach more prospective subscribers but also face more competition from incumbent cable and telephone companies. Figures in Table 10 are used as assumptions for cost and revenue estimates based on the conceptual design, labor, equipment, and materials.[20] Cost estimates do not include cost of money or real estate acquisition.

Table 10. Doña Ana Broadband Network Options Compared

Item	Option 1	Option 2	Option 3
Fiber backbone and distribution network	200 miles	200 miles	1,331 miles
County wireless towers backhaul	188 miles	188 miles	188 miles
Low-Moderate Income Households served	13,500	13,500	13,500
Total Households served	23,500	23,500	70,000
Retail price fiber connection 200/200	$65.00	$65.00	$65.00
Retail price wireless connection 100	$40.00	$40.00	$40.00
Expected take rate period	1-3 Years	1-3 Years	1-5 Years
Revenue share from ISP(s)	$7.00 per subscriber every month		
Annual Dark fiber revenue from ISP(s)	$350,000	$350,000	$750,000

COSTS

The estimated upfront capital costs, shown in Table 11, for Option 2 are higher than Option 1 because it involves underground construction, which is more costly per mile but much more secure and has a much lower operating cost. Option 3 is also aerial and is expanded beyond the 500' buffer.

In contrast, the estimated operating costs of Option 2 are lower because it does not involve pole attachment fees and underground maintenance is less costly. While Option 3 does not involve underground construction, the size of that network drives up the capital costs.

[20] As of March 2022.

Table 11. Doña Ana Broadband Network Option Costs Compared

Item	Option 1	Option 2	Option 3
One-time Capital Costs			
Cost of Fiber Network	$13.6M	$39.0M	$52.0M
Cost of Wireless Network	$1.6M	$1.6M	$1.6M
Total Network Cost	**$15.2M**	**$40.6M**	**$53.6M**
Annual Operating Costs	**Aerial**	**Underground**	**Aerial**
Annual Pole Attachment Fees	$102,000	$10,000	$520,000
Annual Network Maintenance	$65,000	$20,000	$133,000
Annual Internal Operations	$225,000	$175,000	$625,000
Annual Tower Lease Fees	$90,000	$90,000	$90,000
Annual Utilities	$30,000	$30,000	$30,000
Reserves and Contingencies	$100,000	$100,000	$400,000
Total Annual Operating Cost	**$612K**	**$425K**	**$1.8M**

ESTIMATED REVENUE AND SAVINGS

Doña Ana County paid a total of $17,811.31 per month for site connectivity at the time of this study, not counting cable internet or cellular. As summarized in Table 12, about $2K goes to bulk IP. The County had nine dedicated lines connecting its sites, including its primary data center, which cost a total of nearly $12K. These are symmetrical and provided an average aggregate throughput of 146 Mbps. They typically have quality of service guarantees. The average cost per Mbps per month for the dedicated lines was $9. Twenty-five sites had digital subscriber lines, which use twisted pair copper telephone wire. These connections cost a total of $4K per month and averaged 10.27 Mbps download and 1.36 Mbps up. The average cost per Mbps per month was $30.35. The County pays approximately $214K per year for connectivity.

Table 12. Doña Ana County estimated recurring connectivity costs

Service	Monthly
Internet	$1,902.93
Dedicated lines (9)	$11,885.01
Total WAN costs	$13,787.94
DSL lines (25)	$4,023.37
Total network costs	$17,811.31
Annual Recurring Cost	**$213,735.72**

The assumed take rate for all services and in all areas is 40%. Results are 5,400 of underserved clients connected to wireless at $40.00 per month revenue and 4,500 clients connected to fiber at $65.00 per month. ISPs would pay a Dark Fiber lease fee of $350,000 annually and $7.00 per month revenue spilt for connected customer per month, or an estimated $1.3M per year. Doña Ana County itself will realize savings of at least $214K annually. Revenue to the Digital Inclusion Fund, including savings on the County's current connectivity, would be highest for Option 3 in spite of higher operating costs.

Table 13. Doña Ana Broadband Network Options' Revenue and Savings Compared

Item	Option 1	Option 2	Option 3
ISP Annual Gross Revenue	$5.9M	$5.9M	$30.2M
ISP Annual Net Revenue (Partner Revenue)	$5.1M	$5.1M	$26.5M
Annual Dark Fiber Leases	$350,000	$350,000	$750,000
Total Annual Revenue	**$800K**	**$800K**	**$3.7M**
County Connectivity Annual Savings	214K	214K	214K
Total Annual Revenue and Savings	**$1.0M**	**$1.0M**	**$3.9M**
Total Annual Operating Cost	**($612M)**	**($425K)**	**($1.8M)**
Net Annual Digital Inclusion Fund	**$399K**	**$388K**	**$2.1M**

These are conservative estimates based on available data, Magellan Advisors' prior experience in similar markets, and results of the state's survey of the community. The take rate for cheap, fast broadband in under-served areas will be closer to 80%, especially without a competitive response from existing providers. We also believe the Authority will be able to generate more dark fiber lease revenue than estimated here, particularly as anti-donation issues are resolved. Bottom line results could be substantially higher with savings to cities and revenue from other anchor industries and institutions included.

FOCUS AREAS

Doña Ana County identified 16 focus areas for broadband development. Table 12 includes estimates of the amount of distribution infrastructure required for FTTH to under-served locations in these areas, along with cost and revenue estimates.

Table 12. Cost, Coverage, and Revenue Generation Estimates for Focus Areas for Overhead (OH) and Underground (UG) Infrastructure (not including backbone costs or operating expenses)

Area	Miles	Premises	Premises /Mile	Infrastructure Costs (millions) OH	Infrastructure Costs (millions) UG	Annual Revenue (40% TR)	Nominal Payback (years) OH	Nominal Payback (years) UG
Anthony	77	3,467	45.0	$4.62	$12.32	$1,081,704	45.0	4.3
Berino	14	696	49.7	$0.84	$2.24	$217,152	49.7	3.9
Border/Santa Teresa	14	222	15.9	$0.84	$2.24	$69,264	15.9	12.1
Butterfield/Organ	110	3,040	27.6	$6.60	$17.60	$948,480	27.6	7.0
Chamberino	27	670	24.8	$1.62	$4.32	$209,040	24.8	7.7
Chaparral	92	3,180	34.6	$5.52	$14.72	$992,160	34.6	5.6
Dona Ana/San Ysidro	185	7,158	38.7	$11.10	$29.60	$2,233,296	38.7	5.0
Garfield	1	68	68.0	$0.06	$0.16	$21,216	68.0	2.8
Hatch/Rodey	24	991	41.3	$1.44	$3.84	$309,192	41.3	4.7
La Mesa	11	358	32.5	$0.66	$1.76	$111,696	32.5	5.9
La Union	58	1,117	19.3	$3.48	$9.28	$348,504	19.3	10.0
Mesquite/San Miguel	189	6,748	35.7	$11.34	$30.24	$2,105,376	35.7	5.4
Radium Springs	37	875	23.6	$2.22	$5.92	$273,000	23.6	8.1
Rincon	8	177	22.1	$0.48	$1.28	$55,224	22.1	8.7
Salem	7	296	42.3	$0.42	$1.12	$92,352	42.3	4.5
Vado Del Cerro	19	1,019	53.6	$1.14	$3.04	$317,928	53.6	3.6

On average these areas have 34.5 premises per mile, well above the minimum considered required for viable broadband service. Based on approximate construction costs of $60K/mile for aerial fiber deployment and $160K/mile for underground, it would cost between $52.4M and $139.7M to serve these areas. The total is 872 route miles, although four areas—Mesquite/San Miguel, Butterfield/Organ, Dona Ana/San Ysidro, and Chaparral—account for two-thirds of the miles. These costs do not include backbone infrastructure, which would be necessary for all/any of these areas to connect.

Presuming these areas are not served by true broadband, it is reasonable to believe 80% of premises would pay $65/month for fiber-based service, generating about $18.8M per year in revenue. With these rates, aerial infrastructure costs—not including cost of backbone, financing, or operations—could be covered by cash flow in just over three years for aerial and about eight and a half years for underground. With 40% take rate revenue potential is about $9.4M annually and time to capital recovery is about 6.3 for overhead and 16.5 years for underground. The quickest return on investment would likely come from the more densely populated areas: Garfield, Vado Del Cerro, Berino, Anthony, Salem, and Hatch/Rodey. The Santa Teresa border area and La Union are least likely to see investment due to low density.

About the Options

Magellan Advisors developed these options from readily available data about the community. The designs did not incorporate capital improvement projects or current infrastructure assets that might be used to reduce deployment costs. Costs are based on market prices, prevailing local labor rates, and vendor-specified prices, including 15% contingency on construction costs. The prices for service offerings/speeds are relatively low. Take rates are ambitious but reasonable to include full drop and CPE costs. Therefore, these can be seen as financially conservative estimates.

THE BOTTOM LINE

Option 3 provides the best overall return on investment but requires the most investment and substantial capabilities. The County can make incremental, opportunistic investment in backbone infrastructure and recruit various partners to invest in “last mile” infrastructure and retail services. The dual challenges are to allocate resources, including staff capacity, to this endeavor and avoid conflict with

the anti-donation clause. As with the infrastructure itself, the optimal approach to partnerships is to build them in a focused, incremental manner.

Effective private investment recruitment not only requires management capabilities, it depends on the ability of stakeholders to aggregate their assets and demand. The anti-donation clause makes it critical for these factors to be carefully governed. At the same time, assets and customer demand are the factors that will attract private investment. Doña Ana County leadership has expressed scant interest in becoming a provider or even managing assets. Therefore, the possible roles for Doña Ana County are to:

a. Continue in a strictly coordinating role, possibly with stronger permitting requirements (e.g., "Dig Once").
b. Contract out development of County network infrastructure for wide-area network (WAN) connections, along routes in priority areas for digital inclusion, and require contractors deploy privately owned infrastructure.
c. Establish a separate public corporation (i.e., a "Broadband Authority") to coordinate public network investment for maximum benefits, including anchor institution (including the County, too) connectivity, digital inclusion, and private investments.

Addressing the State Constitution's "Anti-Donation" Clause

Magellan Advisors does not provide legal advice, but it is apparent that the "anti-donation" clause of New Mexico's constitution creates barriers to public-private partnerships. Article IX, Sec. 14 says that governments may not "directly or indirectly lend or pledge its credit or make any donation to or in aid of any person, association or public or private corporation or in aid of any private enterprise for the construction of any railroad …" with certain exemptions. This could mean public funds can't be used for broadband development or digital inclusion efforts by private for- and non-profit enterprises.

Doña Ana County should seek legal counsel to assess its options. One approach may be to include requirements for private firms constructing county fiber to offer broadband to unserved or underserved areas along the fiber routes. The County could even long-term capital lease (indefeasible rights of use or IRU) a few strands within a cable deployed by a private firm. A formal Dig Once policy could ensure privately owned conduit is placed in the ground along with other projects to be leased, purchased, or otherwise used by ISPs. Generally, the County can seek co-investors in capital projects rather than leasing fully county-owned assets. It may be

possible to establish a public authority that acts as co-investor to address public priorities without running afoul of this clause.

9. Funding Opportunities

The State of New Mexico has funding available from the ARPA, amounting to $133M for broadband and digital inclusion. The State allocated $70M from its general fund to plan, design, engineer, construct, purchase and equip broadband infrastructure statewide. $5M was allocated for grants to local governments, tribes, electric cooperatives and telephone cooperatives to support efforts develop broadband service in unserved areas. The Departments of Information Technology (DoIT) and Finance and Administration are developing criteria for distributing these funds.

$500K was set aside for the Broadband Office in DoIT and $100,000 for a broadband position in the governor's office. $10M was appropriated for emerging broadband technology projects under the Department of Economic Development. $25M of the public education reform fund was set aside to build statewide broadband infrastructure for public schools (see the discussion of the Public Facilities Development Fund work on the Statewide Education Network, above).

The State of New Mexico Department of Information Technology (NM DoIT) was awarded a U.S. Economic Development Administration (US EDA) CARES Act Recovery Assistance grant for the New Mexico Broadband Technical Assistance Program (NM TAP). NM TAP provides technical assistance to qualified government entities including tribal government, utility coops, companies, non-profits, and communities who are seeking to deploy or expand broadband infrastructure and/or services. It lays the groundwork for communities to build broadband infrastructure which will create jobs for the construction of the network(s).

FEDERAL FUNDING

The American Rescue Plan Act under the Final Rule Released by Treasury on January 5, 2022

On March 11, 2021, the American Rescue Plan Act (ARPA) was signed into law which provided $350B in direct federal funding to states, territories, tribal and local governments to address the social and economic challenges communities have faced in response to the COVID-19 public health emergency.

ARPA recognized the need for improved broadband infrastructure and faster speeds, especially to underserved households and businesses impacted by COVID-19. ARPA also made funds eligible for “government services” which include any service or program traditionally provided by a municipal government. This includes the

construction of roads, buildings, middle-mile and last-mile broadband networks, and other critical infrastructure and equipment to support the provision of public safety and other services, as well as health care delivery and educational services to households impacted by COVID-19.

The enactment of ARPA provides government agencies in Doña Ana County with a once in a lifetime opportunity to fully fund its broadband construction, planning, engineering, deployment and adoption goals over the next five years. Other funding sources funded under ARPA as well as the Consolidated Appropriations Act of 2020 (outlined further below) should also be leveraged to maximize funding resources that best meet the connectivity needs and eligibility requirements for County residential consumers and businesses.

Doña Ana County has allocated a portion of its ARPA funds for network infrastructure. Estimated allocations within Doña Ana County for ARPA include the following amounts for the County and City of Las Cruces:

- Doña Ana County: $42,381,821.00
- City of Las Cruces: $24,759,826.00

Smaller towns were likely also allocated funding, although the amount will vary based on population. The ARPA rules allow for project funds to be obligated no later than December 31, 2024 and finalized by December 31, 2026. This window provides recipients a five-year window to sufficiently build and deploy network infrastructure. The County may engage other local governments to explore the possibility of partnering on the use of ARPA funds.

ARPA Project Eligibility Criteria

The Treasury Departments Final Rule (FR) released on January 5, 2022, contains a non-exclusive list of eligible costs for funding in response to the pandemic as well as considerations for evaluating other potential uses of Fiscal Recovery Funds not explicitly listed.

The FR also provides maximum flexibility for recipients to use Fiscal Recovery Funds (FRF) for programs and/or services that are not identified on these non-exclusive lists but which meet the objectives of the statute by responding to the pandemic and its negative economic impacts.

The FR provides broad latitude to use these funds for the provision of “government services” which can include, but are not limited to, maintenance of infrastructure or pay-go spending for building new infrastructure, including roads; modernization of

cybersecurity, hardware, software, equipment, devices, the protection of critical infrastructure; and the provision of police, fire, and other public safety services.

ARPA funds under the "revenue loss" eligible use category can also be used as a match for non-federal match requirements for other federal grant programs other than those administered by NTIA.[21] In other words, Treasury provides authority to ARPA fund recipients or subrecipients to use these funds for non-federal match requirements from USDA, EDA, and other federal grant management agencies unless otherwise prohibited from that agency.[22]

Broadband Provisions in the U.S. Treasury's Final Rule (FR)

Treasury authorized the use of ARPA funds for eligible broadband projects that reliably deliver at least 100 Mbps down and 20 Mbps up in areas where it is impracticable due to geography, topography, or financial cost. Projects must also be designed to serve unserved or underserved households and businesses, defined as those that are not currently served by a wireline connection that reliably delivers at least 100 Mbps download and 20 Mbps upload speeds.

For broadband investments, recipients can also use their funds to support digital literacy training and other adoption programs that promote access to the Internet. Recipients may also use funds for modernization of cybersecurity, including hardware, software, and protection of critical infrastructure, as part of provision of government services up to the amount of revenue lost due to the public health emergency.

Funds may also be used for both last-mile and middle-mile projects so long as the middle-mile facilities provide connectivity to last-mile entrants.

The Final Rule does not specify a specific technology but encourages recipients to build networks that are "future proof," which indicates a proclivity towards fiber. The FR also provides recipients with significant discretion as to how they will assess whether the project itself has been designed to provide households and businesses with broadband services that meet, or even exceed, the speed thresholds.

It is important to note that ARPA funds cannot be used in areas funded by another federal or state grant or loan program. Any area funded by the FCC's Rural Digital Opportunities Program (RDOF) may not be eligible for funds under ARPA. We caution local and County governments like Doña Ana to carefully identify the specific areas it

[21] SLFRF-Final-Rule-Overview.pdf (treasury.gov)

[22] SLFRF-Final-Rule.pdf (treasury.gov) (Page 269-270)

wishes to build broadband network facilities to ensure it is in alignment with the Final Rule.

Key broadband provisions in the FR:

- Recipients (states, local and County governments) are encouraged to fund projects to serve locations without access to reliable wireline broadband with speeds of 100 Mbps down, 20 Mbps up and in areas with a specific identified need for broadband investment.
- *Recipients are permitted to define "need" in their community however they wish*. Examples of need could include:
    - Lack of access to a reliable high-speed broadband connection
    - Lack of affordable broadband and/or reliable service
- Projects that achieve last-mile connections with fiber are encouraged
- Funds may also be used to modernize cybersecurity for existing and new broadband infrastructure
- Projects funded and built by local governments, coops and/or nonprofits are encouraged
- Recipients using ARPA funds to build broadband networks must also:
    - Participate in the FCC's Affordable Connectivity Program (ACP)
    - Provide access to a broad-based affordability program to low-income consumers similar to ACP
    - Include at least one low-cost option without data caps at speeds to support households with multiple users to telework and engage in remote learning

Magellan urges Doña Ana County to work with local government agencies in Doña Ana County to leverage these provisions to construct a new fiber-optic network to support affordable broadband services to low-income and disadvantaged households and businesses, including last-mile connections to public housing and skilled nursing facilities as well as to schools, hospitals and libraries. Last-mile connections will focus on areas of immediate need such as opportunity zones and local businesses with significant revenue loss due to the pandemic.

Competitive grant programs funded outside of ARPA should also be considered, such as the Community Connect grant program administered by the U.S Department of Agriculture's (USDA) Rural Utilities Service (RUS) as well as the National Telecommunications and Information Administration (NTIA) Tribal Infrastructure grant program.

BROADBAND PROVISIONS IN THE INFRASTRUCTURE, INVESTMENT AND JOBS ACT OF 2021 (IIJA)

President Biden signed the Infrastructure Investment and Jobs Act (IIJA) into law November 15, 2021, which directs that NTIA will administer $42.5B to establish a new program called the Broadband Equity, Access, and Deployment (BEAD) program. This program will provide formula-based grants and technical assistance to states to develop broadband plans, and issue funds to subgrantees to construct and deploy infrastructure in unserved and underserved communities. Each state is designated to receive a minimum of $100M each.

The BEAD program requires states or its subgrantees to provide a 25% match for total project costs. Matching funds can be derived from ARPA allocations as well.

NTIA will also administer two new digital inclusion programs – the State Digital Equity Capacity Grant Program and the Digital Equity Competitive Grant Program which will issue $2.75B to build state capacity and award grants to promote the achievement of digital equity, support digital inclusion activities, support state efforts relating to the adoption of broadband by residents of those states, and make competitive grants directly to entities involved in advancing digital inclusion and digital equity.

NTIA will also administer a new Middle-Mile competitive grant program that will provide $1B to encourage the expansion and extension of middle-mile infrastructure to reduce the cost of connecting unserved and underserved areas to internet backbone networks. These grants will promote broadband connection resiliency through the creation of alternative network connection paths to prevent single points of failure on a broadband network.

We expect the final rules for these programs to be issued sometime towards the end of Q2, 2022 and application windows likely to open sometime in Q3, 2022. The BEAD program rules are also dependent on the completion of the FCC's revised Broadband Locations Map directed by the Broadband Data Act of 2021 and the Bipartisan Infrastructure Act[23]. As of the date of this report, the FCC has been delayed in revising its mapping layers due to pending litigation over its procurement of Cost Quest as the agency's vendor for this project. Therefore, the timing of the release of the BEAD grants may be delayed due to pending litigation at the FCC.

[23] BILLS-117hr3684enr.pdf (page 778)

$42.5 Billion BEAD Program Overview

According to the IIJA, BEAD program funding will be dispersed to states in three phases.

- The first phase allows states to access up to $5M each to support planning efforts, including building capacity in state broadband offices and to fund outreach and coordination activities with local communities and stakeholders.
- The second phase requires states to submit an initial broadband plan to NTIA. These plans must be informed by collaboration with local and regional entities and will lay out how each respective state and territory will use the BEAD funding and other funds to bring reliable, affordable, high-speed broadband to all residents.
- Once NTIA approves the initial plan, states can access additional funds from their BEAD allocation based on the number of unserved and underserved locations proportional to the national average. States and territories will be able to access the remaining funds upon review and approval of a final plan they must submit to NTIA. Each state will receive a minimum of $100M.

Service Area Definitions

Unserved areas are defined as having no access to a minimum of 25/3 Mbps service and underserved areas are those that have no access to a minimum of 100/20 Mbps service. States may distribute funds to subgrantees (local governments, non-profit or commercial entities). Grantees must also offer a low-cost service option, which will be defined by the states and then approved by NTIA.

All projects must achieve at least 100/20 Mbps speeds, serve the entire area, be completed within 4 years, and must not experience network outages that last, on average, 48 hours in a one-year period.

“Unserved Service Projects” are those for which at least 80% of proposed locations are unserved, while “Underserved Service Projects” are those for which at least 80% of proposed locations are either unserved or underserved.

Eligible uses for BEAD funds

- Creation of a new, or fund operations for, a statewide Broadband Office including staffing support, consultants and training
- Broadband data collection efforts for mapping
- Provide grants for new broadband deployment, with the following priorities:

  - Unserved service projects
  - Underserved service projects, once eligible entities certify that all unserved locations will have service provided
  - Connecting eligible community anchor institutions
- Develop preliminary budgets for pre-planning activities
- Publications, outreach, and communications support
- Technical assistance, including workshops and events
- Preferential rankings will be based on:
  - Deploying to persistent poverty counties or high-poverty areas
  - Speed of proposed broadband service
  - Expediency of proposed project plan
  - Demonstrated record of compliance with Federal labor and employment laws
  - Installation of Wi-Fi and internet infrastructure in multi-family dwellings that are unserved and in locations where the percentage of individuals with a household income is at or below 150 percent of the poverty line

Limits on eligible entity spending include a 5% expenditure limit on pre-deployment planning and 2% on administrative expenses.

BEAD Program Requirements for States

State grantees must submit a 5-year action plan that details the level of local, regional and municipal collaboration as well as their investment priorities and associated costs; alignment of planned spending with economic development, telehealth, and related connectivity efforts. States must also address local and regional needs for broadband connectivity supported by data analysis and how those needs could be met with partnerships with non-profits, local governments and/or cooperatives.

$1 Billion for Middle-Mile Broadband Projects

NTIA has also been directed under the IIJA to establish a new competitive grant program to support middle mile infrastructure projects in unserved and underserved areas. Competitive grant funds may be used for the construction, improvement, or acquisition of middle mile broadband infrastructure. Funding will be awarded on a technology-neutral and competitive basis. *The federal share cannot exceed 70 % of total project costs.*

Eligible entities include state, local or tribal governments, technology companies, utilities, cooperatives, public utility districts, commercial broadband or cooperative

providers, nonprofit, regional planning counsels, Native entity, or economic development authorities, or partnerships of such entities.

Program purpose is to encourage the expansion of middle mile infrastructure to reduce the cost of connecting unserved and underserved areas (lacking 25/3 Mbps or 100/20 Mbps) and to promote "broadband connection resiliency through the creation of alternative network connection paths."

Other Broadband Funding Opportunities in the IIJA

Broadband Deployment Locations Map for All Federal Programs Administered by the FCC

The IIJA also directs $10M to the FCC to create a map of the geographic footprint of all broadband infrastructure deployment projects funded by the federal government. The map must include the program title, type of broadband network, company name, project duration timeline, and upload and download speeds. The FCC must post the map on its website with periodic updates. This map will serve as the "centralized, authoritative source of federal funding for broadband infrastructure deployment."

The IIJA statute requires all broadband providers to provide the FCC with any information, in the format, type, or specification to augment the collection of data under the form 477 data collection program. It also authorizes the FCC to give providers 60 days (instead of 6 months) to file the new mapping data and resolve challenges within 90 days after receiving a response from the challenged provider.

The US Census must provide the FCC with housing unit data from the most recent census and the FCC must publish the broadband maps on the internet.

Changes to the Universal Service Fund (USF) Programs Under IIJA and ARPA

The FCC administers over $9B annually in federal subsidies to support broadband access to schools, hospitals, libraries, commercial and non-profit broadband providers as well as low-income consumers including those on federally recognized tribal lands. FCC subsidies are managed and administered by the Universal Service Administrative Company (USAC), which is the program administrator to the FCC. Below is an overview of the most relevant subsidy programs authorized under ARPA, IIJA and the Consolidated Appropriations Act of 2020.

Affordable Connectivity Program (ACP), $14.2 Billion Administered by the FCC

The IIJA created the Affordable Connectivity Program (ACP) which extends the framework of the Emergency Broadband Benefit Program (EBB) by making the monthly subsidy permanent to qualifying low-income households impacted by COVID-19. The newly established ACP benefit provides monthly subsidies to

qualifying households at $30 per month, down from $50 per month authorized under the EBB.

Monthly benefits to eligible households will continue to be distributed through participating mobile or fixed broadband providers who are reimbursed by USAC for the costs of providing discounted monthly service to eligible low-income customers.

Participating providers must establish they provide broadband services to participate in the ACP. Nontraditional providers like wireless Internet service providers, electric cooperatives and municipal governments are permitted to participate.

The ACP benefit applies to all broadband services offered by participating providers. The program prohibits participating providers from using credit checks as a condition of receiving the benefit.

Participating providers must notify existing customers and must publicly advertise the program in coordination with state agencies and non-profit groups. The program also establishes a dedicated complaint process for consumers and adopts rules that prevent "inappropriate" upselling or down-selling, extension of contracts, or restrictions on switching service offerings.

The IIJA expands program eligibility to those with incomes that are within 200% of the poverty level (up from 135%) and to all Women Infants and Children (WIC) program participants. Applicants must provide documentation that they participate or are eligible for any one of the following programs:[24]

- The National School Lunch (Free and Reduced price) or breakfast program
- Federal Pell grant program
- Supplemental Nutrition Assistance Program (SNAP),
- Supplemental Security Income (SSI),
- Medicaid, Federal Public Housing Assistance administered by the US Department of Housing and Urban Development (HUD).
- Veterans Pension and Survivors Program administered by the Veterans Affairs Administration

The ACP, like the EBB program, also provides reimbursement to participating service providers to supply an eligible household with a connected device (laptop, desktop or tablet) of not more than $100. Participating service providers may not seek reimbursement for more than one connected device per household.

[24] Affordable Connectivity Program | Federal Communications Commission (fcc.gov)

FCC's Emergency Connectivity Fund (ECF)

The ARPA authorized another new program within the FCC to provide over $7.17B to fund the costs of eligible equipment and services that can be provided to students, teachers, and library patrons who lack connected devices such as laptop or tablet computers and/or lack broadband access during the pandemic. Tribal libraries are eligible for support under the Library Services and Technology Act. Schools and libraries do not need to be current e-Rate participants.

The following types of equipment purchased for off-campus use by students, school staff, and library patrons who lack sufficient connectivity to engage in remote learning are:

- Laptop and tablet computers
- Wi-Fi hotspots
- Modems (including air cards)
- Routers
- Devices that combine a modem and router

Eligibility:

- Applicants can be reimbursed up to $400 for each laptop or tablet, and a maximum of $250 for Wi-Fi hotpots
- For other eligible equipment and services, the FCC and USAC will review costs to ensure they are reasonable
- Equipment and devices paid for under ARP are not reimbursable under ECF
- Connectivity funded under Emergency Broadband Benefit Program and a connected device through the Emergency Connectivity Fund Program are permissible

Key dates:

- Eligible schools, libraries, and consortia of eligible schools and libraries can submit requests for funding to purchase eligible equipment and services between July 1, 2021, and June 30, 2022.
- Interested schools and libraries can find more information and apply at emergencyconnectivityfund.org

RURAL UTILITIES SERVICE (RUS)

ReConnect Loan and Grant Program

Originally authorized in 2018 as a pilot program, the Rural Utilities Service (RUS) Loan and Grant program is the largest U.S. Department of Agriculture (USDA) funding source for broadband infrastructure in underserved rural and tribal areas lacking broadband service at a minimum speed of 100 Mbps download and 20 Mbps upload. The RUS has over $1.15B funding for broadband projects in FY 2022 under its third Funding Opportunity Announcement (FOA) which was published on October 25, 2021.

Applications under FOA 3 are due on February 22, 2022. Loan awards are made on a first come first serve basis. Grant and loan/grant awards will be issued starting in July/August 2022. The IIJA authorizes an additional $2B to the ReConnect program and will likely be made available under a fourth FOA which may not open until Q4, 2022 at the earliest.

ReConnect Eligibility:

Eligible projects must be located in communities with a population of 20,000 or less. Eligible entities for ReConnect funds include cooperatives, for profit entities, state and local governments or tribal nations (as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. § 450b)).

Speed Tier Eligibility:

- Projects must provide 100 Mbps symmetrical service to every premise in the proposed funded service area (PFSA).
- All premises in the PFSA must be able to receive this service at the same time at this speed.

Eligible service areas:

- Rural areas where at least 90% of the households in the PFSA lack sufficient access to broadband of at least 100/20. Applicants must submit evidence of the lack of sufficient broadband access.
- Applicants must identify all existing providers in the PFSA and indicate what level of service is being provided. If these areas are found to have sufficient service, the application will be rejected.
- Areas served by existing RUS borrowers who are without sufficient access to broadband (100/20).

- Areas receiving or designated to receive RDOF that are without sufficient access to 100/20.
- Applicants receiving or pending to receive federal broadband grants or loans for the PFSA, must explain how ReConnect funds will complement and not duplicate other federal funding sources.

Key priorities for applicants:

- Assisting rural communities to recover economically from the impacts of the COVID-19 pandemic, particularly disadvantaged communities.
- Ensuring all rural residents have equitable access to RD programs and benefits.
- Reducing climate pollution and increasing resilience to the impacts of climate change through economic support to rural communities.

Key programmatic requirements:

- Projects must be completely built out within 5 years from the date funds are first released.
- Projects must be technically feasible.
- All project costs can be fully funded or accounted for.

The following entities are eligible to apply:

- Corporations, limited liability companies and limited liability partnerships
- Cooperative or mutual organizations
- States or local governments or political subdivision, or US territory
- Indian tribes
- Individuals and legal general partnerships formed with individuals are not eligible
- One entity must take the lead on submitting an application. Intercompany agreements can be used to account for revenues and expenses on the applicant's financial projections.

ReConnect fund eligibility in RDOF funded areas:

- Service areas of existing RUS borrowers without sufficient access to broadband (100/20) are eligible. This includes areas receiving or under consideration for RDOF because RDOF funds both operational expenses and capital expenses, while ReConnect funds only capital expenses.
- Applicants seeking funds for RDOF funded areas must explain why RUS should provide additional funding and how the application may provide service to households faster, etc.

- ReConnect applicants who are under consideration for or who have received RDOF funding must submit a statement certifying that the ReConnect funds have not been and will not be reimbursed by RDOF. Funds can only be used for complementary purposes.
- If two applicants seeking ReConnect funds for the same area and score the same points, the applicant who is the RDOF awardee will receive preference over the non-RDOF applicant.

Award categories:

- **100% Loan at 2% interest rate with a 3-year payment deferral**. Applications will be processed and awarded on a rolling basis. Maximum loan amount: $50M
- **50% Loan/50% Grant Combination**: Loan rate is at the treasury rate of interest with a 3-year payment deferral. Applicants may offer cash for the loan component at the time of application; all funds must be deposited into the applicant's operating accounts at the closing of the award. Maximum loan/grant amounts are $25M for both. No match contribution is required.
- **100% Grant**: requires a 25% cash match contribution: Maximum award is $25M.
- **100% Grant for Tribal Governments and Socially Vulnerable Communities**: Maximum grant amount is $25M with no matching requirement; could qualify for funding requests up to $35M if they can demonstrate that the PFSA(s) is comprised of 100% locations within areas classified by the USDA Economic Research Service as FAR Level 4. A GIS layer of FAR Level 4 areas can be found at https://www.usda.gov/reconnect
- If at least 75% of the PFSA(s) consists of Socially Vulnerable Communities, no matching fund requirement and applicants may apply for grant funds to construct the broadband facilities.

Community Connect Grant Program

The Community Connect Grant program is a smaller and simpler version of the ReConnect program. Community Connect provides up to $3M in awards to eligible applicants to deploy either fixed or mobile broadband services throughout rural and underserved communities with a population size of 20,000 or less.

Eligible entities include federally recognized tribes, state or local governments, non-profit cooperatives and for-profit entities. Applicants must provide a matching contribution of 15% of the total award amount. Matching funds must be made in cash, which will be used to fund the operations of the project.

Eligible applicants must have the legal capacity to own and operate a broadband network. Under the FY 2021 FOA, eligible areas must be unserved with broadband at a speed of 10 Mbps download and 1Mbps upload however we expect this will change under this year's program.

Applicants are typically required to provide broadband service at speeds of at least 25 Mbps download and 3 Mbps upload that must also be made available to every residential and business customer in the proposed funded service area (PFSA) in the application. Funds can be used to support the construction, acquisition or leasing of facilities, spectrum, land or buildings used to deploy broadband services throughout the PFSA.

Awardees must provide free broadband service at the minimum broadband grant speed to all essential community facilities for two years. These facilities include public schools, fire stations, public libraries and other publicly held anchor institutions.

Distance Learning and Telemedicine (DLT) Grant program

The RUS Distance Learning Telemedicine (DLT) program provides 100% grant funding to rural communities and tribal areas with a population of 20,000 or less to provide distance learning and telehealth services. The maximum award is $1M, and the minimum is $50K. DLT only covers technology and equipment costs. It does not cover network deployment costs.

Allowable costs for eligible capital assets under DLT include:

- Broadband facilities
- Audio, video and interactive video equipment
- Terminal and data terminal equipment
- Computer hardware, network components and software
- Inside wiring and similar infrastructure that further DLT services
- Acquisition of instructional programming that is a capital asset
- Acquisition of technical assistance and instruction for using eligible equipment

The application window for this program will likely open in Q2, 2022 for a 60-day window. Awards will likely be announced in January 2023.

Community Facilities Loan and Grant program

This program is the most inclusive of all the USDA Rural Development funding sources and can support a wide variety of funding needs of a rural community including tribal nations located in rural areas with a population of 20,000 or less. The Community Facilities program (known as “CF”) funds any essential community facility for the development of that community.

Awardees are eligible for low interest loans, grants, or a combination of both depending on the project and funds available from the applicant. Funds are administered by the State RD office which receives an allocation for projects from the National Office in Washington, D.C.

Eligible entities include local, state or federally recognized tribal governments and funds can be used to purchase, construct and or improve any essential community facility including the purchase of equipment. Typical projects include the construction and inside wiring costs of a health clinic, school, community or childcare center.

It may also be used to fund public safety services such as fire departments, police stations, prisons, fire trucks, police vehicles, radios, towers, and other devices, fire trucks and public works vehicles. The Community Facilities program is open year-round.

Public Works and Economic Adjustment Grant Program

U.S. Department of Commerce, Economic Development Administration (EDA) Public Works program helps economically distressed communities revitalize, expand, and upgrade their physical infrastructure. It also enables communities to attract new industry; encourage business expansion; diversify local economies; and generate or retain long-term, private-sector jobs and investment through the acquisition or development of land and infrastructure improvements needed to expand industrial or commercial enterprises.

EDA Public Works program investments also help facilitate the transition of communities from being economically distressed to becoming competitive by developing key public infrastructure, such as technology-based facilities that utilize distance learning networks, smart rooms, and smart buildings; multi-tenant manufacturing and other facilities; business and industrial parks with fiber-optic cable; and telecommunications and development facilities.

In addition, EDA invests in traditional public works projects, including water and sewer systems improvements, industrial parks, business incubator facilities, skills-training facilities, and broadband networks. There are no population density criteria for EDA funds.

Eligibility Criteria:

- The project must align with at least one of EDA's current investment priorities listed on its website at www.eda.gov.

- The project must increase the capacity of the community or region to promote job creation and private investment in the regional economy. Job creation is a very high priority focus for EDA. Therefore, applicants must demonstrate how the project will create new or retain existing jobs.
- The likelihood that the project will achieve its projected outcomes.
- The ability of the applicant to successfully implement the project, including the applicant's financial and management capacity and its ability to secure the support of key public and private sector stakeholders.

Funding Availability:

Projects are scored and awarded on a rolling basis throughout the year. Grant awards range from $100K to $4M with matching requirements anywhere between 20% to 50% of the total project costs. Matching can either be made in cash or in kind depending on the project and financial status of the applicant. Applicants are encouraged to contact their regional EDA office first to discuss project scope and goals with EDA officials to determine feasibility.

ARPA authorized an additional $3B in supplemental appropriation funds for economic development projects including middle mile broadband network projects.

Key Steps to Get Started

To begin applying for federal or state funds applicants must obtain the following certifications.

- Data Universal Number System (DUNS) number which can be obtained by visiting What is a D-U-N-S Number? (dnb.com)
- System for Award Management (SAM) registration SAM.gov | Home
- Every federal funding application requires completion of an SF 424 SF-424 Family | GRANTS.GOV
- National Telecommunications and Information Administration (NTIA) programs will require registration for access to Grants.gov Home | GRANTS.GOV
- For United States Department of Agriculture Rural Development (USDA RD) programs, you must obtain a Level 2 E-Auth eAuthentication (usda.gov)
- Employer Identification Number (EIN), Tax Identification Number (TIN)

For Federal Communications Commission (FCC) programs, the following certifications are required and can be obtained on the FCC's website:

- Commission Registration System (CORES)

- FCC Registration Number (FRN)
- Service Provider Identification Number(s) (SPINs)
- Study Area Codes (SACs)

10. Conclusions

There are numerous gaps in broadband availability across Doña Ana County because private providers have chosen not to serve some areas. The County and other anchor institutions are also under-served and need better connectivity. Investments in network infrastructure can support digital inclusion for all residents of Doña Ana County and interconnect County and other community anchor sites. Multiple companies expressed interest in investing in better internet access for residents. At least one "grassroots" effort seeks to provide broadband for school students.

A publicly owned backbone routed to and through under-served areas—the airport area, the border crossing area, the colonias, etc.—could greatly reduce capital costs to provide broadband services. The backbone could reduce telecom costs for anchor institutions and enable retail broadband providers to reach more residents. Revenue from providers using the backbone could support digital inclusion. Building the backbone incrementally by integrating it with other projects, particularly roadway improvements, can greatly reduce costs. The County is already well-positioned with allocation of ARPA funds for network infrastructure partnership. IIJA funds and other funding options, including private equity and public debt financing, can be used to continue down this path.

The most feasible means to achieve these goals is a Broadband Authority that provides dark fiber leases and wholesale transport services via a county-wide backbone network, focusing on retail broadband providers as customers. Innovative partnerships or legislative relief will be necessary to address New Mexico's anti-donation law. Partnerships should be structured so private companies absorb most of the risk associated with closing broadband gaps, which is generally with access infrastructure. A special purpose public authority could accomplish this and eliminate any burden on local government. Close collaboration with various public agencies—including State of New Mexico DoIT, DoT, PSFA, and others in Texas, as well as local cities, non-profits, and school districts—is critical to minimize build costs and realize full benefits. Analysis and prioritization of specific areas to invest should be a general next step for Doña Ana County to get "shovel ready" for additional private and public investment.

RECOMMENDATIONS AND NEXT STEPS

Magellan Advisors generally recommends Option 2 for broadband development in Doña Ana County. Specifically, *development should focus on backbone infrastructure like that in the conceptual design for use by anchor institutions, including the County, and multiple private retail broadband providers*. The backbone should extend to all areas of the county, particularly the Colonias, and be routed to all County and community anchor sites. A Broadband Authority should be established to manage and market the network. The Authority may be incubated by a regional non-profit with members of the Doña Ana task force serving as interim board members. It should be carefully structured to avoid violating the state's anti-donation law.

1. Establish a fund for broadband development

A "seed" investment by the County and ideally, by the City as well is essential for kicking off development. Initial opinion of the County's legal counsel indicates such a tactic is viable but may involve oversight by the New Mexico Department of Finance and Administration.[25] The County has already committed American Rescue Plan funds for broadband and plans to acquire Infrastructure Investment and Jobs Act funds for similar investments. The investment will directly enable the community to recover from impacts of the pandemic, provide critical high-performance resilient network infrastructure, and generate dividends to increase digital inclusion for years to come. It is important to aggressively pursue state and federal funding in a coherent, comprehensive manner, so the fund may best be established and run by an independent, not-for-profit, public corporation or "broadband authority."

2. Formalize the business model and establish a Broadband Authority

The business model illustrated in Figure 8 must be formalized via a charter and formation of a non-profit, public corporation with finances, staff, etc. The objectives and metrics from step 3 should be incorporated into the Authority's charter to facilitate governance. The Authority must be carefully structured to avoid violating the state's anti-donation laws. This step was part of the Doña Ana Broadband Task Force recommendations and was being implemented at the regional level as Borderplex Connect[26] at the time of this report. It is also important to begin identifying prospective retail providers during this phase. It will also be necessary to

[25] Input provided via email on July 12, 2022. Magellan Broadband, LLC, does not provide legal counsel. All tactics should be thoroughly reviewed by counsel prior to implementation.

[26] Visit https://www.borderplexconnect.org/ for details on Borderplex Connect.

establish indefeasible rights of use (IRU), revenue sharing, and other roles and responsibilities via formal contracts. A sample IRU contract is attached to assist with this process.

3. Set objectives and metrics for digital inclusion impacts

It is critical for the Doña Ana Network to be governed to specific objectives, with clear, practical metrics for measuring performance. These include the number of subscribers, network performance, and financial performance but also impacts on people's lives. The best way to measure these impacts is via programs. For example, skill improvements can be best measured as part of a training program. Improved health and safety may be practically assessed in conjunction with a program to provide low-cost devices to community members. The objectives must be defined with input from community members and representatives of anchor institutions.

4. Determine development priorities and phasing

The network cannot be built overnight and must start somewhere. Specific geographic areas and sites need to be identified and prioritized for phasing purposes. Generally, Magellan Advisors recommends constructing the backbone first, deploying the CBRS RAN, then extending the GPON access infrastructure. Beyond that, given the digital inclusion goals, it may make sense to start with those areas with the greatest density of low-income families. Key stakeholders should establish a general approach that will inform design and development decisions in step 6.

The approach we recommend is to work with the state DoT, school districts, and other key stakeholders on the priorities and phases based on lack of connectivity and resources available to support broadband development. Private providers interests may also greatly impact phasing. Specifically, routes between Radium Springs through Doña Ana to Las Cruces and into Santa Theresa Airport and Business Park, are of interest to the County, may have value to other local, state, and federal agencies, and could attract private partners, too. Other decisions about the types of access, speed, focus areas, etc., should be made with active involvement of key stakeholders.

5. Identify specific assets that might be used to develop the network

This study identified key assets that might be incorporated into the network, but it was just an initial assessment. Capital improvement projects, particularly for transportation and utilities, can decrease network build costs. Several stakeholders

have horizontal and vertical assets that may be useful. Existing conduit, fiber cables, towers—several of which were part of the conceptual design in this plan—and utility poles are the primary assets to consider. Bike-walk paths, sewer and water lines, streetlights, and tall buildings may also be useful. New Mexico DoT has extensive easements and some fiber assets. All such assets should be evaluated for costs and viability.

6. Design and develop the network infrastructure

Network design involves getting very specific about network components and exactly how and where they are to be deployed in the public rights of way and on existing assets. Input of prospective retail providers should be considered for the design, balanced by the priorities established in step 1 and 2. The design must be value engineered to minimize costs while providing the utmost reliability. Development involves procuring materials, hiring and managing crews, and then inspecting and documenting the final product.

We also believe the Authority will be able to generate more dark fiber lease revenue from underground rather than aerial fiber. These numbers could be substantially higher if savings to the County and revenue from other anchor industries and institutions were included.

Appendix: Stakeholder Participants

Representatives of the following organizations participated in stakeholder input sessions for this study.

Community Development, Economic Development, Planning

- Borderplex Alliance
- Community Foundation of Southern NM
- FDIC
- Federal Reserve Bank of Dallas, El Paso Office
- Las Cruces Chamber of Commerce
- NM Public School Facilities Authority
- The Bridge of Southern NM

Emergency Services, First Responders, Public Safety

- Doña Ana Sheriff's Office
- Doña Ana Fire & Emergency Services
- MVRDA
- OEM

Education, Health and Social Services

- Digital El Paso
- Doña Ana Community College
- Doña Ana County
- Gadsden Public Schools
- Hatch Valley Public Schools
- Las Cruces Public Schools
- New Mexico State University
- Ngage NM
- Paso del Norte Community Foundation

Government Agencies

- City of Anthony
- City of Las Cruces
- City of Sunland Park
- Doña Ana County

- Office of U.S. Senator Ben Ray Lujan
- Office of U.S. Senator Martin Heinrich
- State of New Mexico Department of IT
- Town of Mesilla
- Village of Hatch

Public works, Transportation, Utilities

- Camino Real Regional Utility Authority
- Doña Ana County Utilities
- El Paso Electric

Network Service Providers

- Chaparral Cable
- Charter Communications
- Comcast
- Conterra Networks
- FastWave/MegaHertz
- Jack Rabbit Wireless
- Lumen (CenturyLink)
- Sacred Wind Communications
- WNM Communications