Request for Information

Title: Llano County Broadband Expansion Project for Middle Mile and Last Mile Services	**Response Due By: August 5th**

Project Overview:

Llano County completed a Phase I: Broadband Feasibility Study to evaluate existing broadband infrastructure, identify needs and gaps in service and develop a high-level design and implementation strategy to seek federal funds for broadband expansion. The County now moves into Phase II: Engineering and Implementation to work with providers and partners to determine the optimal network build and structure a public/private partnership (PPP) for implementation. The attached High-Level Design was developed as a part of the Broadband Feasibility Study, suggesting the necessary network infrastructure required, based on an understanding of the access and capacity needs, to establish high-speed broadband connectivity across the County.

The purpose of this RFI is to obtain input from broadband providers and asset owners on the ability to provide a network scope, design and deployment that ultimately provides adequate levels of high-speed broadband service to the residents of Llano County. The focus of this RFI is on the needs identified in Llano County; however, regional considerations are of high interest for overall connectivity and competitive advantage in a potential application. Respondents should identify regional capacity and considerations in their responses. The respondent(s) who are identified for potential PPP will receive a follow up request for further information in relation to federal funding opportunities currently available.

National Telecommunications and Information Administration (NTIA) Middle Mile Grant Program:

Funded by the Bipartisan Infrastructure Law and administered by the Department of Commerce's National Telecommunications and Information Administration (NTIA), the Middle Mile Grants Program is a program to expand middle mile infrastructure and to reduce the cost of connecting unserved and underserved areas. Middle mile infrastructure broadly refers to the mid-section of Internet infrastructure that carries large amounts of data at high speeds over long distances.

Respondents should indicate in their response that they have reviewed the NOFO and are willing and able to perform in compliance with the terms and conditions presented in the NOFO.

Note: This is not a Request for Proposals. A contract will not be awarded based on submissions.

Notes for the High Level Design:

- The tower locations are based on FCC regulation and stakeholder input. Proposed locations are not fixed and can be relocated along the route for optimal coverage based on respondents needs and abilities.
- The delineation of aerial vs.buried is based on topographic conditions and road way design. Each pole line is not verified.
- The end of spoke would be a POP/Demarc for handoff to regional partners or tie into providers existing network.
- Not all clustered towers need to be connected but are shown for reference in seeking coverage throughout the County.

List of Attachments:

- NTIA Middle Mile NOFO
- High Level Design Plan
- Llano County Broadband Feasibility Study
- High Level Design KMZ (to be supplied upon email request)

Project Goals:

- Evaluate potential for developing public/private partnerships with providers and broadband services partners to implement.
- Identify the various applicable technology approaches which would be best suited for the existing conditions in Llano County.
- Understand financial model structure and overall costs for the project(s) and relative share financial risk and benefits within the partnership.
- Identify Last Mile providers to be included in a larger Middle Mile project.

Scope of Work:

Respondents are asked to review the Llano County Broadband Feasibility Study and provide input as to preferred business model(s) and their anticipated role, as well as an overview of capabilities to meet the needs identified in the study. The business model overview should describe in detail their ability to build, manage and maintain a network specified to Llano County's needs. These abilities can include, but are not limited to; passive infrastructure, access services and/or internet services and applications.

Respondents should include an outline of a preferred partnership agreement structure for consideration and evaluation in relation to the NTIA Middle Mile Grant Program. As described in Section III.C of the NOFO, the amount of a middle mile grant awarded to an eligible entity may not exceed 70% of the total project costs, meaning there is a 30% match requirement. Respondents are asked to provide a business plan that would detail their ability to provide the match capital and why the grant funding is necessary for project implementation.

Respondents should define what aspects, or scope, of the overall needs they are willing and able to invest in. This can include middle mile and/or last mile delineation, as well as geographic sectioning to identify which areas of Llano County, or the surrounding counties, they are interested in servicing.

Evaluation Metrics and Criteria:

- If respondent is an internet service provider, they must participate in (or are actively applying to) the Affordable Connectivity Program (ACP).
- Provide past performance evidence relating to the scope of services (middle mile/ last mile) and outline ability to execute include schedule and cost
- Must be willing and able to perform scope of work in accordance with NTIA requirements, unless recommending alternative funding options.

Submission Requirements:

- Business Plan including cost estimates and schedule for providing middle mile/last mile service to Llano County areas of need.
- Documentation of existing assets in and around Llano County. Preferably in relation to updated Fixed Broadband Deployment Data for FCC Form 477 (https://help.bdc.fcc.gov/hc/en-us).
- Documentation of any federal or state funding applied for in and around Llano County.

NTIA Applications due: September 30, 2022
Project Construction Period: TBD (within 5 years)

Question period via email will be open until 5pm CST 7/18/2022.
Responses to all questions received will be compiled and posted as an addendum to this RFI on the County Website.

Contact	**Email**
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NOTICE OF FUNDING OPPORTUNITY

MIDDLE MILE GRANT PROGRAM

EXECUTIVE SUMMARY

A. Federal Agency Name

National Telecommunications and Information Administration (NTIA), U.S. Department of Commerce

B. Funding Opportunity Title

Middle Mile Grant Program

C. Announcement Type

Initial

D. Funding Opportunity Number

NTIA-MMG-2022

E. Assistance Listing (CFDA Number)

11.033

F. Key Dates

Complete applications must be received by NTIA through the Application Portal no later than 11:59 p.m. Eastern Daylight Time (EDT) on **September 30, 2022.**

NTIA expects to complete its review, selection of successful applicants, and award processing by **February 16, 2023.** NTIA expects that the start date for awards under this Notice of Funding Opportunity (NOFO) will be no earlier than **March 1, 2023**.

G. Application Submission Address

Complete application packets must be submitted electronically through the NTIA Application Portal. Complete applications or portions thereof submitted by postal mail, courier, email, facsimile, or other means will not be accepted. *See* Section IV of this NOFO for detailed information concerning application submission requirements.

H. Funding Opportunity Description

The Middle Mile Broadband Infrastructure Grant (MMG) Program provides funding for the construction, improvement, or acquisition of middle mile infrastructure. The purpose of the grant program is to expand and extend middle mile infrastructure to reduce the cost of connecting areas that are unserved or underserved to the internet backbone. *See* Section I of this NOFO for the full Program Description.

I. Funding Instrument

Grant.

J. Eligibility

To apply for the MMG Program, an entity must be a State, political subdivision of a State, Tribal government, technology company, electric utility, utility cooperative, public utility district, telecommunications company, telecommunications cooperative, nonprofit foundation, nonprofit corporation, nonprofit institution, nonprofit association, regional planning council, Native entity, economic development authority, or any partnership of two (2) or more of these entities.

K. Anticipated Amounts

NTIA will make up to $980,000,000 available for federal assistance under the MMG Program ($1,000,000,000 minus two percent set aside to cover NTIA's administrative costs). NTIA expects to make awards under this program within the following funding range: $5,000,000 to $100,000,000. The period of performance for grants issued pursuant to this program ends five years from the date on which the grant funds are made available to the eligible entity.

L. Cost Sharing/Matching

The amount of a middle mile grant awarded to an eligible entity through this program may not exceed 70 percent of the total project cost.[1]

FULL ANNOUNCEMENT TEXT

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I. Program Description

The National Telecommunications and Information Administration (NTIA) issues this Notice of Funding Opportunity (NOFO) to describe the requirements under which it will award grants for the Middle Mile Grant (MMG) Program, authorized by the Infrastructure Investment and Jobs Act of 2021, Division F, Title IV, Section 60401, Public Law 117-58, 135 Stat. 429 (November 15, 2021) (Infrastructure Act or Act), also known as the Bipartisan Infrastructure Law. The MMG Program provides funding for the construction, improvement, or acquisition of middle mile infrastructure.

A. Overview of the Middle Mile Grant Program

In recent decades, access to the internet has played a critical and growing role in the ways in which Americans work, learn, receive health care, and participate in democracy. The COVID-19 pandemic crystalized what many have known for a very long time: Broadband internet access is not a luxury, but a necessity, for all Americans, regardless of their age, race, or income, irrespective of where they live, what languages they speak, what resources they have at their disposal, and what specific challenges they may face in their daily lives.

Recognizing broadband's fundamental role in today's society and its centrality to our nation's continued health and prosperity, President Biden has pledged that every American must have access to a reliable, affordable, high-speed broadband connection. Full participation in our twenty-first century economy requires no less. Yet affordable, reliable, high-speed internet access has remained elusive to many for too long, because they live in a location where no service is available, the speed or quality of the service available is unreliable, or the offering available is unaffordable. This digital divide is particularly acute for communities of color and lower-income areas and spans both urban and rural areas of the country.

Passed on a bipartisan basis, the Infrastructure Act established the Middle Mile Grant Program to complement other programs focused on internet connectivity and digital equity. Middle mile infrastructure does not reach the end user's location, but typically aggregates large quantities of traffic for carriage between networks. The variety of middle mile arrangements is broad. Middle mile infrastructure might carry traffic via undersea cable to remote locations such as Hawaii or American territories and possessions elsewhere in the Pacific, may "backhaul" wireless traffic via a fiber-optic link from an antenna mounted on a tower to the provider's wired network, may bring the internet to previously unserved Tribal or Native lands, or may simply connect neighboring towns. Middle mile service, moreover, might be offered by a wide range of entities, from traditional retail Internet Service Providers, large technology companies that do not offer retail broadband at all, or electric utilities that increasingly recognize their capability to transform the communications market. Regardless of who deploys and operates them, middle mile connections are crucial to connectivity and competition.

Recognizing the middle mile's central importance, Congress appropriated $1 billion for the MMG Program and identified two key objectives: to "encourage the expansion and extension of middle mile infrastructure to reduce the cost of connecting unserved and underserved areas to the backbone of the internet" and to "promote broadband connection resiliency through the creation of alternative network connection paths that can be designed to prevent single points of failure on a broadband network."[2]

NTIA looks forward to receiving and reviewing a broad range of applications proposing creative ways to fill the gaps in our nation's middle mile infrastructure and advance our national goals of increasing connectivity, affordability, and equity.

B. Definitions

(1) Anchor Institution.—The term "anchor institution" means a school, library, medical or healthcare provider, community college or other institution of higher education, or other community support organization or entity.

(2) Assistant Secretary.—The term "Assistant Secretary" means the Assistant Secretary of Commerce for Communications and Information or the individual who holds any successor position.

(3) Commission.—The term "Commission" means the Federal Communications Commission (FCC).

(4) Eligible Entity.—The term "eligible entity" means— (A) a State, political subdivision of a State, Tribal government, technology company, electric utility, utility cooperative, public utility district, telecommunications company, telecommunications cooperative, nonprofit foundation, nonprofit corporation, nonprofit institution, nonprofit association, regional planning council, Native entity, or economic development authority; or (B) a partnership of two (2) or more entities described in (A).

(5) FCC Fixed Broadband Map.—The term "FCC fixed broadband map" means the map created by the Commission under Section 802(c)(1)(B) of the Communications Act of 1934 (47 U.S.C. § 642(c)(1)(B)).

(6) Indian Tribe.—The term "Indian Tribe" means any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act (85 Stat. 688) [43 U.S.C. § 1601 *et seq.*], which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

(7) Interconnect.—The term "interconnect" means the physical linking of two networks for the mutual exchange of traffic on non-discriminatory terms and conditions.

[2] Infrastructure Act § 60401(b)(1).

(8) Internet Exchange Facility.—The term "internet exchange facility" means physical infrastructure through which internet service providers and content delivery networks exchange internet traffic between their networks.

(9) Middle Mile Infrastructure.—The term "middle mile infrastructure"— (A) means any broadband infrastructure that does not connect directly to an end-user location, including an anchor institution; and (B) includes— (i) leased dark fiber, interoffice transport, backhaul, carrier-neutral internet exchange facilities, carrier-neutral submarine cable landing stations, undersea cables, transport connectivity to data centers, special access transport, and other similar services; and (ii) wired or private wireless broadband infrastructure, including microwave capacity, radio tower access, and other services or infrastructure for a private wireless broadband network, such as towers, fiber, and microwave links.

(10) Middle Mile Grant.—The term "middle mile grant" means a grant awarded under the MMG Program.

(11) Native Entity.—The term "Native entity" means— (A) an Indian Tribe; (B) an Alaska Native Corporation; (C) a Native Hawaiian organization (as defined in Section 6207 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. § 7517)); (D) the Department of Hawaiian Home Lands; and (E) the Office of Hawaiian Affairs.

(12) State.—The term "State" means any State of the United States, the District of Columbia and the U.S. Territories and possessions.

(13) Submarine Cable Landing Station.—The term "submarine cable landing station" means a cable landing station, as that term is used in Section 1.767(a)(5) of Title 47, Code of Federal Regulations (or any successor regulation), that can be utilized to land a submarine cable by an entity that has obtained a license under the first Section of the Act entitled "An Act relating to the landing and operation of submarine cables in the United States", approved May 27, 1921 (47 U.S.C. § 34) (commonly known as the "Cable Landing Licensing Act").

(14) Tribal Land.—The term "Tribal Land" means (A) any land located within the boundaries of— (i) an Indian reservation, pueblo, or rancheria; or (ii) a former reservation within Oklahoma; (B) any land not located within the boundaries of an Indian reservation, pueblo, or rancheria, the title to which is held— (i) in trust by the United States for the benefit of an Indian Tribe or an individual Indian; (ii) by an Indian Tribe or an individual Indian, subject to restriction against alienation under laws of the United States; or (iii) by a dependent Indian community; (C) any land located within a region established pursuant to Section 7(a) of the Alaska Native Claims Settlement Act (43 U.S.C. § 8 1606(a)); (D) Hawaiian Home Lands, as defined in Section 801 of the Native American Housing Assistance and Self-Determination Act of 1996 (25 U.S.C. § 4221); or (E) those areas or communities designated by the Assistant Secretary of Indian Affairs of the Department of the Interior that are near, adjacent, or contiguous to reservations where financial assistance and social service programs are provided to Indians because of their status as Indians.

(15) Tribal Government.—The term "Tribal government" means the recognized governing body of any Indian or Alaska Native tribe, band, nation, pueblo, village, community, component band, or component reservation, individually identified (including parenthetically) in the list published by the Secretary of the Interior most recently as of the date of enactment of the Act pursuant to Section 104 of the Federally Recognized Indian Tribe List Act of 1994 (25 U.S.C. § 5131).[3]

(16) Trust Land.—The term "trust land" means any land that (A) is held in trust by the United States for Native Americans; (B) is subject to restrictions on alienation imposed by the United States on Indian lands (including native Hawaiian homelands); (C) is owned by a Regional Corporation or Village Corporation, as such terms are defined in Section 3(g) and 3(j) of the Alaska Native Claims Settlement Act, respectively (43 U.S.C. § 1602(g), (j)); or (D) is on any island in the Pacific Ocean if such land is, by cultural tradition, communally-owned land, as determined by the Secretary of the Interior.

(17) Underserved.—The term "underserved," with respect to an area, means an area— (A) that is designated as a Tribally underserved area through the process set forth in Section III.G.2 of this NOFO; or (B) that— (i) is of a standard size not larger than a census block, as established by the Commission; (ii) is not an unserved area; and (iii) as determined in accordance with the FCC fixed broadband map, does not have access to broadband service with— (I) except as provided in (II) — (aa) a download speed of not less than 100 megabits per second; and (bb) an upload speed of not less than 20 megabits per second; or (II) minimum download and upload speeds established as benchmarks by the Commission for purposes of the Act after the date of enactment of the Act, if those minimum speeds are higher than the minimum speeds required under (I).

(18) Unserved.—The term "unserved," with respect to an area, means an area— (A) that is designated as a Tribally underserved area through the process set forth in Section III.G.2 of this NOFO; or (B) that— (i) is of a standard size not larger than a census block, as established by the Commission; and (ii) as determined in accordance with the FCC fixed broadband map, does not have access to broadband service with— (I) except as provided in (II)— (aa) a download speed of not less than 25 megabits per second; and (bb) an upload speed of not less than 3 megabits per second; or (II) minimum download and upload speeds established as benchmarks by the Commission for purposes of this Act after the date of enactment of this Act, if those minimum speeds are higher than the minimum speeds required under (I).

II. Federal Award Information

A. Funding Availability

NTIA will make up to $980,000,000 available for federal assistance under the MMG Program.

[3] *See* Indian Entities Recognized by and Eligible to Receive Services from the United States Bureau of Indian Affairs, at 86 Fed. Reg. 7554 (Jan. 29, 2021); *see also* Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs; Correction, 86 Fed. Reg. 18552 (Apr. 9, 2021) (updated by the Secretary of the Interior).

B. Period of Performance

To be eligible to obtain a middle mile grant, an eligible entity shall agree to complete the buildout of the middle mile infrastructure described in the application by not later than five (5) years after the date on which amounts from the grant are made available to the eligible entity.

1. Extensions

An eligible entity may submit a request for an extension, which must include the justification for such an extension and all relevant circumstances. At the request of an eligible entity, the Assistant Secretary may extend the buildout deadline by not more than one (1) year if the eligible entity certifies that:

(i) the eligible entity has a plan for use of the grant funds;
(ii) the project to build out middle mile infrastructure is underway; or
(iii) extenuating circumstances require an extension of time to allow completion of the project to build out middle mile infrastructure.

Requests for extensions will be granted at the sole discretion of the Assistant Secretary. If an extension is granted, the Assistant Secretary shall modify any milestones as necessary under the extension.

2. Reversion of Funds

Unless the Assistant Secretary has granted an eligible entity an extension of time to complete its project, NTIA will make any grant funds not expended by the eligible entity by the end of the performance period set forth in the Infrastructure Act available to other eligible entities for the purposes provided in the MMG Program.

C. Award Amount

NTIA expects to make awards under this program within the following funding range: $5,000,000 to $100,000,000. This range is not a required minimum or maximum, but eligible entities requesting amounts for projects outside of this range must provide a reasonable explanation for the variance.

D. Treatment of Unallocated Funds

In the event that any funds remain available after grants have been awarded to eligible entities that submitted approved applications during the initial round of funding for the MMG Program, the Assistant Secretary shall either direct that additional applications submitted in response to this NOFO be subject to further review, issue a new Notice of Funding Opportunity to address disbursement of remaining funds, or both.

E. Type of Funding Instrument

The funding instrument for awards made pursuant to the NOFO will be a grant.

III. Eligibility Information and Program Details

A. Eligible Applicants

An applicant must be an eligible entity as defined in Section I.B of this NOFO.

B. MMG Program Applicant Qualifications

Prior to entering into any award agreement, the Assistant Secretary shall ensure, consistent with the requirements below, that any prospective middle mile grant recipient:

1. Is capable of carrying out the proposed project in a competent manner, including a plan to attract, train, or retain an appropriately skilled and credentialed workforce; and

2. Has the financial, managerial, technical, and operational capability to carry out the proposed project and operate the resulting middle mile broadband network.

To allow the Assistant Secretary to ensure the eligible entity meets the requirements set forth above, each eligible entity must take the steps set forth below in connection with any application for a middle mile grant. Additional threshold, project-specific, eligibility criteria are detailed in Section V.A.1.

1. Financial Capability

a. Certifications

Each applicant must supply a certification from an officer-level employee (or individual of comparable rank) attesting that it is financially qualified to meet the obligations associated with a project, that they will have available funds for all project costs that exceed the amount of the grant, and that they will comply with all MMG Program requirements, including service milestones. To the extent the Grants Officer disburses funding only upon completion of the associated tasks, each applicant must also certify that it has and will continue to have sufficient financial resources to cover its eligible costs for the project until such time as the Grants Officer authorizes additional disbursements.

b. Letter of Credit

During the application process, each applicant must submit a letter from a bank meeting eligibility requirements consistent with those set forth in 47 C.F.R. § 54.804(c)(2) committing to issue an irrevocable standby letter of credit, in the required form, to the applicant. The letter shall at a minimum provide the dollar amount of credit offered and the issuing bank's agreement to follow the terms and conditions of NTIA's model letter of credit. NTIA shall establish a model letter of credit substantially similar to the model letter of credit established by the Federal Communications Commission in connection with the Rural Digital Opportunity Fund (RDOF).[4]

[4] *Rural Digital Opportunity Fund Order*, 35 FCC Rcd at 773-77, Appx. C.

NTIA will ensure, prior to issuing a middle mile grant award, that each eligible entity obtains an acceptable, irrevocable standby letter of credit in a value of no less than 25 percent of the award amount.

Each eligible entity shall provide with its letter of credit an opinion letter from its legal counsel clearly stating, subject only to customary assumptions, limitations, and qualifications, that in a proceeding under Title 11 of the United States Code, 11 U.S.C. § 101 *et seq*. (the "Bankruptcy Code"), the bankruptcy court would not treat the letter of credit or proceeds of the letter of credit as property of the winning bidder's bankruptcy estate under Section 541 of the Bankruptcy Code.

An eligible entity may obtain a new letter of credit or renew its existing letter of credit to reduce its value in accordance with the following limitations:

- Upon demonstrating to the satisfaction of the Assistant Secretary that it has completed the buildout of 40 percent of project miles, an eligible entity may obtain a new letter of credit or renew its existing letter of credit so that it is valued at no less than 20 percent of the award amount.
- Upon demonstrating to the satisfaction of the Assistant Secretary that it has completed the buildout of 60 percent of project miles, an eligible entity may obtain a new letter of credit or renew its existing letter of credit so that it is valued at no less than 15 percent of the award amount.
- Upon demonstrating to the satisfaction of the Assistant Secretary that it has completed the buildout of 80 percent of project miles, an eligible entity may obtain a new letter of credit or renew its existing letter of credit so that it is valued at no less than 10 percent of the award amount.

c. Audited Financial Statements

Each applicant shall submit financial statements from the three prior fiscal years that are audited by an independent certified public accountant. If the applicant is not audited in the ordinary course of business, in lieu of submitting audited financial statements it must submit unaudited financial statements from the three prior fiscal years and certify that it will provide financial statements from the three prior fiscal years that are audited by an independent certified public accountant by an NTIA specified deadline. The Assistant Secretary will not approve any middle mile grant award unless the Assistant Secretary determines that the documents submitted demonstrate the applicant's financial capability with respect to the proposed project.

2. Managerial Capability

Applicants shall submit to the Assistant Secretary one-page resumes for (a) all key management personnel and (b) all key personnel of subcontractors or other entities that will play substantial roles in building, managing, or operating the middle mile network built using MMG Program funding. In addition, each applicant shall submit any necessary organizational chart(s) detailing all of its parent companies, subsidiaries, and affiliates. Each applicant must also provide a narrative describing the applicant's readiness to manage a middle mile broadband network. This narrative should describe the experience and qualifications of key management set to undertake this project, the applicant's experience undertaking projects of similar size and scope, recent and upcoming organizational changes including mergers and acquisitions, and relevant organizational policies. The Assistant Secretary will not approve any middle mile grant unless the Assistant Secretary determines that the documents submitted demonstrate the applicant's managerial capability with respect to the proposed project.

3. Technical Capability

Each applicant must certify that it is technically qualified to complete and operate the proposed project and that it is capable of carrying out the funded activities in a competent manner, including that it will use an appropriately skilled and credentialed workforce (*see* Section III.I of this NOFO).

Each applicant must submit a network design diagram, project costs, build-out timeline and milestones for project implementation, and a capital investment schedule evidencing that the applicant will complete build-out and the initiation of service within five years from the date on which the grant funds are made available to the eligible entity and will meet interim buildout requirements set forth herein and in any other binding document. The Assistant Secretary will not approve any middle mile grant unless the Assistant Secretary determines that the materials submitted demonstrate the applicant's technical capability with respect to the proposed project.

4. Compliance With Laws

Each applicant must demonstrate that it is capable of carrying out funded activities in a competent manner in compliance with all applicable federal, State, and local laws. To ensure that an applicant complies with occupational safety and health requirements, applicants must permit workers to create worker-led health and safety committees with which management will meet upon reasonable request.

5. Operational Capability

Each applicant must supply a certification from an officer-level employee (or individual of comparable rank) attesting to the applicant's operational capability to complete and operate the proposed project. If applicable, the applicant must submit a certification from an officer-level employee (or individual of comparable rank) that it has operated a middle mile broadband network for at least two years or that it is a wholly owned subsidiary of such an entity and must specify the number of years the applicant or its parent company has been operating.

If the applicant has provided a voice and/or broadband service, it must certify that it has timely filed Commission Form 477s and the Broadband DATA Act submission, if applicable, as required during this time period, and otherwise has complied with the Commission's rules and regulations. Alternatively, it must explain any pending or completed enforcement action, civil litigation, or other matter in which it failed to comply or was alleged to have failed to comply with Commission rules or regulations.

If the applicant has operated only an electric transmission or distribution service, it must submit qualified operating or financial reports that it has filed with the relevant financial institution for the relevant time period along with a certification that the submission is a true and accurate copy of the reports that were provided to the relevant financial institution.

The Assistant Secretary will not approve any middle mile grant award unless the Assistant Secretary determines that the documents submitted demonstrate the applicant's operational capability with respect to the proposed project.

6. Ownership

Each applicant shall provide ownership information consistent with the requirements set forth in 47 C.F.R. § 1.2112(a)(1)-(7).

C. Cost Sharing or Matching

The amount of a middle mile grant awarded to an eligible entity may not exceed 70 percent of the total project cost.[5] Except for grants made to Tribal Governments and Native entities, the Infrastructure Act does not contemplate waiver of this requirement, and the Assistant Secretary will not entertain requests for such waivers.

Matching funds may be in the form of either cash or in-kind contributions consistent with the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200.[6] In-kind contributions, which include third-party in-kind contributions, are non-cash donations of property, goods or services, which benefit a federally assisted project, and which may count toward satisfying the non-federal matching requirement of a project's total budgeted costs when such contributions meet certain criteria.[7] In-kind contributions must be allowable and allocable project expenses. The rules governing allowable in-kind contributions are detailed and encompass a wide range of properties and services. NTIA encourages applicants to thoroughly consider potential sources of in-kind contributions, which, depending on the particular property or service and the applicable federal cost principles, could include employee or volunteer services; equipment; supplies; indirect costs; computer hardware and software; and use of facilities. In the broadband context, in-kind contributions could include, consistent with federal cost principles, access to rights of way, pole attachments, conduits,

[5] Infrastructure Act § 60401(f).

[6] *See* 2 C.F.R. § 200.306.

[7] *See id*.

easements, or access to other types of infrastructure. It is important to note that federal funds may not be used as non-federal match, except as expressly provided by federal statute.[8]

D. Buildout Benchmarks

Buildout benchmarks will be established as a condition of any middle mile grant. An eligible entity that receives a middle mile grant shall demonstrate to the satisfaction of the Assistant Secretary that it has completed the buildout of 40 percent of project miles by the end of the second year after the award date, 60 percent of project miles by the end of the third year, 80 percent of project miles by the end of the fourth year, and 100 percent of project miles by the end of the fifth year. For the sake of clarity, the project must be completed, lit, and operating no later than five years from the date on which the grant funds are made available to the eligible entity.

The Assistant Secretary retains the authority to modify buildout benchmarks after consultation with an applicant, imposing more aggressive or less aggressive buildout benchmarks if the nature of and circumstances surrounding the project make it reasonable to do so (*e.g.*, the project covers a short distance or can be deployed in large part using existing conduit, or the project will leverage infrastructure slated to be constructed using other federal funds, but the schedule for the deployment of that infrastructure is incompatible with the benchmarks set out above).

E. Prioritization of Applications Meeting Statutory Criteria

As directed by Section 60401(d)(2) of the Infrastructure Act, the MMG Program will prioritize applications that meet at least two of the following five criteria:

1. The eligible entity adopts fiscally sustainable middle mile strategies.[9]
2. The eligible entity commits to offering non-discriminatory interconnection to terrestrial and wireless last mile broadband providers and any other party making a bona fide request.
3. The eligible entity identifies specific terrestrial and wireless last mile broadband providers that have (i) expressed written interest in interconnecting with middle mile infrastructure planned to be deployed by the eligible entity; and (ii) demonstrated sustainable business plans or adequate funding sources with respect to such interconnection described in (i).

[8] *See id*.

[9] In particular, applicants should submit with their application financial studies, analyses, or other materials demonstrating that reasonably anticipated revenues associated with middle mile projects that are constructed, improved, or acquired using MMG Program funds will be sufficient to allow long-term provision of service in light of reasonably anticipated costs. The required documentation includes organizational historical financials, audited financials, pro-forma financial projections and analysis to substantiate the sustainability of the proposed project, and submission of a letter of credit valued at no less than 25 percent of the requested award amount.

4. The eligible entity has identified supplemental investments or in-kind support (such as waived franchise or permitting fees) that will accelerate the completion of the planned project.
5. The eligible entity has demonstrated that the middle mile infrastructure will benefit national security interests of the United States and the Department of Defense.[10]

F. Connections to Anchor Institutions

Each applicant seeking an award to build middle mile infrastructure using fiber-optic technology shall certify that the proposed project, upon completion, will include direct interconnection facilities that will facilitate the provision of broadband service, at speeds not less than 1 Gigabit per second for downloads and 1 Gigabit per second for uploads to anchor institutions located within 1,000 feet of the middle mile infrastructure.

An eligible entity applying for a middle mile grant may seek, and the Assistant Secretary may grant, a waiver of the requirements set out in the previous paragraph, in full or in part, to the extent the eligible entity demonstrates that the requirement is not technically or economically feasible. *See* Section VIII.E.

G. Special Rules for Tribal Governments and Native Entities

1. Waivers and Alternative Requirements

The Infrastructure Act permits the Assistant Secretary, in consultation with Tribal governments and Native entities, to waive, or specify alternative requirements in connection with, most directives governing the MMG Program if the Assistant Secretary finds that waiver or modification of the requirement is necessary for (a) the effective delivery and administration of middle mile grants to Tribal governments or (b) the construction, improvement, or acquisition of middle mile infrastructure on trust land.

2. Tribal Unserved and Underserved Areas

A Tribal Government may certify whether an area within its own Tribal Land is unserved or underserved based on criteria of its choosing. Any such Tribal Government must certify that the areas where middle mile service is proposed (including any such areas where a provider offers, or has proposed to offer, last-mile service) are unserved or underserved and provide a statement on Tribal Letterhead explaining how the determination that the area is unserved or underserved was made and additional supporting information if available. The Department of Hawaiian Home Lands may also certify whether Tribal Lands in Hawaii are unserved. Neither a Tribal Government nor the Department of Hawaiian Home Lands may certify Tribal Lands as unserved or underserved if there exists a legally binding agreement between (a) a Tribal Government, the

[10] Relevant considerations here include, but are not limited to, whether the funded middle mile infrastructure will increase the redundancy and resiliency of telecommunications networks that support broadband services, other commercial telecommunications services, protection of other critical national infrastructure (*e.g.*, the national power grid and power transmission facilities), border security, or other physical infrastructure sensor and monitoring.

Department of Hawaiian Home Lands, or an authorized agent thereof and (b) a broadband service provider under which the broadband service provider is committed to deploying and providing broadband internet services at speeds of no less than 100 Mbps downstream and 20 Mbps upstream. A Tribal Government and the Department of Hawaiian Home Lands must disclose whether it has terminated an existing agreement of this type in order to support a certification that an area is unserved or underserved under this provision.

H. Fair Labor Practices

Applicants must have a demonstrated record of and plans to be in compliance with federal labor and employment laws where applicable. This will help ensure that projects are carried out in accordance with the law, assist NTIA in ensuring that a prospective awardee is capable of carrying out activities funded by an award in a competent manner in compliance with all applicable federal, State, and local laws, and promote the effective and efficient completion of high-quality middle mile broadband infrastructure projects by ensuring a reliable supply of skilled workers and minimizing disruptive and costly delays.

In order for NTIA to evaluate an applicant's demonstrated record of and plans to be in compliance with federal labor and employment laws, each applicant must provide the following:

1. Information on their record of compliance with federal labor and employment laws, as well as the records of any other entities participating in the project, including contractors and subcontractors. This information must include, at a minimum, information on these entities' compliance with federal labor and employment laws on broadband deployment projects in the last three years. For example, the applicant should provide data on its historical use of contracting and subcontracting arrangements, including staffing plans, and at least one example of each contractor and subcontractor's past performance in the context of a similar project.
2. A certification from an Officer/Director-level employee (or equivalent) of the applicant evidencing consistent past compliance with federal labor and employment laws by the applicant, as well as contractors and subcontractors.
3. Written disclosure of any instances in which the applicant, contractors, or subcontractors have been found to have violated laws such as the Occupational Safety and Health Act, the Fair Labor Standards Act, or any other applicable labor and employment laws for the preceding three years.
4. A written plan for ensuring compliance with federal labor and employment laws. These plans must address, at a minimum, how the applicant will ensure compliance in its own labor and employment practices, as well as that of its contractors and subcontractors, including (1) information on applicable wage scales and wage and overtime payment practices for each class of employees expected to be involved directly in the physical construction of the broadband network and (2) how the applicant will ensure the implementation of workplace safety committees that are authorized to raise health and safety concerns in connection with the delivery of deployment projects. An effective plan for compliance with federal labor and employment laws can include an applicant's binding commitment to strong labor standards and protections for the project workforce (including contractors and subcontractors), which include:

- Using a directly employed workforce, as opposed to a subcontracted workforce;
- Paying prevailing wages and benefits to workers, including compliance with Davis-Bacon and Service Contract Act requirements, where applicable, and collecting the required certified payrolls;
- Using project labor agreements (*i.e.*, pre-hire collective bargaining agreements between unions and contractors that govern terms and conditions of employment for all workers on a construction project);
- Use of local hire provisions;
- Commitments to union neutrality;
- Use of labor peace agreements;[11]
- Use of an appropriately skilled workforce (*e.g.*, through Registered Apprenticeships or other joint labor-management training programs that serve all workers, particularly those underrepresented or historically excluded);
- Use of an appropriately credentialed workforce (*i.e.*, satisfying requirements for appropriate and relevant pre-existing occupational training, certification, and licensure); and
- Taking steps to prevent the misclassification of workers.

NTIA will offer technical assistance and may provide additional guidance on this issue.

I. Highly Skilled Workforce

To ensure that applicants have the technical and operational capacity to carry out the project, applicants must submit a plan for ensuring that the project workforce will be an appropriately skilled and credentialed workforce (including by the applicant and each of its contractors and subcontractors). For purposes of this Section, the "project workforce" includes those employees of the applicant, its contractors, or subcontractors directly engaged in the physical construction of the middle mile infrastructure, but does not include support staff of senior management. The plan for a highly skilled workforce should include the following information:

- The ways in which the applicant will ensure the use of an appropriately skilled workforce, *e.g.*, through Registered Apprenticeships or other joint labor-management training programs that serve all workers;
- The steps that will be taken to ensure that all members of the project workforce will have appropriate credentials, *e.g.*, appropriate and relevant pre-existing occupational training, certification, and licensure;

[11] Ability to require labor peace agreements:
- By a governmental entity: Where a governmental entity receives NTIA grant funds, whether directly as an eligible entity or as a subgrantee, and the governmental entity uses those funds for the construction of facilities over which it will maintain a proprietary interest (*e.g.*, governmental ownership of the network), it is authorized and encouraged to require labor peace agreements, unless prohibited by state or local law.
- By a non-governmental subgrantee: Subgrantees that are non-governmental entities, and construct broadband facilities over which no governmental entity maintains a proprietary interest, are authorized and encouraged to require labor peace agreements, unless prohibited by state or local law.

- Whether the workforce is unionized;
- Whether the workforce will be directly employed or whether work will be performed by a subcontracted workforce; and
- The entities that the applicant plans to contract and subcontract with in carrying out the proposed work.

If the project workforce or any applicant's, contractor's, or subcontractor's workforce is not unionized, the applicant must also provide with respect to the non-union workforce:

- The job titles and size of the workforce (FTE positions, including for contractors and subcontractors) required to carry out the proposed work over the course of the project and the entity that will employ each portion of the workforce;
- For each job title required to carry out the proposed work (including contractors and subcontractors), a description of:
    - safety training, certification, and/or licensure requirements (*e.g.*, OSHA 10, OSHA 30, confined space, traffic control, or other training as relevant depending on title and work), including whether there is a robust in-house training program with established requirements tied to certifications, titles; and
    - information on the professional certifications and/or in-house training in place to ensure that deployment is done at a high standard.

J. Advancing Equitable Workforce Development and Job Quality Objectives

A skilled workforce is critical to meeting infrastructure buildout timelines under the Infrastructure Act and connecting households across the country to reliable, affordable, high-speed broadband. A well-trained workforce will also allow for the safe deployment of sustainable networks. To meet the workforce needs of the MMG Program, applicants must make appropriate investments to develop a skilled, diverse workforce for the jobs that the applicants need to fill.

Each applicant must provide the information described below as part of its application:

1. A description of how it will support the development and use of a highly skilled workforce capable of carrying out MMG Program work in a manner that is safe and effective.
2. A description of the applicant's participation in sector-based partnerships among employers, education and training providers, unions and any other labor-management organizations, the public workforce system, unions, and worker organizations, and community-based organizations that provide relevant training (including through Registered Apprenticeships and pre-apprenticeships that are integrated with Registered Apprenticeships, or other quality work-based learning programs) and provide wrap-around services to support workers to access and complete training (such as child care, transportation, mentorship, *etc.*), to attract, train, retain, or transition to meet local workforce needs and increase high-quality job opportunities.[12]

[12] For additional information on sector-based partnerships, eligible entities should review the Economic Development Administration's Good Jobs Challenge NOFO, EDA-HDQ-ARPGJ-2021-2006964, *available at* https://www.grants.gov/web/grants/view-opportunity.html?oppID=334720.

3. A description of how the applicant will plan to create equitable on-ramps into broadband-related jobs (*e.g.*, how entities plan to engage or partner with stakeholders like State, Territorial, and local workforce boards, training partners, labor and community organizations); maintain job quality for new and incumbent workers engaged in the sector; and continually engage with labor organizations and community-based organizations to maintain worker voice throughout the planning and implementation process.
4. A description of how the applicant will ensure that the job opportunities created by the MMG Program and other broadband funding programs are available to a diverse pool of workers, including by engaging in targeted outreach to populations that have traditionally been underrepresented in broadband and information technology jobs, including but not limited to women and people of color. Applicants should be prepared to report on the demographics of the workforce (including contractors and subcontractors) that is engaged on a project utilizing MMG Program grant funding (this will be aggregate workforce data only, not personally identifiable information), and should expect that this data will be made public.
5. A description of other equitable workforce development and job quality activities the applicant participates in, including, for example:
    a. Providing Registered Apprenticeships and pre-apprenticeships tied to a Registered Apprenticeship, joint labor management partnerships, and other high-quality, on-the-job training opportunities, which may include minimum requirements of contractor or subcontractor job hours to be performed by apprentices; and ensuring that such programs lead to employment with wages at rates not less than the rates prevailing on projects and other eligible activities of a similar character in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code.
    b. Offering "quality jobs."[13]
    c. Prioritizing the hiring of local workers, implementing robust and specific plans to recruit historically underrepresented populations facing labor market barriers, and ensuring that they have reasonable access to the job opportunities created by the applicant. Such populations may include communities of color, women, and other groups (such as persons with disabilities, LGBTQI+ people, disconnected youth, individuals in recovery, individuals with past criminal records, including justice-impacted and reentry participants, serving trainees participating in the SNAP, TANF, and WIC, and veterans and military spouses).

[13] A "quality job" is defined as a job that (a) exceeds the local prevailing wage for an industry in the region, includes basic benefits (*e.g.*, paid leave, health insurance, retirement/savings plan), and/or is unionized, and (b) helps the employee develop the skills and experiences necessary to advance along a career path. *See* Economic Development Administration, ARPA Good Jobs Challenge NOFO, EDA-HDQ-ARPGJ-2021-2006964, at n. 1, *available at* https://www.grants.gov/web/grants/view-opportunity.html?oppId=334720.

K. Climate Resilience

Applicants must demonstrate that they have sufficiently accounted for current and future weather- and climate-related risks to new MMG Program infrastructure projects. At present, weather- and climate-related risks to broadband networks include wildfires, extreme heat and cold, inland and coastal flooding, and the extreme winds produced by weather events such as tornadoes, hurricanes, and other weather events. Because retrofitted and new infrastructure for broadband might be expected to have a lifetime of 20 years or more, applicants must account not only for current risks but also for how the frequency, severity, and nature of these extreme events may plausibly evolve as our climate continues to change over the coming decades. Future projected climate change is expected to continue to result in higher seasonal temperatures and an increased likelihood of extreme heat events, higher risk of wildfires, more intense rainfall events, sea level rise and coastal inundation, permafrost thaw in Alaska, and the potential for stronger hurricanes when they do form, and other climate change related impacts.[14]

Communities that lack broadband are also often the most vulnerable to extreme weather and climate events. This combination often results in a lack of crucial communications infrastructure to respond during these emergencies. Building climate-resilient broadband infrastructure for such communities provides emergency response preparedness and thus greater climate resilience for the community itself.

In light of the above, applicants should make use of available tools and resources from the National Oceanic and Atmospheric Administration (NOAA) and other federal agencies, as well as applicant-level resources and centers of expertise, in drawing up their MMG Program applications. Each applicant must explain in its application how it has utilized these tools and resources to account for, mitigate, and where possible, avoid the known and identifiable risks of current and future projected weather and climate conditions. Applicants also should explain how they addressed these risks through measures such as (but not necessarily limited to) choice of a technology platform suitable to the climate risks of the region, reliance on alternative siting of facilities (*e.g.*, underground construction where appropriate), retrofitting or hardening of existing assets that are critical to the project, additional onsite power resources, use of established plans and processes to deal with extreme weather related risks, use of established plans and processes to deal with extreme weather related risks, the speed of restoration of service in the case of an outage, and use of network and facility redundancies to safeguard against threats to middle mile infrastructure. In particular, each applicant should clearly demonstrate, at a minimum, that it is conducting each of the following:

1. Identify the geographic areas that should be subject to an initial hazard screening for current and future weather- and climate-related risks and the time scales for performing such screenings;

[14] For example, in accordance with Section 2(a)(1) of Executive Order 11988, as amended by Executive Order 13690, before taking an action, the applicant, in coordination with NTIA, must determine whether a proposed action will occur in a floodplain.

2. Identify which weather and climate hazards may be most important to account for and respond to in these areas and over the relevant time horizons, utilizing the tools and resources recommended below or other resources available to the applicant;
3. Characterize any weather and climate risks to new middle mile infrastructure deployed using MMG Program funds for the 20 years following deployment;
4. Identify how the proposed plan will avoid and/or mitigate the weather and climate risks identified; and
5. Detail the applicant's plans for periodically repeating this process over the life of the project to ensure that evolving risks are understood, characterized, and addressed, and that the most up-to-date tools and information resources are utilized.

For flooding hazards, the eligible entity should take into account the Federal Flood Risk Management Standard and Implementing Guidelines established through in Executive Order 14030, *Climate-Related Financial Risk*(86 FR 27967) and Executive Order 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* (80 FR 6425). The Executive Orders and Guidelines can be found at https://www.fema.gov/floodplain-management/intergovernmental/federal-flood-risk-management-standard.

In implementing the above requirements, applicants should make use of the user-friendly resources and tools provided below. The information contained within these tools and resources should be carefully reviewed to understand key characteristics of the information and data provided (*e.g.*, geographic scale of the information, timeframe of the information, levels of confidence in the information).

1. For broad, coarse-level screening of current and projected future weather- and climate-related risks for the project's region, review and cite the regional chapters found in the 2018 National Climate Assessment (https://nca2018.globalchange.gov/).
2. For more applicant-specific information on current and projected climate conditions and risks, refer to the NOAA's 2022 state climate summaries (https://statesummaries.ncics.org/).
3. In assessing current weather-related risks for specific regions, applicants can use NOAA's disaster and risk mapping tool (https://www.ncdc.noaa.gov/billions/mapping). and NOAA's storms event database (https://www.ncdc.noaa.gov/stormevents/).
4. The NOAA tools Climate Explorer and Digital Coast (updated with recently-published regional sea level rise scenarios) allow users to look up historic and future projected environmental variables (*e.g.*, changes in temperature thresholds, sea level rise) for their region.
5. FEMA's National Risk Index (https://hazards.fema.gov/nri/learn-more) provides a composite risk index for all regions across the United States, incorporating a range of natural hazards (most of which, but not all, are weather- and climate-related). FEMA's flood risk maps (https://msc.fema.gov/portal/home) for current conditions and for specific locations.

6. Applicants are also encouraged to consult FEMA-approved Hazard Mitigation Plans prepared by states in which they propose to build middle mile infrastructure to help identify key risks and hazards.

To understand and access climate and weather information, applicants are encouraged to work with NOAA and its partners at the State and regional levels (National Weather Service Weather Forecast Offices (https://www.weather.gov/srh/nwsoffices), Regional Climate Centers (https://www.ncei.noaa.gov/regional/regional-climate-centers), Regional Climate Services Directors (https://www.ncei.noaa.gov/regional/regional-climate-services-directors), academic and other partners under NOAA's RISA program (https://cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA/RISA-Teams), State climatologists (https://stateclimate.org/state_programs/), and any other relevant centers of expertise.

L. Civil Rights and Nondiscrimination Law Compliance

No person in the United States may, on the ground of actual or perceived race, color, national origin, sex, gender identity, sexual orientation, age, disability, or handicap, be excluded from participation in, be denied the benefits of, or be subject to discrimination under, any program or activity receiving federal financial assistance. Prior to distributing any MMG Program funding to a prospective awardee, NTIA will require the prospective awardee to agree, by contract or other binding commitment, to abide by the non-discrimination requirements set forth in the following legal authorities, to the extent applicable, and to acknowledge that failure to do so may result in cancellation of any award and/or recoupment of funds already disbursed:

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq*.) and the Department of Commerce's implementing regulations, published at 15 C.F.R. Part 8, which prohibit discrimination on the grounds of race, color, or national origin under programs or activities receiving federal financial assistance;
2. Title IX of the Education Amendments of 1972 (20 U.S.C. § 1681 *et seq*.) which prohibits discrimination on the basis of sex under federally assisted education programs or activities;
3. The Americans with Disabilities Act of 1990 (42 U.S.C. § 12101 *et seq*.) which prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto, as well as public or private entities that provide public transportation;
4. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), and Department of Commerce implementing regulations published at 15 C.F.R. Part 8b, which prohibit discrimination on the basis of handicap under any program or activity receiving or benefiting from federal assistance;
5. The Age Discrimination Act of 1975, as amended (42 U.S.C. § 6101 *et seq*.), and Department of Commerce implementing regulations published at 15 C.F.R. Part 20, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance;
6. Title VII of the Civil Rights Act of 1964, 42 U.S.C. § 2000e *et seq*., which provides that it is an unlawful employment practice for an employer to discharge any individual or

otherwise to discriminate against an individual with respect to compensation, terms, conditions, or privileges of employment because of such individual's race, color, religion, sex, or national origin. Note in this regard that Title VII, 42 U.S.C. § 2000e-1(a), expressly exempts from the prohibition against discrimination based on religion "a religious corporation, association, educational institution, or society with respect to the employment of individuals of a particular religion to perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities;" and

7. Any other applicable non-discrimination law(s). Application requirements, award terms, and conditions do not impose civil rights and nondiscrimination law compliance requirements on Indian Tribes or Native Entities beyond what would otherwise apply under federal law.

In addition, each applicant must demonstrate in its application that it will account for and satisfy the following authorities or explain why they are not applicable:

1. Parts II and III of Executive Order 11246, Equal Employment Opportunity (30 Fed. Reg. 12319), which requires that federally assisted construction contracts incorporate and fulfill the nondiscrimination provisions of §§ 202 and 203 of Executive Order 11246 and Department of Labor regulations implementing Executive Order 11246 (41 C.F.R. § 60-1.4(b)).
2. Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency (65 Fed. Reg. 50121), which requires federal agencies to examine the services that they provide, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them. Note that the Department of Commerce issued policy guidance on March 24, 2003, (68 Fed. Reg. 14180) to articulate the Title VI prohibition against national origin discrimination affecting LEP persons and to help ensure that non-federal entities provide meaningful access to their LEP applicants and beneficiaries.
3. Executive Order 13798, Promoting Free Speech and Religious Liberty, and Office of Management and Budget, M-20-09 – Guidance Regarding Federal Grants and Executive Order 13798 (January 16, 2020), which provide that States or other public grantees may not condition sub-awards of federal grant money in a manner that would disadvantage grant applicants based on their religious character.

M. Other

1. Eligible and Ineligible Uses of Project Funds

See Section IV.I of this NOFO for information concerning the eligible and ineligible uses of project funding (including non-federal cost share) under the MMG Program.

2. State Coordination on Broadband Projects

Prospective non-State and non-Tribal Government applicants must, prior to submitting an application, coordinate and consult with the State Broadband Office or other coordinating body

located in the jurisdiction in which the eligible entity proposes to deploy middle mile infrastructure to ensure that the proposal is consistent with the State's broadband plan and priorities.

IV. Application and Submission Information

A. Address to Request Application Package

Application forms and instructions are available at https://grants.ntia.gov/. Applications will be accepted until the deadline and will be processed as received. Application packages, or portions thereof, submitted by email, paper, or facsimile will not be accepted.

With respect to electronic methods for providing information about funding opportunities or accepting applicants' submissions of information, NTIA is responsible for compliance with Section 508 of the Rehabilitation Act of 1973, as amended by the Workforce Act of 1998.

B. Content and Form of Applications

Applications for the MMG Program must be complete, must follow the format described in NTIA's Application Portal, and must otherwise comply with this NOFO. Complete applications must be received through the NTIA Application Portal no later than 11:59 p.m. Eastern Daylight Time (EDT) on **September 30, 2022**. NTIA will not accept any application materials submitted prior to the public release of this NOFO.

A complete application packet consists of the information that will be required by the Application Portal at https://grants.ntia.gov/. Required information will include (but not necessarily be limited to) the following:

1. Standard Form 424: Application for Federal Assistance
2. Standard Form 424C: Budget Information for Construction Programs (SF-424C)
3. CD–511 Certification Regarding Lobbying
4. Standard Form LLL, Disclosure of Lobbying Activities (if applicable)
5. Detailed Budget
6. Budget Narrative
7. Project Details and Narrative
8. Negotiated Indirect Cost Rate Agreement (if applicable)
9. Any materials on which the applicant seeks to rely in demonstrating its satisfaction of the eligibility criteria, merit review criteria, and programmatic review criteria set forth in Section V.A of this NOFO.

The Project Details and Narrative, along with the above forms, shall be filled out by the applicant in NTIA's Grant Application Portal. Proposed project application information to be collected will include the following:

1. An Executive Summary of the project, not to exceed two (2) pages (approximately 1,000 words). Please note that if an applicant's proposal is selected for funding, NTIA may use all or a portion of the Executive Summary as part of a press release issued by NTIA, or for other public information and outreach purposes. Applicants are advised not to incorporate information that concerns business trade secrets or other confidential commercial or financial information as part of the Executive Summary. *See also* 15 C.F.R. § 4.9(c) concerning the designation of business information by the applicant;

2. Project Purpose/Need/Beneficiaries

   a. A description of how the applicant's proposal will advance the objectives of the MMG Program–namely, to "encourage the expansion and extension of middle mile infrastructure to reduce the cost of connecting unserved and underserved areas to the backbone of the internet" and/or "promote broadband connection resiliency through the creation of alternative network connection paths that can be designed to prevent single points of failure on a broadband network;"[15]

   b. An overview of the proposed route or service area(s), including information regarding rurality and socio-economic indicators in the area to be served by the proposed project;

   c. A description of need in the proposed service area(s), including communities considered unserved and/or underserved in the proposed service area(s);

   d. Target last mile service objectives, including last mile service provider letters of commitment, agreements, or contracts;

   e. Letters of intent, agreements, or contracts pertaining to other expected users of the proposed middle mile facilities;

   f. Information on existing middle mile offerings in the area, if any, including competitor data if applicable; and

   g. A list of anchor institutions (and types) within 1,000 feet of the proposed route (for fiber projects only).

3. Proposed Project – Technical Approach, Service Area, Build Out Plan

   a. Network route map(s);

   b. Network diagram and system design;

   c. Technical details of the proposed project, *e.g.*, technology type;

   d. List of all proposed interconnection points and point-of-interest locations along the proposed route;

   e. A description of the proposed service offerings, including the pricing of the services to be offered over the proposed facility;

   f. A description of the applicant's nondiscrimination, interconnection, and network management plans;

[15] Infrastructure Act § 60401(b)(1).

g. A timeline for the build-out/implementation of the project with critical path, including key milestones for implementation of the project, preparations, and risk factors;

h. A plan for using an appropriately skilled and credentialed project workforce (including by the applicant, contractors, and subcontractors), as described in Section III.B.3 above.

i. Description of the applicant's efforts to ensure climate resilience for the project and demonstration that the applicant has sufficiently accounted for current and future weather- and climate-related risks to new middle mile infrastructure projects;

j. A service-area environmental description that describes the physical project area and its surroundings (*e.g.*, disturbed or developed land vs. open space; adjacent natural resources, such as rivers, wetlands, or forestlands; and any protected lands or resources in or near the project area), including site photographs and aerial photographs (*e.g.*, Google Earth or Google Maps images), if the project includes construction and/or ground disturbing activities.

4. Project Financials and Organization Financial Capacity

a. Details regarding the federal grant request and non-federal cost share;

b. Details on the project budget and funding, including the level of need for federal funding and details on other federal broadband deployment funding received by the applicant;

c. Non-federal cost share sources, including the proposed percentage of cash vs. in-kind contribution and the source of any contribution (if not the applicant itself);

d. Historical financials for the last three (3) years;

e. Historical Certified Public Accountant (CPA) audits for the last one (1) year;

f. The Letter of Credit referenced in Section III.B.1.b of this NOFO; and

g. Pro forma financial projection and analysis related to the project's sustainability, inclusive of subscriber (*e.g.*, last mile network connections, other wholesale services), across an eight-year forecast period.

5. Project Implementation Team and Organizational Capacity

a. Information regarding the organization's capacity and readiness;

b. Project and organizational chart;

c. Management team and key project personnel resumes, including resumes of key personnel of partner organizations or third parties that will be performing a significant role in the project's completion;

d. Project governance documents and a description of key partnerships;

e. List of all funded and unfunded project collaborators, including partners, consultants, subrecipients, match providers, major contractors/suppliers, details on role/scope of work for project;

f. A description of whether and, if so, how the project will incorporate strong labor standards, including project labor agreements and community benefit agreements that offer wages at or above the prevailing rate and include local hire provisions, and a description of the applicant's workforce plans and practices, per Section III.H of this NOFO (Fair Labor Practices);

g. A description of how the applicant will support equitable workforce development and job quality objectives, per Section III.I of this NOFO (Highly Skilled Workforce).

6. Government and Community Involvement

a. Information on the applicant's coordination with applicable State, Tribal, and local governments, including their awareness of the proposed project and any potential impact to respective service areas; and

b. Information regarding the applicant's involvement and coordination with community organizations, unions and worker organizations, or other relevant partners in the proposed service area.

1. Budget Narrative and Detailed Budget Justification

Each applicant must submit a Budget Narrative and a Detailed Budget Justification Spreadsheet through the Application Portal at https://grants.ntia.gov/. All budget information must support the dollar amounts identified in the SF-424 and SF-424C and demonstrate that the project or activity meets the eligible use requirements in the Infrastructure Act and this NOFO.

The Detailed Budget Justification Spreadsheet must reflect the cost categories that appear on the SF-424C (*e.g.*, administrative and legal expenses; land; structures; rights-of-way; appraisals; construction, etc.) and include itemized calculations for each cost placed under those categories.

The Budget Narrative must explain the necessity and basis for all costs, clearly correspond to the information included in the Detailed Budget Justification Spreadsheet and reflect only allowable costs that are consistent with the project scope. Information on cost allowability is available in the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200, which apply to awards in this program.

With respect to the cost-sharing or matching funds included in the budget, the applicant must identify the non-federal source (*e.g.*, State funding) and distinguish the non-federal and federal portions of the budget in the Detailed Budget Justification and Budget Narrative. Information regarding cost sharing or matching funds is available in 2 C.F.R. § 200.306.

C. Application Format

NTIA will only accept applications submitted electronically via its online Application Portal. Paper, email, and facsimile submissions will not be accepted.

D. Requirements for Attachments Submitted through NTIA's Grant Application System

1. Figures, graphs, images, and pictures

Should be of a size that is easily readable or viewable and may be presented in landscape orientation.

2. Font

Easy to read font (11-point minimum). Smaller type may be used in figures and tables but must be clearly legible.

3. Line spacing

Applicants may use single spacing or double spacing.

4. Margins

One inch top, bottom, left, and right.

5. Page layout

Portrait orientation except for figures, graphs, images, and pictures. Paragraphs are to be clearly separated from each other by double spacing, paragraph formatting or equivalent.

6. Page numbering

Number pages sequentially.

7. Page size

Pages must be 8½ inches by 11 inches, excluding maps of proposed service areas or network or system diagrams.

8. Application language

English.

9. Typed document

All applications, including forms, must be typed.

E. Certifications Regarding Debarment and Suspension (applies to all recipients)

By signing and submitting an application for funding pursuant to the MMG Program, the applicant is making the following certifications (*see* Line 21 on the SF-424, Application for Federal Assistance):

1. Instructions for Primary Tier Participant Certification

a. By signing and submitting this proposal, the prospective primary tier participant is providing the certification set out below and agrees to comply with the requirements of 2 C.F.R. Parts 180, 1200, and 1326.

b. The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective primary tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary tier participant to furnish a certification or an explanation shall disqualify such person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the department or agency may terminate this transaction for cause or default or may pursue suspension or debarment.

d. The prospective primary tier participant shall provide immediate written notice to the department or agency to which this proposal is submitted if at any time the prospective primary tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms *covered transaction, civil judgment, debarment, suspension, ineligible, participant, person, principal, and voluntarily excluded,* as used in this clause, are defined in 2 C.F.R. Parts 180, 1200, and 1326. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary tier participant further agrees by submitting this proposal that it will include the clause titled "Instructions for Lower Tier Participant Certification" including the "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction" provided by the department or

agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions and will require lower tier participants to comply with 2 C.F.R. Parts 180, 1200, and 1326.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any prospective lower tier participants, each participant may, but is not required to, check the System for Award Management Exclusions website (https://www.sam.gov/).

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of this Section IV.E.1, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the federal government, the department or agency may terminate the transaction for cause or default.

2. Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Tier Covered Transactions

a. The prospective primary tier participant certifies to the best of its knowledge and belief, that it and its principals:

i. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any federal department or agency;

ii. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, State or local) transaction or contract under a public transaction; violation of federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

iii. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(ii) of this certification; and

iv. Have not within a three-year period preceding this application/proposal had one or more public transactions (federal, State, or local) terminated for cause or default.

b. Where the prospective primary tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

3. Instructions for Lower Tier Participant Certification (applies to subrecipients)

a. By submitting this proposal and accepting federal funding, the prospective lower tier participant is providing the certification set out below and agrees to comply with the requirements of 2 C.F.R. Parts 180, 1200, and 1326.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the department or agency with which this transaction originated may pursue available remedies, including suspension or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

d. The terms *covered transaction, civil judgment, debarment, suspension, ineligible, participant, person, principal, and voluntarily excluded,* as used in this clause, are defined in 2 C.F.R. Parts 180, 1200, and 1326. You may contact the person to whom this proposal is submitted for assistance in obtaining a copy of those regulations.

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include the clause titled "Instructions for Lower Tier Participant Certification" including the "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion- Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions and will require lower tier participants to comply with 2 C.F.R. Parts 180 and 1200.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any prospective lower tier participants, each participant may, but is not required to, check the System for Award Management Exclusions website (https://www.sam.gov).

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 C.F.R. Part 9, Subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the federal government, the department or agency with which this transaction originated may pursue available remedies, including suspension or debarment.

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any federal department or agency.

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

F. System for Award Management

Pursuant to 2 C.F.R. Part 25, an applicant or recipient (as the case may be) is required to: (i) be registered in the System for Award Management (SAM) before submitting its complete application packet; (ii) provide a valid unique entity identifier in its application; and (iii) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency, unless otherwise excepted from these requirements pursuant to 2 C.F.R. § 25.110. NTIA will not make a federal award to an applicant until the applicant has complied with all applicable unique entity identifier and SAM requirements and, if an applicant has not fully complied with the requirements by the time that NTIA is ready to make a federal award pursuant to this NOFO, NTIA may determine that the applicant is not qualified to receive a federal award.

G. Submission Dates and Times

Complete applications must be received through the NTIA Application Portal no later than 11:59 p.m. Eastern Daylight Time (EDT) on **September 30, 2022.** Complete applications or portions thereof submitted by postal mail, courier, email, or by facsimile will not be accepted. All application forms and documents must be included with an applicant's complete application packet submission through the NTIA Application Portal.

When developing the submission timeline, each applicant should keep in mind that: (a) all applicants are required to have current registrations in the electronic System for Award

Management (SAM.gov); and (b) the free annual registration process in SAM.gov generally takes between three (3) and five (5) business days but can take more than three weeks. Please note that a federal assistance award cannot be issued if the designated recipient's registration in SAM.gov is not current at the time of the award.

NTIA expects to complete its review, selection of successful applicants, and award processing by **February 16, 2023.** NTIA expects that awards under this Notice of Funding Opportunity (NOFO) will be issued no earlier than **March 1, 2023**.

H. Intergovernmental Review

Applications from a State or a political subdivision of the State under this program are subject to Executive Order 12372, "Intergovernmental Review of Federal Programs," which requires intergovernmental consultation with State and local officials. All State applicants are required to submit a copy of their applications to their designated Single Point of Contact (SPOC) offices to the extent they utilize a SPOC.[16]

I. Funding Restrictions

1. Eligible Uses of Funds for the MMG Program

Grant recipients may only use federal award funds and any non-federal cost share committed to an award to pay for allowable costs under the MMG Program. Allowable costs are determined in accordance with the cost principles identified in 2 C.F.R. Part 200, including Subpart E of such regulations for States and non-profit organizations, and in 48 C.F.R. Part 31 for commercial organizations,[17] as well as in the grant program's authorizing legislation. In addition, costs must be reasonable, necessary, allocable, and allowable for the proposed project, and conform to generally accepted accounting principles. Except as set out in paragraph d below (addressing allowable pre-application expenses), federal and non-federal funds committed to an award may only be used to cover allowable costs incurred and for allowable closeout costs incurred during the grant closeout process.

Based on the scope of the MMG Program, below are non-exclusive examples of eligible uses of MMG Program funds:

a. Construction, improvement, and/or acquisition of facilities and telecommunications equipment required to deploy middle mile broadband facilities;

[16] *See* 7 C.F.R. Part 3015, Subpart V.

[17] The government has established a set of principles for determining eligible or allowable costs. Allowable costs are determined in accordance with the cost principles applicable to the entity incurring the costs. For example, the allowability of costs incurred by State, local or Federally-Recognized Indian tribal governments is determined in accordance with the provisions of 2 C.F.R. Part 200, Subpart E and the allowability of costs for commercial organizations is determined in accordance with the provisions of 48 C.F.R. Part 31, unless the Grants Officer decides in writing to apply the cost principles in 2 C.F.R. Part 200, Subpart E, to commercial organizations pursuant to 2 C.F.R. § 200.101(a)(2).

b. Engineering design, permitting and work related to environmental, historical and cultural reviews;

c. Personnel costs, including salaries and fringe benefits for staff and consultants required for the implementation of the MMG Program (such as project managers, program directors, subject matter experts, grant administrators, financial analysts, accountants, and attorneys);

d. Reasonable, post-NOFO, pre-application expenses in an amount not to exceed $50,000. Pre-application expenses, which include expenses related to preparing an application, may be reimbursed if they are incurred after the publication date of this NOFO and prior to the date of issuance of the grant award from NTIA, except that lobbying costs and contingency fees are not reimbursable from grant funds. These costs should be clearly identified in the proposed project budget and must be approved by NTIA and the Grants Officer in writing to be considered allowable. Additionally, pre-application costs are incurred at the sole risk of the applicant and will not be reimbursed by NTIA if the proposed project does not receive an award pursuant to this program; and

e. Other costs necessary to carrying out programmatic activities of an award, not to include ineligible costs described below in Section IV.I.2 of this NOFO.

2. Ineligible Costs for the MMG Program

Ineligible costs include those costs that are unallowable under the applicable federal cost principles. Please note that costs ineligible for the MMG Program may not be paid for with the non-federal cost share committed to an award. In addition, the following costs are specifically identified as prohibited under the MMG Program:

a. Prohibition On Use of Grant Funds For Covered Communications Equipment Or Services under the Secure and Trusted Communications Networks Act

An award recipient or subrecipient (including contractors and subcontractors) may not use grant funds received under the MMG Program to purchase or support any covered communications equipment or service (as defined in Section 9 of the Secure and Trusted Communications Networks Act of 2019 (47 U.S.C. § 1608)).

b. Prohibition on Profit and Fees

A profit, fee, or other incremental charge above actual cost incurred by an award recipient or subrecipient is not an allowable cost under this Program.

c. Prohibition on Use of Grant Funds to Support or Oppose Union Organizing

An award recipient or any subrecipient may not use grant funds, whether directly or indirectly, to support or oppose union organizing.

d. Prohibition on Use of Grants Funds for Non-Middle Mile Infrastructure

An award recipient or subrecipient may not use grant funds received under the MMG Program for broadband infrastructure costs that are not necessary to complete the project that was proposed by the recipient and approved by NTIA.

3. Other

As a condition of receiving a grant under the MMG Program, a provider of broadband service that is receiving the grant is prohibited from using grant amounts:

a. As collateral for a loan made by any public or private lender;

b. For pre-application expenses, including previously incurred administrative costs or previously purchased equipment or construction activities, except as allowed in Section IV.I.1.d of this NOFO.

J. Material Representations and Public Disclosure of Applications

All forms and supporting documents submitted as part of the complete application packet will be treated as a material representation of fact upon which NTIA will rely in awarding grants. Applicants should be aware that NTIA may make all or portions of their applications for grants under the MMG Program publicly available as required under applicable federal laws. *See* Section VIII.B of this NOFO for additional information concerning the confidentiality of information contained in an application.

K. Other Submission Requirements

Complete applications for the MMG Program must be electronically submitted through the NTIA Application Portal, available at grants.ntia.gov. Late or incomplete applications and applications submitted by mail, courier, or by facsimile will not be accepted.

1. Timely Receipt Requirements and Proof of Timely Submission

Proof of timely submission is automatically recorded by the NTIA Application Portal. An electronic date/time stamp is generated within the system when the application is successfully submitted in the NTIA Application Portal. The applicant with the Authorized Organization Representative (AOR) role who submitted the application will receive an email acknowledgement of receipt from the NTIA Application Portal with the successful transmission of their application. Applications received in the NTIA Application Portal after the established due date for the program will be considered late and will not be considered for funding by NTIA.

2. Material Revisions

An applicant shall not be permitted to make any material revision to its application after the submission deadline. NTIA may, however, request or accept clarifications, revisions or

submissions for completeness that are non-material. It is in the Assistant Secretary's sole discretion whether a revision is material or not.

3. Amendments

Any amendments to this NOFO or additional program guidance will be announced on NTIA.gov and BroadbandUSA.NTIA.gov.

V. Application Review Information

A. Review Process for the MMG Program

The review process will be divided into several stages, as outlined below:

1. Initial Administrative and Eligibility Review of Complete Application Packets

NTIA will conduct an initial review of timely received applications submitted in response to this NOFO to determine eligibility, completeness, and responsiveness to the minimum threshold requirements and programmatic requirements of the MMG Program, including a review of the project narrative and budget justification. Applications submitted by any entity other than an eligible applicant will be eliminated from further review as well as any applications that fail to meet any of the requirements of Section III.B of this NOFO. NTIA may continue the initial administrative review process for an application that is timely submitted by an eligible applicant, but that is missing certain information or documentation required by this NOFO and will request missing or incomplete information from the applicant as needed. The applicant will have seven (7) calendar days to submit materials responsive to the feedback provided by NTIA, unless this period is extended by NTIA. An eligible applicant's failure to remedy deficiencies in a timely manner may result in NTIA's denial of the application.

After determining that an application is complete, NTIA will evaluate whether the proposed project meets the Infrastructure Act's threshold eligibility criteria (*see* Section III above) before entering proposals into the Merit Review stage (described below).

***First*,** as directed by Section 60401(d)(3) of the Infrastructure Act (and detailed in Section III.B above), each applicant must provide evidence sufficient to demonstrate that it "is capable of carrying out a proposed project in a competent manner, including by demonstrating that the eligible entity has the financial, technical and operational capability to carry out the proposed project and operate the resulting middle mile broadband network."

Second, as directed by Section 60401(e)(3)(A) of the Infrastructure Act, each applicant (*i.e.*, eligible entity) must certify that the proposed project will, upon completion, be capable of supporting retail broadband service.

Third, as directed by Section 60401(f) of the Infrastructure Act, each applicant must commit to a non-federal cost share of no less than 30 percent of the total project cost. Under the statute, only Tribal governments and Native entities may request a partial or complete waiver of this

requirement for (i) the effective delivery and administration of middle mile grants to Tribal governments; or (ii) the construction, improvement, or acquisition of middle mile infrastructure on trust land. In the event that a Tribal government or Native entity seeks such a waiver, such entities must submit documentation substantiating the need for that waiver. *See* Section III.G.

Fourth, as directed by Section 60401(e) of the Infrastructure Act, each applicant must make a binding commitment to prioritize at least one of the following via the funded middle mile network:

a. Connecting middle mile infrastructure to last mile networks that provide or plan to provide broadband service to households in unserved areas;[18]
b. Connecting non-contiguous trust lands; or
c. The offering of wholesale broadband service at reasonable rates on a carrier-neutral basis.

Fifth, as directed by Section 60401(e)(3)(D) of the Infrastructure Act, an eligible entity that receives a middle mile grant award to build a middle mile project using fiber-optic technology shall offer interconnection in perpetuity, where technically feasible without exceeding current or reasonably anticipated capacity limitations, on reasonable rates and terms to be negotiated with requesting parties. Such interconnection must include both the ability to connect to the public internet and physical interconnection for the exchange of traffic.

2. Merit Review

Applications satisfying the Initial Administrative and Eligibility Review will be evaluated by at least three objective reviewers who have demonstrated expertise in the programmatic and technical aspects of the Middle Mile Grant Program. Reviewers may be federal employees or non-federal persons. During the review process, the reviewers may discuss the applications with each other, but scores will be determined on an individual basis. As applicable, each reviewer will be required to sign and submit a nondisclosure and confidentiality form pertaining to the dissemination of confidential information and to potential financial and other conflicts of interest. Reviewers will evaluate applications according to the following evaluation criteria and will independently score each application based on a scale of 0-100.

a. Project Purpose and Benefits (60 points)

1. Extent to which the project will either (a) facilitate deployment of high-speed broadband networks to currently unserved or underserved areas or (b) improve affordability in already-served markets (*e.g.*, by reducing interconnection costs for last-mile providers or providing opportunities for competitive providers to offer last-mile service). (20 points)

[18] Applicants must specify the date upon which they referenced the FCC fixed broadband map in any application. If the FCC Fixed Broadband Map is not available, NTIA and the applicants may use the most recent mapping data available as set forth in Section 60401(e)(3)(B)(i) of the Infrastructure Act in connection with the application and review process.

2. Whether the project will offer non-discriminatory interconnection in perpetuity, where technically feasible without exceeding current or reasonably anticipated capacity limitations, on reasonable rates and terms to be negotiated with requesting parties. Such interconnection must include both the ability to connect to the public internet and physical interconnection for the exchange of traffic.[19] (10 points)

3. Whether the provider commits to offering access to the funded middle mile infrastructure, in perpetuity, on an open access basis.[20] (10 points)

4. Extent to which the project will otherwise benefit the proposed service area, including, but not limited to, by (a) facilitating development of carrier-neutral interconnection facilities; (b) improving the redundancy or resiliency of existing middle mile infrastructure; or (c) including direct interconnect facilities that will facilitate the provision of broadband service to anchor institutions located within 1,000 feet of the middle mile infrastructure at speeds of at least 1 Gbps symmetrical. (10 points)

5. Comprehensiveness and appropriateness of the proposed technical solution for meeting the community's needs, considering the offering's capacity and performance characteristics. Reviewers will consider the proposed network's ability to serve anticipated last mile networks, and to meet the increasing needs of the households, businesses, and anchor institutions in the areas linked by the middle mile facilities at issue. Reviewers will score favorably construction projects that are "shovel ready" and capable of completion within a two-year period. (10 points)

b. Project Sustainability (40 points)

1. Applicant's organizational capability to complete the specific project proposed.[21] (5 points)

[19] As noted above, such interconnection is required of applicants seeking to construct fiber-based middle mile infrastructure. The points allocated during Merit Review will be available both to fiber projects (which will automatically receive full points, because they cannot reach Merit Review without committing to interconnection meeting this requirement) and to non-fiber projects. This approach will ensure that fiber projects are not disadvantaged via other projects in the scoring process, while providing strong incentives for applicants proposing non-fiber projects to commit to the same interconnection required of fiber-based providers.

[20] As used in this context, "open access" refers to an arrangement in which the eligible entity offers nondiscriminatory access to and use of its network on a wholesale basis to other providers seeking to provide middle mile carriage using the eligible entity's funded network, at just and reasonable wholesale rates.

[21] While applicants must demonstrate their capability in order to enter Merit Review at all, this scoring criterion will account for the extent to which an applicant is *particularly* capable of completing the project at issue. Reviewers will consider the experience and expertise of the project management team and the organization's track record with respect to projects of similar size and scope, as well as the organization's capacity and readiness. Reviewers will also assess the applicant's partnership and/or subrecipient strategy, including how that strategy complements the applicant's organizational capacity, as well as the project approach, feasibility, and timely completion of proposed project.

2. Reasonableness of the applicant's proposed budget.[22] (10 points)

3. Project's fiscal sustainability beyond the award period.[23] (10 points)

4. Applicant's commitment to contribute a non-federal cost share of more than 30 percent of the total eligible project costs as reflected in the proposed project budget. (5 points for non-federal share between 30 and 40 percent, 10 points for non-federal share between 41 and 50 percent, 15 points for more than 50 percent non-federal share)

3. Programmatic Review

a. Prioritization

Applications will be prioritized for programmatic review as follows:

1. NTIA will first review any application that received a mean score of 80 or higher during the Merit Review *and* for which the applicant has demonstrated that it will meet at least two of the five requirements set forth in Section 60401(d)(2) of the Infrastructure Act (*see* Section V.A.1);
2. NTIA will next review any other application receiving a mean score of 80 or higher during the Merit Review;
3. Applications receiving scores below 80, for which the applicant has demonstrated that it will meet at least two of the five requirements set forth in Section 60401(d)(2) of the Infrastructure Act (*see* Section V.A.1), may be entered into Programmatic Review after review of the prioritized applications in the event that (a) the Programmatic Review results in a slate of proposals that do not utilize the entirety of available MMG Program funds or (b) evaluation of other applications is deemed warranted at a later stage in the process to ensure geographic diversity or appropriate diversity in project sizes. At this stage of the review, applications with scores below 80 for which the applicant has demonstrated that it will meet at least two of the five requirements set forth in Section 60401(d)(2) of the Infrastructure Act (*see* Section V.A.1) will receive priority before other applications with scores below 80.

b. Programmatic Review Process

Programmatic Review will involve two steps:

[22] Reviewers will evaluate the reasonableness of the budget based on (a) its clarity, level of detail, comprehensiveness, appropriateness to the proposed technical and programmatic solutions, (b) the reasonableness of its costs, (c) whether the allocation of funds is sufficient to complete the tasks outlined in the project plan, (d) the extent to which the project will leverage existing rights-of-way, assets, and infrastructure, and (e) the extent to which the applicant has secured reduction in permitting or other regulatory barriers.

[23] Reviewers will consider business plans, market projections, third-party funding commitments, and such other data as may be appropriate to the nature of the applicant and the proposed project. Reviewers will consider, among other things, demonstrations of community commitments or anchor tenant commitments that would help promote sustainability.

First, NTIA may ask applicants to submit additional information, as appropriate, to clarify or to further substantiate the representations made in their applications. NTIA Program Staff will review the supplemental information, along with all information submitted with the application, to confirm eligibility and ensure that the application warranted the score assigned during Merit Review. Applicants whose supporting documents are not complete, accurate, and timely submitted or that do not adequately substantiate the representations in their applications may be denied. NTIA will request supplemental documentation before deciding to deny such applications and will reevaluate the application package based on all of the information presented. Applicants will have five (5) calendar days to submit information responsive to the feedback provided by NTIA, unless this time period is extended by NTIA.

Second, NTIA will assess all projects that reach Programmatic Review to consider the extent to which those applications meet the criteria listed below and will calculate weighted scores to reflect each project's likelihood of advancing those goals. Specifically, based on the factors listed below, each project's mean Merit Review Score will be multiplied by between 1.0 (for projects that do not meet any of the objectives listed below) and 1.8 for projects that meet all of the criteria listed below). Weights will be assigned based on the following criteria:

1. Applicant's ability to demonstrate likelihood of material reduction in end-user broadband prices resulting from funded middle mile infrastructure (*e.g.*, by demonstrating decline in middle mile costs that are likely to flow through to consumer broadband prices).
2. Applicant's ability to demonstrate likelihood of material reduction in latency experienced by end users in remote or insular areas (*e.g.*, Hawaii and Pacific Ocean territories) resulting from funded middle mile infrastructure.
3. Applicant's ability to demonstrate that substantial benefits stemming from funded middle mile infrastructure will accrue to (a) high-poverty counties,[24] (b) persistent poverty counties,[25] and/or (c) a substantial number of end users/households that meet any of the following criteria:

    a. Household income for the most recently completed calendar year was at or below 200 percent of the Federal Poverty Guidelines;

    b. Any member of the household meets the qualifications of the Supplemental Nutrition Assistance Program, Medicaid, Federal Public Housing Assistance, Supplemental Security Income, Veterans and Survivors Pension benefit, or Special Supplemental Nutrition Program for Women, Infants, and Children;

[24] For the purposes of this requirement, high poverty areas are areas in which the percentage of individuals with a household income that is at or below 150 percent of the poverty line applicable to a family of the size involved (as determined under Section 673(2) of the Community Services Block Grant Act (42 U.S.C. § 9902(2)) is higher than the national percentage of such individuals.

[25] For the purposes of this requirement, persistent poverty counties are counties that have had poverty rates of 20 percent or greater for at least 30 years as calculated by the Economic Research Service in the Department of Agriculture.

b. Any member of the household meets the qualifications of Tribal specific assistance programs, such as Bureau of Indian Affairs General Assistance, Tribal TANF, Tribal Head Start, or Food Distribution Program on Indian Reservations;

d. Any member of the household has applied for and been approved to receive benefits under the National School Lunch Program or the School Breakfast Program, including through the USDA Community Eligibility Provision;

e. Any member of the household received a Federal Pell Grant during the current award year;

f. The household meets the eligibility criteria for a participating provider's existing low-income internet program.

4. Applicant's ability to demonstrate that substantial benefits stemming from funded middle mile infrastructure will accrue to (a) previously unserved locations, and/or (b) Tribal Lands.
5. Applicant's ability to demonstrate that the route of the proposed middle mile infrastructure is designed to enable connection of unserved anchor institutions, including Tribal anchor institutions.
6. Applicant's ability to demonstrate compliance with requirements set forth in Sections III.H, III.I, III.J, and III.L related to Fair Labor Practices, Highly Skilled Workforce, Advancing Equitable Workforce Development and Job Quality Objectives, and Civil Rights and Non-Discrimination Law Compliance.
7. Applicant's ability to demonstrate the climate resilience of the project in accordance with Section III.K.
8. Applicant's proposed use of community benefit agreements.[26]

With respect to each item above, each applicant should specify which of the above criteria it believes its project meets, and provide evidence that supports its position with respect to each criterion. Programmatic reviewers will consider the evidence presented on its own merit and will not seek out or consider material not included in the application except insofar as they request additional information to clarify or to further substantiate representations made in an application.

NTIA reserves the right at any time during the Programmatic Review process to negotiate with the applicant relative to specific modifications to the application, including but not limited to the resolution of any differences that may exist between the applicant's original request and NTIA's determination of Middle Mile Grant Program funding priorities. NTIA may also ask the applicant to modify its proposal (*e.g.*, to reduce its scope by removing or limiting proposed routes).

Upon completion of the Programmatic Review, NTIA Program Staff will summarize their analysis for each application reviewed, and will provide a ranked list of proposed projects, based on each project's weighted score, to the Associate Administrator for the Office of Internet

[26] A community benefit agreement is an agreement signed by community benefit groups and a developer, identifying the community benefits a developer agrees to deliver, in return for community support of the project.

Connectivity and Growth (OICG Associate Administrator). In the event the list of proposed projects does not account for the entirety of the funding available, NTIA Program Staff shall conduct a Programmatic Review for any application that attained a mean score of between 70 and 79 during Merit review and will add the projects with the highest weighted scores to the list it provides to the OICG Associate Administrator.

4. OICG Associate Administrator Review

Following the conclusion of the Programmatic Review, the OICG Associate Administrator will compose a list of the projects with the highest weighted scores, beginning with the highest-scored application, and moving in order down the list until the projects on the list account for all available MMG Program funds (or until addition of the next project listed would cause demand to exceed available funds), and prepare a package of recommended awards to the Selection Official for consideration, review, and approval. The OICG Associate Administrator's recommendations to the Selecting Official may differ from the ranked list of applications based on consideration of the following selection factors: (a) geographic diversity and (b) appropriate diversity in the size of the funding amount of proposed awards and will make substitutions as warranted.

5. Final Project Selection

After conducting the review described above, the OICG Associate Administrator shall provide a package of recommended awards to the Assistant Secretary for final review. As the Selecting Official, the Assistant Secretary retains discretion to select and recommend an application for funding that was not recommended by the OICG Associate Administrator and/or not to select an application that was recommended for funding by the OICG Associate Administrator based on (a) geographic diversity and (b) appropriate diversity in the size of the funding amount of proposed awards.

The Assistant Secretary will submit the applications recommended for funding, along with the basis for the selection decisions, to the National Institute of Science and Technology (NIST) Grants Officer, who serves as the Grants Officer for the Middle Mile Grant Program. The final approval of selected applications and the issuance of awards will be made by the NIST Grants Officer.

The award decisions of the NIST Grants Officer are final. All awards are subject to the availability of federal award funds at the time of award. Unsuccessful applicants will be notified in writing after all selections are finalized.

B. Federal Awarding Agency Review of Risk Posed by Applicants

After applications are proposed for funding by the Selecting Official, the NIST Grants Management Division (GMD) will perform pre-award risk assessments in accordance with 2 C.F.R. § 200.206, which may include a review of the financial stability of an applicant, the quality of the applicant's management systems, the history of performance, reports and findings from audits, and/or the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities. In addition, prior to making an award where the

total federal share is expected to exceed the simplified acquisition threshold (currently $250,000), NIST GMD will review and consider the non-publicly available information about that applicant in the Federal Awardee Performance and Integrity Information System (FAPIIS). Upon completion of the pre-award risk assessment, NIST GMD will determine whether the applicant is qualified to receive the award and, if so, whether appropriate specific award conditions that correspond to the degree of risk posed by the applicant should be applied to the award.

C. Anticipated Announcement and Award Dates

NTIA expects to complete its review, selection of successful applicants, and award processing by **February 16, 2023.** NTIA expects that start dates for awards under this NOFO will be no earlier than **March 1, 2023**. NTIA anticipates announcing awards made under the MMG Program on a rolling basis during calendar year 2023.

VI. Federal Award Administration Information

A. Federal Award Notices

A grants officer from the NIST Grants Office will serve as the Grants Officer for awards issued pursuant to this NOFO. Applicants will be notified in writing by the NIST Grants Officer if their application is selected for an award. If the application is selected for funding, the NIST Grants Officer will issue the grant award (Form CD-450), which is the authorizing financial assistance award document. By signing the Form CD-450, the recipient agrees to comply with all award provisions, terms, and conditions.

If an applicant is awarded funding, neither NTIA nor NIST is under any obligation to provide any additional future funding in connection with that award or to make any future award(s). Amendment of an award to extend the period of performance is at the discretion of NTIA and the NIST Grants Officer.

B. Notification to Unsuccessful Applicants

Unsuccessful applicants will be notified by e-mail and will have the opportunity to receive a debriefing after the opportunity is officially closed. Applicants must make a request within 10 business days of the email notification to receive a debrief from NTIA. NTIA will then work with the unsuccessful applicant in arranging a date and time of the debrief.

C. Retention of Unsuccessful Applications

Unsuccessful applications will be retained in accordance with NTIA recordkeeping requirements.

D. Administrative and National Policy Requirements

Grant recipients will comply with applicable statutes and regulations, including but not limited to:

1. Uniform Administrative Requirements, Cost Principles and Audit Requirements

Through 2 C.F.R. § 1327.101, the Department of Commerce adopted Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200, which apply to awards in this program. Refer to http://go.usa.gov/SBYh and http://go.usa.gov/SBg4.

2. Department of Commerce Financial Assistance Standard Terms and Conditions

The Department of Commerce will apply to each award in this program, the Financial Assistance Standard Terms and Conditions in effect on the date of award. The current version, dated November 12, 2020, is accessible at Department of Commerce Financial Assistance Standard Terms and Conditions. Refer to Section VII of this NOFO if you need more information.

3. Pre-Award Notification Requirements

The Department of Commerce will apply the Pre-Award Notification Requirements for Grants and Cooperative Agreements dated December 30, 2014 (79 FR 78390), accessible at http://go.usa.gov/hKkR. Refer to Section VII of this NOFO if you need more information.

4. Environmental and National Historical Preservation Requirements

Awarding agencies are required to analyze the potential environmental impacts, as required by the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq*.) and the National Historic Preservation Act (NHPA) (54 U.S.C. § 300101 *et seq*.) for applicant proposals and awardee projects seeking funding under the MMG Program. Applicants with projects containing construction and/or ground disturbing activities are required to submit all required environmental documentation in their application package or describe in their project narrative the physical project location, photographs, and how they will comply with applicable environmental and national historical preservation requirements. It is the applicant's responsibility to obtain all necessary federal, State, and local governmental permits and approvals necessary for the proposed work to be conducted. Applicants are expected to design their projects so that they minimize the potential for adverse impacts on the environment. Applicants also will be required to cooperate with NTIA in identifying feasible measures to reduce or avoid any identified adverse environmental impacts of their proposed projects. The failure to do so may be grounds for not making an award. Applications will be reviewed to ensure that they contain sufficient information to allow agency staff to conduct a NEPA analysis so that appropriate NEPA documentation can be submitted to NTIA, along with the recommendation for funding of the selected applications. If additional information is required after an application is accepted for funding, funds can be withheld by NTIA under a specific award condition requiring the awardee to submit additional environmental compliance information sufficient for the agency to make an assessment of any impacts that a project may have on the environment.

5. Property Trust Relationship and Public Notice Filings for Grant-Acquired Property

In accordance with 2 C.F.R. § 200.316, any real property, equipment, and intangible property, acquired or improved with a federal award must be held in trust by the recipient or subrecipient as trustee for the beneficiaries of the project or program under which the property was acquired or improved. This trust relationship exists throughout the duration of the property's estimated useful life, as determined by the Grants Officer in consultation with the Program Office, during which time the federal government retains an undivided, equitable reversionary interest in the property (Federal Interest). In this connection, NTIA may require the non-federal entity to record liens or other appropriate notices of record to indicate that personal or real property has been acquired or improved with a federal award and that use and disposition conditions apply to the property. Awards issued pursuant to this NOFO may contain specific award conditions pertaining to the use and disposition of grant-acquired property and to a requirement that the recipient or subrecipient file certain public notices (*e.g.*, UCC-1, Covenant of Purpose, Use and Ownership, etc.) with respect to grant-acquired property. NTIA may provide information regarding the useful life schedules associated with assets acquired with grant funds.

6. Domestic Preference for Procurements (Buy American)

The Infrastructure Act presents an important opportunity to ensure that American taxpayer dollars are spent procuring needed products and supplies from American workers and businesses, strengthening and growing U.S. domestic manufacturing capacity. Accordingly, all funds made available through the MMG Program for broadband infrastructure must comply with the Build America, Buy America Act.[27] The Build America, Buy America Act requires that all of the iron, steel, manufactured products (including but not limited to fiber-optic communications facilities), and construction materials used in the project or other eligible activities are produced in the United States unless a waiver is granted. Under the Build America, Buy America Act and the Buy America Guidance issued by the Office of Management and Budget on April 18, 2022,[28] the Secretary of Commerce (Secretary) may waive the application of this preference when (1) applying the domestic content procurement preference would be inconsistent with the public interest; (2) types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project or other eligible activities by more than 25 percent. Consistent with the waiver principles detailed in Sec. 70921(b)(1) of the Build America, Buy America Act and the Buy America Guidance, the Secretary will seek to minimize waivers, and any waivers will be limited in duration and scope.

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[27] Infrastructure Investment and Jobs Act of 2021, Division G, Public Law 117-58, 135 Stat. 429 (November 15, 2021).

[28] *See* Shalanda D. Young, Director, OMB, *Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure*, M-22-11 (Apr. 18, 2022), available at https://www.whitehouse.gov/wp-content/uploads/2022/04/M-22-11.pdf (Buy America Guidance).

In determining whether a product is produced in America, applicants must comply with definitions included in Section 70912 of the Build America, Buy America Act, which provides that a manufactured product is considered produced in the United States if the manufactured product was manufactured in the United States and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation.

In addition to the provisions above, MMG funding may not be used to purchase or support any covered communications equipment or service, as defined in Section 9 of the Secure and Trusted Communications Networks Act of 2019 (47 U.S.C. § 1608).

7. Contracting with Small and Minority Businesses, Women's Business Enterprises, and Labor Surplus Area Firms

Minority Businesses Enterprises (MBEs) and Women's Business Enterprises (WBEs) are major catalysts for economic growth and job creation. However, data shows that MBEs and WBEs historically face significant contracting disparities compared to other businesses. Pursuant to 2 C.F.R. § 200.321, any eligible entity that receives an award must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps must include:

a. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

b. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;

c. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;

d. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;

e. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and

f. Requiring subrecipients to take the affirmative steps listed above as it relates to its subcontractors.

E. Reporting

Eligible Entities will be required to comply with reporting requirements. In addition to the reporting requirements found in 2 C.F.R. Part 200, NTIA will provide additional reporting instructions in connection with the requirements set forth in this Section, including details on the manner and format that Eligible Entities will be required to report information (a) in support of federal agency obligations under the ACCESS BROADBAND Act, 47 U.S.C. § 1307, and

Infrastructure Act § 60105; and (b) on the use and performance of middle mile infrastructure funded under this MMG Program.

1. Bi-annual Performance Reporting and Final Report

An eligible entity that receives an award shall biannually, until the funds have been expended, submit to the Assistant Secretary (via email to the NTIA Federal Program Officer listed in the recipient's award documents) a report, with respect to the six-month period immediately preceding the report date, that:

1. Describes how the eligible entity expended the funds and includes an SF-425 form and all required financial reporting information.

2. Certifies that the eligible entity complied with the requirements of the Infrastructure Act and the MMG Program, including:

   a. A description of each service provided with the grant funds; and

   b. Information regarding the middle mile infrastructure constructed, improved, or acquired, including material describing specific routes deployed, splice points and interconnection points along such routes, interconnection points, any interconnection or wholesale agreements in place with third parties, and connections to last-mile infrastructure.

3. Describes whether the project prioritizes local hires.

4. Describes whether the project has a Community Benefit Agreement, with a description of any such agreement.

5. Identifies each subrecipient that received a subaward or subcontract from the eligible entity and a description of the specific project for which grant funds were provided.

6. Technical progress reporting information as prescribed in 2 C.F.R. § 200.329 (http://go.usa.gov/xkVgP) and Department of Commerce Financial Assistance Standard Terms and Conditions (dated November 12, 2020), Section A.01.

7. For projects over $5,000,000 (based on expected total cost):

   a. A recipient may provide a certification that, for the relevant project, all laborers and mechanics employed by contractors and subcontractors in the performance of such project are paid wages at rates not less than those prevailing, as determined by the U.S. Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code (commonly known as the "Davis-Bacon Act"), for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the civil subdivision of the State (or the District of Columbia) in which the work is to be performed, or by the appropriate State entity pursuant to a corollary State prevailing-wage-in-construction law (commonly known as "baby Davis-Bacon Acts"). If such certification is not provided, an awardee must provide a project employment and local impact report detailing:

      i. The number of contractors and sub-contractors working on the Project;

ii. The number of workers on the Project hired directly and hired through a third party;
iii. The wages and benefits of workers on the Project by classification; and
iv. Whether those wages are at rates less than those prevailing.[29]

b. If a recipient has not provided a certification that a project either will use a unionized project workforce or includes a project labor agreement, meaning a pre-hire collective bargaining agreement consistent with section 8(f) of the National Labor Relations Act (29 U.S.C. § 158(f)), then the recipient must provide a project workforce continuity plan, detailing:

i. Steps taken and to be taken to ensure the project has ready access to a sufficient supply of appropriately skilled and unskilled labor to ensure construction is completed in a competent manner throughout the life of the project (as required in Section III.B), including a description of any required professional certifications and/or in-house training, registered apprenticeships or labor-management partnership training programs, and partnerships with entities like unions, community colleges, or community-based groups;
ii. Steps taken and to be taken to minimize risks of labor disputes and disruptions that would jeopardize timeliness and cost-effectiveness of the project;
iii. Steps taken and to be taken to ensure a safe and healthy workplace that avoids delays and costs associated with workplace illnesses, injuries, and fatalities, including descriptions of safety training, certification, and/or licensure requirements for all relevant workers (*e.g.*, OSHA 10, OSHA 30, confined space, traffic control, or other training required of workers employed by contractors), including issues raised by workplace safety committees and their resolution;
iv. The name of any subcontracted entity performing work on the project, and the total number of workers employed by each such entity, disaggregated by job title; and
v. Steps taken and to be taken to ensure that workers on the project receive wages and benefits sufficient to secure an appropriately skilled workforce in the context of the local or regional labor market.

Recipients must maintain sufficient records to substantiate all information above upon request.

Reports must be submitted on a biannual basis for the periods ending March 31 and September 30 of each year. Reports will be due within 30 days after the end of the reporting period. Eligible entities shall certify that the information in the report is accurate.

[29] As determined by the U.S. Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code (commonly known as the "Davis-Bacon Act"), for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the civil subdivision of the State (or the District of Columbia) in which the work is to be performed.

Eligible entities that receive an award shall comply with any other reasonable reporting requirements determined necessary by the Assistant Secretary. Further, in addition to the above requirements and those reporting requirements found in 2 C.F.R. Part 200, eligible entities that receive an award will be required to submit a final report as a part of the grant close-out process that describes the programmatic objectives achieved through the funding and completion of the grant-funded project, including those elements collected in the bi-annual report.

2. Provision of Information to NTIA, FCC, Relevant Tribal Governments, and State Broadband Offices

In accordance with and subject to the provisions of Section 60401(e)(3)(B)(ii) of the Infrastructure Act, an applicant that receives a middle mile grant award shall share the location of all middle mile broadband infrastructure constructed, improved, or acquired using such grant with the Assistant Secretary, the Commission, any Tribal government with jurisdiction over the area that will be served by the infrastructure, and the State broadband office for the State in which the area that will be served by the middle mile infrastructure is located.

F. Recipient Integrity and Performance Matters

In accordance with Section 872 of Public Law 110-417 (as amended; *see* 41 U.S.C. § 2313), if the total value of a recipient's currently active grants, cooperative agreements, and procurement contracts from all federal awarding agencies exceeds $10,000,000 for any period of time during the period of performance of an award made under this NOFO, then the recipient shall be subject to the requirements specified in Appendix XII to 2 C.F.R. Part 200,[30] for maintaining the currency of information reported to SAM that is made available in the Federal Awardee Performance and Integrity Information System (FAPIIS) about certain civil, criminal, or administrative proceedings involving the recipient.

G. Audit Requirements

2 C.F.R. Part 200, Subpart F, adopted by the Department of Commerce through 2 C.F.R. § 1327.101, requires any non-federal entity that expends federal awards of $750,000 or more in the recipient's fiscal year to conduct a single or program-specific audit in accordance with the requirements set out in the Subpart. Additionally, unless otherwise specified in the terms and conditions of the award, entities that are not subject to Subpart F of 2 C.F.R. Part 200 (*e.g.*, commercial entities) that expend $750,000 or more in grant funds during their fiscal year must submit to the Grants Officer either: (i) a financial related audit of each DOC award or subaward in accordance with Generally Accepted Government Auditing Standards; or (ii) a project specific audit for each award or subaward in accordance with the requirements contained in 2 C.F.R. § 200.507. Applicants are reminded that NTIA, the Department of Commerce Office of Inspector General, or another authorized federal agency may conduct an audit of an award at any time.

[30] *See* 2 C.F.R. Part 200, Appendix XII, *available at* http://go.usa.gov/cTBwC.

H. Federal Funding Accountability and Transparency Act of 2006

In accordance with 2 C.F.R. Part 170, all recipients of a federal award made on or after October 1, 2010, are required to comply with reporting requirements under the Federal Funding Accountability and Transparency Act of 2006 (Pub. L. No. 109-282). In general, all recipients are responsible for reporting sub-awards of $30,000 or more. In addition, recipients that meet certain criteria are responsible for reporting executive compensation. Applicants must ensure they have the necessary processes and systems in place to comply with the reporting requirements should they receive funding.[31]

VII. Federal Awarding Agency Contact(s)

A. Please direct programmatic inquiries to:

Sarah Bleau
Director of Middle Mile
Office of Internet Connectivity and Growth
National Telecommunications and Information Administration
U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230
Phone: (202) 482-2048
Email: middlemile@ntia.gov

B. Please direct grant management inquiries to:

Scott McNichol
NIST Grants Officer
Grants Management Division
National Institute of Standards and Technology
325 Broadway
Boulder, CO 80305
Phone: (303) 497-3444
Email: scott.mcnichol@nist.gov

[31] *See* Office of Management and Budget (OMB), Requirements for Federal Funding Accountability and Transparency Act Implementation, Interim final guidance to agencies with opportunity to comment, 75 FR 55663 (Sept. 14, 2010), *available at* http://go.usa.gov/hKnQ.

C. Please direct media inquiries to:

Stephen F. Yusko
Public Affairs Specialist
Office of Public Affairs
National Telecommunications and Information Administration
U.S. Department of Commerce
1401 Constitution Avenue NW, Room 4897
Washington, DC 20230
Phone: (202) 482-7002
Email: press@ntia.doc.gov

VIII. Other Information

A. Transparency

The Infrastructure Act contains robust reporting requirements for Eligible Entities, and requires NTIA, the Commission, and other agencies to coordinate to make information regarding federal broadband funding, low-cost plans, and other aspects of the MMG Program readily available to and understandable by the public. NTIA will fulfill its obligations to the fullest extent possible. Recipients of U.S. Department of Commerce and NTIA grants also should be cognizant of the access to records requirements set forth at 2 C.F.R. § 200.337.

B. Protected and Proprietary Information

The applicant acknowledges and understands that information and data contained in applications for financial assistance, as well as information and data contained in financial, performance, and other reports submitted by the applicant, may be used by the Department of Commerce in conducting reviews and evaluations of its financial assistance programs and for statistical purposes. For this purpose, information and data may be accessed, reviewed, and evaluated by Department of Commerce employees, other federal employees, federal agents and contractors, and/or by non-federal personnel, all of whom enter into appropriate confidentiality and nondisclosure agreements covering the use of such information. As may be provided in the terms and conditions of a specific financial assistance award, applicants are expected to support Program reviews and evaluations by submitting required financial and performance information and data in an accurate and timely manner, and by cooperation with the Department of Commerce and external program evaluators. In accordance with 2 C.F.R. § 200.303(e), applicants are reminded that they must take reasonable measures to safeguard protected personally identifiable information and other confidential or sensitive personal or business information created or obtained in connection with a Department of Commerce financial assistance award.

NTIA will protect confidential and proprietary information from public disclosure consistent with applicable law, including the Trade Secrets Act, as amended (18 U.S.C. § 1905) and the Economic Espionage Act of 1996 (18 U.S.C. § 1831 *et seq*.). In the event that a submission contains information or data deemed to be confidential commercial information or that otherwise should not be publicly disclosed, that information should be identified, bracketed, and marked as

Privileged, Confidential, Commercial or Financial Information. Based on these markings, the confidentiality of the contents of those pages will be reviewed for protection consistent with applicable law.

Additionally, some of the information submitted in the course of applying for funding under this Program or provided in the course of its grant management activities, may be considered law enforcement sensitive or otherwise important to national security interests. This may include threat, risk, and needs assessment information, and discussions of demographics, transportation, public works, and industrial and public health infrastructures. In the event that a submission contains such information or data, that information should be identified, bracketed, and marked appropriately. Based on these markings, the confidentiality of the contents of those pages will be reviewed for protection consistent with applicable law. The applicant should be familiar with the regulations governing Protected Critical Infrastructure Information (6 C.F.R. Part 29) and Sensitive Security Information (49 C.F.R. Part 1520), as these designations may provide additional protection to certain classes of homeland security information.

C. Funding Availability and Limitation of Liability

Funding for the program listed in this NOFO is contingent upon the continued availability of appropriations. In no event will NTIA, NIST or the Department of Commerce be responsible for application preparation costs, including, but not limited to, if the program fails to receive funding or is cancelled because of agency priorities. Publication of this NOFO does not oblige NTIA, NIST or the Department of Commerce to award any specific project or to obligate any available funds. NTIA will fund only projects that are deemed likely to achieve the MMG Program's goals and for which funds are available.

D. Third Party Beneficiaries

The MMG Program is not intended to and does not create any rights enforceable by third party beneficiaries.

E. Waiver Authority

It is the general intent of NTIA not to waive any of the provisions set forth in this NOFO. However, under extraordinary circumstances and when it is in the best interest of the federal government, NTIA, upon its own initiative or when requested, may waive the provisions in this NOFO. Waivers may only be granted for requirements that are discretionary and not mandated by statute or other applicable law. Any request for a waiver must set forth the extraordinary circumstances for the request.

F. Paperwork Reduction Act

This NOFO contains an information collection requirement subject to the Paperwork Reduction Act (PRA) (44 U.S.C. § 3501 *et seq*.). The PRA requires each federal agency to seek and obtain OMB approval before collecting information from the public. Federal agencies may not collect information unless it displays a currently valid OMB control number. For purposes of the MMG Program, NTIA will use the MMG forms in the Application for Broadband Grant Programs

information collection (0660-0046) and Standard Forms 424 (Application for Federal Assistance), 424C (Budget Information for Construction Programs), 425 (Federal Financial Report), and SF-LLL (Disclosure for Lobbying Activities) under the respective control numbers 4040-0004, 4040-0008, 4040-0014, and 4040-0013.

G. Transparency, Accountability, And Oversight Required

1. Generally

NTIA, recipients, and subrecipients have a critical role to play in ensuring that the MMG Program is implemented in a manner that ensures transparency, accountability, and oversight sufficient to, among other things:

1. Minimize the opportunity for waste, fraud, and abuse;

2. Ensure that recipients of middle mile grants use grant funds to further the overall purpose of the Program in compliance with the requirements of the Infrastructure Act, this NOFO, 2 C.F.R. Part 200, and other applicable law; and

3. Allow the public to understand and monitor grants and subawards awarded under the Program.

To that end, NTIA shall:

1. Conduct such audits of recipients and subrecipients as are necessary and appropriate.

2. Develop monitoring plans, subject to the approval of the Assistant Secretary, that may include site visits or desk reviews, technical assistance, and random sampling of compliance requirements.

3. Impose specific conditions on grant awards designed to mitigate the risk of nonperformance where appropriate.

Each award recipient and/or subrecipient shall, as appropriate:

1. Comply with the reporting requirements set forth in Section VI.E above.

2. Comply with the obligations set forth in 2 C.F.R. Part 200 and DOC Financial Assistance Standard Terms and Conditions.

3. Establish and widely publicize telephone numbers and email addresses for the recipient's internal ethics office (or comparable entity) for the purpose of reporting waste, fraud, or abuse in the Program. Recipients shall produce copies of materials used for such purpose on request of the Federal Program Officer.

2. U.S. Department of Commerce Office of Inspector General

The U.S. Department of Commerce Office of Inspector General (OIG) seeks to improve the efficiency and effectiveness of the Department's programs, including deterring and detecting fraud, waste, abuse, and mismanagement. The OIG accomplishes this mission primarily through investigations, audits, and inspections of Department activities, including grants, cooperative agreements, loans, and contracts.

a. Disclosures

Recipients of financial assistance originating from the U.S. Department of Commerce, including NTIA, shall timely disclose, in writing, to the OIG and awarding agency, whenever, in connection with the award, performance, or closeout of this grant or sub-award thereunder, the recipient has credible evidence that a principal, employee, agent, or sub-recipient has committed:

1. A violation of federal criminal law involving fraud, conflict of interest, bribery, or gratuity violations found in Title 18 of the United States Code; or

2. A violation of the civil False Claims Act (31 U.S.C. §§ 3729-3733).

b. Reporting

The OIG maintains a hotline to receive allegations of fraud, waste, or abuse. To report such allegations, please visit https://www.oig.doc.gov/Pages/Hotline.aspx. Upon request, the OIG will take appropriate measures to protect the identity of any individual who reports misconduct, as authorized by the Inspector General Act of 1978, as amended. Reports to the OIG may also be made anonymously.

3. Whistleblower Protection

Recipients, sub-recipients, and employees working on this grant award will be subject to the whistleblower rights and remedies established under 41 U.S.C. § 4712.

An employee of a recipient or sub-recipient may not be discharged, demoted, or otherwise discriminated against as a reprisal for disclosing information that the employee reasonably believes is evidence of: gross mismanagement of a federal contract or award; a gross waste of federal funds; an abuse of authority (*i.e.*, an arbitrary and capricious exercise of authority that is inconsistent with the mission of NTIA or the U.S. Department of Commerce or the successful performance of a contract or grant awarded by NTIA or the Department) relating to a federal contract or award; a substantial and specific danger to public health or safety; or a violation of a law, rule, or regulation related to a federal contract (including the competition for or negotiation of a contract) or grant.

The recipient or sub-recipient shall inform its employees and contractors, in writing, in the predominant language of the workforce or organization, of employee whistleblower rights and protections under 41 U.S.C. § 4712, as described above and at https://www.oig.doc.gov/Pages/Whistleblower-Protection-Program.aspx.

4. Enforcement

NTIA shall take enforcement action against recipients as necessary and appropriate. A recipient (or applicable subrecipient) that fails to comply with any requirement under Section 60401 of the Infrastructure Act or this NOFO shall be required to return up to the entire amount of the award at the discretion of the Assistant Secretary (or, in the case of a subrecipient, the Assistant Secretary or the recipient).

NTIA may also enforce applicable rules and laws by imposing penalties for nonperformance, failure to meet statutory obligations, or wasteful, fraudulent, or abusive expenditure of grant funds. Such penalties include, but are not limited to, imposition of additional award conditions, payment suspension, award suspension, grant termination, de-obligation/clawback of funds, and debarment of organizations and/or personnel.

H. Unauthorized Use of Funds

To the extent that the Assistant Secretary or the Inspector General of the Commerce Department determines that a MMG Program recipient or subrecipient has expended grant funds received under the MMG Program in violation of the requirements set forth in Section 60401 of the Infrastructure Act, 2 C.F.R. Part 200, the terms and conditions of the award, or other applicable law, the Assistant Secretary shall, if appropriate, recover the amount of funds that were so expended.

CobbFendley

Llano County High Level Design

Design Path

- Proposed Ring
- Proposed Spoke
- Lateral
- Existing
- Planned

Towers

- Existing
- Proposed
- Planned

Maximum Tower Range

5 Miles

- Existing
- Proposed

Esri, NASA, NGA, USGS, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

N W E S

10 Miles

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Broadband Feasibility Study

Prepared for:

Llano County, Texas

June 24, 2021

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1 EXECUTIVE SUMMARY

Broadband networks, while once an emerging technology and luxury service, today can be looked at as the 4th utility alongside water, gas, and electricity[1]. It is critical to the functionality of everyday needs, providing access to information, increasing home safety, and enhancing overall quality of life. It is also still a technology, evolving in its form and function and inspiring innovation in its application as a foundational aspect of other technological advancements.

The Coronavirus Pandemic and Winter Storm Uri highlighted the necessity for online/remote interaction and generated a sense of urgency to enhance access to this critical infrastructure for millions of Americans, especially in rural communities like Llano County. With this understanding and the goal to improve access to reliable, available, and affordable high-speed broadband internet services, Llano County officials formed a Broadband Improvement Initiative and approved the contract to develop a Broadband Feasibility Study. This study aims to identify the broadband needs and gaps within the County and provide a high-level design and strategy, with associated cost-estimates, to demonstrate a potential broadband infrastructure build plan which can be implemented through federal grant programs and partnerships.

Given the critical nature of this infrastructure and the reality that broadband networks have not been equally nor adequately deployed across communities, there has been a historic investment of funding from Federal, State and Local levels in addressing the issues to close the digital divide and promote digital equity. The Infrastructure Investment and Jobs Act (IIJA) has prioritized broadband infrastructure allocating $65 billion in federal funds to be administered across several federal agencies working on broadband deployment. Of the total allocation, $45 billion will be administered by the National Telecommunications and Information Administration (NTIA) through the "Internet for All" programs with the goal of providing affordable, reliable high-speed internet to every American across the country[2].

These federal agencies developed standards for determining adequate access to broadband and therefore associated eligibility for funding. Unserved areas are considered anywhere receiving below 25 Mbps download and 3 Mbps upload speeds followed by Underserved areas being anywhere with speeds below 100 Mbps download and 20 Mbps upload. Community anchor institutions should have speeds of at least 1 Gbps symmetrical (1/1 Gbps). CobbFendley's base recommendation for this Broadband Improvement Initiative is a network solution which meets or exceeds a minimum of 100Mbps symmetrical (100 /100Mbps) speed for residential service.

The proposed network design seeks to provide Middle Mile infrastructure to provide adequate capacity for Last Mile connectivity. Our analysis shows that the main fiber backbone and distribution, once built, will allow for network infrastructure to reach Unserved and Underserved communities, paving the way to incentivize internet service providers with a less costly Last Mile build. This solution suggests the application for several grants and promotes partnerships with private sector providers who have a vested interest within this region. Construction of the proposed network infrastructure is recommended to be completed in phases, aligning with grant funding timelines with consideration for densification and prioritization of needs.

The benefits to be realized from investing in this infrastructure will have immediate and long-term effects on Llano County. From a workforce and economic development perspective, there will be immediate job opportunities for the construction, operations, and maintenance of the network expansion, as well as the opportunities for economic development with increased access and reliability of high-speed internet. For the long-term, investing in this infrastructure is a key component to future-proofing the County to be able to expand its digital transformation footprint, promote growth throughout the County and provide foundational critical access for the residents of Llano County to enhance their overall quality of life.

[1] Rethinking the Fourth Utility Connectivity Conundrum (bbcmag.com)
[2] Biden-Harris Administration Launches $45 Billion "Internet for All" Initiative to Bring Affordable, Reliable High-Speed Internet to Everyone in America | U.S. Department of Commerce

2 VISION

The vision for the County-wide broadband solution includes the following three major elements:

- Addressing the digital divide by implementing solutions to create robust access to broadband and enhance digital equity.
- Constructing Middle Mile infrastructure to incentivize service providers to build affordable Last Mile connectivity in Underserved areas, increasing the overall broadband coverage, and providing more options for broadband services and applications for residents and stakeholders alike.
- Connecting public facilities and critical infrastructure, supporting public services, with a reliable, secure, and modernized broadband network.

3 STUDY ORIGIN AND OVERVIEW

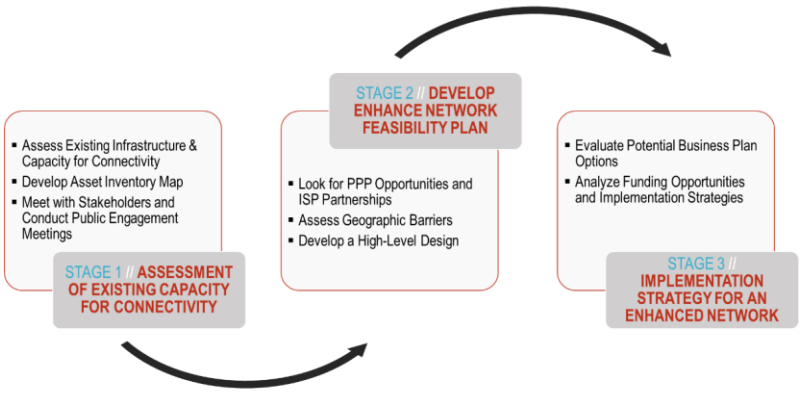
In 2020 and 2021, Llano County governments, residents, and businesses experienced significant broadband communications challenges with the closures of businesses, schools, and government offices due to both COVID-19 and adverse weather conditions. I, along with the Llano County Commissioners, recognize the critical need for reliable communications to better prepare for future emergencies in and around Llano County. A more vibrant network needs to not only be developed to assist local, state, and federal officials communicate under extreme emergency conditions, but to assist with future and increasing economic development and education needs.

On October 15, 2021, Llano County Commissioners Court voted for and approved a Llano County Broadband Feasibility Study to better identify the Underserved and Unserved areas of Llano County in order to better identify solutions for Llano County. CobbFendley, a professional engineering firm was selected following a competitive Request for Qualification process.

We look forward to working with CobbFendley, our local governments, businesses, and citizens to improve broadband connectivity throughout Llano County.

- Ron Cunningham
Llano County Judge

The Broadband Feasibility Study was developed in three stages with constant communication between the consultant team, County Officials and community stakeholders. A workshop presentation of the findings was held on May 10, 2022, where community leaders and stakeholders gathered to review the study findings, high level design recommendations, and explore options the County could exercise towards implementation.



4 RECOMMENDATIONS

As a concluding element of Phase I: Broadband Feasibility Study, CobbFendley has developed several recommendations for the County to consider moving towards implementation in Phase II of the Broadband Improvement Initiative. Our recommendations are as follows:

1. **Conduct Preliminary Engineering of the High Level Design for Middle Mile:** A High Level Design (HLD) was developed as a part of the Broadband Feasibility Study, presenting the necessary network infrastructure required, based on an understanding of the access and capacity needs, to establish high-speed broadband connectivity across the County. Our recommended Middle Mile focused design utilizes fiber-optic transport and distribution to existing and proposed fixed wireless tower sites, and we believe this converged architecture will minimize the level of effort and costs associated with Last Mile connections, while maximizing the coverage and access for residents. We recommended simplified fiber routing along TxDOT roadways reducing external environmental factors such as jurisdictional permitting and timelines, while maintaining design considerations which ensure future-proof capacity, and redundancy in a ring-based topology. Limited to a High Level Design in the Feasibility Study scope, there are additional details and further network architecture and topology considerations which need to be explored concluding the study and through evaluation, selection, and collaboration with private partner(s). The initial design recommendations and associated cost-estimates in the study should be further refined with input from specific providers that are willing and able to implement the network. Through this refinement with partners, further design and cost estimations can be performed providing the necessary detail required for grant application and implementation. The preliminary engineering activities for this effort would include:

   - Conducting a detailed route analysis to review network architectures, topology, routing, constructability, sustainability, fiber, and conduit capacity.
   - Conducting a detailed jurisdictional analysis identifying the permits required for implementation.
   - Evaluating material and labor specifications for major line-item materials required for construction and assisting in procurement discussions.
   - Developing a detailed engineering schedule and cost estimate for detailed design and permitting.

2. **Distribute a Request for Information (RFI to identify potential Public-Private Partnerships (PPP)):** At the completion of Phase I: Broadband Feasibility Study, a recommendation is to move into Phase II: Engineering and Implementation to work with providers and broadband services partners to determine the optimal network build and structure a public/private partnership (PPP) to apply for funding for implementation. There is a range of providers operating within Llano County currently, with several others seeking to invest in the near term. An RFI process will enable the County to further explore applicable business models and expand on potential PPP contract structure and terms, allowing for a well-informed determination by the County on partner selection and implementation plans. The goals of the RFI would be to:
   - Evaluate potential for developing public/private partnerships with providers and broadband services partners.
   - Evaluate the various applicable broadband solutions presented in relation to the Study findings and recommendations based on the existing conditions in Llano County.
   - Understand financial model structure and overall costs for the project(s) and relative share financial risk and benefits within the partnership.
   - Identify Last Mile providers to be included in a larger Middle Mile project.

   Evaluation criteria and requirements from potential bidders would include:
   - If respondent is an internet service provider, they must participate in (or are actively applying to) the Affordable Connectivity Program (ACP).
   - If submitting information for Middle Mile or Last Mile, provide evidence of past performance and ability to execute.
   - Ability to supply levels of service in accordance with NTIA requirements for Middle Mile and Last Mile.
   - Documentation of existing assets in and around Llano County, preferably in relation to updated Fixed Broadband Deployment Data for FCC Form 477.
   - Documentation of any funding applied for in and around Llano County.

3. **Apply for Competitive Funding Sources for Implementation:** The IIJA provides an unprecedented amount of funding for municipal infrastructure projects that impact our daily lives including specific funding sources for expanding broadband access across the Country. An analysis of the various funding sources that can be utilized for broadband infrastructure can be found in Section 7- Funding Analysis including three key programs for Llano County to consider:

Table 1: Competitive Funding Sources for Implementation

Grant Program	Funding Agency	Description	Timeline	Total Allocation
Middle Mile Grant Program[3]	National Telecommunications and Information Administration (NTIA)	National awards will be issued on a technology-neutral, competitive basis to eligible entities for the construction, improvement, or acquisition of Middle Mile infrastructure.	Sept. 30, 2022	$1 Billion
ReConnect Program[4]	United States Department of Agriculture (USDA)	Provides loans and grants for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide broadband service in eligible rural areas.	Fall 2022	$2 Billion
Broadband Equity, Access, And Deployment (BEAD) Program[5]	National Telecommunications and Information Administration (NTIA)	Through state allocation and planning, this program intends to expand high-speed internet access by funding planning, infrastructure deployment and adoption programs.	Spring 2023	$42.5 Billion

The consultant team would like to thank County officials, community stakeholders and the Llano County IT Committee that lead this initiative, providing input and guidance throughout the process.

Ron Cunningham, County Judge
Peter Jones, Commissioner Precinct 1
Clay Etter, IT Liaison
Kerry Hancock, IT Consultant

5 ABOUT COBBFENDLEY

CobbFendley is a civil engineering and surveying firm with expertise in providing planning and design services related to communications infrastructure. Now in its 41st year of providing broadband consulting to the municipal and private sector, CobbFendley understands the importance of broadband infrastructure and formed an internal Broadband Department to focus on the planning, design and technology associated with these important projects. The team includes dedicated personnel who have worked with public and private clients to plan, design, and make operational fiber networks that improve the lives of businesses and residents in their communities. CobbFendley supports their clients with leading feasibility studies, business planning/strategy advising, engineering and implementation support services across a full range of functional areas. Clients include existing broadband operators as well as entities considering deploying these systems, with services and expertise covering the full potential of the industry including local telephony, video entertainment, high speed Internet access, and smart grid systems across a full range of broadband network technologies.

[3] Enabling Middle Mile Broadband Infrastructure Program | Internet for All
[4] ReConnect Loan and Grant Program | USDA
[5] Broadband Equity, Access, and Deployment (BEAD) Program | Internet for All

6 CURRENT STATE OF BROADBAND IN LLANO COUNTY, TX

Section Highlights

- CURRENT BROADBAND STANDARDS FOR ADEQUATE LEVELS OF SERVICE:
  - UNSERVED: BELOW 25/3MBPS
  - UNDERSERVED: BELOW 100/20MBPS
- MOST INCUMBENT PROVIDERS DO NOT CURRENTLY PROVIDE COVERAGE WITH ADEQUATE SPEEDS FOR CURRENT STANDARDS

In Llano County, like much of rural America, access to affordable, reliable high-speed internet is a major concern and negatively impacts the quality of life for residents. Outside of the main population centers, including the City of Llano, Kingsland, Horseshoe Bay, and Sunrise Beach, there is an even greater lack of access to even basic broadband networks. The hard topography of the Hill County creates a natural challenge to the way infrastructure can be deployed, coupled with the rurality of population prohibits and the added factor of today's markets; rising inflation, supply chains and labor markets together makes solely private sector investing cost-prohibitive for internet providers. However, with the historic amount of funding being allocated to broadband and synergy with local partners currently investing in infrastructure in the region, these factors can be addressed with a Public-Private Partnership (PPP) approach. To examine how to best propose new broadband infrastructure for residents and businesses of Llano County, the current conditions must be reviewed in relation to industry standards and the funding eligibility requirements.

In 2015, the FCC set the minimum speeds for broadband to be adequately served at 25/3 Mbps based upon perceived sufficient internet usage at the time and mainly focused on internet browsing, email, and limited streaming media (i.e., primarily download focused). While in 2015 those levels may have been adequate and may still be for certain households' usage, the rise in videoconferencing and other common applications in recent years has created a need for higher bandwidths for uploads and downloads. For example, at the home of a family of four, if two children are attending classes using Zoom and two adults are using their broadband connections to attend meetings, send e-mail, and do research, their combined required bandwidth could easily exceed the minimum level of broadband service set. Add on the additional bandwidth needs of smart devices and other technologies operating on a household's network, it becomes clear that today's technology dependence requires a higher capacity threshold.

Recognizing this trend in usage, the minimum speed requirements were revised to now define *Unserved* areas as anywhere receiving below 25 Mbps download and 3 Mbps upload speeds followed by *Underserved* areas being areas with speeds below 100 Mbps download and 20 Mbps upload. Community anchor institutions should have speeds of at least 1 Gbps symmetrical (1/1 Gbps). These levels will not only dictate industry standard but are all the benchmarks for funding eligibility. For this study, while 100 Mbps symmetrical is ideal to look at "future-proofing" communities, 100/20 will be the minimum standard used to evaluate the existing data and develop an implementation plan.

Note: When discussing internet speeds, the written form may occasionally be seen in the format of "YxZ" or "Y/Z" where Y is the download speed (typically with units of Mbps), and where Z is the upload speed (also typically with units of Mbps).

6.1 Internet Services in Llano County

The following figures and table depict the available internet services offered in Llano County based on information gathered from ConnectedNation and the FCC's Form 477 data from December 2020 and analyzed based on the level of service standards described above. At the time of the study, 2021 data was not publicly available for analysis. The form 477 data is self-reported by the providers and has several limitations that impact the information represented within existing data sources like ConnectedNation. In the current forms, providers are able to include infrastructure they plan to construct, in addition to already deployed networks. This projection of intended infrastructure leads to potential over-reporting in coverage and therefore does not reflect the actual infrastructure currently in operations. In addition, the level of detail requested by the FCC in the current forms does not require providers to delineate who they provide service to down to each household but instead is reported at the

census block level. This can lead to an over-representation of coverage if a provider offers coverage in one section of a census block, then the entire block will show up as served by that level of coverage even if there are households not served by that provider specifically.

The FCC is aware of the limitations of the current reporting format in the form 477 and in response is currently conducting an overhaul of the mapping system. At the time of this study the FCC is currently conducting a Broadband Data Collection (BDC) program to give the FCC, industry, state, local and Tribal government entities, and the general public the tools needed to improve the accuracy of existing maps.[6] During the BDC process will be opportunities for providers and the public to provide feedback to the data presented with the goal of having granular data maps that accurately reflect the broadband coverage across the Country. Given, these updated maps are not complete at the time of this study, the previous limitations discussed should be taken into consideration when reviewing the data of this study.

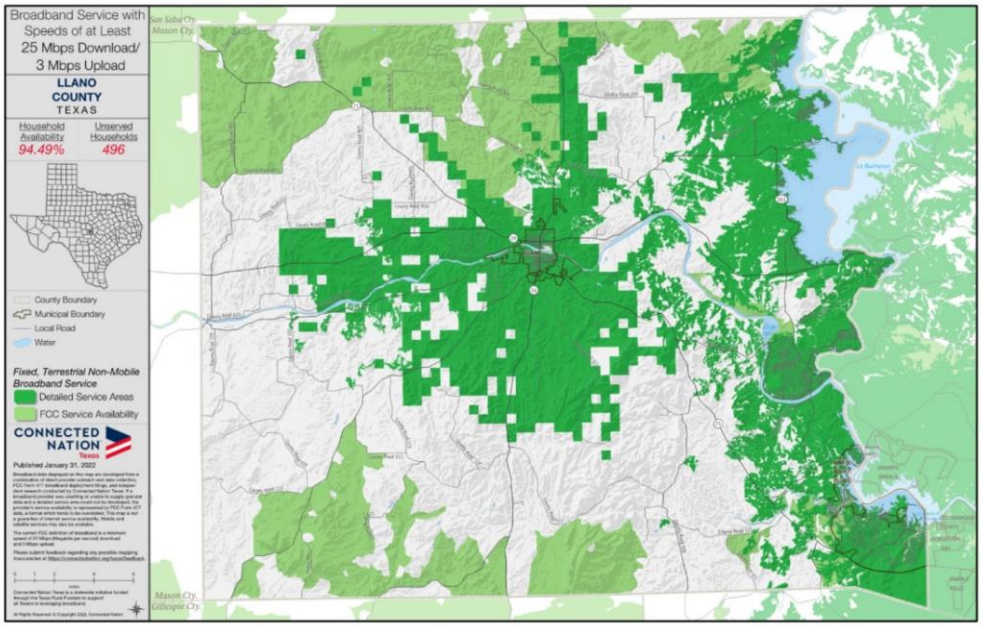


Figure 1: ConnectedNation Showing 25 Mbps/ 3 Mbps Coverage in Llano County

Figure 1, identifies the areas that are considered served with 25/3 Mbps service, based on FCC data and ConnectedNation. Figure 2, however, shows the inverse of
Figure 1, meaning this figure does identify where these Unserved areas are within Llano County. These Unserved areas are critically lacking adequate infrastructure and coverage for broadband and are considered a priority for upgrades.

[6] Broadband Data Collection | Federal Communications Commission (fcc.gov)

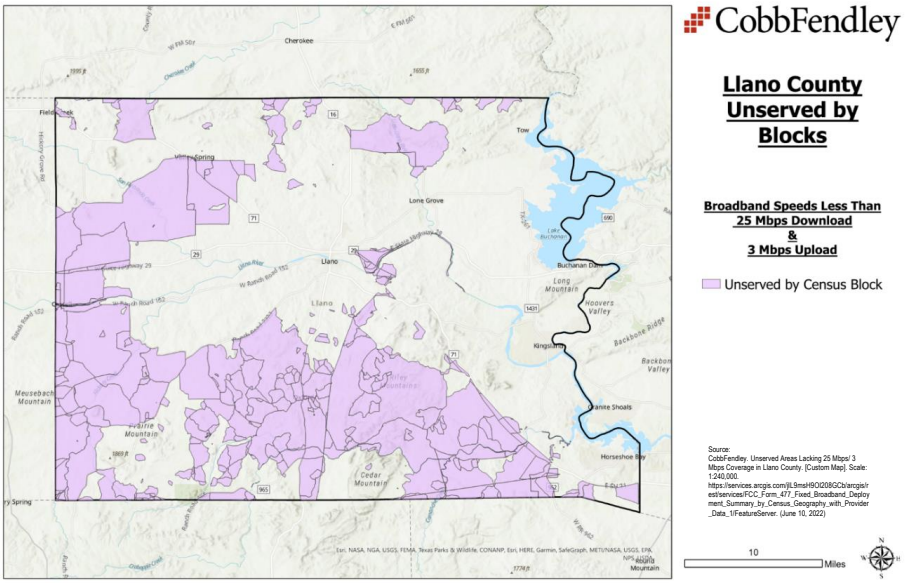


Figure 2: Unserved Areas Lacking 25 Mbps/ 3 Mbps Coverage in Llano County

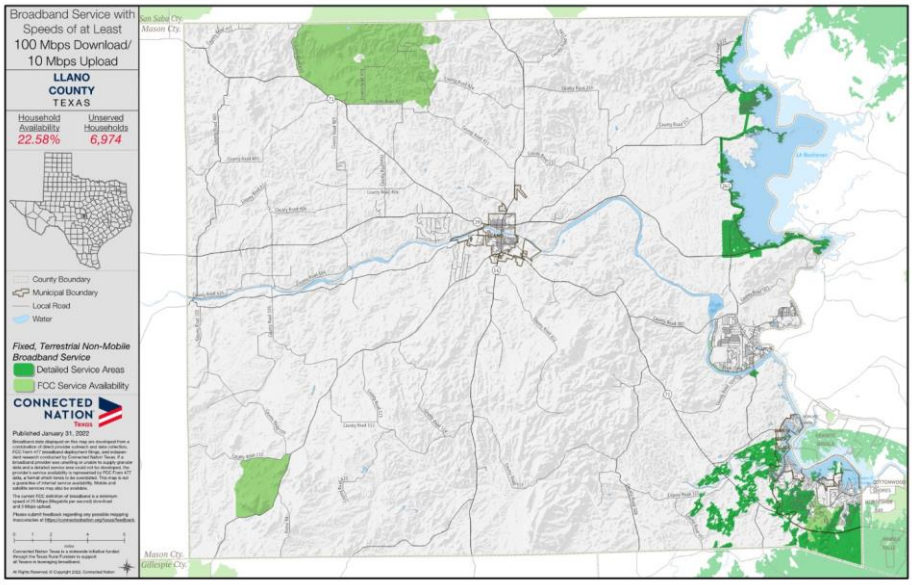


Figure 3: ConnectedNation Data of 100 Mbps/ 10 Mbps Coverage in Llano County

Figure 3 Shows areas that are currently receiving at least 100/10 Mbps and comparatively, Figure 4 below, depicts areas that do not have levels of service meeting the newly defined Underserved requirement of 100/20 Mbps. CobbFendley developed the map in Figure 4 to determine areas within the County that would be eligible for National Telecommunications and Information Administration (NTIA) funding utilizing existing speed data from the FCC 477 data.

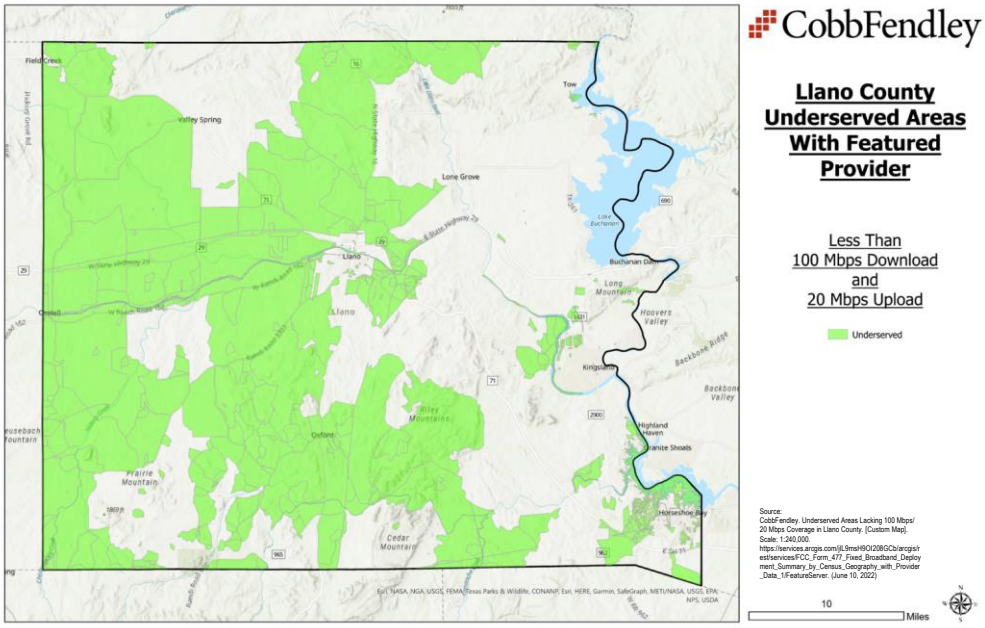


Figure 4: Underserved Areas Lacking 100 Mbps/ 20 Mbps Coverage in Llano County

It is important to note that there may be discrepancies between Figure 3 and Figure 4 in the inverse proportionality of the information. As seen in these two figures, the only locations that contain adequate service for the future-proof speeds are the major cities in the County which include Llano, Horseshoe Bay, and Sunrise Beach Village. The areas around Buchanan Dam and up north towards Tow are considered covered through the FCC, but upon further research the project team also considers this area to be showing out-of-date FCC information due to the company called "Roll-Call" currently being closed. Roll-Call is the same company as "RCBroadband" or "Rainbow Connection Broadband" and does not currently provide internet service in Llano County. More information about this will be covered later in the report, within the NEEDS AND GAP ANALYSIS.

When reviewing the current state of broadband within Llano County, it can be seen that adequate coverage is not available in most of the County. Few providers offer speeds of at least 100/20 Mbps and there are no residential offerings of 100 Mbps symmetrical. Several key providers have speeds below the minimum threshold (25/3Mbps) deeming them as *Unserved*. There are clear gaps in coverage for residents in rural Llano County, and current infrastructure prohibits many residents from receiving adequate service.

Table 2: Current Internet Offerings in Llano County

PROVIDER	PROVIDER DOING-BUSINESS-AS NAME	TECHNOLOGY	MAXIMUM DOWNLOAD SPEED (Mbps)	MAXIMUM UPLOAD SPEED (Mbps)
Hill Country Telephone Cooperative, Inc.	HCTC	Fiber	1000	1000
Central Texas Telephone Cooperative, Inc.	Central Texas Tel Coop Inc.	Fiber	1000	100
Charter Communications, Inc.	Spectrum	Cable	940	35
*Roll Call Security & Communications	Texas Broadband (R5)	Fiber	275	75
HCWireless	Hill Country Wireless and Technology	Fixed Wireless	100	25
Rio Broadband, LLC	Rio Broadband	Fixed Wireless	51	10
Hill Country IT	Hill Country IT	Fixed Wireless	50	50
Bee Creek Communications, Inc.	Bee Creek Communications	Fixed Wireless	50	20
Hill Country Telephone Cooperative, Inc.	HCTC	DSL	50	10
Rise Broadband	Rise Broadband	Fixed Wireless	50	10
325 Internet, LLC	Rio Broadband	Fixed Wireless	50	5
VGI Technology	VGI Technology	Fixed Wireless	50	5
*Roll Call Security & Communications, LLC	Texas Broadband (R5)	Fixed Wireless	45	15
Communications Etc.	Particle Communications	Fixed Wireless	25	10
HomeSmart Satellite Station Fire & Security	HomeSmart Internet	Fixed Wireless	25	5
Frontier Communications Corporation	Frontier	DSL	25	3
T-Mobile USA, Inc.	T-Mobile	Fixed Wireless	25	3
Zero2 Wireless	Zero2 Wireless	Fixed Wireless	25	3
Riviera Telephone Company Inc	Gulf Coast Broadband	Fixed Wireless	15	15
ERF Wireless Bundled Services, Inc.	ERF Wireless	Fixed Wireless	10	2
Texas Wireless Internet	Texas Wireless Internet	Fixed Wireless	10	1
Zeecon Wireless Internet, LLC	Zeecon Wireless	Fixed Wireless	10	1

LEGEND
RED = Unserved, Below 25/3 Mbps
ORANGE = Underserved, Below 100/20 Mbps
GREEN = Meets Current Standards

**Services listed under Roll Call are not applicable since there are no current operations in Llano County.*

Table 1, above, is a list of Internet Service Providers that are considered to be serving the Llano County area, as collected by ConnectedNation from the FCC. For the services offered by Hill Country Telephone Cooperative, Inc. and Central Texas Telephone Cooperative, Inc., it should be noted that these services are highlighted by the green polygons in Figure 3 in the Northwest and Southwest. It is understood that these providers tie into various pieces of infrastructure and equipment within the polygons, but residential services cannot be verified. Based on this data available, Charter/ Spectrum and HCWireless are the

only current providers of broadband offerings of at least 100/20 to their coverage areas within the County. There are several key providers either looking to expand services in the County, upgrade existing infrastructure or invest in bringing a new service to the County. These current developments reenforce that there is a need for enhanced capacity of broadband services and that the influx of funding available is incentivizing the business case for development. For the purposes of this study, while certain projects are in the works that the County is aware of, the review of the current state of broadband focuses on existing assets with the goals of further developing project potential with partners in the next phase of the Broadband Improvement Initiative.

The future of broadband is through the convergence of multiple network types and platforms but, at the core, modernization requires a strong fiber backbone and wireless infrastructure that can deliver heavy bandwidth services. The broadband network presented in this study will enable providers with more advanced network architectures to fill the gaps in services and enhance existing networks with the goal of having broadband access throughout the County.

6.2 Broadband Network Infrastructure in Llano County

In addition to ConnectedNation and the other publicly available data sources, CobbFendley has access to database resources that show additional broadband networks that may be present to create a more granular understanding of existing infrastructure. Fiber Locator is a source that helps provide "access to fiber maps, lit buildings and data centers"[7] and is generally used for infrastructure owners to help advertise available fiber resources that could be for sale or lease. The information gathered from Fiber Locator helps the team identify potential stakeholders and understand how existing assets could be leveraged into a potential partnership. This information doesn't typically dictate where fiber to the home (FTTH) is a possible option, but it does help provide a starting point for stakeholder engagement conversations. When searching within the Llano County area though, neither Long Haul nor Metro Networks were shown to be available. For lit buildings, there were some data points available, as illustrated by Figure 5. The location of these fiber-lit buildings matches existing information about network coverage in the population centers in Llano County. The lack of information present on Fiber Locator reenforces the fact that there is a need for investing in fiber assets to build out the back-bone of broadband infrastructure throughout the County to support the deployment of Last Mile services.

[7] https://www.fiberlocator.com/

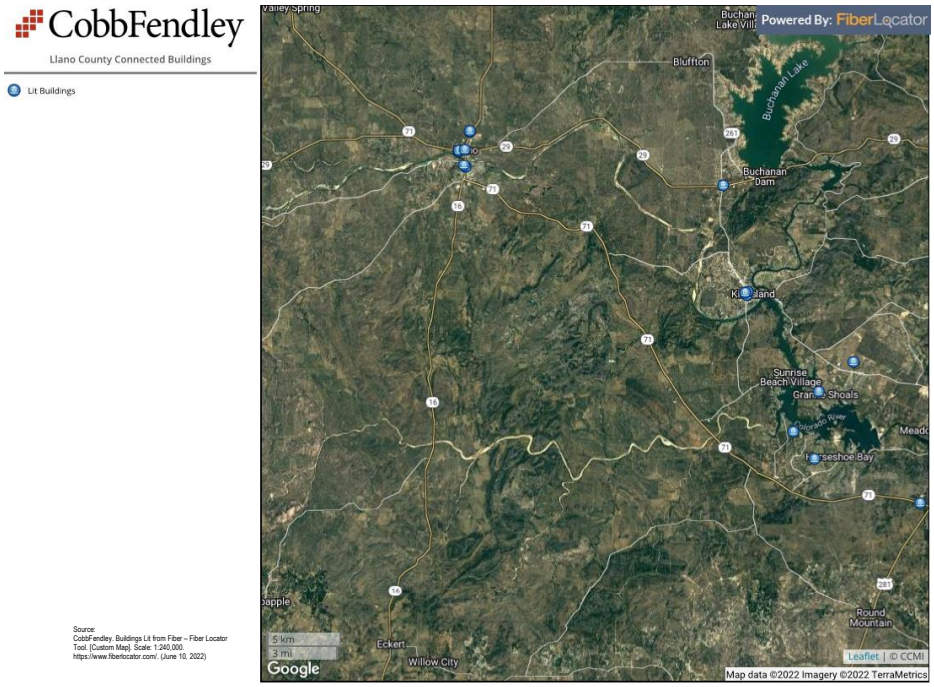


Figure 5: Buildings Lit from Fiber – Fiber Locator Tool

Additionally, Table 3 below, collected from ConnectedNation[8], helps provide a percentage quantity for households served in Llano County by various types of broadband technologies. Comparing to Table 2, the data in Table 3 builds more onto how these technologies actually are used to provide to-the-home services.

Commented [MB1]: @Jacob Triska not sure if I screwed something up here...

Table 3: Percent of Households Served with Broadband in Llano County

Texas County-Level Broadband Availability Estimates by Technology Type									
		25 x 3 Mbps (Percent of Households Served)				100 x 10 Mbps (Percent of Households Served)			
County	Number of Households	Cable	DSL	Fiber	Fixed Wireless	Cable	DSL	Fiber	Fixed Wireless
Llano	9,008	0.77%	1.32%	15.83%	92.50%	0.77%	0.20%	15.83%	6.09%

Fixed Wireless services at speeds of 25/3 is available to 92.5% of residents. However, fixed wireless services that offer 100/10 Mbps, which is still deemed *Underserved*, drops to 6% of residents. This illustrates the limitations of the fixed wireless technologies that are being utilized by current providers in the area. Fixed wireless systems and hybrid approaches can offer the necessary speeds for adequate coverage when the right equipment, network technologies and infrastructure placements are utilized.

[8] https://connectednation.org/texas/planning/

6.3 Potential Barriers to Additional Infrastructure

Physical and geographic barriers are often overlooked as having an impact to broadband services, but they can be a valid deterrent to utility construction as the natural and manmade boundary features can be costly to build across and significantly delay the project in permitting. In reviewing both Figure 6 and Figure 7, there could be barriers that may limit or prevent additional infrastructure.

From Figure 6, the soil conditions vary dramatically across the County landscape. Unfortunately, where many of the densely populated cities are located are some of the harder classifications of soil and rock, as seen by the purple polygons in the figure. For example, in places like Horseshoe Bay or Kingsland the conditions contain "coarse-grained, pink, quartz-plagioclase-microcline rock, in part porphyritic with large microcline phenocrysts"[9] which are not particularly a condition that would allow digging or trenching in without very high expected costs. Therefore, underground or buried conduits and fibers are not a likely cost-effective solution in areas of these environments, and unfortunately these granite masses cover a lot of the Llano County area and even other regions nearby including Gillespie County. While this granite is found throughout a lot of the County, the dominate soil or rock seen within Llano County is schist or gneiss, as highlighted by the pink color polygons in Figure 6. While technically not as hard as granite, the conditions experienced with schist or gneiss rock are going to be very similar. It should be noted that in these conditions, or the previously mentioned granites, underground boring or trenching can occur, but project costs and timelines should account for these considerations should the implementation proceed with that direction. It is most likely going to cause the proposed broadband infrastructure to proceed through aerial pole attachments.

In Figure 7, the expected major permitting entities can be seen. Most routes across the County would likely occur on TXDOT owned roadways, and the remaining construction would likely occur within Llano County Right of Way (ROW). For this Middle Mile, as well as any Last Mile considerations, the city specific ROWs would contain the remainder of proposed infrastructure and permitting requirements for each would need to be considered. As mentioned above, should aerial attachments be the proposed method to route the fiber across the County, then accommodations will need to be made through Central Texas Electric Co-Op or the City of Llano. There is one main railroad line that extends from Kingsland, parallel with Highway 29, to the City of Llano that is owned by Capital Metropolitan Transportation Authority. Any railroad crossings will need to be prepared for additional permitting. For any water crossing, the Colorado River comes into Llano County along the eastern border near Horseshoe Bay and Kingsland. From there, smaller rivers and the Llano River continue across the County and would need to be taken into consideration for proposed plans for water body crossings. These will need to be approved by the Llano County Floodplain Management team. Finally, the Seminole Pipeline from Enterprise Products, the Atmos Pipeline, and the Kinder Morgan Texas Pipeline Co all cross through Llano County, as well as a potential for other pipelines. An 811 call across the planned route should be completed to get a better understanding of which pipelines, and other utilities, will need to be coordinated with during the design and implementation process. Additional permits may need to be included based on these utility and pipeline crossings.

[9] https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=TXpCAt;0

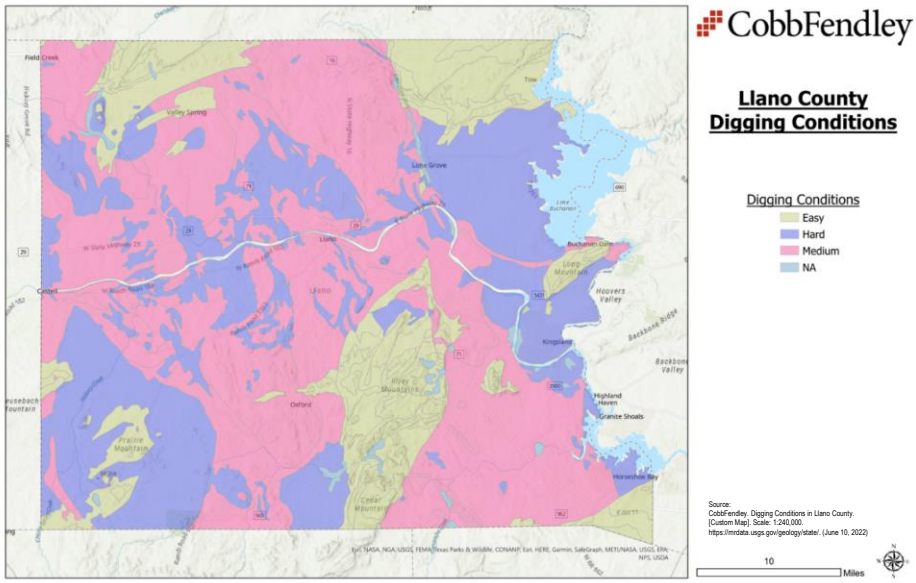


Figure 6: Digging Conditions in Llano County

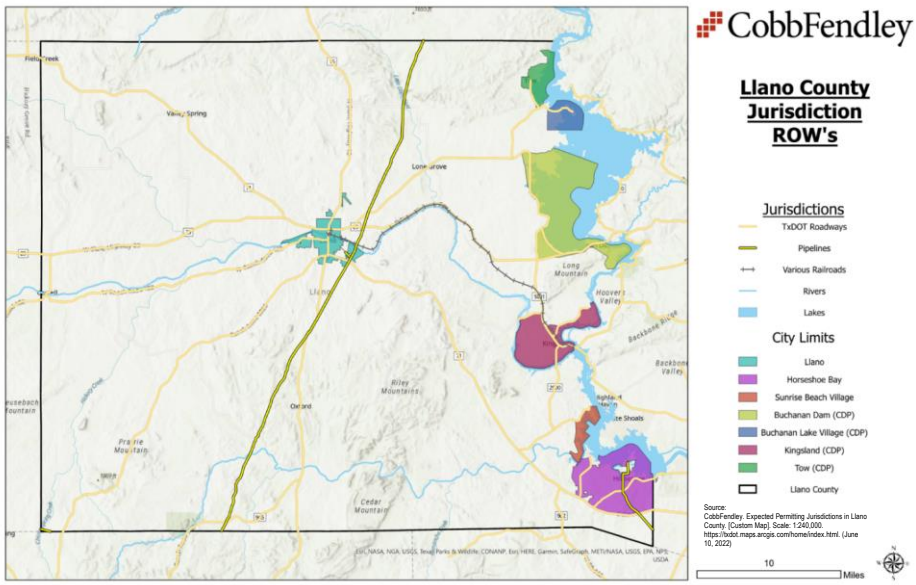


Figure 7: Expected Permitting Jurisdictions in Llano County

7 PUBLIC OUTREACH

Section Highlights

- MANY AREAS WITHIN THE COUNTY DO NOT HAVE ADEQUATE LEVELS OF SERVICE
- SURVEY RESULTS INDICATE THAT RESIDENTS ARE NOT SATISFIED WITH THEIR CURRENT BROADBAND ACROSS ALL QUALITATIVE FACTORS
- WHILE SPEED TESTS RESULTS CORRELATE WITH EXPECTED ADVERTISED SPEEDS, THE COSTS ARE HIGH FOR THE LEVEL OF SERVICE RECEIVED IN MOST AREAS

As a part of Llano County's Broadband Improvement Initiative, collaboration with the community and both public and private entities is an essential step in the study of a needs and gap analysis. This public outreach included stakeholder engagement, to evaluate everything from existing conditions to potential partnerships, as well as feedback from the community and its current residents through a public survey and accompanying speed test. The data collected from these engagement activities contextualized the existing conditions data to determine the feasibility of potential broadband projects.

7.1 Stakeholder Engagement

The Llano County IT Committee was actively engaged in the process, relaying their known contacts, proposed demand points (facilities needing broadband service), preliminary research, and observations, all of which contribute to the understanding of the needs of the County and the communities it serves. Internal meeting between CobbFendley and the IT Committee occurred on a bi-weekly basis to discuss updates, potential options for implementation, and funding opportunities.

Stakeholder discussions addressed the goals for the projects, state of the current broadband infrastructure footprint, perceived service and application needs, potential for future expansion, and any concerns or constraints that would help formulate recommendations. Engagements with local public entities focused on understanding their needs and gaps, while engagements with providers, operators, and other potential focused on existing assets and future growth plans. The Stakeholder Engagement, while one of the first tasks of the study to begin, happens throughout the study process as ideas for potential projects and partnerships develop and new stakeholders emerge. A summary of the engagements, separated by the type of stakeholder, can be seen below.

7.1.1 Municipalities and Public Entities

The following municipalities and entities were met with for discussions as it relates to the Llano County Broadband Improvement Initiative:

7.1.1.1 Llano County Information and Technology Department

Discussions with the IT Department for Llano County were essential to understand the current landscape of broadband within the County. The locations of the County owned facilities were discussed, identifying the speed, provider, backup options, and other factors for each of these locations. The County owns the network infrastructure located within "The Square" in the City of Llano which includes the buildings of Llano County Tax Assessor-Collector's Office, Llano County District Clerk's Office, Llano County Courthouse, and Llano County District Attorney. In addition to facility discussions, the IT team helped identify locations of growth within the County that should be accounted for in potential plans.

7.1.1.2 CAPCOG – Capital Area Council of Governments

To better understand what level of effort communities throughout the region were taking as it relates to broadband, engagement occurred with the Capital Area Council of Governments (CAPCOG). Llano County is a participating member in CAPCOG and their team was able to share planning efforts that are currently underway at the COG level and at the County level which include:

- There is a TXDOT study in the final stages that will include information primarily covering economic development and transportation but is likely to include information about broadband within the economic development section.
- The Lower Colorado River Authority (LCRA) is actively working with Connected Nation, which is a nonprofit

organization aimed at supporting broadband expansion and understanding. Additionally, the City of Burnet and Blanco County are partnered with Connected Nation to help ensure residents within their communities understand the reason for potential projects, the processes it entails to implement upgrades, and background on what broadband can provide to a person or place.

- Williamson County and Bastrop County are also very interested in expanding their broadband services at this time.

Additionally, potential funding sources were discussed to help direct the project team towards potential partners and grants that could be leveraged in implementation.

7.1.1.3 Horseshoe Bay – City Council and Information Technology Department

The City of Horseshoe Bay is currently underway with the implementation and construction of their own broadband infrastructure project. Llano County is partnering with the City to execute this project. However, upon completing their feasibility study and moving towards implementation, construction costs increased by one million dollars due to the topography and cost of trenching in that area. The plan is to serve the greater Horseshoe Bay Resort area through phase 1, the next quarter of the city's population in phase 2, and then continue to expand the infrastructure. To complete this new build, some new towers were included in the plan which would include point to multi-point technologies. For Llano County, seeing how additional tower infrastructure using this point to multi-point technology could help expand the coverage from the resort area to the other communities.

7.1.1.4 LEDC - Llano Economic Development Corporation

CobbFendley met with the Economic Development Corporation of Llano to understand where the areas of need and growth are in the greater Llano region. At present, there are a few developments that are being invested in which include a hospital, affordable housing, an events center, and broadband. For broadband, the EDC has been active with stakeholders about the fact that while fiber is the best option in a vacuum for upgrading broadband infrastructure, it's not always practical in Llano County and that expectations should be managed. They have worked on figuring out various solutions by speaking with stakeholders such as Central Texas Electric Cooperative (CTEC) and Bandera Electric to help understand the obstacles the Llano area is facing. There were issues with some of the roadway infrastructure around Llano regarding pole usage for aerial distribution that needed to be replaced.

7.1.2 Potential Infrastructure and Service Provider Partners

The following telecommunication infrastructure owners and services providers, shown in alphabetical order, were met with for discussions as it relates to the Llano County Broadband Improvement Initiative. It should be noted that specific details were either omitted during meetings or within this study due to proprietary information.

7.1.2.1 Charter Communications/ Spectrum

Charter has been in negotiations with the City of Horseshoe Bay and partners to construct a network in the area. Due to the igneous and intrusive conditions of the hard soil, trenching has not been easy to accomplish and has both delayed production and raised costs. Conversations between the partners are ongoing.

7.1.2.2 LCRA – Lower Colorado River Authority

There have been multiple discussions with LCRA about existing infrastructure and future plans within Llano County. The first discussion helped the project team learn about the LCRA Middle Mile and backhaul that is currently in service and has the goal of allowing ISPs to reach rural areas and other County areas. The current fiber set up includes a 72 count fiber with 24 fibers being leased. ISPs have the ability to build to the LCRA substation which helps connect to Austin and San Antonio from Llano County. LCRA builds infrastructure within their own easements but not in the public Right of Way (ROW), and the entire transmission system is available to use with more easements expected to develop. As customers expand for their electricity, plans for fiber and new substations are expected to expand as well. Within the City of Llano, multiple providers are leasing from the LCRA fiber which includes NexStream, Zeecon, VGI, TSID, and VTX1. For pole infrastructure use throughout the County,

pole attachment agreements will need to be completed with Central Texas Electric Cooperative (CTEC) as they own the poles, not LCRA. A follow up discussion include conversation about their equipment, providers leasing, cities they expand to and overall that LCRA would be interested in assisting Llano County with overall broadband expansion. Upcoming funding opportunities, such as the Broadband Equity, Access, and Deployment (BEAD) Program, would help make a big difference in next steps as well.

7.1.2.3 Nextlink

Nextlink has an active Connect America Funds (CAF) award in Llano County, and they plan to use those funds to implement speeds of 100 Mbps/ 20 Mbps in the southern portion of Llano County, which will also include new towers by the end of 2022. Nextlink has the capacity to offer both fiber and fixed wireless solutions and have an adequate business model in place that has worked in similar situations and topographies to Llano County. When discussing options with a municipality, Nextlink aims to model the implementation plan around the needs of the municipality without a predetermined approach. In addition to their future plans, Nextlink is currently participating in the Affordable Connectivity Program (ACP) which helps provide financial assistance for broadband resources to those who qualify and are an E-Rate provider for school districts across Texas.

7.1.2.4 NexStream

NexStream has been building infrastructure and offering network services in Texas since 2005. On the infrastructure side, they help build for other providers, and on the internet service side they offer both fiber and fixed wireless services. For internet service developments, their practice is typically greenfield in nature, and look to build off of their Priority Access Licenses (PALs) by increasing their Points of Presence (POPs). To do that, they are currently working alongside LCRA and CTEC, and are prepared to move into Llano city to provide service. In addition to serving Llano, NexStream is also prepared to help expand their footprint throughout the County with fiber, where applicable. Due to the conditions of the soil, fiber may not be available to bury everywhere, so aerial architecture or other proposed solutions will need to be implemented. In addition to working with the public cooperatives, NexStream has also partnered with many wireless internet service providers (WISPs) and is open to partnership opportunities which may include open access business models. NexStream is currently participating in the Affordable Connectivity Program (ACP) which helps provide financial assistance for broadband resources to those who qualify, and frequently look to invest their own capital to help meet the need of the Underserved and Unserved.

7.1.2.5 Rio Broadband

Rio Broadband's network expands through the counties of Llano and Burnett and are always looking to expand their footprint. Expansion for Rio can occur wherever their Middle Mile is available to connect to, and expansion typically involves greenfield processes when connecting to the contiguous part of their network. They offer both fiber and fixed wireless options, location dependent, with fiber becoming more common business lately and fixed wireless being the quicker to implement method. Rio is self-funded, but is open to potential partnerships, if available. Both commercial and residential services are offered by Rio Broadband, and current markets in the County include Kingsland and Granite Shoals while future markets may include Lake Buchanan, Sunrise Beach, Lampasas, and more. They are currently looking into permission to build more towers in Llano County and are open to expanding into the rural areas through fixed wireless solutions.

7.1.2.6 VGI Technology

VGI has a long standing relationship within the Horseshoe Bay area and are expecting to expand throughout the eastern portion of the County into the Kingsland area. To meet the growing need of higher speed for internet, VGI has upgraded infrastructure to allow for their customers to now receive up to 500 Mbps through the use of Point to Point, Point to MultiPoint, and FCC Licensed Spectrum. In terms of commercial offerings, VGI delivers the bandwidth through either fixed wireless or Fiber to the Premise (FTTP) of up to 10Gbps. For backhaul, VGI leases from various companies to get the transport services they need, and VGI also specializes in tower and network design, should that be needed for Llano County.

7.1.2.7 VTX1 - Valley Telephone Cooperative, Inc.

VTX1 is currently in the general area of Llano County and is looking to expand, where applicable. Recently, VTX1 acquired multiple fixed wireless companies that operate based out of Georgetown and out of San Antonio. Through these fixed wireless services, VTX1 is able to offer symmetrical speeds of 100 Mbps and up to 400 Mbps, in addition to their DSL and fiber offerings. Unfortunately, after internal discussions on their end, VTX1 decided that it doesn't make business sense from their perspective to expand further into Llano County at this time.

7.1.2.8 Vyve Broadband

Vyve currently has a large presence throughout Llano County with a main focus on commercial business but also provides residential services as well. They currently serve in 16 states, are approaching 240,000 customers, and have been serving for the last 10 years. In Llano County, they serve the major cities of Horseshoe Bay, Kingsland, Llano, and Sunrise Beach through a hybrid fiber/ co-axial approach. Over the past several years, they have upgraded their infrastructure to now allow up to 1+GB at the home, up from 25 Mbps, and now include diverse routes for redundancy. Vyve typically uses their own funds on projects, and they are constantly looking to build out where they can. To reach as many customers as possible in the Llano Count area, where topography needs to be considered, both fiber/ co-axial hybrid and fixed wireless is offered, location dependent. They are actively looking to expand their fiber footprint and are currently building into Unserved developments within Llano County. Vyve is currently participating in the Affordable Connectivity Program (ACP) which helps provide financial assistance for broadband resources to those who qualify.

7.2 Community Engagement

Llano County made it clear that the involvement of the community is critical to the success of this initiative. In addition to the extensive discovery sessions with regional partners and private companies, an important group for input included the residents and business owners themselves. CobbFendley helped design a public engagement pursuit with an ongoing opportunity for feedback to educate and invite commentary through implementing a residential specific survey, a business specific survey, and a speed test.

The survey results helped provide a better understanding of the current market situations and helped inform residents that they are not in this situation alone. With large sums of people agreeing that there is a problem with the current services offered, it was made clear that a fix is required for the County and its residents as soon as possible. The results of the survey confirmed the issues that were determined through the analysis of the existing conditions.

7.2.1 Public Residential Survey

The following information presented below shows the questions that were administered by CobbFendley, and the answers collected by the residents of the greater Llano County area.

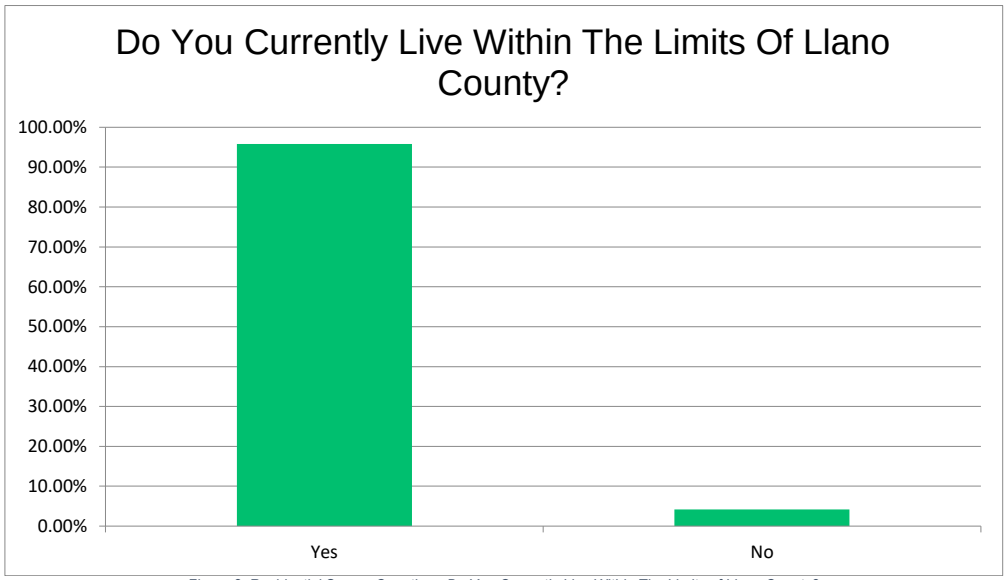


Figure 8: Residential Survey Question - Do You Currently Live Within The Limits of Llano County?

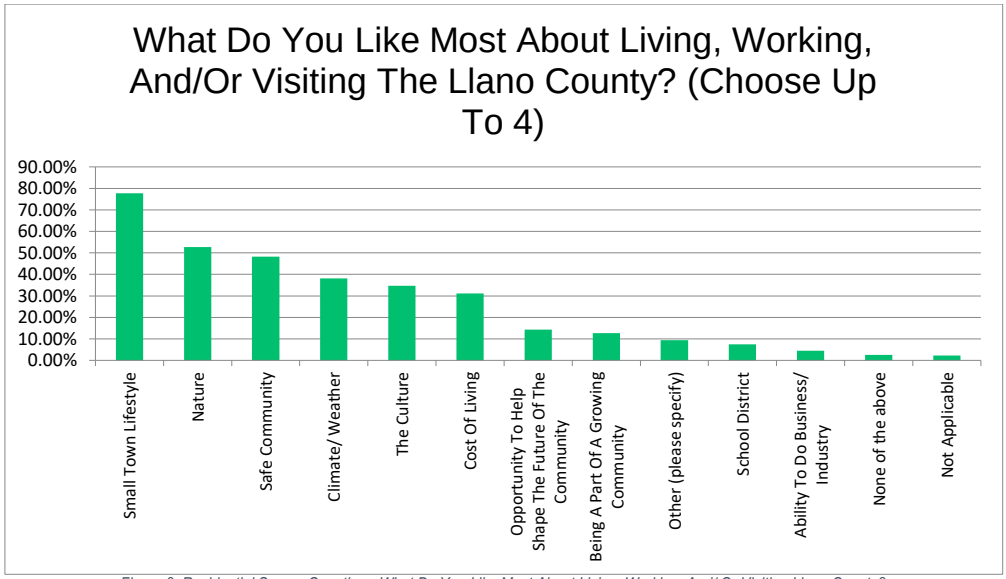


Figure 9: Residential Survey Question - What Do You Like Most About Living, Working, And/ Or Visiting Llano County?

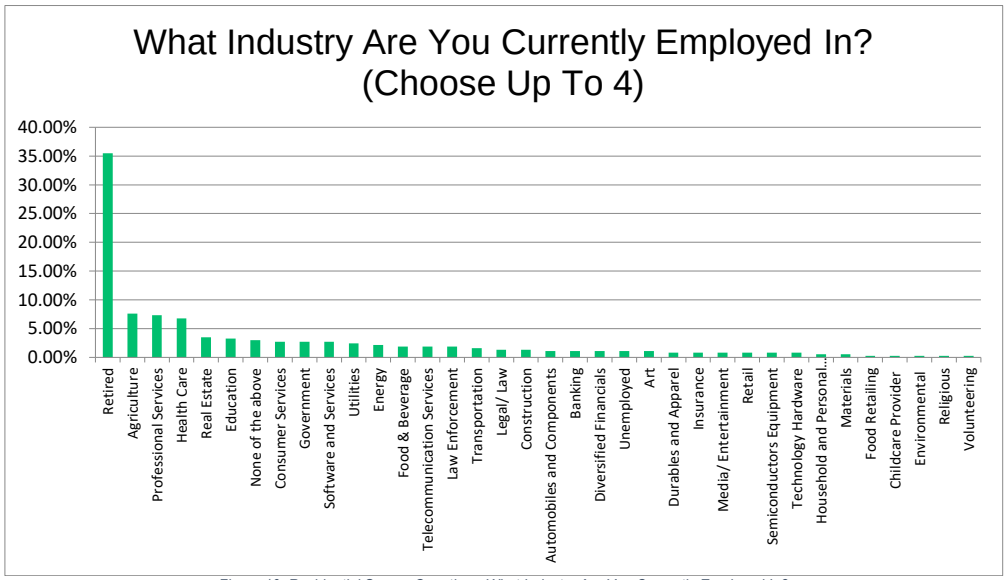


Figure 10: Residential Survey Question - What Industry Are You Currently Employed In?

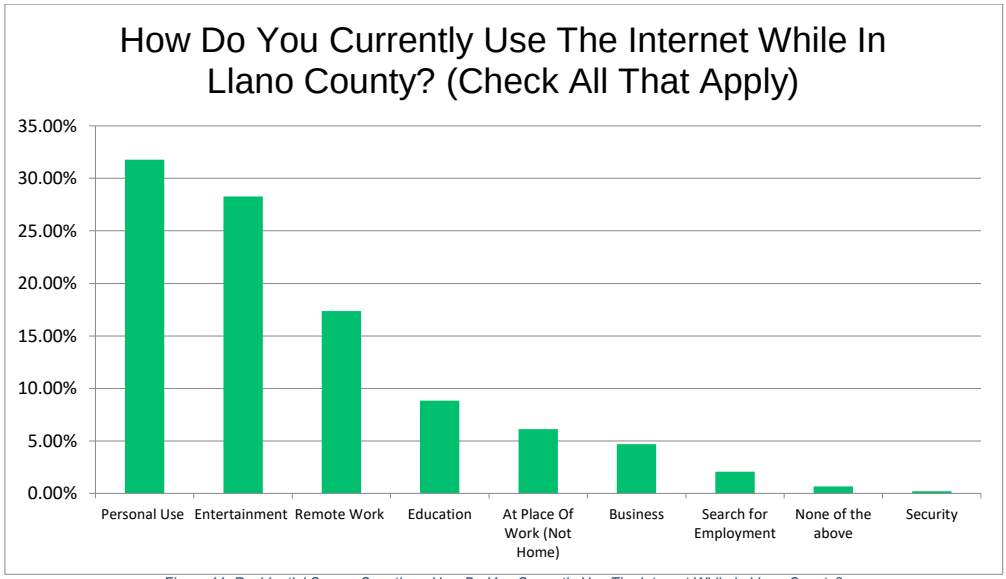


Figure 11: Residential Survey Question - How Do You Currently Use The Internet While in Llano County?

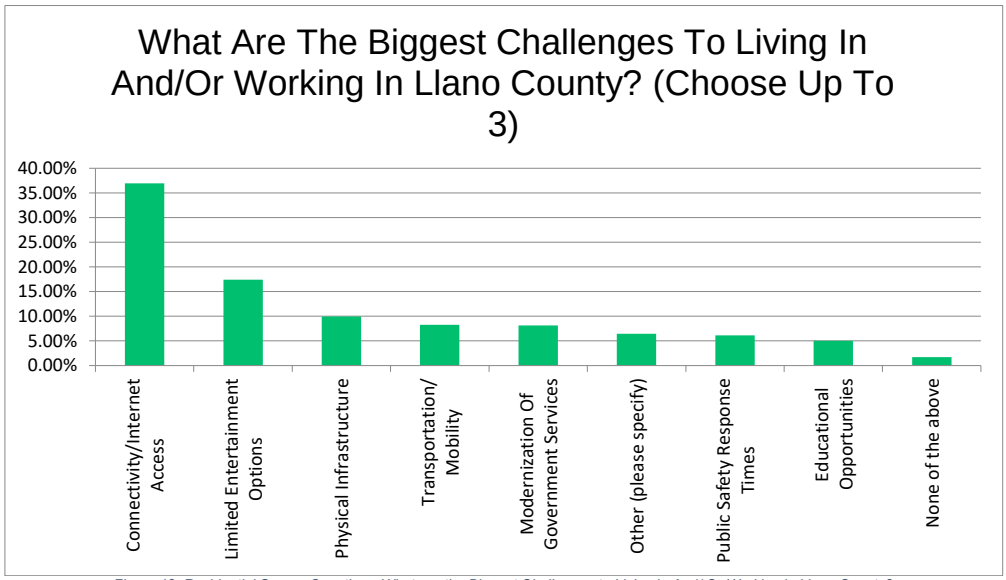


Figure 12: Residential Survey Question - What are the Biggest Challenges to Living in And/ Or Working in Llano County?

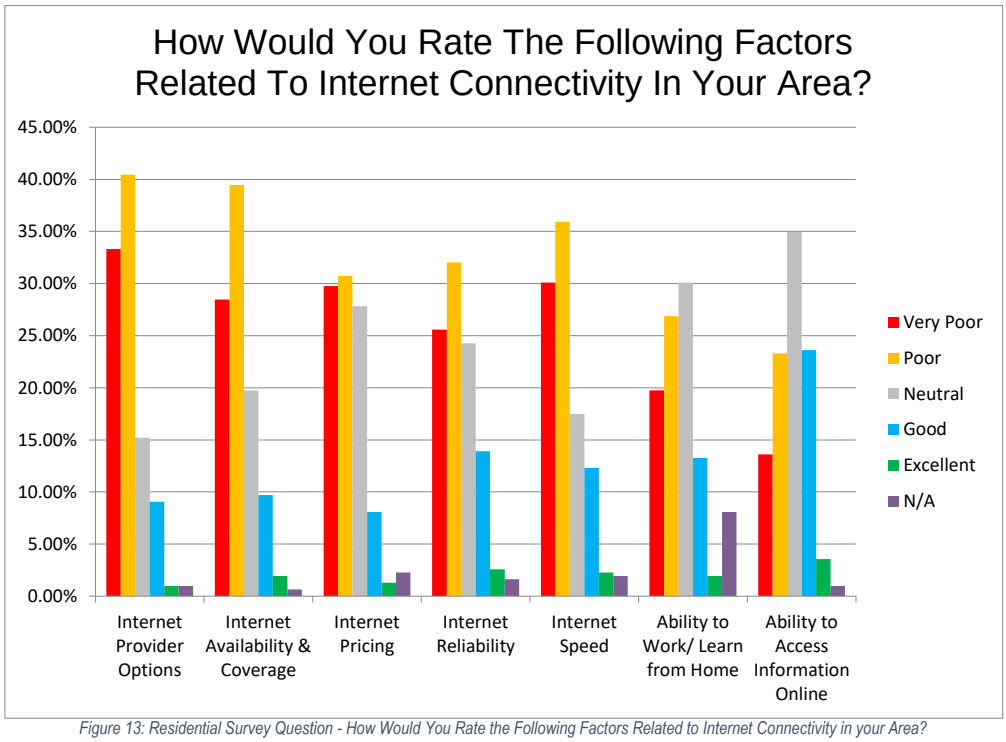


Figure 13: Residential Survey Question - How Would You Rate the Following Factors Related to Internet Connectivity in your Area?

Table 4: Survey Score Based on Internet Connectivity Ratings

Survey Score	
Internet Provider Options	-297
Internet Availability & Coverage	-256
Internet Pricing	-246
Internet Reliability	-198
Internet Speed	-245
Ability to Work/ Learn from Home	-152
Ability to Access Information Online	-61

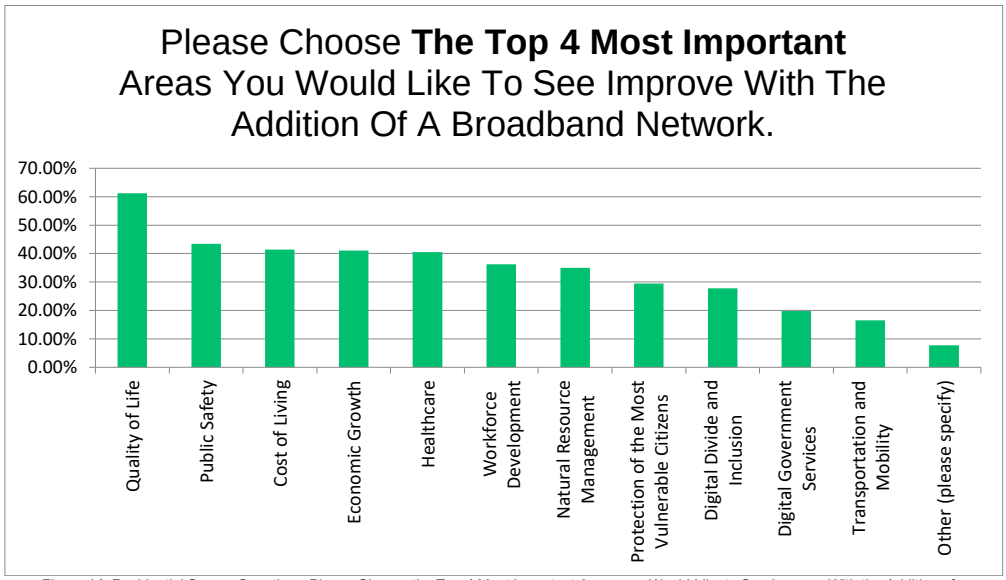


Figure 14: Residential Survey Question - Please Choose the Top 4 Most Important Areas you Would Like to See Improve With the Addition of a Broadband Network

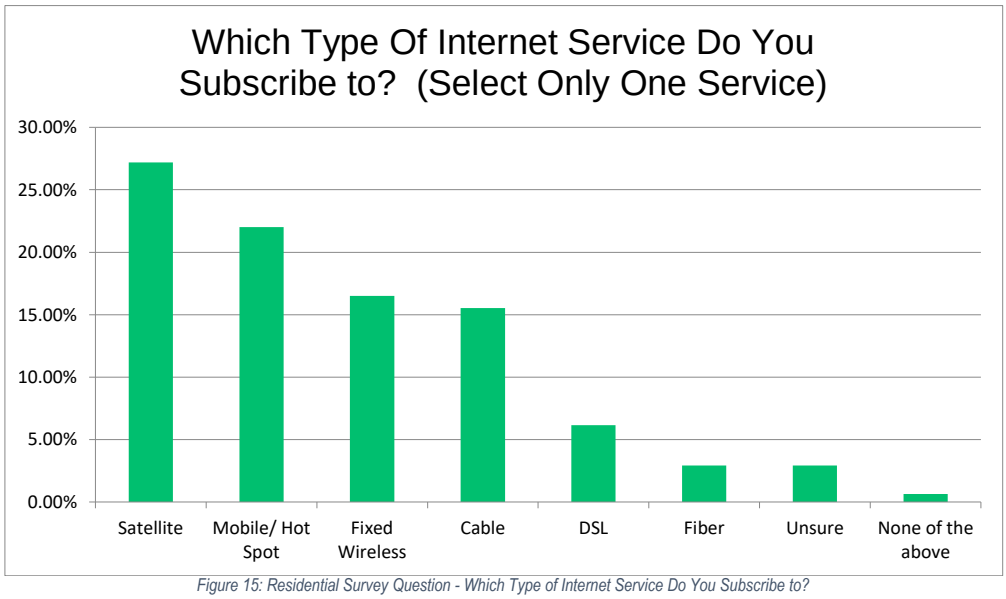


Figure 15: Residential Survey Question - Which Type of Internet Service Do You Subscribe to?

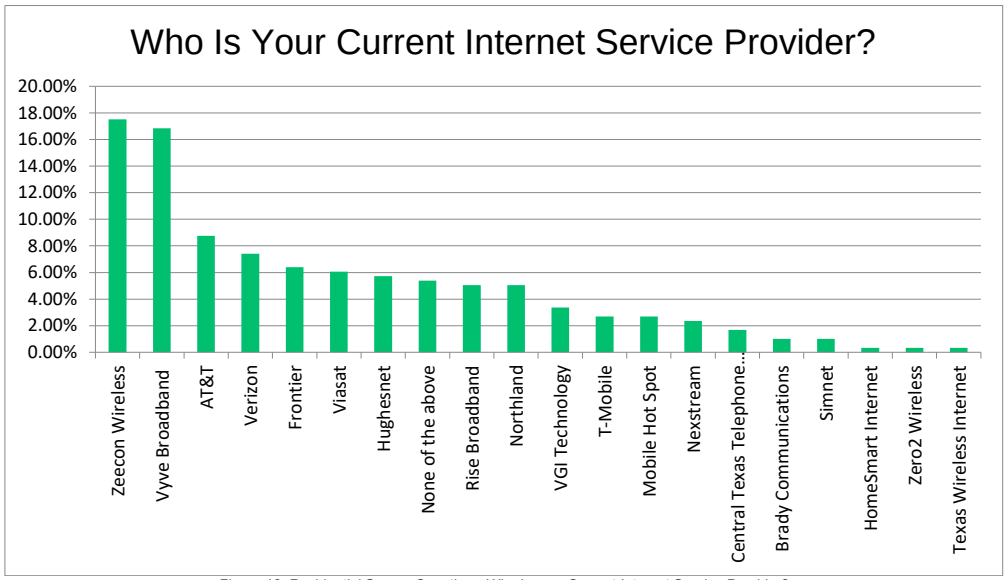


Figure 16: Residential Survey Question - Who is your Current Internet Service Provider?

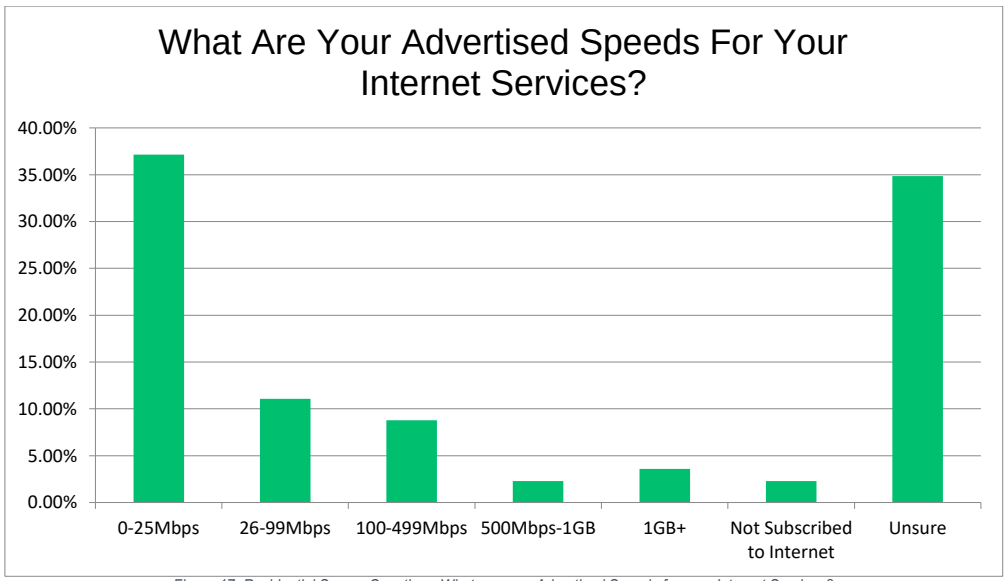


Figure 17: Residential Survey Question - What are your Advertised Speeds for your Internet Services?

Table 5: Residential Survey Question - What is your Cost Per Month for your Subscribed Internet Services?

What Is Your Cost Per Month For Your Subscribed Internet Services? ($/ Month)	
Average	96.28
Median	84.50

7.2.1.1 Residential Survey Analysis

Starting with Figure 8, about 4% of the respondents for the survey specifically responded that they do not currently live in the County limits of Llano County, TX. Since this survey was shared through email and social media outlets, the responses are going to be included as these few residents may work, live nearby, or be active in the Llano County community on a regular basis.

In both Figure 9 and Figure 10, an approximate understanding of why someone chooses to live in a specific city or area is suggested. Using the data based on this survey alone, we might expect that many residents of Llano County are living there to settle down, whether that's moving there after deciding to retire or just having never left the County in the first place. Through various discussions, high speed internet coverage is often seen as a luxury that small towns and rural areas don't typically experience. The small town lifestyle, and the benefits that come from that, are a big reason people enjoy their time in Llano County, as highlighted from the bulk of the responses. This is why implementing these upgrades now is a big priority for places like Llano County since these federal and state funds for broadband specifically are not likely to come again for a long time. The retired folks who love their communities deserve these modern services as much as anyone else. As seen in later figures, as well as in additional sections of this report, these communities are just not receiving adequate service or options. If providers thought serving residents in communities that are as rural as Llano County made business sense, it would have happened already.

In Figure 11 and Figure 12, the questions asked help provide insight as to what the internet is currently being used for, and its overall impact on the community. While the internet has become a primary source of entertainment for many people, it has also become a method of creating a living. Both of these factors can be seen as the main influence in the mentioned figures. Personal use, entertainment, remote work, and education/ school are the primary uses of internet and the biggest challenges to living or working in the County are from internet access, entertainment, infrastructure, and mobility. Currently, many households in the County cannot connect to a high enough internet speed to conduct business or continue their education and are forced to exclude that from their current options. With connectivity being the highest response by nearly 20% compared to the next highest response, and physical infrastructure being the third highest, the residents believe that upgrades are needed to these services. Once these broadband upgrades are completed, remote work and education can become a larger priority for those in need. In addition to the given responses in Figure 12, some of the write in answers under the "Other" option include:

- "lack of local employment opportunity"
- "lack of affordable housing, lack of higher paying jobs"
- "lack of health care"
- "medical options, law enforcement safety and accessibility"
- "lack of variety of restaurants"
- "cost of living and housing skyrocketing"

Figure 13 and Table 4 helps highlight the ultimate need for this study. The information within Table 4 is sourced from the survey and Figure 13 specifically but is represented numerically instead of graphically. In this question, residents were asked their opinion on provider options, coverage, pricing, reliability, speed, ability to work or learn from home, and the ability to access information, all as it relates to the internet in Llano County, where respondents were able to choose from "Very Poor", "Poor", "Neutral", "Good", "Excellent", or not applicable. The overwhelming response to all of the questions overall was "Very Poor", and

this is where Table 4 provides the most value. Table 4's data was created by giving a score to each response of "Very Poor", "Poor", "Neutral", good, "Excellent", or not applicable with the values of -2, -1, 0, 1, and 2, respectfully (where not applicable did not receive scoring). Based on the number of responses, these values were then calculated. To get a sense of where overall opinion would be, a negative score in Table 4 would be on the "Poor" side, a positive value would be on the good side, and something close to zero would be on the "Neutral" side. As can be seen in Table 4, many of the responses provided a very low score, with the ability to access information online as the closest answer to "Neutral", especially as seen in Figure 13. Relatively, provider options, coverage, pricing, reliability, speed, and the ability to work from home all scored abysmally. As a reference, in other locations where this survey was administered, the data from Table 4 never went as low as -297, and even usually provide an overall positive score for the choices like ability to work and learn from home or from ability to access information. Regardless of what providers are advertising for this region, Llano County residents are not content with the current broadband options and responded appropriately to relay that information.

It is well documented that access to high speed broadband increases your overall quality of life. When respondents answered the question stated in Figure 14, residents are aware of the current focus at the national and state levels to provide quality, affordable broadband to communities across the country . Quality of life upgrades will absolutely be improved by the addition of a broadband network, and that can also be address by the other areas that were voted on which include public safety, cost of living, economic growth, healthcare, workforce development, and so on. For public safety, advancements like Next Generation 911 (NG911, or Next Gen 911) have the ability to be implemented. In summary, what Next Gen 911 can improve includes, "enhance[d] emergency number services to create a faster, more resilient system that allows voice, photos, videos and text messages to flow seamlessly from the public to the 911 network. NG911 will also improve public-safety answering point (PSAP) ability to help manage call overload, natural disasters, and transferring of 911 calls and proper jurisdictional responses based on location tracking."[10] Furthermore, the weather is known to contribute to the damage of physical infrastructure in Texas by means of hurricane, freeze storms, flooding, and more. Should a buried fiber line be implemented, where applicable, then communication between public safety facilities and community leaders will continue through times of the most importance for residents. This aligns with healthcare as well. Telehealth is a viable medical option, where accessible. With the rurality of Llano County, the nearest medical facility could take hours to reach after completing drive times and waiting times. With a viable internet solution, telehealth can help reduce in patient demand on medical facilities and can help residents receive the care they need in a shorter time frame, as proven from the Hartman Executive Advisors, "the average wait time for a new patient appointment is 24 days compared to just 20 minutes for a telehealth appointment."[11] Finally, the workforce development and overall economic impact from an addition to the broadband network are immensely valuable. Hiring locally for projects like this help reduce construction times and helps diversify workforce opportunities through outlets such as construction, network design, information and technology (IT), and more.

Finally, Figure 15, Figure 16, Figure 17, and Table 5, help identify what most residents actually choose for their internet services. Unsurprisingly, most choose satellite or mobile hot spot, for those that subscribe to cable, fixed wireless, DSL, or fiber, they are most likely with Zeecon Wireless or Vyve Broadband, with more than 35% of respondents selecting the lowest speed which is considered Unserved by most funding opportunities in 2022 and pay between $80-$100 per month for these services. These prices with this level of service is inadequate, especially in a post COVID-19 world where students were forced to learn online at home for over a year. Through these responses, you can see why the Survey Score values in Table 4 are so low, and why residents are desperate for internet upgrades in Llano County.
Another statement that was captured in the survey was, "If you have any questions or comments you'd like to ask or share, please add them here." Most of the responses presented below were reiterated through the 100 respondents that decided to leave feedback. A highlight of those anonymous answers can be found below:

[10] https://www.911.gov/issue_nextgeneration911.html
[11] https://hartmanadvisors.com/what-are-the-advantages-of-telehealth-for-patients/#:~:text=Telehealth%20has%20proven%20to%20be,minutes%20for%20a%20telehealth%20appointment.

- "Had to invest in an AT&T Hot Spot because I could get NO service anywhere from ANY PROVIDER!"
- "Advertised [speeds] at 100 [Mbps], actual speed test, around 10 down and 2.5 up"
- "Availability in rural areas must improve"
- "Better service is needed for remote workers such as myself."
- "Cost of service is an issue for some people in Kingsland, and cost of devices to connect."
- "I cannot get internet where I live. I can only use my mobile phone. My child has to use an iPad which has mobile service to do schoolwork and even though we have unlimited services once you have gone over 20 GB your service slows down significantly and is very difficult to stay connected. We just like to have internet available in our area."
- "I often lose our internet connection randomly throughout the day and night."

7.2.2 Business Specific Survey

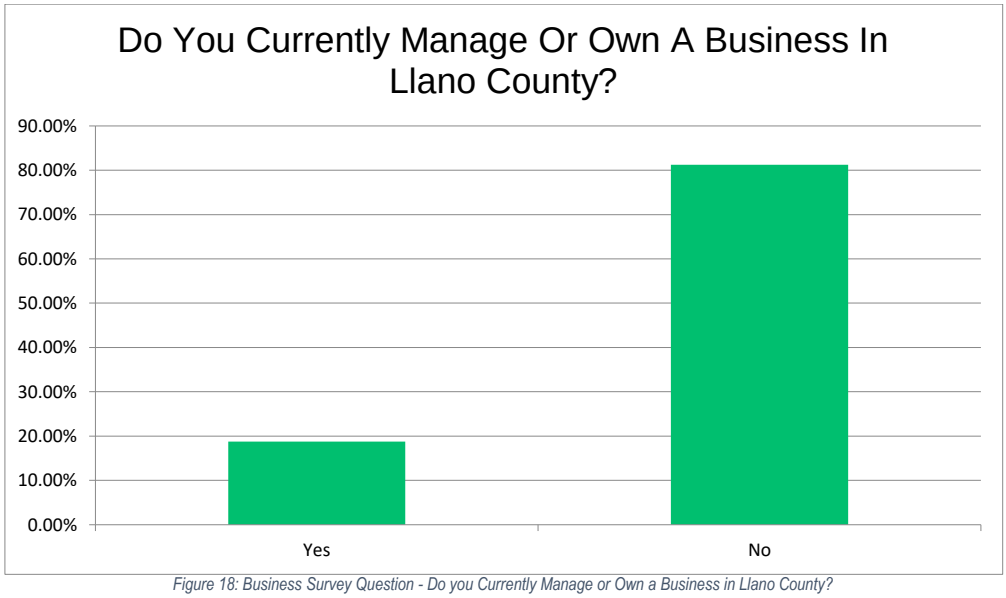


Figure 18: Business Survey Question - Do you Currently Manage or Own a Business in Llano County?

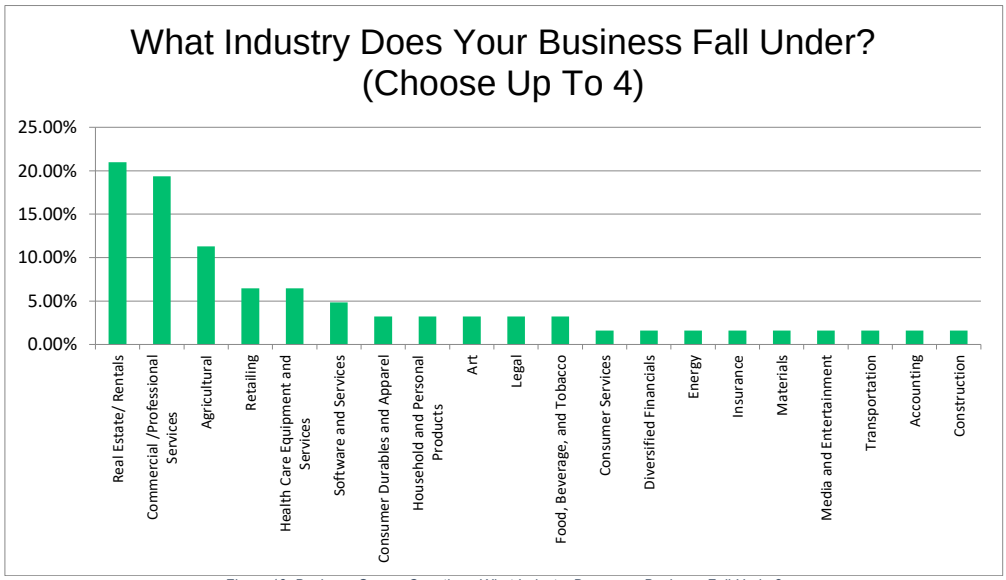


Figure 19: Business Survey Question - What Industry Does your Business Fall Under?

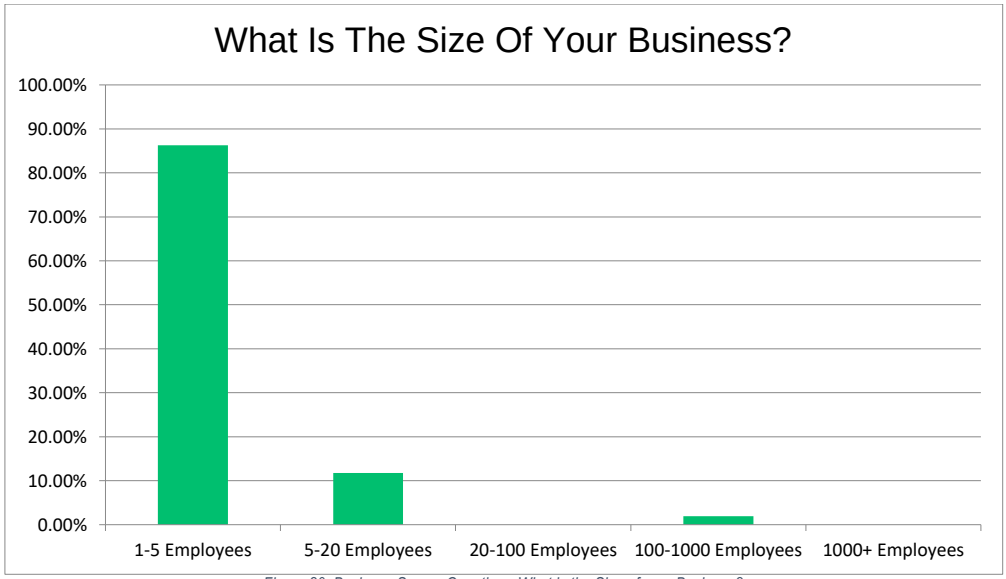


Figure 20: Business Survey Question - What is the Size of your Business?

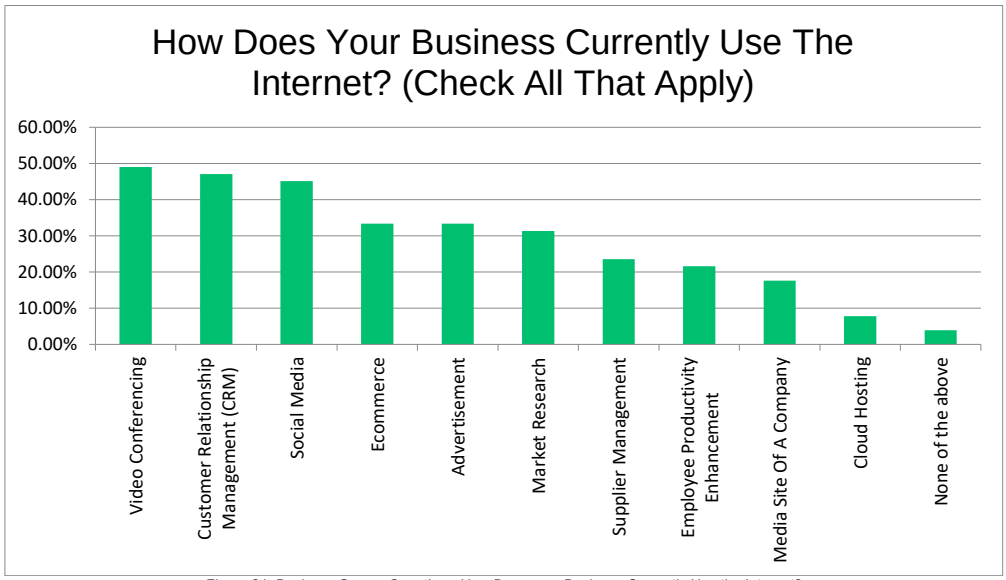


Figure 21: Business Survey Question - How Does your Business Currently Use the Internet?

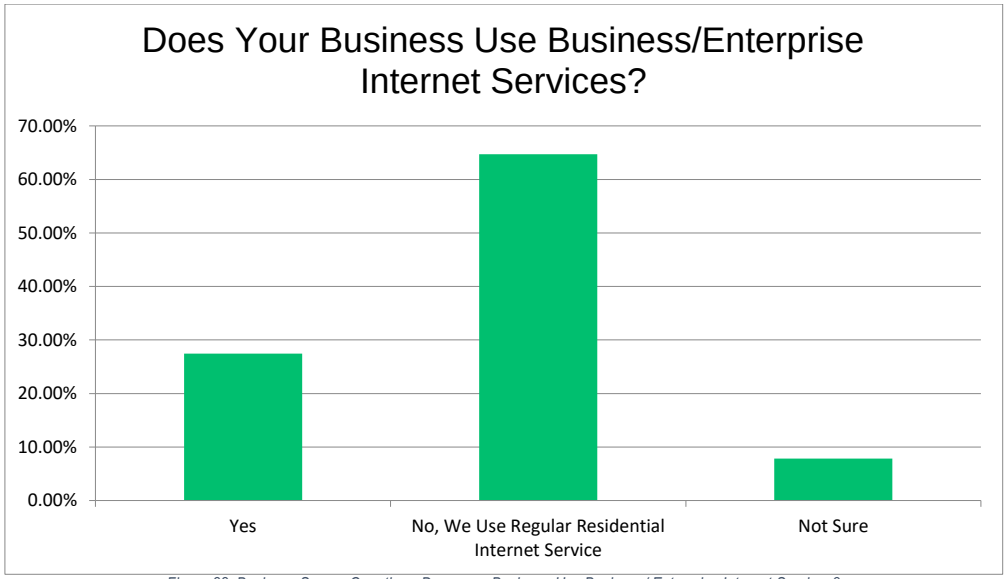


Figure 22: Business Survey Question - Does your Business Use Business/ Enterprise Internet Services?

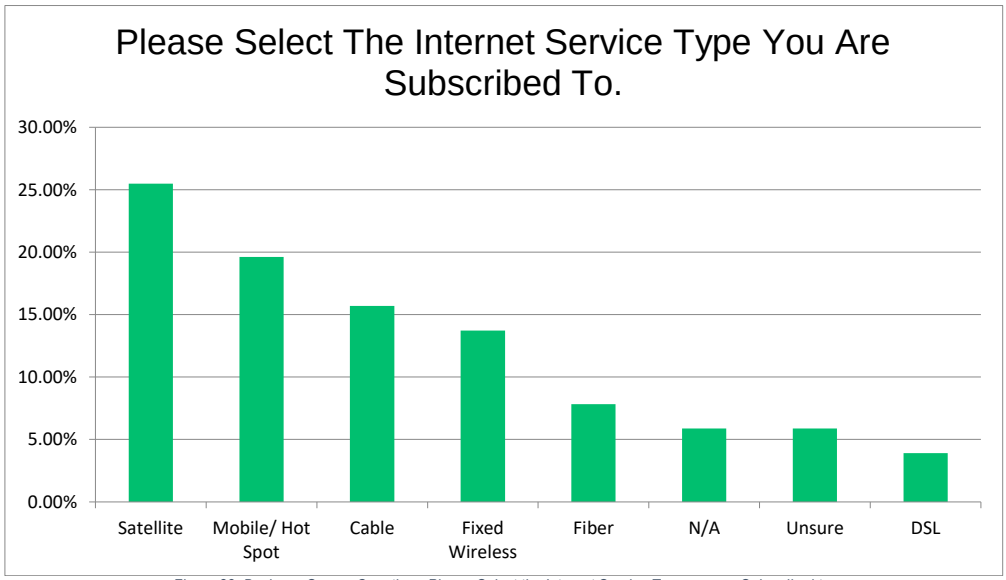


Figure 23: Business Survey Question - Please Select the Internet Service Type you are Subscribed to.

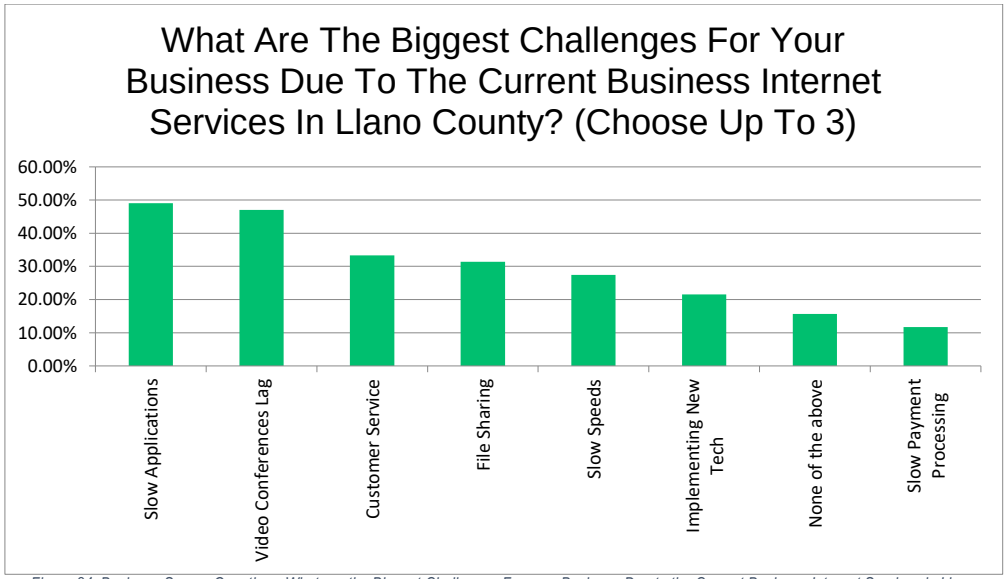


Figure 24: Business Survey Question - What are the Biggest Challenges For your Business Due to the Current Business Internet Services in Llano County?

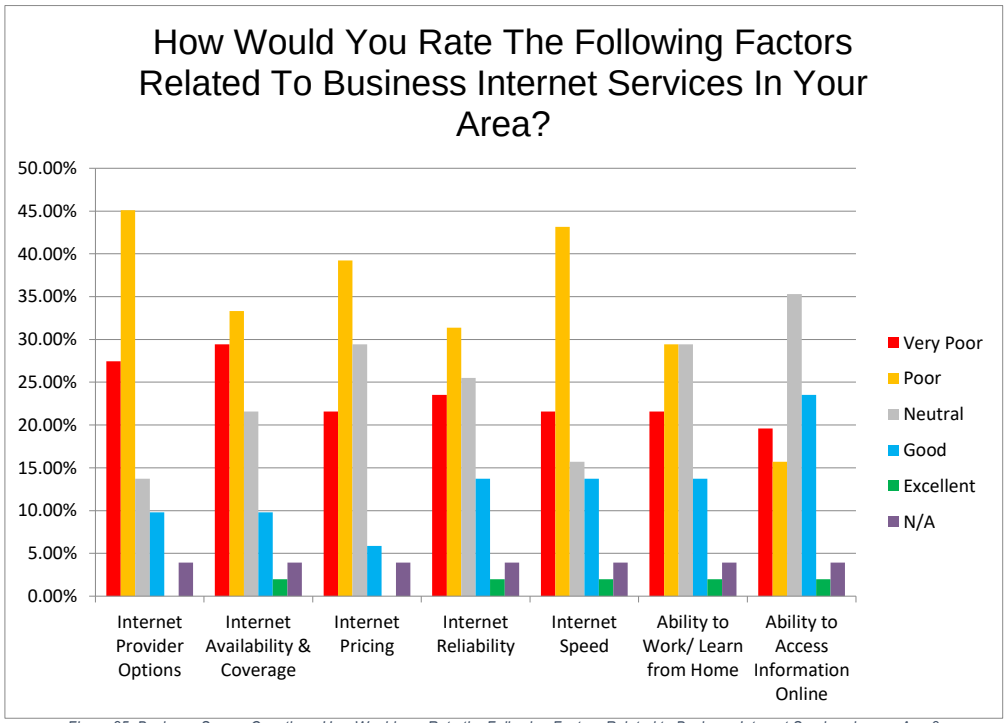


Figure 25: Business Survey Question - How Would you Rate the Following Factors Related to Business Internet Services in your Area?

Table 6: Survey Score Based on Internet Connectivity Ratings

Survey Score	
Internet Provider Options	-46
Internet Availability & Coverage	-40
Internet Pricing	-39
Internet Reliability	-31
Internet Speed	-35
Ability to Work/ Learn from Home	-28
Ability to Access Information Online	-14

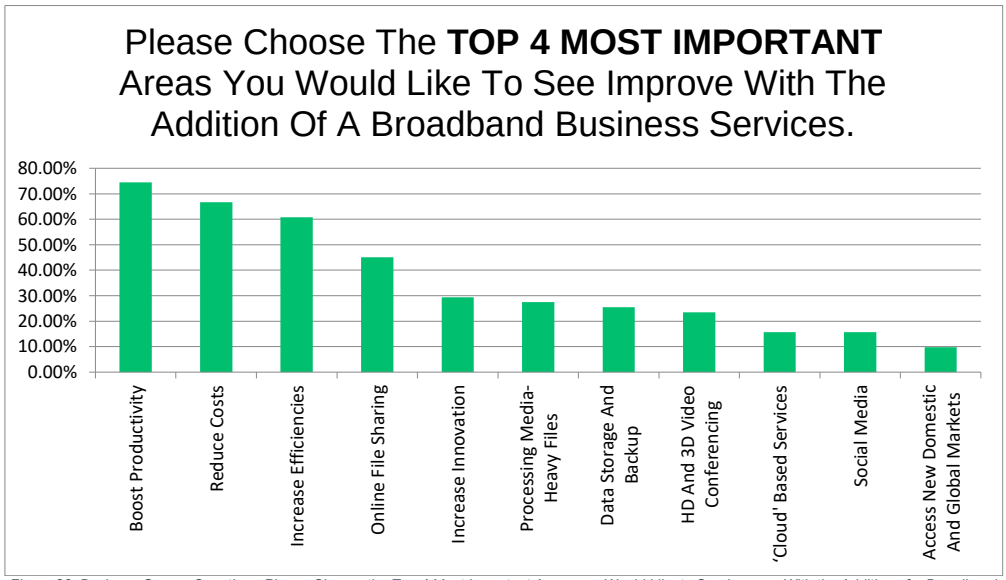


Figure 26: Business Survey Question - Please Choose the Top 4 Most Important Areas you Would Like to See Improve With the Addition of a Broadband Business Service.

7.2.2.1 Business Survey Analysis

Out of the 309 responses received overall by the survey, 58 of those (about 19%) answered on behalf of a business and its needs in Llano County, TX. According to the US Census[12] data from 2021, which is the most recent that could be established, there are about 485 total employer establishments within the County. Using that data, approximately 12% of businesses responded to this survey.

From the figures presented above, nearly all of the businesses that responded to the survey are small in size with 1-5 employees (Figure 20), typically work in commercial/ professional services, real estate, agriculture, retail, or healthcare (Figure 19), and use the internet primarily for video calls, customer relationships, social media, and ecommerce (Figure 21).

About 65% of businesses do not use enterprise/ commercial internet services (Figure 22) and show the same trend as residential respondents of where their internet comes from which is primarily satellite, hot spots, cable, or fixed wireless (Figure 23).

In terms of challenges experienced and improvements requested, the speed and technologies are underperforming and customer services has become an issue (Figure 24) while businesses would like cheaper costs to help increase productivity, efficiency, and innovation while allowing the option to adequately share files (Figure 26).

Ultimately, the overall trends presented in Figure 25 and Table 6 match that of the residential responses shown in Figure 13; all of the responses are overwhelmingly "Poor" at best, with the exception of the ability to access information online also scoring relatively "Neutral" in this business case.

Trends seen within both the business responses and the residential responses are quite similar and based on what has been

[12] https://www.census.gov/quickfacts/fact/table/llanocountytexas,whitehousecitytexas/PST045221

reviewed about the infrastructure and services offered throughout this feasibility study, it is known that Llano County does not have options for adequate service. It is not a lack of adoption that is an issue for the County, but just an overall lack of access or options for high-speed reliable broadband.

7.2.3 Speed Test Results

In addition to the survey that was administered to the community of Llano County, a speed test was also requested for residents to take so that real world application of the advertised speeds could be reviewed. The results gathered from the speed test are not invasive to where they can specify physical addresses of those that took the speed test, if a VPN was used, or anything explicit about location data other than city, state, and general location. Because of that, some of the data gathered may include outliers that could not be filtered since there is no indication that external tests were completed that may affect the goal of collecting speeds from the primary internet source. Additionally, it should be noted that some factors can impact speed test results. Some of these factors include:

- Time of Day the Speed Test was Taken
  - Certain "peak hours" may result in slower speeds
- Location of Where the Speed Test was Taken
  - Having a line of sight to the router will indicate better results compared to on a second floor or in rooms further away from the router.
  - Certain construction materials in the home may cause dead spots for the Wi-Fi.
- Devices Connected to the Internet
  - Many devices in the background could be downloading or uploading data which may indicate a negatively impacted speed test
- Using a Virtual Private Network (VPN)
  - This typically throttles speeds since the internet is being routed through additional locations. Using a VPN would lower the values collected from a typical speed test.

With that in mind, all results are presented below apart from results that were gathered from tests taken outside of the state of Texas and outside of the general Llano County area. The results of the speed test are as follows.

Table 7 below displays the upload and downloads speeds in terms of both median and average. Since the use of median helps eliminate outlier answers compared to average it was necessary to include it in addition to average.
Note: This speed test was hosted on the internal servers of speedtest.net from Ookla.

Table 7: Average Speed Test Results Based on Provider

Provider Name	Number of Speed Tests Recorded with This Provider	Average Download Speed (Mbps)	Average Upload Speed (Mbps)	Median Download Speed (Mbps)	Median Upload Speed (Mbps)
Vyve Broadband	59	89	19	61	14
Zeecon Wireless Internet L.L.C.	32	7	3	5	2
AT&T Wireless	28	23	3	13	2
Frontier Communications	28	11	9	4	1
VERIZON WIRELESS	21	23	5	18	3
VIASAT	17	14	3	17	3
Rise Broadband	11	25	5	24	6
Spectrum Business	10	15	3	16	3
T-MOBILE USA	8	20	9	21	6
Lumen	6	10	11	5	3
Hughes Network Systems	5	26	0	32	0
AT&T U-verse	5	47	15	65	20
West Central Wireless	4	5	3	5	3
Brady Communications, LLC	4	16	3	15	3
Spectrum	3	180	16	81	12
iCloud Private Relay	3	37	21	35	24
Guadalupe Valley Telephone Cooperative	2	80	124	80	124
STARLINK	2	42	7	42	7
AT&T Services	2	30	51	30	51
FiberLight, LLC	2	77	29	77	29
Windstream	2	202	14	202	14
CenturyLink	2	4	5	4	5
Maxihost LLC	1	6	0	6	0

Table 8 below displays the maximum and minimum values recorded for both upload and downloads speeds. It should be noted that only responses from Table 7 that had at least 10 responses recorded from that provider are listed below. The maximum and minimum values with less responses would not provide additional context outside of the few responses recorded.

Table 8: Maximum and Minimum Speed Test Results Based on Provider

Provider Name	Maximum Download Speed (Mbps)	Minimum Download Speed (Mbps)	Maximum Upload Speed (Mbps)	Minimum Upload Speed (Mbps)
Vyve Broadband	**255**	**3**	**148**	**0**
Zeecon Wireless Internet L.L.C.	**80**	**2**	**11**	**0**
AT&T Wireless	**151**	**1**	**20**	**0**
Frontier Communications	**90**	**1**	**93**	**0**
Verizon Wireless	**65**	**1**	**27**	**0**
VIASAT	**24**	**2**	**5**	**1**
Rise Broadband	**51**	**11**	**6**	**0**
Spectrum Business	**24**	**2**	**6**	**2**

7.2.3.1 Speed Test Result Analysis

Compared to the survey results only about 83% of respondents also completed a speed test (258 in total). A key point to highlight from the speed test results is that three out of the top 10 recorded providers are from cellular carrier sources. These speeds were not capable of recording the current definition of even Underserved broadband (25 Mbps/ 3 Mbps). Out of the remainder of the recorded responses, there were zero services that would be considered as having adequate levels of broadband by the NTIA funding requirements of at least 100 Mbps/ 20 Mbps. Shown in Table 7, Windstream and Spectrum did offer higher than most download speeds on average, but even with that data presented the median eliminates the outliers in the Spectrum data showing a median download speed of 81 Mbps, and the Windstream data appears to be from two tests at the same source. Overall, the data presented in Table 7 matches what was shown previously in Figure 17, that the majority of people are paying for 25 Mbps download speeds or less. While speed tests have their own limitations as stated above in this section, most of these speeds recorded are similar to what is advertised, assuming that most of the people responding selected that they sign up for the 0-25 Mbps speeds. Typically, upload speeds are not prominently advertised when they are not symmetrical, and both Table 7 and Table 8 highlight why that is. Many of these providers could not exceed 10 Mbps in uploads speeds, and even recorded as low as zero in the minimum value. To have success in remote education, telehealth, or remote work, the upload speed is essential for video conferencing. All of the current services, that are predominantly factored in this survey, could not adequately sustain those needs for now. Through stakeholder engagement, the project team did learn, as stated above, that Vyve has upgraded their existing infrastructure to include more fiber, and these upgrades can be seen in the data above in Table 8. Based on the data collected, Vyve is providing speeds that at most recorded 255 Mbps download, 148 Mbps upload, average at 89 Mbps for download, and 19 Mbps for upload proving to be the best option for Llano County residents, where available. However, from the information gathered above in Table 7 & Table 8, the overall speeds are not enough for the residents in these communities.

8 NEEDS AND GAP ANALYSIS

Section Highlights

- A LACK OF ADEQUATE LEVELS OF HIGH SPEED BROADBAND IS AN ISSUE THROUGHOUT LLANO COUNTY
- ADOPTION RATES ARE LIMITED TO WHAT FEW SERVICES ARE AVAILABLE, THOUGH INCOME AND DIGITAL LITERACY ALSO PLAY A ROLE
- LLANO COUNTY RESIDENTS NEED FUTURE PROOF BROADBAND SOLUTIONS

Llano County and its broadband infrastructure is a good representation of how broadband is across the country, the cities have it, but the rural areas do not. The eastern side of the County is where most of the population is located outside of the City of Llano, including Horseshoe Bay, Kingsland, and Buchanan Dam and several other areas along the river. These areas have more options to choose from that mostly contain adequate speeds. However, once you leave those cities, any viable option quickly becomes sparce or unavailable. Residents, businesses, schools, and the local government require an affordable, capable, and reliable communications infrastructure to operate efficiently, which cannot be accomplished with patchwork coverage and non-competitive pricing tiers that are not valued-based on the quality of service (QoS) for the end customer. The concept and impact of the digital divide is finally under a national spotlight largely due to the COVID-19 pandemic and, more recently, Winter Storm Uri which crippled the state's electrical grid and localized utilities. Without a comprehensive understanding of the root causes of lack of infrastructure in a particular region, a meaningful solution that is uniquely catered to address the broadband gap and the community's needs cannot be developed.

8.1 Understanding the Data and Sources

From a federal standpoint, the Broadband needs and gap analysis is extremely high level and trend-based at best. Until recently, the Federal Communication Commission (FCC) has been the single source of broadband coverage data, which is gathered primarily through FCC Form 477, which ISPs are required to submit twice a year. The primary issue with these forms is that they capture limited data at a census block granularity, ultimately providing an inaccurate analysis of broadband availability at the consumer level within that census block. If a fixed provider (provides services to fixed devices/locations, i.e., ethernet or Wi-Fi to fixed devices) offers service to a single household, the entire census block reflects this service regardless of whether any other household has broadband service from this provider. As a result, in rural census blocks, the gap analysis is severely misrepresented. In addition, mobile providers (services to mobile devices, i.e., smartphones and tablets) only need to submit maps of their coverage area by broadband technology. Conclusively, the FCC's broadband coverage maps and data do not provide an adequate single source for determining broadband needs, which ultimately feed reports on qualifying metrics for state and/or federal funding and assistance. The FCC is aware of and has admitted the need for an overhaul of this data and has created a Broadband Data Task Force and various web-based tools and broadband experience repositories to capture data outside of the single source form. Non-profit, state, and local entities have created working groups and committees that strive to collect better broadband data to help communities determine the needs, understand the cause, and consult on the development and implementation of applicable broadband solutions.

ConnectedNation Texas is a statewide initiative funded by the Texas Rural Funders to support all Texans in leveraging broadband. ConnectedNation expands upon existing Form 477 data and aims to provide more localized and accurate reports of broadband coverage and technologies. While the data may be misleading when reviewed as a single, isolated source and in isolation, it does provide a sounding board to contrast with further research of the existing conditions and feedback through meaningful stakeholder engagement. The approach for this Broadband Improvement Study was to start by collecting the latest publicly available broadband data as a foundation, build in new layers that provide additional content for analysis and overlay the proposed network footprint and service requirements. Many of the following figures and maps below may use

ConnectedNation[13] resources and data which are ultimately derived from FCC Form 477 [14] data which was most recently updated in December 2020.

8.2 Identifying Lack of Adoption Areas

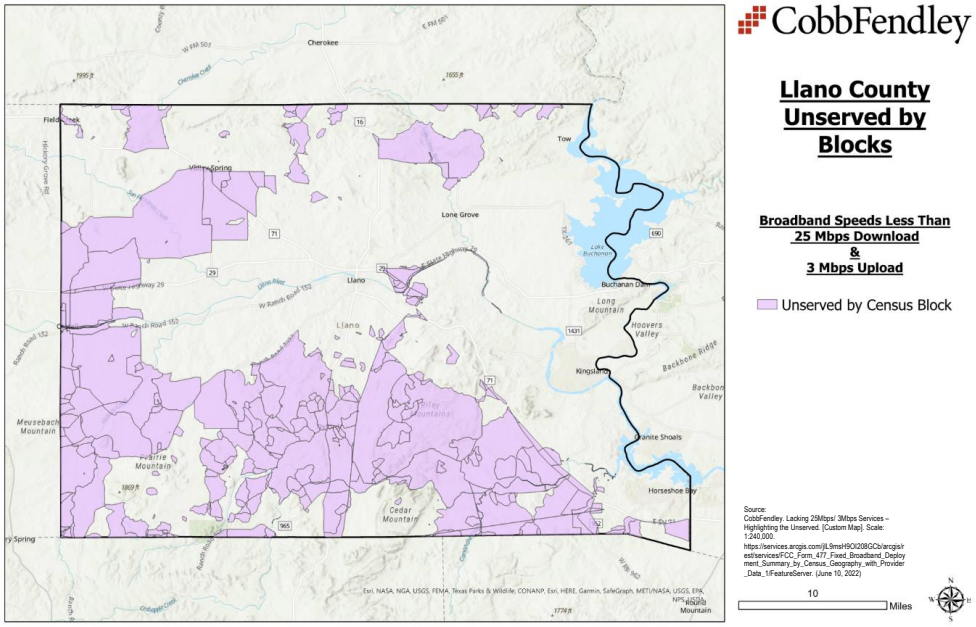


Figure 27: Lacking 25Mbps/ 3Mbps Services – Highlighting the Unserved

Llano County and its residents do not have many options, if any, for high-speed internet. As seen later in this study, people live in Llano County because of its small community atmosphere, the nature, and feeling that it is a suitable place to retire. However, for many of the reasons people live in Llano County, that is why providers thus far have not provided adequate infrastructure to a majority of the County area. If it made business sense to provide service in these rural areas, it would currently exist. For this reason, the digital divide has expanded through many of the rural communities across Texas, but especially here in Llano County. The term "Unserved" is considered broadband speeds that do not meet the 25 Mbps/ 3 Mbps definition of broadband by the FCC, while the term "Underserved" is considered broadband speeds that do not meet the 100 Mbps/ 20 Mbps threshold, as defined by funding opportunities such as NTIA.

As initially seen in Figure 27, the Unserved area of Llano County is expansive. Nearly half of the County is considered Unserved, which is an issue when 25 Mbps/ 3 Mbps speeds are already considered outdated, especially by the NTIA's required speed standard. It should be acknowledged that these figures above do not account for satellite based service. While these technologies may help provide a solution to people in these areas, this solution is not considered sustainable for long term purposes. With that, while Figure 27 does show areas that have available speeds greater than 25 Mbps/ 3 Mbps, the best long

[13] https://gis.connectednation.org/portal/apps/webappviewer/index.html?id=9e10c6120228435ca35c759fac3d805e
[14] https://www.fcc.gov/economics-analytics/industry-analysis-division/form-477-resources

term solution of fiber is not available and the fixed wireless solutions offer at most a 4 Mbps download speed in some of these locations. In a time where video conferencing for remote work, health, or education and streaming entertainment is a primary demand amongst families, these locations need the infrastructure in place to receive adequate coverage.

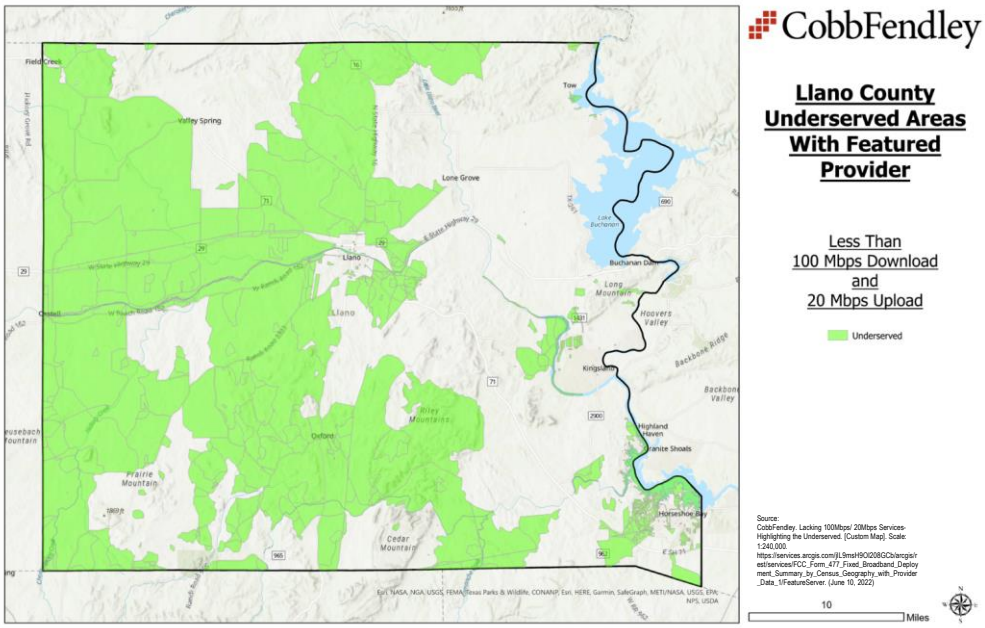


Figure 28: Lacking 100Mbps/ 20Mbps Services- Highlighting the Underserved

Figure 28 identifies the areas of Llano County that meet the needs of the NTIA funding, which highlight the Underserved areas lacking 100 Mbps/ 20 Mbps speeds. This is nearly the entire County, with the exception of the eastern side where the majority of the cities are located. The areas that are shown on the western side of the County to serve a speed of 100 Mbps/ 20 Mbps or greater are actually infrastructure tie ins for Cooperatives from other areas outside of the County. Whether that service can be used in the home in Llano County is still undetermined. On the eastern side of the County, it would appear that residents are mostly covered with adequate speeds. However, when analyzing the data, it was determined that one of the providers has shut down business operation. Research was done to try and figure out what had happened to their existing infrastructure in Llano County, and while most of it was purchased by another provider, there was also a discrepancy of their actual coverage area in the County on the FCC maps. The figures below help highlight this area in question.

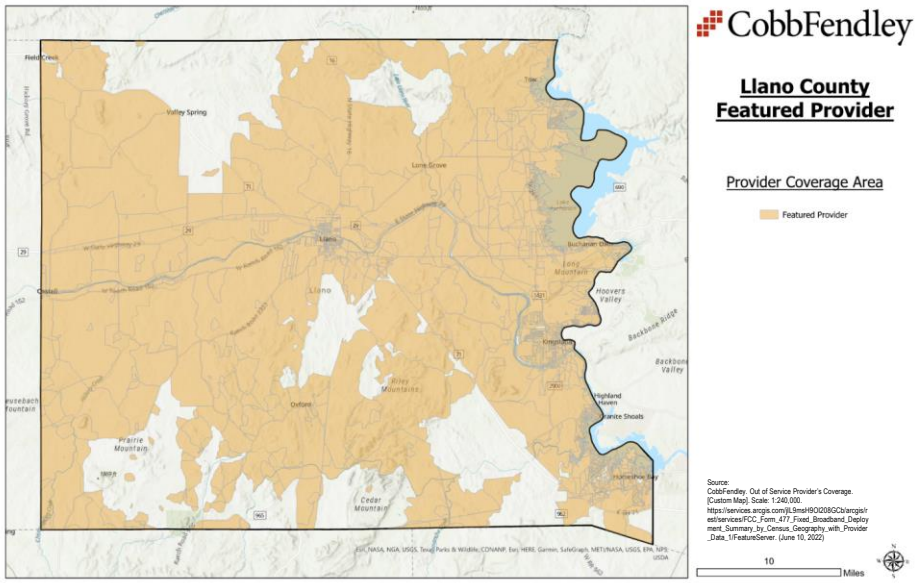


Figure 29: Out of Service Provider's Coverage

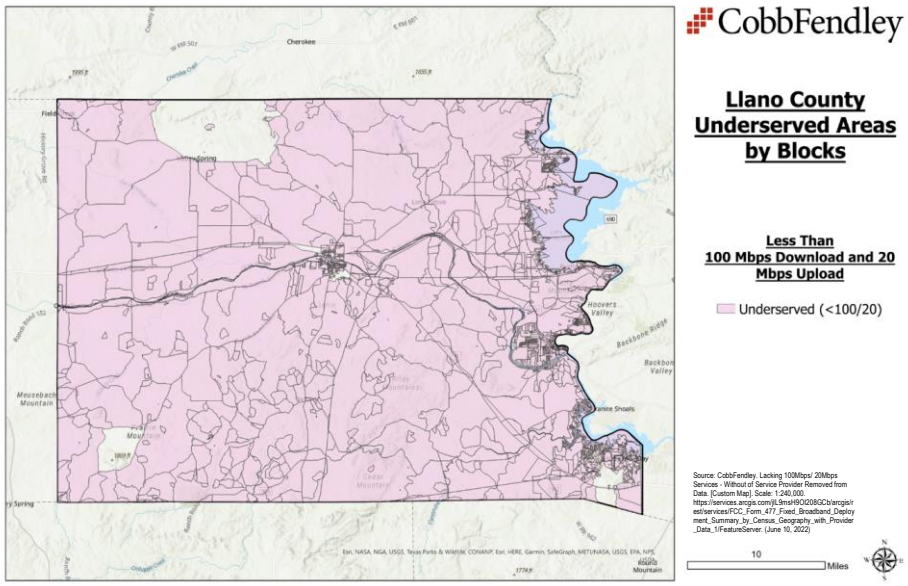


Figure 30: Lacking 100Mbps/ 20Mbps Services - Without of Service Provider Removed from Data

As you can see with these areas in Figure 29 now removed and excluded from the FCC map data, Figure 30 indicates a more accurate representation of the areas which lack speeds of 100 Mbps/ 20 Mbps or greater. Essentially, all of Llano County is Underserved. While this is good news in terms of being eligible for certain funding considerations to upgrade broadband infrastructure, this is a terrible situation for residents. While places like Horseshoe Bay and Sunrise Beach have taken steps to address this already, many of the communities outside of those two places don't have the representation to help tackle this problem due to their rurality. At present, as discussed earlier, satellite internet is essentially the only viable option for internet in many parts of Llano County, and satellite is not a long term solution for internet. While upgrades for Horseshoe Bay and Sunrise Beach are underway and have received higher speed services thus far, it is still recommended to include them in any design proposals that come from this study as not to avoid competition in the marketplace. Adding services that people cannot afford will not help address the digital divide.

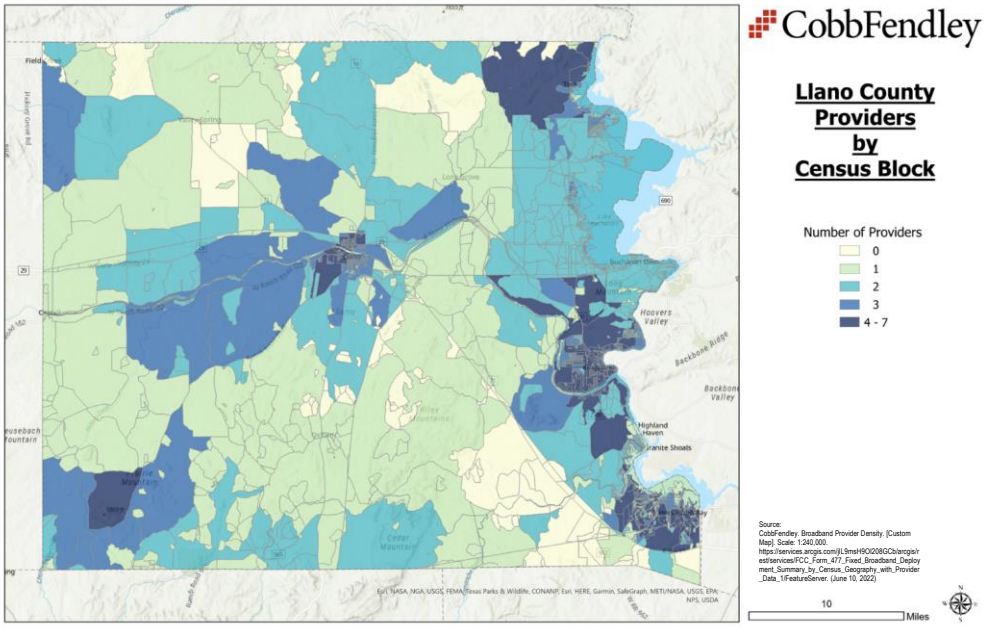


Figure 31: Broadband Provider Density

Regarding competition, Figure 31 helps show just how many providers are actually present across the County. As you get closer to and into the cities, Llano, Kingsland, Horseshoe Bay, etc., the number of providers increases considerably. This could also be showcasing the range of the fixed wireless solutions in many of these cities, but essentially, as showcased here again, the rural communities do not receive the options they deserve. For areas with multiple options, as shown in the figures above, the services are still inadequate. With upgrades currently in progress for some of these providers, there are high-speed options on the way.

There will be necessary processes needed to be made for subscribers though, as customer service and digital literacy play a large part of adoption rates. The figures below help indicate areas that may need assistance with adoption.

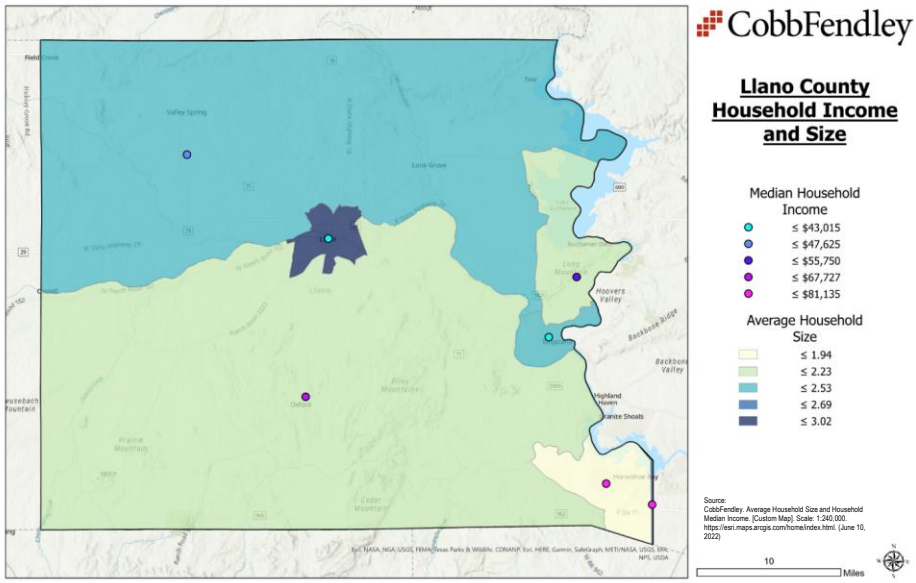


Figure 32: Average Household Size and Household Median Income

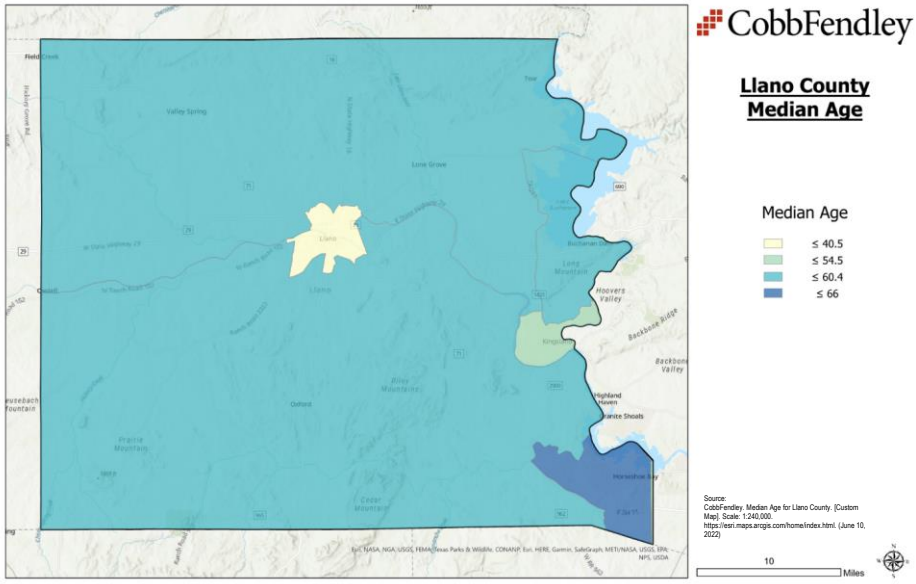


Figure 33: Median Age for Llano County

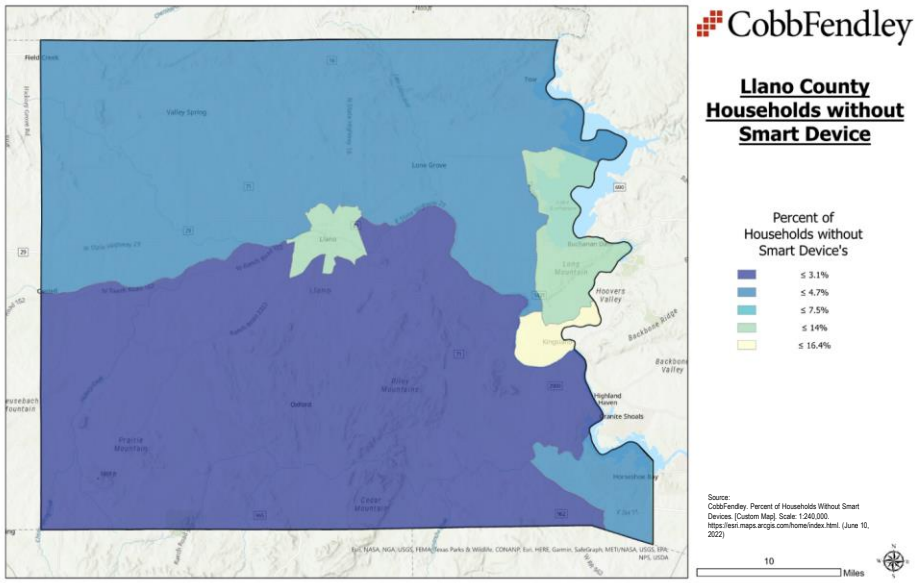


Figure 34: Percent of Households Without Smart Devices

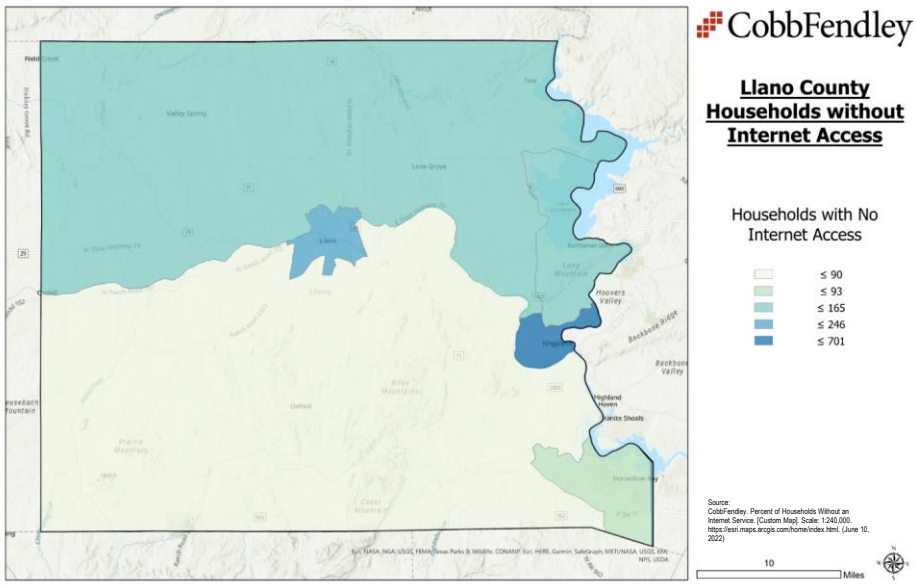


Figure 35: Percent of Households Without an Internet Service

The figures above contain information directly from US Census data. In terms of adoption, one of the leading causes that lead to families not adopting is pricing. Excluding the efforts from the Affordable Connectivity Program and other initiatives, connecting to high speed internet is an expensive amenity for those looking to get the full effectiveness it provides. On top of the monthly internet service, one needs the hardware to receive the internet, such as modems, routers, or satellites, for example. One is then also required to have a device that has the ability to access these speeds, such as a mobile phone, a tablet, or a computer, for example. Every step of this process requires investing into various items, and as the digital divide continues and technology advances exponentially, attempting to understand the situation can be cumbersome or problematic.

In Figure 32, the combination of median household income compared to the average household size can be reviewed. Household size is added to this figure with the thought that if a family has more members within it, the less expendable income there would likely be to invest in broadband connectivity in the home. While this could be a factor for a lack of adoption in some areas, that does not generally appear to be the case for the greater Llano County area. As seen in later sections of this report, Llano County is home to many retired individuals. The trends of those within a retirement community are vastly different than one within a low income community. However, both the City of Llano and Kingsland contain the lowest income within the County, based on census tract, in addition to containing the largest family size. While this doesn't really match any of the other communities within the County, this could be a factor for Llano and Kingsland citizens with broadband adoption. For the remainder of the County, age is a potential factor that could lead to a lack of adoption. Compared to the median age for the state of Texas and the rest of the United States[15], the median age of Llano County residents is about 20 years older. The median age of Texas is about 34 years old, in the United States its about 38 years old, but the average age of Llano County residents is about 58 years old[16]. This is the second oldest county within the state of Texas[17], and this further reiterates the notion that the County is mostly population by retired families. Once more, the City of Llano shows a more average demographic with a median age of about 40 years old. Based on these trends, the City of Llano appears to be where most younger families are raising their children within the County, and places like Horseshoe Bay, as well as many of the rural areas, are where families are settling down.

Finally, Figure 34 and Figure 35 both provide additional context into actual references that are directly related to broadband adoption. Through these figures, the ownership of smart devices and the percentage of households without internet service can be examined. Overall, the percentages of households that do not have a smart device to access broadband services ranges from about 3% to upwards of about 16%. The locations displaying a higher percentage showing no smart devices are primarily in the cities, such as Kingsland, Buchanan Dam, and Llano, and not the rural areas. Since these are denser, the amount of people in these census blocks is showing a far greater number of residents without these devices compared to if the rural areas showed a lack of ownership. On Figure 35, the same trend can be seen. These same cities, Kingsland, Buchanan Dam, and Llano, show a lesser number of households that have broadband internet. Knowing this, these two aspects could be considered to be corelated, and factor into lack of adoption.

15 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjeqbPc9f33AhUMn44IHVcIDbEQFnoECCAQAw&url=https%3A%2F%2Fgov.texas.gov%2Fuploads%2Ffiles%2Forganization%2Ftwic%2FDemographics_Update_2016.pdf&usg=AOvVaw1QKuVrGWD9moB4krXomsyh

16 https://datacommons.org/tools/timeline#&place=geoId/48299&statsVar=Median_Age_Person

17 https://datacommons.org/ranking/Median_Age_Person/County/geoId/48?h=geoId%2F48299

8.3 Reasons for Lack of Adoption in Llano County

Based on all of the figures above, the following adoption factors can be analyzed:

- Age
  - Age may typically be a factor for lack of broadband adoption but based on the data the locations that have a higher median age of residents are not really experiencing a lower adoption rate. The places that show the highest median ages are seen to have higher adoption rates, but this may be due to the higher income of these residents. In these areas where the recorded ages are noticeably higher than the other census tracts, there is higher densities of residents as well and the infrastructure is proven to be more sustainable.
- Lack Of Providers
  - The lack of Internet Service Providers (ISP)s in the County is the main cause for a lack of adoption. Frankly, there is nothing to adopt for most of the areas within the County. The bigger cities have at least one major option, some with more than one, but for rural Llano County, that is not the case. Most of rural Llano County has one option to choose from, outside of satellite internet services, and these offering are not up to modern standards.
- Lower Income Households & Cost of Services and Devices
  - The City of Llano and Kingsland appear to be the focal point for lower income being a factor in broadband subscriptions. There is a clear trend that mutually links smart device ownership, income, and lack of subscribed services in these two locations. It should be noted that here, should a service be introduced (which is currently underway), it may need to include a lower entry pricing point for adoption to occur. The remainder of the County doesn't appear to be affected by income factors.
- Digital Literacy
  - In areas and populations where there is a lack of access to modern networks and applications, knowledge gaps of emerging technologies can stunt adoption and disadvantage these populations. Broadband technologies are evolving and changing at rapid rates, and it's easy to feel left behind and an individual may be overwhelmed and so dissuaded from adopting. If an individual does not have access to broadband services, they are also likely to be unaware of the benefits of such a service. Overall, it can be assumed that a lack of experience ultimately leads to a lack of knowledge about the expansive features of broadband. There are trends seen within the data that suggest digital literacy could be a big factor leading towards a lack of broadband adoption within the rural parts of Llano County.

8.4 Emergency Management and Public Safety Needs

Emergency management, especially as it relates to security functions and healthcare, typically requires secure and dedicated channels which do not share bandwidth within the network. Through this study various emergency management and healthcare facilities have been identified which will benefit from local connectivity while also ensuring the security and integrity of sensitive data that may stay local within the network or go into VPN-based (Virtual Private Network) cloud charting systems, patient databases, etc. Depending on how advanced a hospital and its specialty is, there can be a broad range of content of varying sizes from text charting to high-resolution scans and videos for surgical documentation. Healthcare facilities within this region need to have the network capacity to expand and take advantage of bandwidth-heavy applications to stay competitive and provide the best care for the local populace. Wireless facilities play a large role in connecting mobile device for emergency services such as fire and police. These wireless facilities are more reliable when they have fiber backhaul connections to central facilities where they can manage connections to an array of applicable databases. Having interconnectivity between emergency service facilities would greatly increase the effectiveness of law enforcement and emergency response by consolidating network assets and removing costly leased lines.

9 COMMUNITY IMPACT ASSESSMENT

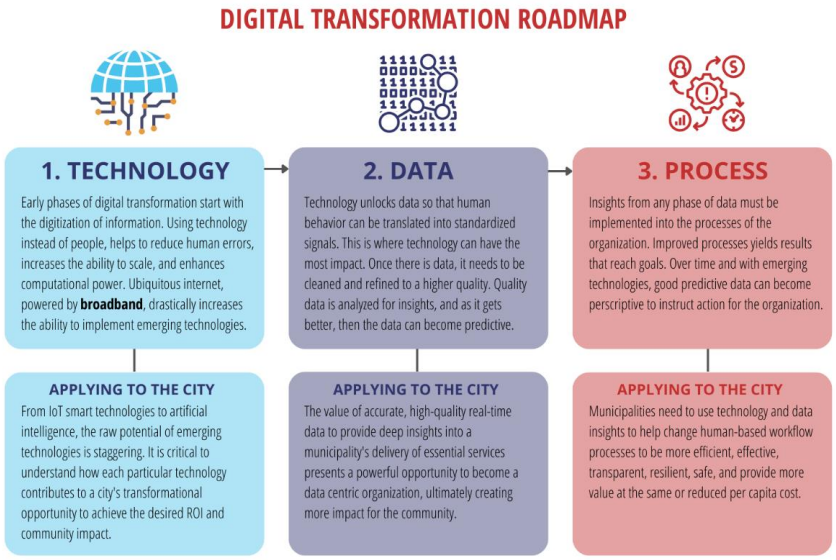
Section Highlights

- WITHOUT HIGH-SPEED, UBIQUITOUS BROADBAND, SMART TECHNOLOGIES CANNOT OPERATE PROPERLY.
- THE ECONOMY, QUALITY OF LIFE, AND MORE ARE ALL POSITIVELY IMPACTED

Understanding Llano County's community benefits from the deployment of fiber requires a review of the roles broadband plays in long-term community success as it relates to both economic development and quality of life for residents. This section will provide an overview and contextualized understanding of the impact of broadband in the following ways:

- The key role of broadband as a tool for digital transformation for local government
- The technical need for broadband to enable implementation of technology now and in the future
- The potential qualitative and quantitative economic and community impacts specific to Llano County based on broadband deployment that enables multi-layered technology stacks

9.1 Digital Transformation



Llano County's leadership recognizes the opportunity to not only install a reliable and resilient communications network with a fiber backbone but also use this foundational technology as a tool for economic development. More than ever, economic development is fueled by the ability to maintain or improve the quality of life for residents. Modern and future technologies available to government improve efficiency, effectiveness, transparency, cost-effectiveness, resiliency, and safety, all of which improve life experiences in homes, places of work, and in the community. The ongoing application of these emerging technologies to improve the government performance is defined as digital transformation. According to Harvard Business Review[18], digital transformation can be categorized into a few key components: technology, data, process, and organizational

[18] https://hbr.org/2021/11/the-essential-components-of-digital-transformation

change capability. For the purposes of this analysis, technology, data, and process are considered the focus.

For the city, digital transformation requires many different things to be successful. First, leadership must have the willingness, interest, and financial resources to match their digital transformation vision and goals. An essential component in the Technology phase of the journey to digital transformation is infrastructure, such as a fiber network, to enable high-speed, ubiquitous internet which serves as the foundation for all technology applications.
The community impact calculations, provides a closer look at the opportunities that digital transformation can play in unlocking the economic potential of a community when the transformation is properly planned, implemented, and maintained. These direct and indirect community impacts could be considered a return-on-investment (ROI).

This analysis is intended to provide a high-level understanding of the potential economic impact that is the result of enhanced technology, more robust data, and more efficient processes that Llano County could experience, ultimately lead to a higher quality of life for residents, businesses, and visitors. These efforts help to save money, increase digital equity and provide a platform for future growth.

Without high-speed, ubiquitous broadband, smart technologies cannot operate properly.

9.2 Broadband and Smart Technology Overview

Technology architecture is classified in layers, with infrastructure such as broadband at the foundation. Understanding the how these layers are accretive and complementary demonstrates the necessity of broadband for innovation and future transformation. These layer-oriented categorizations are based on the component's critical architecture, functional impact and/or complementary characteristics. The three layers are:

- **Foundational** - Essential technology that provides a dependent foundation for other technology applications to function
  - It should be noted that physical infrastructure (roads, streets, utility poles, etc.) can also be a foundational layer, although it may not be "technology"
  - Policy is also considered part of the foundation for operational compliance
- **Enabling** - Technology that provides specific functions
- **Impacting** - Technology that enhances or complements technology, usually at the enabling technology layer

Fiber infrastructure is in the **foundational layer** as a critical building block for other technology.

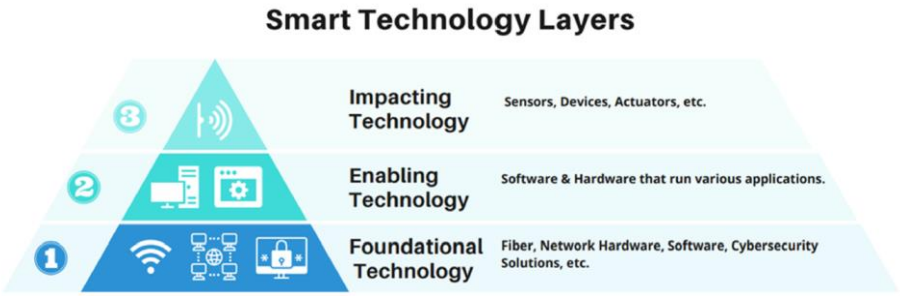


Figure 36: Technology Layers

It is also important to note that each layer enables the layer above it. Without high-speed, ubiquitous broadband, smart technologies cannot operate properly, and the desired outcome will not be achieved with the risk parameters.

With broadband fiber availability, Llano County will have an expanded ability to implement various "smart" technologies on the path to digital transformation. A few examples of how these technologies could improve quality of life and the delivery of municipal services are shown below.

Technology Example	Impact
Agricultural Technologies	Increased opportunity for ranchers to adopt emerging AgTech with better connectivity such as equipment monitoring, livestock biometrics, precision farming, and online marketplaces.
Building Automation	Protect the investment of the Events Center and Rodeo arena and attract new events with facility energy cost savings, improved event experience and connectivity.
Smart Street Light Poles	Proven technology. Provides energy cost savings and creates a platform for other hardware installation. City of Llano's poles already need replacement and as a key asset should consider future-proofing

Figure 37: Impact of Smart Technologies in Llano County

9.3 Phases of Broadband Economic Effects

All four phases of broadband economic effects are calculated in this analysis, covering near-term and future, direct and indirect community impacts.

1. **Enablement** – The construction of the Middle Mile fiber network enables a "broadband-ready" community for an internet service provider to connect to. This provider may be a private sector company, a municipality, or a hybrid model in which a partnership is created. This provides a catalyst to securing internet service providers, cultivates economic development and creates the essential, most cost-effective foundation to enable a community to become fully digital and reach universal levels of service.
2. **Adoption** - The adoption of broadband within the community, leads to a multifactor productivity gain, which in turn contributes to growth of GDP. Businesses increase output and/or lower cost and residential adoption drives an increase in household real income to promote equitable outcomes.
3. **Spillover** – The longer-term benefits include enhanced access to information, entertainment, and public services.
4. **Future Proofing** – Broadband provides a digital infrastructure and backbone that can enable future technology applications to allow business growth, digital e-government services and provide consumers a higher quality of life through the means of future technologies that can make Llano County competitive and a good place to live, work, and play in the future.

9.4 Examples of Broadband Impact on Llano County

As new technology emerges and impacts daily activities and needs, such as telemedicine, telecommuting (post-COVID), e-commerce, and remote learning (post-COVID), the residents of Llano County need to have access to high-speed, stable, state-of-the-art internet. Some examples of how broadband can impact Llano County are:

- With a robust fiber ring and multiple provider options, the community will be able to adopt these future technologies and receive the new benefits faster, with less cost and less disruption due to lack of installed base technology.
- Llano County officials can benefit from higher quality, more robust (real-time) data that will allow them to move from descriptive and diagnostic data to predictive and prescriptive business models that allow proactive management that saves money, reduces errors, and increase resident satisfaction.
- Llano County could incentivize growth and development by having enhanced capacity for residential and business services including necessary factors like the ability to telework and provide e-commerce business engagement.
- Enhancing the Llano ISD's network capacity could reach more students and provide a reliable online education platform to more students.

9.5 Methodology for the Impact Analysis

Using data from a wide variety of trusted sources*, economic impact areas were compiled and where possible, quantified in specific terms. A variety of models have been used in this analysis to measure the impact of broadband on Llano County's economy with different formulas and variables.

Some of these impact calculations provide specific return on investments (ROI)s, while others have ROI ranges. In some cases where quantitative values were not relevant or able to be produced, we have provided quantitative commentary throughout to reflect the positive impact that broadband will have on Llano County and the surrounding region.

Some of the economic benefits will require additional technologies to be installed on the broadband network. These smart technologies are in wide use throughout municipalities and are not considered speculative or emerging. Other economic benefits are derived from the increase in speed or access to the Llano County community**.

**The calculations used data from a variety of sources including: U.S. Census Bureau, Bureau of Labor and Statistics, datausa.io, Llano County Texas Website, Llano Independent School District, Texas Department of Transportation, and U.S. Federal Reserve. Then additional information used from published research done by McKinsey Global Institute (MGI), Pew Research, Brookings Institute, FCC, and Deloitte.*

***Lack of broadband access disproportionately affects low- and moderate-income (LMI) communities. Households in the U.S. making $25,000 or less have a broadband adoption rate of 47 percent, while those making more than $100,000 have an adoption rate of 92 percent. For purposes of this analysis, these two groups are not differentiated.*

9.6 The Economic Impact of Digital Transformation for Llano County

The economic impact (or the return-on-investment) for Llano County's digital transformation (installation of fiber to enable high-speed broadband to be activated, followed by the implementation of additional hardware and software to provide additional, new values to the community) is a multifaceted calculation. It involves easily quantified financial impact ROIs, along with the social impact areas, such as reducing the digital divide, enhancing social equity, improving social justice, etc. Below are primarily financial impacts, but to best understand the full impact, a holistic understanding should be used as each area that is improved affects another area of the community. Llano County's "product" is the total composite of the "live, work, and play" quality of life that people seek when they choose a community.

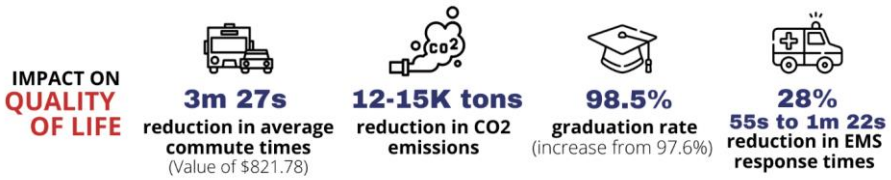
The following represents a list of potential, economic benefits. This list is not all-inclusive but does reflect specific calculations based on data for Llano County, Texas.

Economy

Broadband-enabled communities experience higher economic growth rates and can achieve a higher quality of life.

- According to the US Bureau of Economic Analysis and the Federal Reserve, Llano County, Texas had a reported 2020 Gross Domestic Product of $83,331,000.
  - Broadband in Llano County could increase GDP by 0.9% to 1.5%. The estimated **GDP increase ranges from $749,979 to $1.249 million per year** (based on multiple calculation methods). The 10-year impact ranges (not adjusted for inflation) are $7,499,790.00 to $12,499,650.00.
- Reduce the cost of living by up to 1%. Llano County has a cost-of living factor of 82.6. Based on the type of community, we project this could be reduced to a factor of 81.8 which makes Llano County extremely attractive from a cost-of living perspective compared to Texas's cost of living average of 93.9.
  - Note – Housing in Llano is exceptionally inexpensive and makes the overall weighted average skew lower than norm. Groceries in Llano are more on scale with the rest of Texas, with its factor of 92.4 being compared to Texas average of 93.7.
- Increase property value by 1.3% to 3.1%. Llano's median value for owner-occupied property is $235,700. This can create an additional $3,064.10 to $7,306.70 of new household wealth per homeowner based on an increase in home value using the median property tax growth rate.
  - Based on the Property Tax Rate as of FY2022 of $0.52100 per $100 assessed valuation, the average property tax collected per household is $1,227.99. The potential increase property tax revenues for Llano County is between $278,698 and $664,589.
- Increase employment by 1.2% to 13% (relative to employment rates). This could create **an additional 46 to 498 new jobs**.
  - Enhanced high speed broadband would open up new remote work possibilities for its residents. 6.45% of Llano County residents currently work from home.
  - Llano County's three trades with the highest numbers of residents working in them, all benefit greatly from enhanced internet access that is provided by fiber: Farming, Fishing, & Forestry Occupations (4.54 times higher than expected), Law Enforcement Workers Including Supervisors (3.17 times), and Construction & Extraction Occupations (2.88 times).
  - The highest paid jobs held by residents of Llano County, TX, by median earnings, are Computer, Engineering, & Science Occupations ($75,833), Management, Business, & Financial Occupations ($50,250), and Management Occupations ($46,719). These jobs use the internet extensively and the ability to have high speed broadband enhances these good paying jobs and supports these workers to perform at their highest levels of competency.
- Increase the quality of jobs (higher wages for existing jobs). We project **average wage growth of approximately $2,386** based on per capita income. Increased wages per person is based on higher employer productivity gains, which is related to enhanced broadband access.

- Llano County median household income (in 2020 dollars) is $58,941. The average broadband enabled community experiences **an increase in household income.**
  - More than 50% of households report that the use of broadband has enabled them to increase their household income in one way or another. The two most obvious ways that the internet and broadband connections can be used to generate household income are teleworking (remote work) and home-based businesses. These create income directly from employment and from business activities respectively.
    - 12.8% earn an additional $1,000 - $5,000 annually
    - 9.1% earn an additional 5,000 - $10,000 annually
    - 18.2% earn an additional $10,000 or more
  - Excluding these households, more than 41% of the remainder still generate additional household income online at some level.



Quality of Life

- Llano County, Texas has average commute time of 29 minutes. **Commute times could drop by approximately 3 minutes 27 seconds** due to intelligent traffic systems, wayfinding and other technologies that require connectivity. It is projected that a new commute time of approximately 25 minutes 33 seconds could be achieved. This represents a reduction of 1,740 minutes per year.
  - The **value of this time savings is $821.78 for every commuter**.
- Communities with high-speed broadband have **lower rates of poverty** than those without it. Llano County has a 10.9% rate of poverty.
  - Families that enroll in government program that provide internet access at no cost, were 8% more likely to be employed and experienced a $147 increase in annual income.
  - The Affordable Connectivity Program (ACP) will provide plans of at least 100 Megabits per second of speed for no more than $30. An estimated 48 million Americans will qualify. In order to qualify for the ACP, a Llano County family of four must have a household income of $53,000 or below. Llano County has a significant population that will qualify for subsidized high-speed broadband access.

Health

- Llano County has a much higher than average senior (over 65 years old) population at 37.3% (versus Texas average is 12.9%). According to BLS, households led by someone who is 65 or older spend an average of $6,668 a year on health care.
  - Broadband communities enable increased **use of telemedicine, which saves on average $361 per patient**. Telemedicine was found to be more cost effective ($335 per patient/year) compared to routine care ($585 per patient/year) and on-site care ($1,166 per patient/year).
- Broadband communities also experience **a 45% to 65% reduction in time spent accessing healthcare**. This is especially important for Llano County due to its high number of seniors who may be less mobile and need telemedicine support.

- Llano County has a higher than national average rate of 23.30% for persons without health insurance, under age 65 years**. Increased telemedicine access can help manage and lower the cost** burden to the community.

Sustainability

- Llano County has an average of 2 cars per household. Based on an assumption of 18,062 cars that produces 121,918 tons of greenhouse gases (CO_2) per year, Llano County could **reduce its total CO_2 emissions by approximately 12,191 to 15,849 tons per year.**
    - The City of Llano treats surface water from the Llano River. Chemically speaking, carbon dioxide makes the water more acidic, decreasing its pH level. Llano River pH has steadily decreased, with few alterations, from an average of 8.6 to an average of 7.7 over the years.

Education

- Llano ISD has a 2021 reported high school graduation rate of 97.6%. Broadband access could **increase graduation rates to 98.5% (or more)** through additional remote learning options enabled by high-speed internet, ubiquitous connectivity and improving the current rate of households with a broadband Internet subscription (83.6%).
    - Public Schools in Llano Independent School District have an average math proficiency score of 45% (versus the Texas public school average of 51%) and reading proficiency score of 48% (versus the 47% statewide average). Increased high-speed internet access could increase these scores significantly.

Public Safety

- Due to advanced traffic technologies that require high-speed broadband and ubiquitous connectivity, broadband communities experience up to a 28% reduction in EMS response times, depending on the type of geography, technology state, street miles and number of traffic signals.
    - Hamilton County Hospital District approved an Interlocal Agreement to provide emergency medical services (EMS) to Llano County, Texas. The service area for Hamilton EMS is nearly 4,000 square miles, serving 41K people and 40,000 calls annually.
    - As of April 2022, the current emergency response times for Llano County was 11 minutes 18 second (within the County). Inside of Llano proper it was 8 minutes, 7 seconds.
        - The City of Llano currently has 46 miles of streets open. Inside of the city, we would expect **EMS times to drop to 6 minutes 54 seconds to 7 minutes 12 seconds**.
        - In the County we would expect **EMS response times to drop to between 9 minutes, 56 seconds to 10 minutes 23 seconds.**
- Broadband communities experience fewer crimes due to the related technologies that can be enabled. Llano County could experience up to 30% fewer crimes annually, especially in violent crime and property crimes categories.
    - Llano reported 44 property crimes in 2020. The biggest impact would likely be on property crime reduction by as much as 14 fewer crimes per year. Vehicle theft and burglary would also be positively impacted but are not statistically large enough to compute impact range.

Government

- Given the distance that a Llano County resident may have to drive, digital government services would be beneficial, and some may require broadband access by all parties for optimal experience.
    - 51% of Americans prefer to access public services through digital technologies or mobile apps, according to a national survey undertaken by researchers at the Brookings Institute. Only 13 percent say they prefer accessing services through phone calls, 9 percent favor personally going to government offices, and 27 percent don't know.
- An assessment of Llano County current services noted the following digitization of county services:
    - Renew Vehicle Registration - Online
    - E-Library Services - Online
    - Pay Property Tax (Online through 3rd party site)
    - Marriage License – must call to schedule an appointment
    - Property Records Search (Online through edocTechnologies)
    - Business licenses – not online (through the mail or in person service)
    - Birth / Death certificate – paper form
- Llano County would benefit from a migration (digital transformation) to more digital resident services. The benefits are:
    - 24/7 access means a better online user experiences for citizens
    - Increased public participation for public issues
    - 50% less time spent interacting with public
        - Improved internal efficiency and productivity resulted in as much as 60% reduction in handling
    - Less burden on IT (when delivered with cloud-based technologies).
    - Better collaboration among departments
    - 50% lower overall costs

10 HIGH LEVEL DESIGN

10.1 Map Development Approach

Section Highlights

- BURIED FIBER IS THE PREFERED ROUTING METHOD BUT IS NOT A FEASIBLE OPTION IN PARTS OF LLANO COUNTY.
- FIXED WIRELESS SOLUTIONS WILL BE A NECESSARY METHOD TO ENSURING BROADBAND CONNECTIVITY TO RESIDENTS AND BUSINESSES.

The High Level Design (HLD) serves as a visual representation of the necessary broadband infrastructure footprint required to address the needs and gaps as explored in prior sections. The development of this HLD requires first understanding factors which dictate network design criteria and bringing these in as visual overlays onto the map of Llano County.

To define the space, boundaries for the County and Cities are brought in, followed by other jurisdictional boundaries and limits such as TxDOT control section maps, railroads, water authorities, state or federal lands, and any other reference that may dictate initiative and subsequent project limits. Next, maps from our Needs and Gap Analysis are overlayed to highlight identified demand points and determined areas of needs. Through stakeholder engagement with public entities, facilities were identified as lacking the necessary broadband services to effectively serve their communities and these locations were added to the map. Market research layers, such as the maps which show the Unserved (25/3Mbps) and Underserved (100/20Mbps) were overlayed and contrasted with public and stakeholder feedback to develop a proposed coverage area for the initiative.

Finally, existing assets, such as private sector network fiber and towers, as well as any public network infrastructure, were overlayed as a reference prior to adding any proposed facilities as part of the HLD. There are many other factors which were researched, and reference layers developed and reviewed that provided additional perspective as to the existing network landscape and geographical barriers, such as soil mapping and elevation maps, which helped inform construction methodology and tower placement. Having completed this background research, data accumulation, and overlay development sets the stage for a considerate and deliberate High Level Design where all relevant factors are present and informing in design decisions.

10.2 Existing and Proposed Design Elements

The High Level Design, as represented in Figure 38, consists of many elements which are detailed below in a bulleted summary to breakdown the infrastructure components that together make up a Middle Mile network throughout the County.

Orientation: The map extents include all of Llano County, which is represented by the black line border, with a slight buffer to visualize adjacent counties. North is up and the map scale is set for 10 miles. The legend on the right hand side of the map includes the following elements:

Design Paths: These lines represent linear routing of proposed conduit and fiber paths within the network Middle Mile, their function and status.

- Proposed Ring - The reason that the blue lines are differentiated is due to the redundancy that these designed routes would create. The redundancy in this network plan ensures constant connection to the network during times of emergency or times when accidents occur to the physical infrastructure. These proposed ring lines would be best suited with a larger fiber size.
- Proposed Spoke – The green colored proposed spokes are an expansion of the backbone infrastructure that is the same as the ring, but currently without built-in redundancy. These routes help reach more isolated locations and allow for regional connectivity. The proposed spoke lines would be best suited with a larger fiber size.
- Proposed Lateral - The lateral routes help expand the network to various locations from the Middle Mile backbone that would be used to connect Last Mile infrastructure and are shown as pink lines. These Last Mile routing locations on this high-level design are primarily focused on connecting to various towers.
- Existing – This layer of red colored lines is indicating infrastructure that is currently in place that can be leveraged through partnership options. This can be used within the proposed plan from the County as efforts would not need to

be duplicated with additional infrastructure.

- Planned – This route is an additional fiber based Middle Mile line that is currently proposed by a potential partner that could be leveraged for the County's proposed plan and are represented as orange lines. It is expected to be implemented by the time the County moves forward with their plan.

Towers: These are macro tower locations (lattice, monopole, or guyed) which are part of the Fixed Wireless and Last Mile component of this design. These structures were identified through FCC Registration and other market research efforts.

- Existing – The towers that are currently in place, as represented by red stars, were collected from the FCC database. Each tower has differentiating properties that can impact a fixed wireless solution and have specific considerations that may impact availability.
- Proposed - Where existing towers could not encompass a maximum number of residents, additional tower infrastructure was proposed to help close the gaps. These proposed tower locations, shown as yellow stars, are strategically placed in locations that can approximately fill the remaining population gaps with additional five-mile ranges of coverage. Many considerations are needed to proposed tower locations, and those considerations can be reviewed with the Section for **Error! Reference source not found.**.
- Planned – The locations of these towers, depicted with orange stars, were collected by potential partners that shared information through stakeholder engagement. Similar to the Planned Fiber Routes, these towers are not currently erected, but there are plans underway to implement the structures. By the time the County's plan is expected to be implemented, these Planned towers may be in place.

Maximum Tower Range: These elements represent an assumed effective wireless signal range from the identified Towers. A five-mile radius was determined as an acceptable assumption, confirmed by local providers and research conducted for modern Fixed Wireless solutions. Residents, businesses, and public entities within the represented circles, have the potential to receive internet services from the respective tower as a part of this proposed solution. Further engineering and propagation analysis will confirm actual coverage.

- Existing – Represented through purple circles, the range shown is a five mile radius with the center being the existing or planned tower locations. This value was determined as an average conservative value since technologies can expand as far as eight to 10 miles from the tower, but as near as three miles or less.
- Proposed –Shown as pink circles, these are also five mile estimated ranges but from the proposed tower locations.

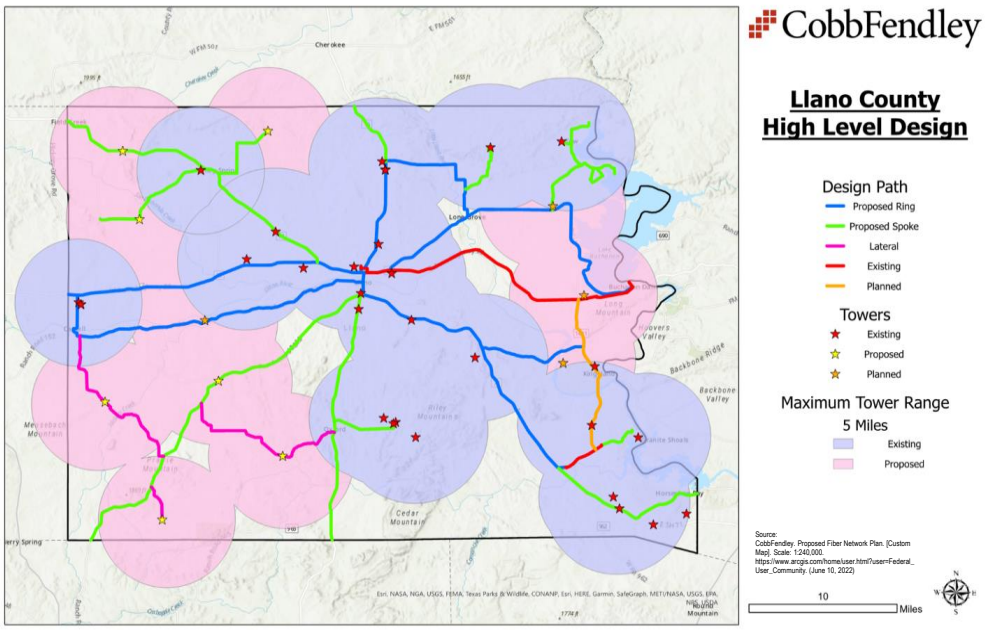


Figure 38: Proposed Fiber Network Plan

10.3 Methodology for Design

With the development of the map reference overlays, and the proposed network design elements to be included in the Middle Mile High Level Design, the design could commence. The first consideration is the desired overarching network architecture, or the type of networks, to be utilized. Ultimately, the decision was made to pursue a converged network with both fixed fiber and wireless broadband to facilitate the Middle Mile and Last Mile, respectively.

In this High Level Design, the focus is primarily on the Middle Mile infrastructure need, while suggesting the Last Mile providers consider fixed wireless solutions from existing or proposed tower locations. While a purely fiber solution is ideal and provides the highest quality of service, it is not cost effective, even with subsidies, in Llano County at this time. This converged network does extend fiber all the way to the tower site to allow for a more reliable backhaul, and with this extension of Middle Mile fiber, the potential for fiber extension and densification is much more feasible in the future. Fixed Wireless offers a solution that can meet and exceed federal guidelines, offer a faster deployment, and serve more residents in a more cost-effective way, in so, reducing the broadband service fees to encourage adoption as well. These two architectures can complement each other in that fiber provides the more reliable and low latency backhaul to towers, towers can be added onto the proposed fiber Middle Mile for added coverage and redundancy, and fiber extensions along the Middle Mile are much more feasible. Essentially, this gives the network the opportunity to grow in multiple ways.

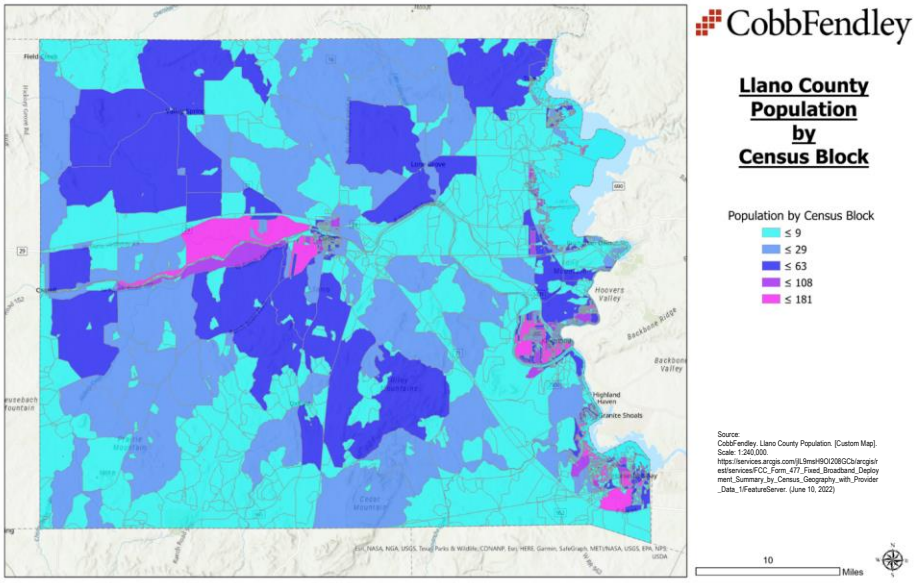
Understanding the proposed coverage, theoretical range of Fixed Wireless technologies, and logical distribution routes within the County, the proposed fiber routing focused on connecting existing towers along TxDOT roadways. TxDOT ROWs already

contain most long-haul utilities and have utility pole infrastructure, green space for buried construction, and utility accommodation process in place to allow for simplified design, permitting, and construction measures.

10.3.1 Routing the Network to Include Rural Llano County

Another consideration in routing methodology pertains to making the case for rural connectivity. As most the of County is considered extremely rural with relatively even dispersion, see Figure 39, the middle mile footprint needs to distribute out in all directions and to each corner of the County, so that each fiber cable, or spoke, can be centrally located to an effective serving area. In new fiber builds with no existing infrastructure, known in the industry as "greenfield", this approach is used to start with a centralized location in the middle of the marker, then start dividing that marking into quadrants, representing the sub service areas which need to be served. By extending fiber from the centralize location across the middle of these quadrants, any demand points on either side of the fiber can be tied into the network without extensive laterals going from one end to the other. The network topology, or how the infrastructure is physically laid out, takes on a "Hub and Spoke" or "Star" topology in this way. Applying the greenfield approach to routing with a geographically appreciate centralized Hub, we applied this topology to the existing TxDOT roadways in building out evenly dispersed infrastructure across the most rural areas of the county. These routes were further adjusted, and laterals added, to allow for connections to existing and proposed tower locations as they bisected the various serving areas. Furthermore, ring topologies were introduced which, when paired with a "Hub and Spoke", allows for redundant connections to demand points by connecting back to adjacent spokes. Many business and commercial properties require this kind of connection as it eliminates or at least reduces any downtime for network maintenance or damages.

Figure 39: Llano County Population



It should be noted that routing for a High-Level Design does not include detailed alignments at the street level, with considerations for right of way, easements, existing utilities, permitting design requirements, or final construction methodology. Routing at the High Level does allow for providing an overall order or magnitude and is the foundation for a successful Low

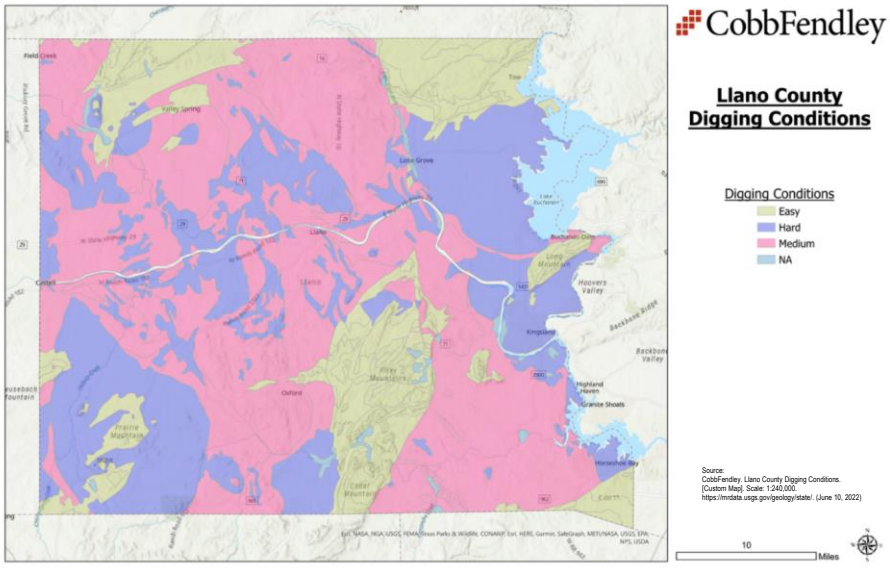
Level Design and engineering. To round out the High-Level Design and analysis, further consideration for aerial or buried construction, material, and capacity in the following subsections.

10.3.2 Aerial Attachment Considerations

The necessity of accessing existing pole infrastructure needs to be included in the High Level Design, due to the known soil conditions in Llano County, which prohibits the feasibility of a purely underground solution given the potential impact to construction costs and timelines. In the areas with harder soil conditions, as detailed in the Section covering the NEEDS AND GAP ANALYSIS and seen again within Figure 40 below, boring and trenching can be incredibly expensive and may delay project timelines. Where the hard soil conditions overlap with existing utility pole infrastructure, pole attachment for an aerial route is recommended across the County. Those locations in Figure 40, where the digging conditions are noted as "Hard", shaded purple, and "Medium", shaded pink, the County and any potential partner is likely to consider above ground construction. The rocky and mountainous areas will create challenges, but that does not necessarily prohibit residents from receiving adequate internet service. The high-level design suggests fixed wireless as a primary solution to combat this potential issue, along with utility pole attachments. Buried fiber is generally more protected, as it is less exposed to weather events or damages from traffic accidents or vandalism, Aerial attachments of fiber-optic cable includes the following conditional benefits:

- The cost to attach to poles is generally cheaper than burying underground, especially within hard rock conditions, although some pole owners may have increased pricing due to terrain demands.
- The time to completion for this method of fiber routing is typically faster compared to underground trenching or boring, even though pole analysis for each pole needs to be conducted prior to attachment.
- Construction of aerial attachments are less likely to damage existing utilities within the ROW given the visibility of existing attachers and power conductors. SUE or utility locates are required to avoid conflict with existing buried facilities which are not visible to the contractor.
- When repairs are needed to fiber attached to a pole, the procedures and timing are more efficient which greatly reduces downtime.

Figure 40: Llano County Digging Conditions



10.3.3 Material and Capacity Considerations

As previously discussed throughout this study, existing broadband infrastructure is severely limited in Llano County. As such, it is even more important to leverage these existing assets as to reduce to overall build costs and minimize overbuild. Fiber, conduit, handholes, facilities with space for collocated equipment, poles and tower structures should be considered when exploring partnerships.. Compatibility with the proposed infrastructure is very important as existing assets may not have the required capacity from a physical space perspective in conduit and ducts or available dark fiber in existing cables. When sizing for capacity, both physical and network aspects are considered.

The proposed conduit system would consist of 2-2" HDPE pipes, allowing space for overpulling addition fibers, maintenance, and potentially leasing. Fiber cables would be upsized to allow for growth and in the middle mile and any distribution directly off of the cable to demand points along the route. The ring and spoke components consider a 144 strand fiber cable, this size of fiber promotes growth, redundancy, and a potential source of revenue via dark fiber leasing. Both the spoke and ring routed design help carry the bulk of the network across the County, and the laterals help expand the network to various locations that could be considered Last Mile, which includes any stakeholder provided demand points or tower locations. Sizes of the fiber laterals off these components can dropped down based on capacity needs of the particular demand points or last mile wireless serving areas. For the transition from outside plant to inside plant, whether at tower locations, demand points, or anywhere else, 48 strands ensure proper connectivity in case of emergency and additionally will promote growth for nearby future projects.

For the capacity of the network, the most important factor to consider is scalability. The capacity of a County sized network will not experience the same demand today that it does ten to 20 years from now. As the surge capacities for each identified demand point and future demand points is unknown, a lower capacity that is manageable and can increase as the network traffic is monitored and analyzed. This is the most economical and responsible method to scale the network capacity. While this does not necessarily impact the routing, it is important to consider in terms of the inside plant facilities are the relative space needed for equipment and associated costs. Network technologies have allowed for existing infrastructure to yield more capacity than when originally placed by smarter network routing and multiplexing.

The High Level Design as presented in this section represents the collective understanding of the existing conditions, needs and gap analysis, stakeholder/partner capabilities and assets, broadband network design criteria, and with consideration for scalability, future-proofing, economic growth and regional connectivity.

11 BROADBAND NETWORK IMPLEMENTATION CONSIDERATIONS

Network implementation is one of the most complex and challenging portions of establishing a broadband network. Feasibility studies are a crucial component as this effort establishes the needs, proposes applications, and presents options, all of which ultimately determines the various network architectures involved. Preliminary engineering was conducted as a necessary part of this study to determine capacity requirements and network footprint. The capacity assessment is necessary for the determination and incorporation of network equipment into the cost estimate and overall order of magnitude. Network equipment and network footprint are interdependent considerations in the High Level Design (HLD), which is necessary for the quantification of distribution assets and translation into relative costs for construction, maintenance, and operations. Other considerations include efforts to ensure modularity and future proofing of the network, and external environmental constraints in constructability and sustainability.

Section Highlights

- STANDARDS FOR CONSTRUCTION AND NETWORK ACCESS NEED TO BE ESTABLISHED FOR CORRECT IMPLEMENTATION
- PROCUREMENT OF MATERIAL AND LABOR MAY BE ONE OF THE BIGGEST BARRIERS AND COST DRIVERS

11.1 Outside Plant Implementation

Outside plant (OSP) is the physical manifestation of a fiber-optic network within the public Right of Way as it is the most visible and easily conceptual component of the network. OSP includes the civil engineering and construction to design and install underground conduit, fiber optic cables, handholes, and splicing cases among various other components. The outside plant is designed, constructed, and implemented in accordance with both jurisdictional and owner standards. In this case, there are a multitude of jurisdictional standards to be met regarding applicable clearances from existing utilities, placement in the ROW in accordance with required typical cross section alignments, and other specified design and construction standards. Owner standards for this network will ultimately depend on the business model selected, whether the operator has established OSP standards and specifications or if these will need to be developed through a collaborative effort in future preliminary engineering phases. Determining OSP standards is critical in ensuring the quality and consistency of near-term and future design and construction of the network. These standards would be summarized and implemented into participating entity design manuals and ordinances to streamline broadband development in conjuncture with community growth and expansion. Future proofing of the network in OSP is accomplished by overbuilding physical infrastructure as to allow for future growth of the region network in conduit space, distribution fiber availability and slack storage capacity.

11.1.1 Fixed Wireless Network

With the increased available spectrums and technologies such as Citizens Broadband Radio Service (CBRS) and private Long-Term Evolution (LTE), broadband networks commonly converge traditional wireline fiber networks with fixed wireless networks. Fixed wireless is an ideal broadband solution for areas that may struggle to place fiber underground or in areas that may need more cost-effective measures. Geography typically dictates the necessity and effectiveness of fixed wireless implementation. Terrain with considerable elevation fluctuation makes for extremely difficult underground construction of fiber networks and even placement or attachment to aerial pole lines can be a challenge. Coupled with difficult digging conditions in hard soils and dense vegetation, the case for fixed wireless becomes more appealing to many operators and providers. Fixed wireless broadband uses antennas, which are mounted on towers, building roofs, poles, etc., that use specific frequency bands to reach an antenna located at a user's house or place of business to provide internet access to the user. It is important to note that fixed wireless is different from mobile broadband, which is catered towards data services for mobile devices, whereas fixed wireless focuses on internet services for stationary locations and devices such as residences and computers.

When considering fixed wireless as a solution there are two scenarios to take into consideration: New Tower Build or Co-location build. Both scenarios come with specific processes and requirements.

For a Co-Located tower application, we must consider multiple factors such as the height and type of the existing tower. Surveys would be conducted to determine if there is space to accommodate a new sector of antennas on the tower and new base station equipment on the ground. Accessibility to sufficient power sources and the relative proximity to the location of the new equipment needs to be considered. A structural analysis will be required to prove that the existing structure can handle the weight of the new sector being added. Lease negotiations with the current tower owner will have to be in place before any new construction can be done. Once the existing site survey and evaluation is conducted, detailed planning and design of the build can occur. Design considerations include the number of antennas needed and type of antenna mounts that will be used, which is normally based off the type of existing structure, whether it is a monopole or self-support tower. Installation of the base station equipment on can be located on a new or existing platform, or in a new tower shelter. All new equipment installed will need to have the proper power and grounding to run. Material and construction prices will be based off the equipment specifications and labor requirements for installation.

There are quite a few more considerations for New Tower Builds. First, the location will need to be confirmed and lease negotiations will need to take place. The location must be secured with the property owner before proceeding with the next steps. An environmental study will need to be done to make sure the tower is not being placed in protected wetlands, tribal area, or migratory bird pattern. There are also federal regulations to consider as the tower must also be FCC compliant. This consists full NEPA, SHPO, Tribal, 1A/2C documents and any other FCC requirements for a new tower, such as proper lighting. Once the prerequisite actions have been completed, tower and equipment specifications and design can commence. There are options for monopole, self-supporting, or guyed towers, depending on the available space and topography. The height of the tower, number of antennas to be installed, and type of ground equipment will need to be determined. New power to the location will need to be confirmed and secured with the local utility company. Much like Co-Located Towers, the cost of materials and construction will vary depending on what is being installed. Simply put, the taller the tower and the more equipment installed, then the higher the price will be. The structural analysis will be provided by the tower manufacturer and will have details of all the equipment and heights that it will be installed. Both scenarios have their pros and cons and will be dependent on what is needed in the coverage area. Co-locations will be cheaper and easier to build. Where New Tower Builds have the potential for ROI because tower and ground space can be leased out to other carriers or customers in the area.

Depending on the desired level of service and coverage area, the design will need to evaluate spectrum and license availability, required power, fiber backhaul capacity, tower height and equipment requirements to develop an applicable solution. Economies of scale come in to play when considering tower placement and propagation. Higher frequency spectrums don't travel as far and so require denser tower placement and have more extensive power requirement. Newer technologies have emerged which utilize spectrum and equipment which can range many miles, making the case for rural fixed wireless much more feasible.

11.2 Inside Plant Implementation

Inside plant (ISP) refers to the network build which connects to core network facilities such as data centers, distribution points of presence (POPs), customer premises, and other network assets outside of the public ROW. Like OSP, this component includes the civil engineering and construction to design and install drops, or connections, from a meet-me location in the public ROW and routed inside building to the designated demarcation where the fiber is taken into facility telecommunication rooms. In this case, jurisdictional requirements are replaced by property management requirements in the penetration of exterior walls and routing through ceiling racks across the building. Owner requirements and specifications will need to be established for uniformity in the same manner they are needed for OSP. Future proofing of the network in the ISP space still involves designing for additional conduit space and providing for growth of the facility or customer premise network needs. ISP can also refer to the network equipment space which will be reviewed after considering the capacity requirements and method of implementation.

11.3 Capacity Requirements and Implementation

Capacity requirements of a network are dependent on the scale and complexity of the needs and applications that need to be addressed and supported. Network architectures represent the various solutions needed to accomplish this and provide adequate capacity within their specific function and to the identified customers. When reviewing network capacity, it is important to understand that there is traffic that stays within the network to communicate within and between the connected facilities, and

there is also traffic that needs to leave the network and connect to larger access network such as the internet. Traffic that leaves the network requires transport circuits, the capacity of which is dependent upon the scale and consistency of the traffic. When determining the transport capacity, it is important to consider that this is easily scalable and does not need to immediately be sized to the future anticipated growth of the network. From a cost-savings perspective, transport capacity should be estimated to meet the immediate needs, monitored, and increased as the network grows. This concept not only applies to the transport, but also to all network links or connections. Through the course of this Feasibility Study, the determined estimated capacity requirements for demand points based on their function or as recommended by the stakeholders can be seen below in Table 9.

Table 9: Proposed Capacity Based Upon Location Type

Location Type	Proposed Capacity per Location (GB)
AIRPORT	1-3
LOCAL GOV. FACILITIES	1
FIRE	1
MEDICAL	1-3
OTHER	1
POLICE/SHERIFF	1-3
SCHOOL	5-10

Another key concept when considering capacity is bandwidth management, which consists of understanding that advanced fiber networks can control traffic in ways that individual links are making efficient use of bandwidth through techniques such as multiplexing. What this translates to is that individual capacity estimates for customers represent the absolute maximum capacity needs which will rarely, if ever, be required at a given time. These links share bandwidth where applicable and so determination of the network capacity is not simply a summation of all estimated max capacities. Instead, it is based on an estimation of the surge capacities. For example, if there are ten 10GB links in a network and the average surge capacity for these links is only around 200Mb at a given time. The network size does not need to support 100GB as 2GB would handle the network surge. As the surge capacities for each identified demand point and future demand points is unknown, it is logical to begin with a lower capacity that is manageable and increase as the network traffic is monitored and analyzed. This is the most economical and responsible method to scale the network capacity. It is also the reason that future proofing and modularity of network components are critical as they need to have the ability to scale with the network from both a distribution and capacity standpoint. With the understanding of the concepts above and capacity estimates for all demand points, it was determined that a good starting point for the network would be two 40GB transport circuits for redundant connections to the access network. The backhaul links should be 100GB between network data centers and distribution POPs. Individual demand points in the Middle Mile will have anywhere from 100Mb-10GB links depending on their classification and anticipated needs.

11.4 Future-Proofing and Modularity

The important consideration here is the fiber distribution network in the OSP is not modular in the same way as the ISP and network equipment. Components can be added or swapped out to support greater link capacities, and larger transport services can be secured very easily and quickly, whereas building additional conduit and pulling new fiber in the OSP is costly and time consuming. So, while one may start small and build in the ISP, it is not economical to take the same approach in the OSP. Network architectures such as Gigabit Passive Optical Networks (GPON) share capacity among multiple customers and are typically seen in fiber to the home network builds. The latest variant of this architecture is XGS-PON (or 10 Gigabit Symmetrical PON) which takes the same concept but is not limited to 1GB connections and can support variable optics up to 10GB which can be used to service 32 or more large customers requiring up to 10GB services on the same active link. Fixed wireless Last Mile solutions also provide an opportunity to share capacity between multiple customers, with the advantage of reducing the wireline fiber build into the customer premise while also providing high quality wireless connections required in an advanced broadband network. While GPON and XGS-PON are more efficient from a distribution fiber standpoint, fixed wireless solutions provide necessary flexibility in Last Mile connections. These proposed network infrastructures must be able to support these

architectures and so building a robust core network in the OSP and with scalable capacity equipment is crucial.

11.5 Data Center and POP Considerations

To effectively implement a network, the equipment and facility component of the ISP must be a concurrent effort with OSP network infrastructure. The physical plant must correlate with and complement the network equipment that will ultimately facilitate and manage the network connection. Data centers and distribution Points of Presence (POPs) are where the distribution and core networks converge and connect to transport networks through centralized network equipment such as core/edge routers, optical line terminals or distribution switches, OSP patch panels, and supporting power management and security systems. Data centers are the primary facilities that transport connections house the core/edge routers which manage the network. These locations can be centralized or be diversified on opposite ends of the network to provide physical separation for ISP connections. Robust power supply, storage and management are required at these locations to condition or rectify power and allow the network to operate reliably. Placement of these facilities is dependent on network topology and suitability criteria such as flood adverse locations, security, access to sustainable power sources, and necessary space to accommodate equipment and network staff. POPs differ from Data Centers in that they contain mainly distribution equipment and do not typically receive the ISP transport connection and core/edge routing equipment. Distribution POPs are placed centrally, along the backhaul, in customer heavy areas where the distribution OSP can be condensed and so reduced in terms of physical plant to individual customers. The network topology utilized in most distribution POPs is the Star or Hub & Spoke because it caters to a centralized point of distribution. POPs can be as small as a handhole in the public Right of Way where the network can tie into other networks and leased lines or as large as a Data Center depending on the required function. Very dense locations may have thousands of customers and require significant power and rack space to accommodate the distribution. In this case, POP locations would service as access and distribution points for the expansion of these spokes. Depending on the capacity needs of the area the POP will distribute into, the required space will likely be no larger than a large storage closet or small room to house distribution switches, patch panels, power supply, and cooling systems. Data Center and POP facilities, like the equipment they contain, need to be scalable and should consider the feasibility of future expansion in considering suitable locations.

11.6 External Environmental Factors

The final factors that go into network implementation are environmental externalities, constructability, and sustainability. These factors are usually an afterthought in network engineering, but they are essential as they challenge the network build with real concerns and constraints, whereas design can be completed in a vacuum. External environmental factors include regulatory and jurisdictional constraints, industry trends and competition, and the socio-political conditions. These factors have the potential to disrupt the network build and so should be anticipated and contingencies should be formulated to control risk. Regulatory and jurisdictional entities introduce constraints such as the engineering design and construction requirements of the OSP, as previously mentioned, and these constraints may further impact the build in the form of a permitting process. While this is a necessary process, the timeline and fees involved should be considered as they impact the budget and schedule of the build. Design engineering firms will need to have the knowledge and experience of working with these entities to ensure that the permitting schedule does not delay and fragment the construction efforts.

11.7 Local Public Policy

Broadband technologies are ever evolving and so the municipalities and jurisdictions should have a clear understanding of the proposed infrastructure components and impact to the ROW. Ordinances, design manuals, and permitting requirements should be updated and clarified to protect the ROW, but to also streamline processes for partners of this initiative, as well as other broadband expansion projects. In many instances, broadband facilities have been subject to the same requirements as public utilities in lieu of having specific requirements which are more applicable and reasonable. A couple of examples would be requiring the same horizontal and vertical clearances of 2" HDPE conduit as for large diameter water lines or requiring small cell poles or attachments to go through the same processes as monopole or lattice macro towers. Another strongly recommended policy would be to update residential subdivision ordinances so that developers consider broadband facilities for fiber to the home (FTTH), or potential small cell fixed wireless solutions. For existing subdivisions, section typicals should have space for broadband facilities as to reduce service utility strikes and damages during installation. Having a clear-cut process is an

enticement for broadband providers as this reduces costly delays and frustration for all parties. Municipal Engineering and Public Works should have a defined role and involvement in all proposed municipal broadband projects, for both visibility and strengthen relationships with local providers. Llano County does not currently have any design requirements or ordinances regarding broadband infrastructure deployment.

For any examples of a detailed set of standards, it is recommended to implement what TxDOT uses for their fiber and broadband processes. TxDOT has decades of experience, and their standards evolve to reflect the necessary changes that come with new technologies. For this initiative specifically, much of the fiber is expected to be placed within TxDOT ROW, and similar, if not exact, requirements would help expedite the permitting and procedural aspect later down the timeline. In the links below, you may explore the requirements set by TxDOT in the TxDOT Manual and the Utility Accommodation Rules (UAR).

TxDOT UAR:
http://onlinemanuals.txdot.gov/txdotmanuals/utl/compliance_with_the_uar.htm

TxDOT Manual:
http://onlinemanuals.txdot.gov/txdotmanuals/utl/introduction.htm

11.8 Design and Construction Implementation

The network and civil engineering designs must complement each other to meet the needs of the network operation and the construction of network infrastructure. Civil engineering design takes constructability into consideration as to develop both an economical design, on behalf of the client, and a feasible design, to ensure the contractor is setup for success. Constructability considerations include understanding soil conditions and the method of construction that is most conducive, whether that is aerial construction, directional drilling, plowing, or trenching. Critical crossings, such as drainage canals, floodways, freeway underpasses, and railroads, must be evaluated from both a permitting and constructability perspective as crossing these locations can be costly and time consuming. For example, the perpendicular crossing of a depressed section of freeway would require an extremely deep and expensive wireline bore up to 100 or more feet deep. At this depth, the contractor cannot accurately locate the bore and so risk of hitting obstruction in the bore increases. Engineering design would need to evaluate alternatives such as bridge attachments, aerial attachment to existing poles, installing new poles, or even rerouting to cross at a shallower depth. Successful implementation of the fiber network requires that the preliminary and detailed design engineering work be thoughtful and comprehensive to support the subsequent construction effort, without delay and need for change orders.

11.9 Procurement & Equipment

Another critical component of the implementation is continued refinement of the network build Order of Magnitude (OOM) into detailed bill of materials (BOM), cost estimates, and schedules. Even from a preliminary engineering standpoint, quantifying the OSP and ISP is essential in understanding the procurement needs and timeline feasibility. Our Cost Estimate section is based upon this preliminary quantification and assumed network OSP materials and ISP equipment. The OOM serves as a project charter document that guides the client in the procurement process, especially considering the global shortages and increasing price tag of essential network materials such as HDPE and fiber cable. Given the state of the industry when it comes to supply chain, it is essential that the OOM is flexible and adaptive to quickly swap out various materials and equipment to provide insight on the updated costs and ensure compatibilities. Changes in equipment and materials during the procurement process may have impacts on the OSP design and ISP equipment may lose functionality that provides for future proofing, modularity, and sustainability of the network. Therefore, it is essential to implementation that the services and materials procurement effort is collaborative and deliberate so that these impacts are discussed and weighed before making final decisions so that there is not excessive redesign of the network through a continually varying BOM. When considering procurement as a municipality or consortium, state purchasing cooperatives offer an advantage in the current environment in terms of cost regulation and supplier/manufacturer relationships. The telecommunications market is incredibly competitive and with the influx of broadband funding at the federal and state levels, there are new ISPs, infrastructure companies, and municipalities competing in this space. Compounded with the global supply issues, materials and services are increasingly difficult to attain at competitive prices and within a reasonable timeline. Common components such as HDPE and splice closures are experiencing more than 26-week

lead times and quotes are only held for weeks to months at best as demand surges. Due to these external factors, direct sales with individual suppliers, or wrapping up material procurement into the construction vendor contract through generalized specifications, may result in significantly limited options and risk of inferior quality materials being used in the build. Partnering with well-established operators in the telecommunications space or contracting purchasing cooperative services presents the most favorable options for procurement, which is key in enabling implementation of the broadband network build.

As reviewed in the section above, there are a multitude of components involved in the implementation of the network and internal and external factors that impact the effectiveness of the implementation. Understanding the relationship of these components, and the applicable considerations, is crucial in the follow through of the implementation methodology. The feasibility study, preliminary and detailed engineering of the OSP and ISP, procurement, and construction all play into the overall network implementation. The final steps of implementation involve securing transport and transit services, installation, registration, and licensure of equipment, and establishing network management policies. Once the business model and network ownership has been determined, the final steps of implementation can be determined and carried out by the appropriate parties.

11.10 Innovative Solutions for Cost Savings

- Co-locate POPs in existing public facilities that meet the suitability criteria.
- Utilize spare duct and available fiber capacity in an existing fiber network by a third-party provider.
- Utilize wholesale pricing for material procurement with regional approach.
- Utilize plough construction in TXDOT ROW rural segments.
- Modularize the ISP – "Buy as You Go" Model.
- Bulk Procurement and Construction of OSP for better pricing/schedule in a competitive environment.

11.11 Operations And Maintenance

To ensure proper performance of this potential broadband plan, regular maintenance will need to occur to repair any problems with the fiber network. One benefit of a fiber network is the low amount of maintenance needed to keep the system up and running. The system should work properly unless there is specific damage that occurs somewhere in the network. The maintenance will stem from breaks that occur in the fiber due to damage to infrastructure like conduit, or any damage to the end equipment, such as a splice cabinet knockdown or a patch panel disconnection. It is recommended that to reduce risk of damage to fiber infrastructure that the contractor should install tracer wire with the conduit. The current outlook for maintenance responsibilities is that the partnership collaboration will lead to hiring an operator who would perform all maintenance.

During the build phase of the route, the contractor is responsible for the build until it is completed. Therefore, the costs are covered by the builder for any issues that occur during the build phase such as cracked handholes. As the equipment ages the maintenance needs will grow, especially in more rural areas. It is important to understand that maintenance costs will not be consistent from month to month, especially in the early years of the equipment. The operation costs are invaluable to a fiber network in the present day with the current lifestyle and digital dependence. The operator will ensure that the connectivity to users and business is uninterrupted should any major or minor disaster occur again and would ensure that connectivity is always a priority.

To ensure proper performance of the fiber network, some level of permanent staff will likely be needed to monitor the system and perform regular preventative and reactive maintenance. Since the operator will be planning on leasing fiber strands out to commercial clients for internet access on behalf of the municipality, the operator will need staff in place to manage all billings for commercial client use of the network.

With the further development and implementation of the fiber network, there will be an increase in possible locations that have issues. Maintenance for the end equipment for each run of fiber located at the network hubs will need to be routinely checked and maintained by qualified IT staff with the municipality. There are a few options for maintenance on the equipment located in the field, such as the fiber-optic cables and splice cabinets.

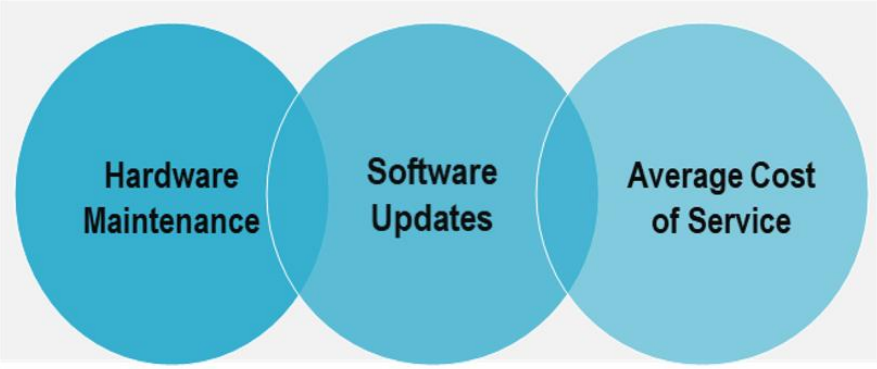


Table 10: Operations and Maintenance Estimate

Network Details		
Miles	Capacity	Network Cost
248	100GB 10GB	~ $23 M
Maintenance Details		
Maint. Terms	Monthly Maint. Cost	Maint. Cost Estimate
20 Years	~ $24,000	0.1% Network Cost
Operations Details		
Managed Service Terms	Monthly Service Cost	Operations Cost Estimate
7 Year	~ $10,000	0.04% Network Cost

Commented [JT2]: This is updated in the Cost Estimate. Are we going to include it here as well?

Commented [JB3R2]: @Jacob Triska – the miles and calcs need to be updated here

As part of this analysis, we have checked with other cities/counties regarding their operations budgets to roughly estimate the costs of operating a fiber network based on the reference design the project team proposed.

Costs for replacement are expected to be low for the first twenty years following construction. However, since all circumstances are unknown initially, the municipality should consider allocating a portion of funding for a replacement fund. These funds would be utilized in the event of a catastrophic failure where entire portions of infrastructure would be required to be replaced. This would also include end equipment such as switches or routers, which may have expired warranties after 3-5 years. The City may also consider earmarking revenue generated by the system, via commercial clients, for a replacement fund. This revenue, and revenue created via Last Mile networking, could also help pay for any maintenance costs over time.

In summary, the implementation of our recommended plan consists of further engagement with ISPs promoting a PPP that is specifically catered towards building a network that addresses the needs of the Underserved and incentivizes business development. Criteria for selection of an operator will include their ability to secure grants and funding opportunities geared towards digital equity and economic development.

If the County wishes to expand the fiber network in the future, the budget will need to expand to help pay for this growth. This could come from money raised by commercial client leasing of fiber. Any expansions costs will vary based on the scale and nature of the expansion but using revenue from commercial clients will likely be the easiest source of funding for an expansion after initial funding incentives are utilized for the build out with the goal of developing a sustainable operation.

12 COST ESTIMATES

12.1 High Level Infrastructure Costs for Middle Mile Labor and Materials

Section Highlights

- THE COMPREHENSIVE MIDDLE MILE PLAN IS EXPECTED TO COST $23M+
- POTENTIAL PARTNERSHIP AND FUNDING OPPORTUNITIES ALLOW FOR COST SAVINGS FOR THE COUNTY
- SUPPLY CHAIN ISSUES AND MATERIAL SHORTAGES MAY IMPACT THESE PRICES WHEN IMPLEMENTATION BEGINS

Table 11: Labor and Materials Cost Estimate, Infrastructure Only

Total Cost Estimate (Year 0 - Construction Phase)	
Materials	$5,540,000
Labor	$17,733,000
SUM	**$23,273,000**

Table 11, as seen above, represents the total construction cost for the Llano County broadband network update as if Llano County were to take on this project on their own with no partners, consisted of the infrastructure needed based on the HLD, and proposed aerial attachment solutions where soil conditions would not find boring or trenching a feasible option. The cost for this broadband network can be broken down into two main categories for this project i.e., Materials and Labor. Both of which come with specific assumptions and unit costs and can each be split into various subcategories. The materials included are using recent prices from a local vendor, but with the current material shortages and supply chain issues in many fields it is recommended to use these values as an estimate. For that reason, Table 12 below has a lower and higher range associated with various costs.

Table 12: Cost Estimate Ranges

Type of Cost	Lower Range	Upper Range
Underground Labor	$12,885,990	$19,328,985
Underground Materials	$3,712,991	$5,569,486
Aerial Labor	$832,174	$1,248,261
Aerial Materials	$559,283	$838,924
Splice Labor	$211,272	$316,908
Splice Materials	$36,510	$54,765
OSP-ISP Transition Labor	$256,800	$385,200
OSP-ISP Transition Materials	$122,700	$184,050

The fiber and conduit sizes were determined based on current and future demands, promotes redundancy, and allows for expansion or leasing options, should the County be interested in that. To do that, fiber sizes of 48FO minimum and 144FO maximum were picked, where the larger size is to accommodate the Middle Mile infrastructure and smaller size is for Last Mile connectivity purposes, also built to include redundancy. To accommodate for redundancy or any future building, it was also decided to include 2 – 2" HDPE conduits for fiber placement underground. There are natural water bodies and railroads that will need crossings, and including more ducts helps aid future adaptations to this fiber build by minimizing construction and labor costs. This size and quantity of conduit will also help promote safety within the network by having those spare ducts available. Rural specific handholes were included and are typically placed approximately every 7,500 linear feet of fiber. The number of handholes included in this project takes these fiber lengths and sizes into account to determine the estimated total amount of handholes. Based on the fiber size and the natural conditions, a 36" x 60" x 24" handhole seems proficient to meet the needs of this network.

Aerial conditions were considered where digging conditions, in previous figures, were shown as harder. Now, it should be noted that underground operations can occur even in the most difficult of soil conditions, but costs and timing are impacted by that. Should the County or any potential partner prefer to still go underground to avoid the varied complexities that aerial attachments include, then having a plan in place, with updated cost estimates to reflect that, should be considered. For this HLD and cost estimate though, the various construction and material costs include anchors, down guys, risers, snowshoes, and more based on the expected linear footage that is within that hard rock condition.

Additionally, both splicing and the transition from OSP to ISP were considered. The assumptions for these conditions include prep splice closures based on sizing, fusion splicing ribbon or loose tube, splitters, and more. For plant transition, the assumptions include 1.25" Plenum innerducts, Hoffman boxes, building entrances, core drilling, 4" EMT, drop cable, and more. Both splicing and OSP to ISP costs are based on the number of expected demand points, towers, handholes, and expected footages.

The material prices are then determined to be based on the linear footage for each project, size of fiber, and more. The breakdown of these linear footage values can be seen below in Table 13:

Table 13: Material Quantities

Fiber Size	Linear Footage
144F	1,271,201
48F	19,500
Estimated Slack	16,300
Conduit Size	**Linear Footage**
2-2"	1,676,414
Handhole	**Quantity**
36" x 60" x 24"	163

The labor pricing in the above cost estimates is for labor alone and does not include the costs of the actual workers. Additional consideration that need to be included consists of bore crews, fiber crews, splicing crews, traffic control, mobilization, engineering, administration, and contingency. The construction estimates were derived from local vendors, and the remaining costs were based on federal communications studies for fiber optic construction. Construction Engineering pertains to inspection, oversight, and field engineering (not detailed design). These assumptions may not reflect the current landscape which includes inflation, supply chain issues, and material shortages, but estimates can be seen below in Table 14.

In the tables below the assumptions are detailed for each labor cost.

Table 14: Additional Cost Estimate Assumptions

Bore Crews	Excluding Weekends, 2,000LF/Day, 3-Person Crew ($30/hr./mem.)
Fiber Crews	Excluding Weekends, 6,500LF/ Day, 3-Person Crew ($32/hr./mem.)
Splicing Crews	Excluding Weekends, 400 Splices/ Day 3-Person Crew ($25/hr./mem.)
Traffic Control	7% of Total Labor Cost
Mobilization	9% of Total Labor Cost
Construction Engineering	10% of Total Labor Cost
Administration	7% of Total Labor Cost
Contingency	20% of Total Labor Cost

To assume the estimated timeline using these considered crews, Table 15 below highlights the expected time per 1 crew for each of boring, fiber, and splicing based on number of weeks. To decrease the time to completion, more crews could be hired at additional costs.

Table 15: Estimated Work Crew Durations

Crew Type	Number of Weeks
Bore Crew Days	84
Fiber Crew Days	54
Splicing Crew Days	5

As detailed in additional sections, the expected Operations and Maintenance cost estimate can be seen below. Depending on the business model chosen by Llano County, this may not need to be paid by the County.

Table 16: Operations and Maintenance Estimate

Network Details		
Miles	Capacity	Network Cost
248	100GB 10GB	~ $23 M
Maintenance Details		
Maint. Terms	Monthly Maint. Cost	Maint. Cost Estimate
20 Years	~ $24,000	0.1% Network Cost
Operations Details		
Managed Service Terms	Monthly Service Cost	Operations Cost Estimate
7 Year	~ $10,000	0.04% Network Cost

12.2 Additional Costs Considerations for Data Center, POP Locations, and Towers

Data Center and POP Location construction and upgrades were not included in the materials and labor aspect of the design but should still be considered. With the variability of factors relating to these locations that will be further discussed below, specific cost values cannot be calculated at this time.

The proposed solution would require at least one Data Center (a large room with specific HVAC and electrical needs), one large Pop Location (located within a spare room/ closet), and a smaller POP location (an external large handhole). Depending on the business model chosen by Llano County, these may be managed by a potential partner. Materials needed for these locations would include port line cards, breakout cables, aggregation cards, transceivers, chassis shelves, distributed denial-of-service (DDoS) appliances, distribution switches, firewalls, patch panels, servers, batteries, rectifier systems, generators, mounting hardware, and other various building upgrades. Data Centers and POPs are available to collocate with established County owned buildings and would therefore not require the purchase of new facilities. A passive infrastructure model would be the most cost-effective way for the County to include these locations.

Similar to the Data Center and POP location considerations, the same thoughts need to apply to that of towers for fixed wireless solutions as well. Whether the plan is to collocate on existing towers or propose new towers, there are different factors that apply to either situation. When considering the colocation process for towers, through a rough estimate it can be assumed that collocation itself will range from $30-75k. The price is determined by the number of antennas or radios currently installed on the tower as well as what would be on the ground. For ground equipment, factors that can impact pricing would be determining the number of cabinets required, does there need to be a generator installed, what is the current situation of sending power to the tower from the local energy provider and is it easy to access at the tower, and more. If proposing a new tower is a viable option, then costs for this situation will vary based on the height of the tower with costs ranging from $100-200k should be expected. For adequate consideration of locations, the ground conditions for foundations, tower ancillaries and ground equipment are required. If the tower height needs to be higher than anticipated, then the amount and types of equipment will need to be updated to reflect those changes which will also impact costs. Furthermore, outside of material and labor costs, additional considerations for towers will include various regulatory requirements. Each tower proposed will need several environmental studies completed that range from geotechnical soil analysis, to bird flight path migratory patterns, and even protected wetland or tribal area evaluation. The FCC has regulatory compliance documents that will need to be completed which include NEPA, SHPO, Tribal, 1A/2C, and more. All of these considerations, and more, can be further detailed in supplementary developments.

13 BUSINESS MODEL OPTIONS

There are multiple, applicable business models to consider for municipal broadband projects with Middle Mile, Last Mile, and digital equity components. These models are determined and shaped based on available funding opportunities, potential partner capabilities and levels of investment, community and public utility stakeholder input, actual demand and anticipated take rates, forecasted economic output, and regulatory framework and a regional and national level. Fortunately, there are many diverse funding opportunities and a tiered range of options to build catered versions of these models as no municipalities and broadband infrastructure needs scenarios are the same. The models listed below should be considered base ownership and operation models and will be further developed and defined through subsequent phases which may include a request for information, qualifications, or proposals from interested parties.

Section Highlights

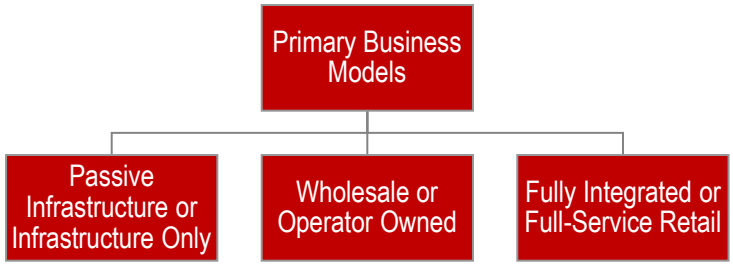
- THERE ARE VARIOUS LEVELS OF INVOLVEMENT LLANO COUNTY CAN HAVE IN DEVELOPING A PPP FOR IMPLEMENTATION
- CONSIDERING THE FINANCIAL INCENTIVES AVAILABLE IT IS IMPORTANT TO NOTE THAT INVESTMENT DOES NOT NECESSARILY ASSUME UNIQUE OWNERSHIP

13.1 Considerations For Business Model Selection & Partnership

Prior to evaluating and planning for the appropriate business model, there are some base considerations which will conceptualize the necessity, values, and risks of municipal broadband networks in any form. The first and most apparent consideration is the necessity of municipal involvement further than promotion of the issues and driving initiatives to improve broadband access and adoption. This study presents finding and data which can help inform this consideration. In many cases, the study and initiative itself drive private sector action and spur modernization of incumbent networks and draw attention for new providers to saturate the market. While there may be some private sector movement, there is no guarantee that it will be to the extent that the municipality envisions and there are still additional incentives to the municipality to play a role in broadband development. Municipalities can benefit from improved broadband network infrastructure in their own network operations and applications across departments and public service components, such as Supervisory Control And Data Acquisition (SCADA) and Automatic Meter Reading system (AMR) for public utilities. Cities and counties are often considered a tier one commercial account for providers and so they themselves are a potential benefactor in the initiative and an attraction for partners to provide commercial services. Local governments can influence how broadband deployments are implemented through public policy, which can serve as both and incentive in a partnership and to manage the public ROW and protect community interests. Regardless of the selected model, or variant of, it is imperative that those municipalities and jurisdictions involved in the initiative have considered their own standards when it comes to new broadband infrastructure. Refer to Section 11.7 on Public Policy. Local governments can introduce further financial incentives in the forms of subsides or tax credits, incentivizing providers and adoption. Municipal infrastructure can be leveraged as broadband assets and reduce cost or provide revenue generation. This concept applies to existing assets such as water towers and properties for collocated ISP facilities in addition to any broadband specific assets the municipality may own as a part of a proposed network. In exploring these models, it is imperative that the municipality and partners consider shared risks and incentives, areas of expertise and resourcing, and taking measure to ensure a healthy competitive market.

13.2 Ownership & Operations Models

There are three primary models based on the level of involvement of municipalities and private partners, across three network service components: Infrastructure, Access, and Service. The infrastructure component consists of civic components such as conduit, poles, dark fiber, and handholes. The access component comprises of electronics and services to “power” the network and connect to transport networks. The service component covers providing the actual commercial and residential services to the end customers. The three models reflect the inclusion of one or more of these components, starting with the least involvement at the infrastructure component, adding access, and then finally service. Respectively, these models are: Passive Infrastructure or Infrastructure Only, Wholesale or Operator Owned, and Fully Integrated or Full-Retail Service. We have provided multiple common terminologies as these vary across municipal broadband model studies.



It is important to note that there are accessory models within these base models such as Open Access, Public Policy Only, Public Services, Commercial Only, and Residential Only. These accessory models focus on specific needs within the base structure, for example, a municipality may want to pursue a Wholesale model where they provide both infrastructure and access components, but only for target commercial customers (Commercial Only) or local government facilities (Public Services). The Open Access model is inherent in both the Passive Infrastructure and Wholesale models where there is a neutral operator and can be used to promote healthy competition of providers at the access and service levels. Depending on the range of scope for the municipal broadband initiative, there may be multiple models and accessory models to serve different purposes.

13.2.1 Passive Infrastructure | Infrastructure - Only

In this model, the municipality's involvement is limited to facilitating some or all the passive infrastructure needed for the broadband network. Passive infrastructure only includes the labor and network materials at the physical layer, such as conduit, dark fiber (fiber not being actively used), utility poles, towers, buildings and properties for Data Center and POPs. This infrastructure is usually the most costly and essential to support the network but does not include the necessary transport equipment and connections for access or equipment and provisioning for internet services. A private sector provider or operator would manage the access and service components. The municipality has the option to own and lease or sell some or all their infrastructure to broadband service providers or operators. This model allows for full open access at both the access and service levels given the municipality enters an agreement with a neutral operator where the network infrastructure is available to both access providers and service providers. Typically, the passive infrastructure does not include residential development as this is often costly and there are many implications in the access and service levels that need to be considered in the design and implementation. This model is effective to incentivize operators and providers to serve areas of need that were otherwise cost-prohibitive. If the municipality retains ownership of the infrastructure and opts for the leasing option, there needs to be clear delineation in the agreement with the operator or provider as to maintenance. Ownership of the infrastructure may be beneficial to the municipality given fixed costs, indefinite use, ability to influence cost to consumers, ensure equal access across the communities, and can be leveraged for public services and applications. These benefits of ownership need to be weighed with the cost and resources required for maintenance, competitive rates for lease while ensuring ROI, and the potential for the open access components to dissuade providers from entering the market.

13.2.1.1 Lease and Selling Options

The following are optioning the municipality would have in terms of the sale or lease of infrastructure assets:

1. Purchase Agreement: Municipality would be paid upfront or through annual payments and transfer titles
2. Indefeasible Right of Use: Municipality would be paid upfront with annual maintenance payments for a certain capacity of their fiber for ~10-20 years
3. Lease: Municipality would be paid monthly for use of infrastructure assets for ~3-5 years

4. Asset Swap: Municipality could exchange assets and would transfer titles accordingly

These options also apply from the opposite perspective, should the municipality look to purchase or lease infrastructure from operators or providers.

13.2.2 Wholesale | Operator Owned

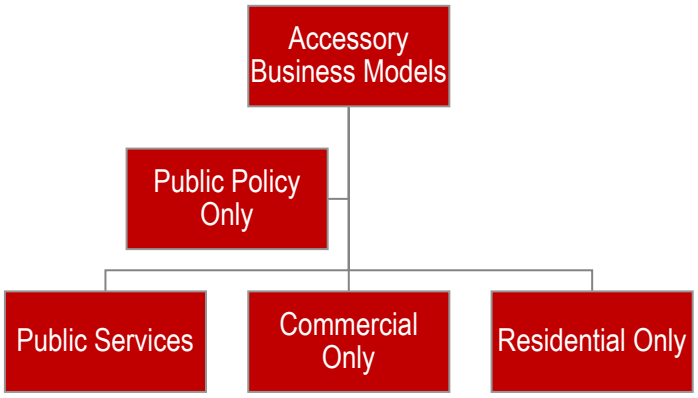
The Wholesale model increases the involvement from the Passive Infrastructure Model to include the municipality facilitating the access component, including all necessary equipment and transport services to activate the network. In this scenario, the municipality could be the neutral operator, responsible for providing wholesale broadband access to private operators or providers. The municipality may still opt to engage a private operator as they typically prefer to own the access component and sell to providers. This is often a large step towards a full blown Fully Integrated model and requires increased staffing and expertise. For this reason, Public Private Partnerships are often a more viable solution for municipalities considering this option. From an open access perspective, there is still full competition from service providers as the access component is now the responsibility of the municipality. When a municipality owns the access component, and does not contract an operator, there is typically more hesitation from private providers to use the municipal network given the relative experience the municipality has in managing wholesale services and the risk associated. Benefits include more control over selection of quality service providers and revenue options in wholesale broadband access to operators and providers. As with the previous model, maintenance and operations costs will increase and consideration should be taken in that broadband technologies are constantly evolving and require more frequent investment than other utilities.

13.2.3 Fully Integrated | Full-Service Retail

With the addition of the service components, the Fully Integrated Model requires comprehensive involvement from the municipality as broadband service provider. Municipalities can provide Middle Mile and Last Mile services to residential and commercial customers services from end to end. The municipality owns the network and can often converges this with other public utilities for billing simplicity and other verticals. The municipality is responsible for operations, management, construction, maintenance, network monitoring, billing, marketing, retail offerings, troubleshooting and customer service. While this model can create significant value, it also assumes the most risk and should only be considered when there are no willing and capable private sector providers willing to enter the market or provide the level of services required to meet the needs of the communities. This Full-Service Retail model looks attractive and garners public attention when implemented as there have been remarkable success stories, such as the City of Mont Belvieu, TX's "MBLink," there have also been many failures which can put a municipality in financial hardship and the burden falls to taxpayers. Another consideration to this model is that is eliminate the open access concept as the new municipal ISP would be considered a competitor with private sector providers at all levels. There is space within this model to still allow for healthy competition when the municipal ISP only serves Unserved or Underserved markets which the private sector has not elected to serve. While a municipal ISP does need to consider ROI and healthy financial operations, the goals of the municipality for their ISP often focuses on other factors such as promoting local competition to bolster the local economy and target areas which require subsidy or at cost services to promote adoption. Successful municipal ISPs using this model often have advanced economies which can steady concerns over the financial risks in taking on such an initiative. Any municipality considering this model should strongly evaluate their expertise, capabilities, resources, and the overall necessity of this make-or-break model.

13.3 Accessory Models

The base models above are not rigid and can be catered to the unique needs and capabilities of the municipality to assume differing levels of responsibility and investment. Accessory models accentuate or serve as sub models to represent some of the more common options associated. As mentioned previously, different models can serve various project scopes as a part of the broadband initiative and so there is no need to resort to a one model-fits-all mentality.



13.3.1 Public Policy Only

In a Public Policy Only model, the municipality can still play a role in promoting broadband expansion through the available policy tools at their disposal, and without having to invest in any of the infrastructure, access, and service components. Consider this model at the lowest end of the risk spectrum, where the municipality and local government entities facilitate private sector investment through streamlining jurisdictional processes and red tape that might otherwise delay or deter broadband expansion efforts. Through public policy, municipalities can promote an "ISP Friendly" market and may influence improvement of services or expansion into areas of need, but it is unlikely that this level of investment will incentivize private providers where they cannot profit.

13.3.2 Public Services

The Public Services model relies on municipality and local public entity support to address broadband needs solely for municipal and public entity facilities and relative applications. Oftentimes, municipalities look to improve their internal services in conjunction with broadband initiatives focused on residential and commercial services. Public sector IT groups typically look to reduce operational and service costs associated with leased lines and Multiprotocol Label Switching (MPLS) networks through building their own dark fiber and providing data services to other public organizations. This model can be considered in isolation, focused on building municipal interconnects between ISDs, public utilities buildings, governmental buildings, Emergency Operations Centers (EOCs), and public safety assets. There are many benefits to this which indirectly improve quality of life for communities which rely on these public services and facilities. Municipalities may also leverage private sector competition to provide these services to incentivize private investment in the residential and commercial areas of need. All three base models can be catered towards strictly public services, where the municipality can determine their level of involvement.

13.3.3 Commercial Only

Similar to Public Services, The Commercial Only model can utilize one of the three base models to focus strictly on providing commercial services to businesses and commercial properties. The availability of capable commercial services is a huge economic growth driving by attracting businesses to the market and retaining those already currently in place. Most modern, large companies require multiple, redundant connections from tier one providers and so attracting multiple capable providers to the market in the Middle Mile space can be very impactful. Municipalities can directly offer these services through the Fully Integrated base model but should consider if their presence in the commercial service space would deter the necessary private sector saturation. As commercial customers are often in the Middle Mile space, open access is a possibility here where there is a known necessity for multiple providers to provide these multiple, redundant services. Commercial Only can be implemented as a separate scope or part of a larger initiative including public and residential services.

13.3.4 Residential Only

Residential Only is a sub model to the three base models in which the municipality would focus solely on involvement in providing residential services. As this is one of the more costly and complex targeted services, in most cases, private providers have the expertise to deploy and operate in residential markets. The risk and investment associated with providing residential services are higher than that of commercial and public services, and regarding digital equity, the greatest needs are often with residents in the Unserved and Underserved communities, and this is where municipal influence can make a significant impact. A Passive Infrastructure model, catered towards residential only would be a logical, catered model for a municipality looking to incentivize private provider saturation. However, open access potential would be limited as residential customers do not require redundant services connections and private providers will likely avoid using infrastructure owned by a municipality in this space. Residential Only can be implemented as a separate scope or part of a larger initiative including public and residential services.

13.4 Business Model Funding

Another layer to business model determination is the funding aspect, representing tangible investment and risk assumed by the parties involved. Funding a component of a broadband network does not necessarily translate to unique ownership of specific assets as there is a need to ensure that the right party focuses on their area of expertise. For example, while a municipality may elect to cover the costs of the access components to spur development of a network, they may have no intention of handing the install, operations, or maintenance of this component as they do not have the resources nor expertise to manage. As touched on in the business model outlines above, there are benefits to the municipality in ownership such as being able to promote open access, lease, and generally have more control over the network. On the other hand, there is increased risk of crowding out the private sector or discouraging their investment, the learning curve in obtaining the expertise and training to manage and operate, and costs of maintenance and frequent technology upgrades. Weighing all these considerations in mind, a municipality must determine the feasibility and necessity of public funding or public-private partnership funding. In isolation, a municipal broadband network can be funded entirely through public sector means such as bonding, grants, loans, and Community Reinvestment Act (CRA) or Public Welfare Investments (PWI). Other than grants requiring no match, the municipality has all the financial burden and would not offset costs through private sector investment. As the private sector is constantly looking for where to expand and invest to grow their business, a public-private partnership leverages this pending investment and reduces municipal risk.

13.5 Public Private Partnerships (PPPs)

Public-Private Partnerships take the best of both worlds where all parties focus on their areas of expertise and shares the risks and benefits associated with the network development. PPPs can allow municipalities to attract private capital when it would not be feasible otherwise[19]. Collectively, the partnership compartmentalizes and accommodates all aspect of the network, leveraging assets from both the private and public sectors for mutual benefit. The initial infrastructure investment, operational and maintenance costs, and revenue sharing are all considered in the following PPP contracts.

Table 17: Various Forms of Broadband Public Private Partnerships

Contract	Network Funding	Network Operations	Subscription Fees Collected By	Revenue Share To
Third Party Run	Municipality	Private Operator	Municipality	Private Operator
Lease	Municipality	Private Operator	Private Operator	Municipality
Special Purpose Vehicle	Both	Both	Both	Both
Build Operate Transfer	Private Operator	Private Operator	Municipality	Private Operator
Concession	Private Operator	Private Operator	Private Operator	Municipality

13.5.1 Municipality-Funded PPP Networks

In a Third Party Run Service Contract, the network is funded and built by the municipality, but the connectivity and end user services are provided by a private operator. Subscription fees are collected by the municipality, possibly through existing utility billing services. The municipality then transfers a share of the revenue to private operator to cover costs of operations, maintenance, and quality of service (QOS) expenditures. Allows for a return on capital.

In a Lease Contract, the network funded and built by the municipality and then leased by the private operator, who in turn provides connectivity and services. Subscription fees are collected by private operator and a portion of the revenue is transferred to the municipality to cover the network rental fees.

In a Special Purpose Vehicle Contract, the network is co-financed, built, and operated by the municipality and private operator, who both share in the return on investment.

13.5.2 Private Sector-Funded PPP Networks

In a Build Operate Transfer (BOT) Contract, the municipality facilitates private investment through a "tender," such as a Request for Information (RFI), Request for Qualifications (RFQ) or Request for Proposals (RFP) to a private operator to fund, build, and operate the network. Subscription fees are collected by the municipality, possibly through existing utility billing services. The municipality then transfers a share of revenue to the private operator to cover operations, maintenance, and QOS expenditures. Allows for a return on Capital

[19]Municipal Broadband Networks-opportunities, business models, Challenge. ifc.org. (n.d.). Retrieved June 13, 2022, from https://www.ifc.org/wps/wcm/connect/publications_ext_content/ifc_external_publication_site/publications_listing_page/municipal+broadband+networks

In a Concession Contract the network is funded, built, and operated by a private operator. Subscription fees are collected by the private operator as well. This contract requires that municipality allows the private operator access to municipal resources or assets such as utility poles and ducts. Concession fees are paid to the municipality for use of their assets.[20]

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13.6 Managed Services

Partnerships are not limited to private operators or providers but can also include broadband services companies that do not necessarily own or provide direct internet services. These companies can support the municipality and their partners in the service activation and service assurance aspects of the network. As previously mentioned, broadband networks are dynamic and complex in comparison to traditional utilities and require substantial expertise, in which the municipality, and sometimes even the operator or internet service provider, needs external resources. Managed services are typically catered, modular solutions which fill in the implementation and operational components of the network to include monitoring, troubleshooting, performance analysis, inventory management, cybersecurity and much more. For a municipality considering more extensive involvement and ownership, or in a partnership with smaller private operators, managed services companies can assist in standing up the network and making necessary connections to operations and business support systems (OSS/BSS), to include municipal billing and notification systems. Managed services should be considered early in the broadband network development and not as an afterthought when operations suffer or there are delays due to unforeseen complications. Under a Full Retail Service Model, managed services can be essential to round out the municipality-team, providing necessary resources and even training leading towards a potential transfer to a municipally run or sponsored ISP.

[20] Houngbonon, G. V., Strusani, D., & Rossotto, C. M. (2021, November). Municipal Broadband Networks-opportunities, business models, Challenge. ifc.org. Retrieved June 1, 2022, from https://www.ifc.org/wps/wcm/connect/publications_ext_content/ifc_external_publication_site/publications_listing_page/municipal+broadband+networks

14 FUNDING ANALYSIS

As outlined and reenforced throughout this study, broadband is a necessary component to everyday life across the globe. Federal sources state that 30 million Americans do not have access to at least minimally acceptable internet speeds and according to the Economic Co-operation and Development (OECD), among 35 countries studied, the United States has the second highest broadband costs. Recognizing these facts, Congress, through the Bipartisan Infrastructure Deal identified broadband as a high priority from the initial drafting of the Infrastructure Investment and Jobs Act (IIJA). The final bill allocated $65 billion (out of $1.2 trillion) to several federal agencies with the goal of ensuring every American has access to reliable high-speed internet.[21]

To achieve this goal, 4 key initiatives were identified:

1) Deploy future-proof connectivity to all Americans;
2) Provide broadband subsidies for low-income users;
3) Provide funding to accelerate the Country's progress toward addressing both broadband access and adoption challenges;
4) Provide funding to address digital literacy and digital equity.

Section Highlights

- $65 BILLION IN FUNDING ALLOCATED FOR BROADBAND CONNECTIVITY PROGRAMS
- LEVERAGING THESE FUNDING SOURCES WITH PRIVATE/LOCAL MATCH THROUGH PPP WILL INCREASE OVERALL IMPACT
- LLANO COUNTY HOUSEHOLDS SHOULD GO TO GETINTERNET.GOV TO SEE IF THEY QUALIFY AND APPLY FOR THE AFFORDABLE CONNECTIVITY PROGRAM

14.1 State Broadband Development Office

One of the key components of the IIJA was the decision to place a majority of the funding in the Broadband Equity, Access and Deployment program (BEAD), with the responsibility for administering these funds falling to each state government and US territories' representatives. Each entity is required to develop a state-wide plan for how they will administer the funds to new infrastructure projects at the local level and in order to do so, had to establish a State Broadband Deployment Office (BDO). Some states already had offices overseeing broadband policy and deployment while others have had to form one at the direction of the funding guidelines. In Texas, the State BDO is overseen by the Comptroller of Public Accounts office.[22] The Texas BDO office's mission is to:

- Create an accurate broadband map of eligible vs. ineligible areas for financial assistance. The map will have a challenge process to dispute any perceived inaccuracies.
- Establish a long-term, statewide plan that addresses strategies and goals for expanding access to and further adoption of broadband service.
- Award grants or other financial instruments to meet the goals of the plan.
- Set the effective threshold speed for broadband service (25 Mbps download/3 Mbps upload).
- Engage in outreach to communities regarding the expansion.
- Address barriers for future expansion efforts.

In its development, the BDO created a 10-member Board of Advisors to provide guidance regarding the expansion, adoption, affordability and use of broadband service and the programs administered by the office. The Board is chaired by the Texas Comptroller and includes a representative of the BDO as a non-voting member. The other appointees come from the Offices of the Texas Governor, Texas Lieutenant Governor and the Speaker of the House. At the time of this study, the Chair and non-gubernatorial appointees are as follows:

- Glenn Hegar, Chair
- Representative Trent Ashby, Board Member
- Sergio Contreras, Board Member
- Adriana Cruz, Board Member

[21] Fact Sheet: The Bipartisan Infrastructure Deal | The White House
[22] https://comptroller.texas.gov/programs/broadband/leadership/#mission

- Robert F. McGee, Board Member
- Dr. Scott Muri, Board Member
- Mari Robinson, Board Member

As a part of the BDO's mission to create a statewide plan in relation to the BEAD funding, the Comptroller held 12 regional listening tours in communities across Texas to gain insights about internet access and collect input for the plan.[23] The BDO office is working on a Toolkit that will assist local communities, service providers and stakeholders with information and resources for identifying community needs and gaps, developing effective leadership strategies for implementation and analyzing funding opportunities.[24] The State is currently working to develop the State Plan for the BEAD funding and the information gathered and analyzed as a part of this study will be presented to the Texas BDO for review and inclusion in the states planning efforts.

The Texas BDO developed the following chart to display the current known funding allocations to Texas for broadband initiatives. The $100 million per state listed under BEAD includes an initial $5 million in planning funds for each state to develop their five-year plan which is in development. As the State develops the plan, Llano County will be well positioned to submit their project for consideration with this study and future partnerships for implementation.

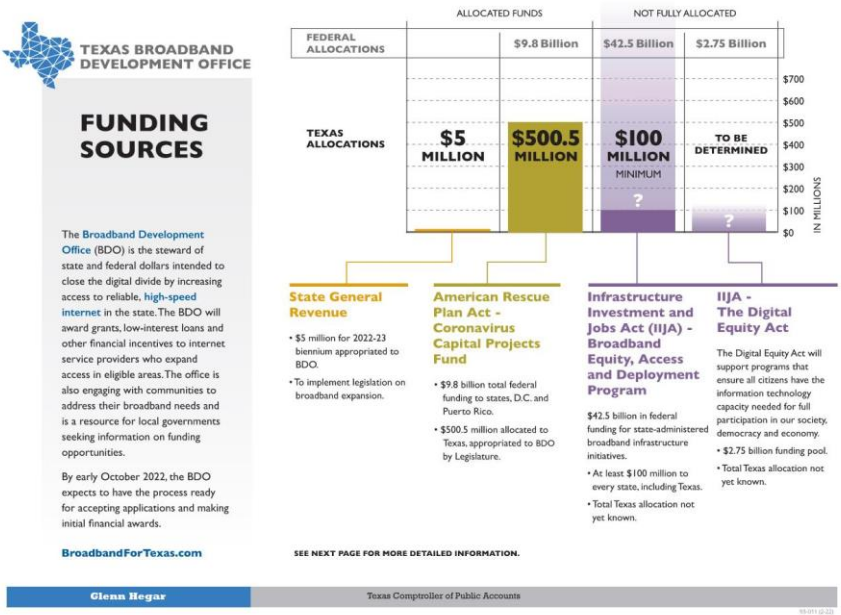

Figure 41: Breakdown of IIJA Funding to Texas BDO

[23] Texas Broadband Listening Tour 2022
[24] https://comptroller.texas.gov/programs/broadband/toolkit/

14.1.1 Affordable Connectivity Program

Under the terms of the Affordable Connectivity Program (ACP), an eligible household that signs up for the program will receive a discount of up to $30/month on any internet service plan a participating provider offers. The ACP is the largest high-speed internet affordability program in our nation's history. Under the terms of the ACP, an eligible household that signs up for the program will receive a discount of up to $30/month on any internet service plan a participating provider offers. It is estimated that 48 million households—or nearly 40% of households in the country—qualify for the ACP based on the following eligibility criteria:

- Supplemental Nutrition Assistance Program (SNAP), formerly known as Food Stamps
- Medicaid
- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
- Supplemental Security Income (SSI)
- Federal Public Housing Assistance (FPHA)
- Veterans Pension and Survivors Benefit
- Free and Reduced-Price School Lunch Program or School Breakfast Program, including at U.S. Department of Agriculture (USDA) Community Eligibility Provision schools
- Federal Pell Grant (received in the current award year)
- Lifeline
- Certain Tribal assistance programs, including Bureau of Indian Affairs General Assistance, Head Start (only households meeting the income qualifying standard), Tribal Temporary Assistance for Needy Families (Tribal TANF), and Food Distribution Program on Indian Reservations
- Meets the eligibility criteria for a participating broadband provider's existing low-income internet program.

Each of the following companies committed to offer all ACP-eligible families at least one high-speed plan for $30/month or less, with no additional fees and no data caps.[25]

- Allo Communications
- AltaFiber (and Hawaiian Telecom)
- Altice USA (Optimum and Suddenlink)
- Astound
- AT&T
- Breezeline
- Comcast
- Comporium
- Frontier
- IdeaTek
- Cox Communications
- Jackson Energy Authority
- Mediacom
- MLGC
- Spectrum (Charter Communications
- Starry
- Verizon (Fios only)
- Vermont Telephone Company
- Vexus Fiber
- Wow! Internet, Cable, and TV

[25] FACT SHEET: President Biden and Vice President Harris Reduce High-Speed Internet Costs for Millions of Americans | The White House

14.2 Key Programs for Llano County Consideration

Commented [JT5]: @Melissa Beaudry did the "Conclusion" get removed?

Four key programs for Llano County to consider being an applicant or partner on applying include the following programs. There are various factors for consideration, including match requirements, levels of service, partnership agreements and other factors, that would impact which funding source(s) should be applied to and leveraged collectively to try and bring as much funding to Llano County as possible.

Table 18: Llano County Specific Funding Opportunities

Grant Program	Funding Agency	Description	Timeline	Total Allocation
Middle Mile Grant Program[26]	National Telecommunications and Information Administration (NTIA)	National awards will be issued on a technology-neutral, competitive basis to eligible entities for the construction, improvement, or acquisition of Middle Mile infrastructure.	Sept. 30, 2022	$1 Billion (Nationally Competitive)
Capital Projects Fund[27]	American Rescue Plan Act (ARPA)	For payments to states, territories and tribal governments to complete capital projects directly enabling work, education and health monitoring, including remote options, in response to the public health emergency	Sept. 24, 2022 (State to submit plan)	$10 Billion, ($500 Million to Texas)
ReConnect Program[28]	United States Department of Agriculture (USDA)	Provides loans and grants for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide broadband service in eligible rural areas.	Fall 2022	$2 Billion (Nationally Competitive)
Broadband Equity, Access, And Deployment (BEAD) Program[29]	National Telecommunications and Information Administration (NTIA)	Through state allocation and planning, this program intends to expand high-speed internet access by funding planning, infrastructure deployment and adoption programs.	Spring 2023 (State submitting plan by July 18, 2022)	$42.5 Billion ($100 million initial to Texas)

[26] Enabling Middle Mile Broadband Infrastructure Program | Internet for All
[27] Capital Projects Fund | U.S. Department of the Treasury
[28] ReConnect Loan and Grant Program | USDA
[29] Broadband Equity, Access, and Deployment (BEAD) Program | Internet for All

15 APPENDIX

15.1 Acronyms

ACRONYM	MEANING
ACP	Affordable Connectivity Program
ADSL	Asymmetric Digital Subscriber Line
AMR	Automatic Meter Reading System
BOM	Bill Of Materials
BDC	Broadband Data Collection
BDO	Broadband Deployment Office
BEAD	Broadband Equity, Access, And Deployment
BOT	Build Operate Transfer
CAPCOG	Capital Area Council Of Governments
CTEC	Central Texas Electric Cooperative
CBRS	Citizens Broadband Radio Service
CRA	Community Reinvestment Act
CAF	Connect America Funds
COG	Council Of Governments
DDoS	Distributed Denial-Of-Service
OECD	Economic Co-Operation And Development
ESC	Education Service Center
EBB	Emergency Broadband Benefit Program
EMS	Emergency Medical Services
EOC	Emergency Operations Centers
FCC	Federal Communications Commission
FPHA	Federal Public Housing Assistance
FTTH	Fiber To The Home
FTTP	Fiber To The Premise
GLO	General Land Office
GIS	Geographic Information Systems
Gb	Gigabit
GPON	Gigabit Passive Optical Networks
Gbps	Gigabits Per Second
GDP	Gross Domestic Product
HDPE	High Density Polyethylene
HLD	High Level Design
ISD	Independent School District
IT	Information And Technology
IIJA	Infrastructure Investment And Jobs Act
ISP	Inside Plan Implementation
ISP	Internet Service Providers

KMZ	Keyhole Markup Language
LEA	Local Education Agency
LTE	Long-Term Evolution
LMI	Low- And Moderate-Income
LCRA	Lower Colorado River Authority
MGI	Mckinsey Global Institute
Mb	Megabit
Mbps	Megabits Per Second
MPLS	Multi-Protocol Label Switching
NTIA	National Telecommunications And Information Administration
NG911	Next Generation 911
OSS/BSS	Operations And Business Support Systems
OOM	Order Of Magnitude
OSP	Outside Plant Implementation
POP	Points Of Presence
PALs	Priority Access Licenses
PWI	Public Welfare Investments
PPP	Public-Private Partnerships
PSAP	Public-Safety Answering Point
QoS	Quality Of Service
RFI	Request For Information
RFP	Request For Proposals
RFQ	Request For Qualifications
ROI	Return On Investment
ROW	Right Of Way
RDOF	Rural Digital Opportunity Fund
SHR	Self-Healing Ring
SNAP	Supplemental Nutrition Assistance Program
SSI	Supplemental Security Income
TxDOT	Texas Department Of Transportation
Tribal TANF	Tribal Temporary Assistance For Needy Families
USDA	United States Department Of Agriculture
USAC	Universal Service Administrative Company
UAR	Utility Accommodation Rules
VPN	Virtual Private Network
WISP	Wireless Internet Service Providers
WIC	Women, Infants, And Children

15.2 Glossary of Terms (from Broadband.Money[30] and NTIA[31])

0-9	
3G	The term for the 3rd generation wireless telecommunications standards usually with network speeds of less than 1 Mbps
4G	The term for 4th generation wireless telecommunications standards usually with network speeds greater than 1 Mbps.
5G	The term for emerging 5th generation wireless telecommunications standards usually associated with network speeds of up to 1 Gbps or more
63-20 Financing	In Revenue Ruling 63-20 the IRS ruled that, in certain circumstances, bonds issued by a nonprofit corporation (the "Nonprofit") will be considered issued on behalf of a Governmental Unit – thus allowing the interest on such bonds to be eligible for tax-exempt treatment. A 63-20 financing may help avoid certain political and legal hurdles that otherwise might be present if the Governmental Unit were to issue the bonds directly.
A	
Aerial Installation	A type of fiber optic cable that is usually used for outside installation on poles. Due to its installation environment, the design of aerial fiber optic cable must consider how to protect it from destruction by nature or man-made damage.
Affidavit	A written declaration or statement that is sworn or affirmed before a person who has authority to administer an oath. Affidavits verify the legitimacy of a claim and are used in conjunction with witness statements or other related evidence in a dispute or a criminal matter. The person who signs the affidavit must be personally aware of the facts contained within, and he or she must swear that the affidavit is 100% true.
Affordable Connectivity Program (ACP)	Under the Infrastructure Investment and Jobs Act, the previous Emergency Broadband Benefit Program has been renamed the Affordable Connectivity Program. Although the program's benefit has been lowered from $50/month to $30/month, the definitions and operative terms of the program remain intact. Under those definitions, an Affordable Connectivity offer is one that is affordable for four-person household that includes two dependents under age 18 and has an income 136% of poverty line. IIJA Section 60502, "Broadband Affordability". For white-labeled, turnkey ACP automation, please contact Ready.
Asymmetric	When the upload and download speeds do not match. A rate of 10 Mbps down/1 Mbps up would be asymmetric.
Asymmetrical Digital Subscriber Line (ADSL)	A form of Internet service communications technology that delivers constantly accessible data transmissions over copper telephone lines. ADSL is a common brand of DSL and has download speeds between 2 and 6 Mbps and upload speeds reaching 512 Kbps.
Asynchronous Transfer Mode (ATM)	A transmission method where information is re-structured into cells. It is asynchronous due to the fact that the recurrence of cells from an individual user is not necessarily periodic.

[30] https://broadband.money/broadband-grant-terms
[31] https://broadbandusa.ntia.doc.gov/sites/default/files/publication-pdfs/bbusa_broadband_glossary.pdf

Attestation	The process for scrutinizing the authenticity of a document by corroborating every detail given on it and then manifesting it authentic with the sign and stamp of verifying personnel on it.
Average Revenue Per User (ARPU)	The term is used by companies that offer subscription services to clients. It is a measure of the revenue generated by one subscriber per unit time, typically per year or month. It is a particularly useful measurement for companies in the telecommunications industry, which relies on subscribers or users.
B	
BEAD Timelines	Eligible entities decide whether to participate in the BEAD program, which will provide ~$42B for infrastructure planning and implementation. If they choose to, they need to submit a letter of intent to NTIA by the deadline. To read in more details about the multitude of deadlines for the BEAD program, as well as any newly established deadlines from the National Telecommunications and Information Administration themselves, refer to our Timeline of Key Milestones and Grant Application Deadlines.
Backbone	The Internet is really a network of networks, and the large trunk lines that connect them are referred to as the "backbone." It can also be thought of as being like the highway system: the interstate highways are the backbones that connect regions that have highway networks of their own.
Bandwidth	In the world of Internet service, bandwidth has come to mean the speed of Internet service, measured in bits per second. Not to be confused with bandwidth referring to a range of radio wave frequencies, which may be used in more technical discussions about how data is transferred.
Bank Loan	An amount of money loaned at interest by a bank to a borrower, usually on collateral security, for a certain period of time.
Bit	A bit is the basic unit of information in computing. The name comes from "binary digit," and each bit has one value, either 1 or 0, or on and off. It usually takes eight bits to represent one character of text; a group of eight bits makes a byte. Data file sizes are measured in bytes while data speed is measured in bits.
Broadband	Shorthand term for any high-speed Internet access that is faster than dial-up and, unlike dial-up, is always on. Over the years, as what we use the Internet for has demanded a larger capacity for moving data, different entities have set speed definitions for broadband, implying that an Internet-access service shouldn't be called "broadband" or "high-speed" unless it meets a certain speed level.
Broadband Deployment Accuracy And Technological Availability (DATA) Act	Passed on March 10, 2020, just prior to the significant shutdown occasioned by the coronavirus pandemic, the Broadband Deployment Accuracy and Technological Availability (DATA) Act established new guidelines and rules for the Federal Communications Commission's production of broadband availability and deployment maps. The rules effectively require an address-by-address inventory of broadband. These requirements are codified at 47 U.S.C. Section 642.
Broadband Deployment Accuracy And Technological Availability (DATA) Act Maps	Under the Infrastructure Investment and Jobs Act, funding eligibility for areas that are "Unserved" and "Underserved" will be determined by reference to the Broadband DATA Maps created under the Broadband DATA Act. IIJA, Section 60103.

Broadband Equity, Access And Deployment Program (BEAD) Program	A $42.45B formula grant program directed towards states and territories with the objective of closing the availability gap, as Congress finds that "access to affordable, reliable, high-speed broadband is essential to full participation in modern life in the United States."
Broadband Initiatives Program (BIP)	The Broadband Infrastructure Program is a $288 million broadband deployment program directed to partnerships between a state, or one or more political subdivisions of a state, and providers of fixed broadband service to support broadband infrastructure deployment to areas lacking broadband, especially rural areas.
Broadband Technology Opportunities Program (BTOP)	The Broadband Technology Opportunities Program (BTOP) is an approximately $4 billion grant program administered by NTIA to help bridge the technological divide; create jobs; and improve education, health care, and public safety in communities across the country. Funded by the American Recovery and Reinvestment Act of 2009, BTOP projects are deploying broadband Internet infrastructure, enhancing and expanding public computer centers, and encouraging the sustainable adoption of broadband service.
Buried Fiber Deployment	Buried fiber deployments are buried below the layer where the soil freezes so they are immune to wind and ice damage. This means that underground deployments are often more reliable than aerial routes, especially where poor weather is common.
Burstable	Authorizes a connection to exceed its specified speed, normally up to a set maximum capacity for a period of time.
Burst Speed	A method which momentarily allots additional bandwidth to consumer's services for short periods of time.
Byte	A unit of digital information that most commonly consists of eight bits. Historically, the byte was the number of bits used to encode a single character of text in a computer and for this reason it is the smallest addressable unit of memory in many computer architectures.
C	
Cable	A category of broadband Internet access that uses the infrastructure of cable TV network to provide Internet services. Cable Internet provides connectivity from the Internet service provider (ISP) to the end users in a similar manner as digital subscriber line (DSL) and fiber-to-the-home (FTTH).
Capital Expenditures (Capex)	A category of broadband Internet access that uses the infrastructure of cable TV network to provide Internet services. Cable Internet provides connectivity from the Internet service provider (ISP) to the end users in a similar manner as digital subscriber line (DSL) and fiber-to-the-home (FTTH).
Capital Structure	Also Known As: Capital Structure - The structure of all capital that is invested into a company. At a high level, this means that the capital stack includes both the equity and the debt invested to date. More specifically, though, this means all types of both equity and debt. That means both common and preferred equity, and both junior and senior debt. These categories can be further split. You can have different types of preferred equity, for example.

Census Block	The smallest geographic area for which the Bureau of the Census collects and tabulates decennial census data. Generally small in area. In a city, a census block looks like a city block bounded on all sides by streets. Census blocks in suburban and rural areas may be large, irregular, and bounded by a variety of features, such as roads, streams, and transmission lines. In remote areas, census blocks may encompass hundreds of square miles. Census blocks are grouped into block groups, which are grouped into census tracts.
Challenge Process	The process of grant applicants engaging communities they intend to serve, and the right of refusal held by communities for broadband grant applications. Each Eligible Entity shall develop and describe in the Initial Proposal, a transparent, evidence-based, fair, and expeditious challenge process under which a unit of local government, nonprofit organization, or broadband service provider can challenge a determination made by the Eligible Entity in the Initial Proposal as to whether a particular location or community anchor institution within the jurisdiction of the Eligible Entity is eligible for grant funds.
Churn	Churn rate, sometimes known as attrition rate, is the rate at which customers stop doing business with a company over a given period of time. Churn may also apply to the number of subscribers who cancel or don't renew a subscription. The higher your churn rate, the more customers stop buying from your business.
Coax	A type of cable used to transmit data, the internet, video and voice communications. A coax cable is made up of an aluminum and copper shield with an outer plastic jacket with the dielectric insulator helping to minimize signal loss.
Common Equity	The amount that all common shareholders have invested in a company. Most importantly, this includes the value of the common shares themselves. However, it also includes retained earnings and additional paid-in capital.
Communications Act Of 1934	Signed into law by Franklin D. Roosevelt, the Communications Act of 1934 created a unified regulatory system for communications. Among other things, it created the Federal Communications Commission, which replaced the Federal Radio Commission, and took over the regulation of interstate telephone services from the Interstate Commerce Commission. The central principle of the act was that a comprehensive nationwide communications system "with adequate facilities at reasonable charges" was good for the country.
Community Anchor Institution (CAI)	Signed into law by Franklin D. Roosevelt, the Communications Act of 1934 created a unified regulatory system for communications. Among other things, it created the Federal Communications Commission, which replaced the Federal Radio Commission, and took over the regulation of interstate telephone services from the Interstate Commerce Commission. The central principle of the act was that a comprehensive nationwide communications system "with adequate facilities at reasonable charges" was good for the country.
Conduit Financing	A means for private companies, nonprofit organizations (NPO), and public entities to raise capital via tax-exempt municipal bonds to fund large-scale

	projects that typically benefit the general public. Such projects can include hospitals, airports, industrial and housing projects, public facilities, and schools.
Connect America Fund (CAF)	The Connect America Fund was unveiled in 2011 as part of the Universal Service Fund, redesigned to help fund Internet infrastructure in the nation's high-cost areas. CAF put a new emphasis on Internet service.
Connecting Minority Communities Pilot Program (CMC) Pilot Program	The Connecting Minority Communities Pilot Program is a $268 million NTIA grant program to Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), and Minority-Serving Institutions (MSIs) for the purchase of broadband internet access service and eligible equipment or to hire and train information technology personnel. The CMC grant program was established by the Consolidated Appropriations Act of 2021 to support MSIs and their surrounding communities.
Consolidated Appropriations Act Of 2021	The Consolidated Appropriations Act of 2021 created the $980 million program to provide grants to expand regular and remote broadband access and adoption by Tribal entities, the $268 million Connecting Minority Communities Pilot Program, and the Emergency Broadband Benefit.
Content Provider	A website or organization that handles the distribution of online content such as blogs, videos, music or files.
Co-Op	Also Known As: Co-Op - An autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned enterprise. Cooperatives are democratically owned by their members, with each member having one vote in electing the board of directors.
Customer Premises Equipment (CPE)	Refers to any piece of connected equipment that is used for accessing the Internet or generally accessing services on a provider network, whether directly or indirectly connected to that network. CPE can be provided by the telecommunications provider, such as a cable operator, telephone company or satellite provider. These companies either rent this equipment to the customer, provide it at no charge as part of the service, or allow a customer to purchase and provide their own equipment.
D	
Dark Fiber	Fiber that is in place but not being used for broadband services. ("non-lit" fiber, also see "Lit Fiber").
Data Packet	Data is sent over the Internet as packets. One file is divided into many packets when it is sent, then reassembled into one file again at its destination. Using packets allows data to travel much faster since the individual packets are smaller than the original file and can travel separately over different routes before reassembling.
Debt	Debt is an obligation that requires one party, the debtor, to pay money or other agreed-upon value to another party, the creditor. Debt is a deferred payment, or series of payments, which differentiates it from an immediate purchase.
Debt/EBITDA	A ratio measuring the amount of income generated and available to pay down debt before covering interest, taxes, depreciation, and amortization expenses. Debt/EBITDA measures a company's ability to pay off its incurred debt.

Demand Point Passed (DPP)	Total number of active and potential subscribers that an ISP's network could service.
Digital Divide	The Digital Divide, or Digital Canyon, is the gap between people who have access to affordable, reliable Internet service (and the skills and gadgets necessary to take advantage of that access) and those who lack it.
Digital Equity	Recognizes that digital access and skills are now required for full participation in many aspects of society and the economy. Digital Equity links Digital Inclusion to social justice and highlights that a lack of access and/or skills can further isolate individuals and communities from a broad range of opportunities.
Digital Inclusion	Implies that individuals and communities have access to robust broadband connections; Internet enabled devices that meet their needs; and the skills to explore, create and collaborate in the digital world.
Digital Literacy	The ability to leverage current technologies, such as smartphones and laptops, and Internet access to perform research, create content and interact with the world.
Digital Skills	Any skills related to operating digital devices or taking advantage of digital resources.
Digital Subscriber Line (DSL)	A group of technologies used to transmit data over telephone lines. DSL made high-speed Internet access possible for ordinary consumers without having to do a great deal of rewiring. "ADSL" stands for asymmetric digital subscriber line, meaning the data travels downstream and upstream at different rates.
Data Over Cable System Interface Specification (DOCSIS)	The international telecommunications standard for cable signaling data and spectrum sharing.
E	
Earnings Before Interest Taxes Depreciation And Amortization (EBITDA)	A company or project's earnings before interest, taxes, depreciation, and amortization is a measure of a company's profitability of the operating business only, thus before any effects of indebtedness, state-mandated payments, and costs required to maintain its asset base.
Economic Development Incentive	An array of benefits designed to promote new business activity or to encourage business or job retention. These benefits principally encompass tax and economic incentives provided by federal, state, or local governmental bodies. Other entities, such as utilities and non-profits, can also make incentives available for these purposes. They accord the recipient, in some manner, a monetary benefit (i.e., tax incentives) or an in-kind benefit (e.g., state regulatory releases of environmental liability, municipal infrastructure improvements).
Eligible Community Anchor Institution	A Community Anchor Institution that lacks access to gigabit-level broadband service. IIJA, Section 60102.
Eligible Entity	Under the Infrastructure, Investment and Jobs Act, an "eligible entity" is a state, a territory, the District of Columbia, or an eligible Tribal entity. IIJA, Section 60102.
Enterprise Value (EV)	A measure of a company's total value. It is a combination of the value of common stock, preferred stock, cash, and debt. Determining the value of public companies is much easier than private companies which don't make their financials available to the public. You can use the comparable company analysis approach, which involves looking for similar public companies. Using findings from a private company's closest public

	competitors, you can determine its value by using the EBITDA or enterprise value multiple.
Equity	The value that would be returned to a company's shareholders if all of the assets were liquidated and all of the company's debts were paid off. Equity financing involves selling a stake in your company or project in return for a cash investment. Unlike a loan, equity finance doesn't carry a repayment obligation. Instead, investors buy shares in the company in order to make money through dividends (a share of the profits) or by eventually selling their shares.
F	
FCC Registration Number (FRN)	The FCC Registration Number (FRN) is a 10-digit unique identifying number that is assigned to entities doing business with the Federal Communications Commission. The FRN is obtained through the Commission Registration System (CORES).
Feasibility Study	An analysis that considers all of a project's relevant factors—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully.
Federal Communications Commission (FCC)	The FCC was created by the Communications Act of 1934 and today regulates "interstate communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia and U.S. territories."
Fiber	A fiber optic cable is made up of bundles of hair-thin strands of very pure glass or plastic. Data passes over them in the form of light pulses created by lasers. Because of the purity of the glass or plastic, data can travel much farther and faster on fiber than on copper wires with much less loss of data.
Fiber-To-The-Curb (FTTC)	The installation and use of optical fiber cable directly to curbs near homes or businesses. Coaxial cable or another medium carries signals the short distance from the curb to the home or business. As such, this system is inexpensive to employ. The basic idea of fiber to curb technology is that suitable wires can carry high-speed signals at short distances. The twisted wire pairs or coaxial cables have acceptable bandwidth loss while sending signals only a few hundred feet. Also known as integrated fiber in the loop (IFITL).
Fiber-To-The-Home (FTTH)	Equipment used in fiber access deployments where fibers extend all the way to the end-user premises and the equipment is designed and optimized for use in residential applications.
Fiber-To-The-Node (FTTN)	Equipment used in fiber access deployments where fibers extend to the network connection point/box/node in a neighborhood and no farther.
Fiber-To-The-Premises (FTTP)	The installation and use of optical fiber from a central point directly to individual buildings such as residences, apartment buildings and businesses to provide high-speed internet access.
Fixed Wireless Broadband Access	The use of wireless devices/systems in connecting two fixed locations, such as offices or homes. The connections occur through the air, rather than through fiber, resulting in a less expensive alternative to a fiber connection.
Formula Grant	A United States federal grant specifying a precise formula in the legislation creating the program. Formula grants include quantifiable elements, such as population, amount of tax effort, proportion of

	population unemployed or below poverty level, density of housing, or rate of infant mortality.
G	
General Obligation (GO) Bond	A municipal bond backed solely by the credit and taxing power of the issuing jurisdiction rather than the revenue from a given project. General obligation bonds are issued with the belief that a municipality will be able to repay its debt obligation through taxation or revenue from projects. No assets are used as collateral.
Grant Adjusted Yield On Cost (YOC)	The percentage an unlevered broadband project pays out per year in EBITDA based on the initial cost of the project but the grant is subtracted from total project cost.
Grant Anticipation Note (GAN)	Short-term municipal financing issued in anticipation of receiving a grant from the federal government or one of its agencies.
Gross Profit Margin	Is net sales less the cost of goods sold (COGS). In other words, it's the amount of money a company retains after incurring the direct costs associated with producing the goods it sells and the services it provides. The higher the gross margin, the more capital a company retains, which it can then use to pay other costs or satisfy debt obligations. Companies use gross margin, gross profit, and gross profit margin to measure how their production costs relate to their revenues. For example, if a company's gross margin is falling, it may strive to slash labor costs or source cheaper suppliers of materials. Alternatively, it may decide to increase prices, as a revenue-increasing measure. Gross profit margins can also be used to measure company efficiency or to compare two companies of different market capitalizations.
Guaranteed Bank Loan	A guaranteed loan is backed by a third party, and if the borrower defaults, the third party repays the loan.
H	
High Cost Area	A "high-cost area" is an Unserved area in which the head of the National Telecommunications and Information Administration determines that the cost of deploying broadband service is higher than the average cost of deploying broadband service to other Unserved areas. The head of NTIA has flexibility in making the determination, also considering: -the remote location of the area -the population density of the area -the unique topography of the area -a high rate of poverty -any other factor that contributes to the cost of deploying broadband service IIJA, Section 60102.
I	
Incumbent And Competitive Local Exchange Carriers (ILEC)	Before the Telecommunications Act of 1996, telephone companies operated as legal monopolies in defined territories of service, called exchanges. After the 1996 act and its emphasis on competition, these carriers became incumbent local exchange carriers in their operating territories. At the same time competing local exchange carriers were

	allowed to enter any territory, build their own infrastructure, and offer services.
Indefeasible Right Of Use (IRU)	The effective long-term lease (temporary ownership) of a portion of the capacity of an international cable. IRUs are specified in terms of a certain number of channels of a given bandwidth. IRU is granted by the company or consortium of companies that built the (usually optical fiber) cable. Some IRU legal agreements forbid resale of the capacity ownership. For at least one major international cable owner, an IRU ownership period is granted for 25 years. An IRU gives a large-scale Internet service provider (ISP) the ability to assure its own customers of international service on a long-term basis.
Industrial Development Bond (IRB)	Municipal debt securities issued by a government agency on behalf of a private sector company and intended to build or acquire factories or other heavy equipment and tools.
Infrastructure Investment & Jobs Act	Passed by the Senate on August 10, 2021, by the House of Representatives on November 5, 2021, and is expected to be signed into law by President Joe Biden on November 15, 2021, the Infrastructure Investment and Jobs Act (IIJA) is a landmark bipartisan bill providing $65 billion in funding for broadband infrastructure and deployment.
Interconnection	The linking of numerous telecommunications networks to exchange user traffic.
Internet Protocol	The computer language that allows all the above-mentioned technologies to speak to each other. Before the invention of Internet protocol (IP), telephone networks could only transfer data on other telephone networks, cable networks on other cable networks and so on. IP makes the transfer of data technology-neutral, allowing networks everywhere to transfer data anywhere.
Internet Service Provider (ISP)	An organization that provides services for accessing, using, or participating in the Internet. Internet service providers can be organized in various forms, such as commercial, community-owned, non-profit, or otherwise privately owned.
L	
Last Mile	The term that describes the last link connecting the provider's network to the customer's premises, either a house or a business. The Last Mile is the most expensive part of the network to build or upgrade because of the number of units involved. One fiber cable may be trenched down a street, but there may be twenty houses on the street that need to be connected. Upgrading the copper cable connection between each house and the fiber in the street would be the Last Mile. This last link can also be the reason customers often don't receive the level of Internet speed advertised by their provider. Since data travels more slowly on copper compared to fiber, when the data hits the copper, it slows down.
Latency/ Ping	The reaction time of your connection. How quickly your device gets a response after you've sent out a request. A low latency (fast ping) means a more responsive connection. Latency is measured in milliseconds (ms).
Letter Of Credit (LOC)	A letter from a bank guaranteeing that a buyer's payment to a seller will be received on time and for the correct amount. In the event that the

	buyer is unable to make a payment on the purchase, the bank will be required to cover the full or remaining amount of the purchase.
Limited-Tax General Obligation Pledge	Asks the issuing local government to raise property taxes if necessary to meet existing debt service obligations. However, this increase is bound by a statutory limit. With limited-tax general obligation pledges, governments can still use a part of already-levied property taxes, use another stream of income, or raise property taxes to an amount equating to existing debt service payments to answer its debt obligations.
Lit Fiber	An active fiber optic cable capable of transmitting data.
Loan	A type of credit vehicle in which a sum of money is lent to another party in exchange for future repayment of the value or principal amount. In many cases, the lender also adds interest and/or finance charges to the principal value which the borrower must repay in addition to the principal balance.
Local Area Network (LAN)	A group of network devices that are on a high-speed connection and typically within the same building or location.
Local Coordination	The process of grant applicants engaging communities they intend to serve, and the right of refusal among communities held by communities for broadband. Language in the local coordination component is going to drive community
Local Multipoint Distribution Service (LMDS)	A wireless broadband service that uses microwave signals to render communications service – voice, data, Internet – to customers within the Last Mile.
Low-Cost Broadband Service Option	Under the Infrastructure, Investment and Jobs Act, each state will submit to NTIA its own definition of a "low-cost broadband service option." Each state's definition shall apply to the award recipients that receive funds from the state in question. "Nothing in this title may be construed to authorize the Assistant Secretary or the National Telecommunications and Information Administration to regulate the rates charged for broadband service." IIJA Section 60102, subsection (h)(5)(D).
Long Term Evolution (LTE)	A 4G wireless broadband technology that provides speeds up to 100 Mbps download and 30 Mbps upload.
M	
Make Ready Work	Before an Internet Service Provider (or any company) can add a new attachment or line to a utility pole, the existing attachments may need to be moved around so that the pole can be made ready to handle a new attachment or line. This is known as 'Make Ready Work.' The reason Make Ready Work is necessary is that, under Federal Law, to prevent the risk of outages or other issues, lines on utility poles must be spaced a certain distance apart from each other based on how many lines are on the pole. Under federal guidelines, Make Ready Work must occur sequentially, meaning that attachments can only be moved in the order with which they were originally placed on the line. This process can create massive delays, as well as other large disruptions in high traffic areas, such as alongside major roadways. In addition, the make ready work can take months, or even years, to complete as every company involved must send out their own approved contractor to move only their respective attachment. Each contractor must also schedule their work to not conflict

	with other contractors performing Make Ready Work, as well as taking into account other local factors, such as weather, traffic, and maintenance work (such as road paving). These factors must be considered as the United States primarily uses aerial work platforms to perform Make Ready Work.
Match Funding	The portion of the project or program costs that are not paid by the funding agency. If the award is federal, only non-federal expenses qualify as cost sharing. Most broadband grant programs require between 25% to 50% matching capital. Common private match capital sources include equity, debt, and forward-receivables purchases. For more information about match capital including capital providers, see the Match Capital channel. Notes - Sub-grantees are required to provide a contribution of at least 25% derived from non-Federal funds (or funds from a Federal regional commission or authority), except in high-cost areas. Waivers to match can be granted at the discretion of NTIA. Eligible Sources - While most applicants will get their match capital from their own balance sheet, or through a combination of equity and / or debt investors, the match may also be provided by the State, a unit of local government, a utility company, a cooperative, a nonprofit organization, a for-profit company, regional planning or governmental organization, a Federal regional commission or authority, or an combination thereof. May include in-kind contributions and may include funds that were provided to an Eligible Entity or sub-grantee under: -Families First Coronavirus Response Act -The CARES Act -Consolidated Appropriations Act 2021 -The American Rescue Plan Act of 2021 -Any amendment made by an Act described above For definition, Federal regional commission or authority means: -Appalachian Regional Commission -Delta Regional Authority -Denali Commission -Northern Border Regional Commission
Mezzanine Debt	Any subordinated debt or preferred equity instrument that represents a claim on a company's assets which is senior only to that of the common shares. Mezzanine financings can be structured either as debt or preferred stock. Mezzanine debt bridges the gap between debt and equity financing and is one of the highest-risk forms of debt—being subordinate to pure debt but senior to pure equity.
Middle Mile/ Backhaul	The section of the network that connects the Last Mile portion of the network to the service provider's core network, where the services such as broadband, TV, and phone service originate from. More specifically, any broadband infrastructure that does not connect directly to an end-user location, including an anchor institution; and includes leased dark fiber, interoffice transport, backhaul, carrier-neutral internet exchange facilities, carrier-neutral submarine cable landing stations, undersea cables, transport connectivity to data centers, special access transport, and other similar services; and wired or private wireless broadband infrastructure,

	including microwave capacity, radio tower access, and other services or infrastructure for a private wireless broadband network, such as towers, fiber, and microwave links.
Millimeter Wave	Millimeter waves are also known as extremely high frequency (EHF). It's a radio frequency that would allow transmission frequencies between 30 GHz and 300 GHz, compared to 5 GHz frequencies used by previous mobile devices. It also has wavelengths between 1 mm and 10 mm, compared to the several-dozen centimeter wavelengths possessed by smartphones' current radio waves. At this point in time, millimeter waves are only used by radar systems like satellites. But mobile network providers have already started utilizing EHF in various ways, making it a new and promising approach. There are two ways to increase the speed of wireless data transmission. The first is increasing spectrum utilization. The second is increasing the spectrum bandwidth, often seen as a more simple and direct approach. That is the approach that millimeter waves would provide for 5G to increase transmission speeds.
Mobile	Mobile wireless Internet, accessed via smartphones. Data is transferred between cell phone towers, which are connected to the service provider by fiber.
Multiple Dwelling Unit	Residential duplexes, triplexes, fourplexes, apartment buildings, condominiums, mobile home parks, trailer courts, or similar types of multiple dwelling unit arrangements on one parcel of land.
Municipal Bond	A debt security issued by a state, municipality, or county to finance its capital expenditures, including the construction of highways, bridges, or schools. They can be thought of as loans that investors make to local governments. Municipal bonds are often exempt from federal taxes and most state and local taxes (for residents), making them especially attractive to people in higher income tax brackets.
N	
National Telecommunications And Information Administration (NTIA)	The National Telecommunications and Information Administration is an agency of the U.S. Department of Commerce. The NTIA resides within the Executive Branch of the federal government, and is the president's principle advisor of telecommunications matters. By contrast, the Federal Communications Commission - the other agency with significant telecommunications- and broadband-related responsibilities - is an independent agency outside of the official purview of the White House. NTIA has existed since 1978 and has numerous communications responsibilities. It is the principal federal agency responsible for administering grants and funding under the Infrastructure Investment and Jobs Act.
Network Node	A connection point in a communications network. Each node is an endpoint for data transmissions or redistribution. Nodes have either a programmed or engineered capability to recognize, process and forward transmissions to other network nodes.
Nielsen's Law Of Internet Bandwidth	A high-end user's connection speed grows by 50% per year.

Notice Of Funding Opportunities (NOFO)	Notice of Funding Opportunities (NOFO) describe the requirements under which a federal agency will award grants for funding as instructed by a specific law. In this case, it's the Infrastructure, Investment, and Jobs Act, Public Law 117-58, November 15th. 2021. The Infrastructure, Investment, and Jobs Act, provides new federal funding for the Assistant Secretary to make grants on a competitive basis for the deployment of broadband infrastructure. It also provides funding for Middle Mile projects, tribal broadband funding and digital inclusion and digital equity activities
O	
Open Access Network	Networks that offer wholesale access to network infrastructure or services provided on fair and reasonable terms with some degree of transparency and nondiscrimination.
Operating Margin (EBITDA Margin)	A measure of a company's operating profit as a percentage of its revenue. Knowing the EBITDA margin allows for a comparison of one company's real performance to others in its industry. EBITDA margin is calculated by dividing EBITDA by revenue.
Optical Line Terminal (OLT)	The device that serves as your ISPs endpoint of the passive optical network (PON). The OLT also provides the interface between a PON and your ISP's core network. Simply put, an OLT is ISP equipment. The OLT is the device that exists at your ISPs central hub. An OLT has a few purposes: -Control the information flowing upstream and downstream. -Convert the standard signals used by fiber optic service to the frequency and framing used by a PON system. -Coordinate the multiple analog or digital signals that are combined into one signal (called multiplexing) that happens between the ONT conversion devices. The upstream channel transmits different types of data and voice traffic from users to the ISP. The downstream channel is what receives data, voice and video traffic and sends it to all ONT devices on your network.
Optical Network Terminal (ONT)	The device that serves as the telecommunication chain's endpoint of the PON on your end. Another abbreviation to know is an ONU, which stands for Optical Network Unit. ONU and ONT are often used interchangeably. More or less, they are the same. Simply put, an ONT/ONU refer to the user side equipment. The ONT/ONU is the device that exists at your home or office. The ONT acts as an optical modem and communicates with your ISP through a fiber optical cable. The ONT sends user data upstream to the OLT and receives data on the downstream channel. ONT and OLT are essential devices in a PON network system.
Outside Plant	In civilian telecommunications, outside plant refers to all of the physical cabling and supporting infrastructure (such as conduit, cabinets, tower or poles), and any associated hardware (such as repeaters) located between a demarcation point in a switching facility and a demarcation point in another switching center or customer premises.
P	

Packet Loss	Occurs when a packet of data being sent over the internet is not received or is incomplete. This is described in percentage of packets lost compared to packets sent. Packet loss in most cases is a result of poor signal/line quality.
Peering And Transit Agreements	Agreements that govern moving one entity's data traffic over another entity's network. With peering agreements, network owners allow each others' traffic to move over their networks at no cost or in some kind of cost-sharing arrangement. With transit agreements, the entity that wants to move the data (it may be an ISP or a content provider like Netflix) must pay the network owner to use their network. If a provider moves its own customers' data on its own network (e.g., sending an email to someone served by the same provider), there are no fees. If two entities don't have an agreement, the data may have to travel farther around on networks they do have agreements with, which can also slow traffic down.
Point of Presence	The particular place or facility where local Internet service providers connect to other networks. Distance from the Point of Presence can affect service availability and pricing.
Point To Point	A Point to Point Connection is a private data connection securely connecting two or more locations for private data services. A point to point connection is a closed network data transport service which does not traverse the public Internet and is inherently secure with no data encryption needed. Point to Point connections are available in a range of bandwidth speeds including point to point T1, point to point Ethernet or point to point DS3. A point to point connection provides unparalleled quality of service (QoS) as it is not a shared service (a private line) and follows the same direct network path every time. Point to Point links are used by businesses to provide reliable, secure point to point network data service for applications including credit card processing, file sharing, data backup, point to point VOIP, and video conferencing. A point to point network can also be configured to carry voice, video, Internet, and data services together over the same point to point connection. Point to Point circuits are also known as a Point to Point Link, Private Line, Leased Line, or Data Line.
Preferred Equity	A type of shareholder class. When a company files for bankruptcy, equity and debt holders are paid in a specific order that is dependent on the type of financing they are holding (also called the capital stack): 1. Bondholders (debt) 2. Preferred equity 3. Common stock
Project Finance	Project finance is the funding (financing) of long-term infrastructure using a non-recourse or limited recourse financial structure. The debt and equity used to finance the project are paid back from the cash flow generated by the project.
Public-Private Partnership	Arrangements in which a governmental unit engages a private party to deliver an integrated solution for the design, construction, financing, operation and/or management of new or existing government-owned infrastructure projects.
Public Utility Company	An organization that maintains the infrastructure for a public service (often also providing a service using that infrastructure). Public utilities are subject to forms of public control and regulation ranging from local community-based groups to statewide government monopolies. Public utilities are meant to supply goods/services that are considered essential;

	water, gas, electricity, telephone, and other communication systems represent much of the public utility market.
R	
Revenue Bond	A category of municipal bond supported by the revenue from a specific project, such as a toll bridge, highway, or local stadium. Revenue bonds that finance income-producing projects are thus secured by a specified revenue source. Typically, revenue bonds can be issued by any government agency or fund that is managed in the manner of a business, such as entities having both operating revenues and expenses.
Revolving Credit Line	A type of financing that allows a borrower to maintain an open credit line up to a specified limit and make minimum monthly payments based on the balance and interest rate per the credit agreement. A revolving credit line typically comes with a variable interest rate set by a bank, meaning it can fluctuate with market conditions.
Rights-of-Way (ROW)	ROW are legal rights to pass through property owned by another. ROW are frequently used to secure access to land for digging trenches, deploying fiber, constructing towers and deploying equipment on existing towers and utility poles.
Rural Digital Opportunity Fund (RDOF)	The RDOF is the latest iteration of the FCC's universal service fund (USF), more recently referred to as the Connect America Fund (CAF). This program was developed decades ago to fund the construction and operation of telecommunications networks, and later, broadband networks. The goal of the program was to ensure comparable telecommunications services at affordable costs to rural Americans, to be on par with their urban counterparts. The initial focus of the USF was telephone service, but it has shifted focus in recent years to broadband service through the CAF. The RDOF is an extension of the CAF and will provide $20.4 billion in funding over a ten-year period to support broadband networks in rural communities across the country. The funding roots of RDOF come from traditional high-cost universal service funding previously earmarked for territories served by large "price cap" telecom carriers such as CenturyLink, Frontier, AT&T, and Verizon. Historically, the FCC provided this funding directly to these legacy telecom carriers to support broadband service in the rural communities served by them. But RDOF changed this process significantly.
Rural Electrical Cooperatives (RECs)	Electric cooperatives play a vital role in transforming communities. They are energy providers that act as engines of economic development in rural areas, responsible for 42% of U.S. electric distribution lines. These local energy and technology providers are shaped by the specific needs of the communities they serve, powering over 20 million businesses, homes, farms, and schools in 48 states. RECs are eligible to apply for and win IIJA broadband funding.

Rural Utility Service	A division of the U.S. Department of Agriculture, Rural Utility Service grew out of the Depression-era Rural Electrification Administration. Its mission is to help provide public utilities—water and sewer, electrification, and telecommunications—to rural areas through public-private partnerships providing loans and grants. RUS is one of three agencies that make up USDA Rural Development (including Rural Business-Cooperative Service and Rural Housing Service).
S	
Satellite Internet	Internet service provided via satellite. Satellite can be the only option for remote residents, but it is generally considered slow, less reliable, and more expensive than other options if and when they are available.
Secured Debt	Debt that is backed by property, like a car or a house. Should you default on the repayment of the loan or debt, the creditor can take the collateral instead of opening a debt collection on your record or suing you for payments.
Security	A certificate or other financial instrument that has monetary value and can be traded. Securities are generally classified as either equity securities, such as stocks and debt securities, such as bonds and debentures.
Senior Debt	Borrowed money that a company must repay first if it goes out of business.
Simple Agreement For Future Equity (SAFE)	An agreement between an investor and a company that provides rights to the investor for future equity in the company similar to a warrant, except without determining a specific price per share at the time of the initial investment.
Spectrum	A conceptual tool used to organize and map the physical phenomena of electromagnetic waves. These waves propagate through space at different radio frequencies, and the set of all possible frequencies is called the electromagnetic spectrum.
Subgrantee	The government or other legal entity to which a subgrant is awarded and which is accountable to the grantee for the use of the funds provided. Under the Infrastructure, Investment and Jobs Act, the grantee must be an eligible entity.
Subordinated Debenture	An unsecured loan or bond that ranks below other, more senior loans or securities with respect to claims on assets or earnings. In the case of borrower default, creditors who own subordinated debt will not be paid out until after senior bondholders are paid in full.
Subsidiarity	Subsidiarity is a principle of social organization that holds that social and political issues should be dealt with at the most immediate (or local) level that is consistent with their resolution.
Symmetric	When the upload and download speeds match. A rate of 10 Mbps down/10 Mbps up would be symmetric.
T	
Take Rate	The percentage of potential subscribers who are offered the service that actually do subscribe. Within the context of information infrastructure investment, take rate has become a byword for network viability and success, making it a key economic driver of the investment.
Tax-Exempt Debt	An investment in which the income produced is free from federal, state, and/or local taxes. Most tax-exempt securities come in the form of municipal bonds, which represent obligations of a state, territory or

	municipality. For some investors, U.S. Savings Bond interest may also be free from federal income taxes.
Taxable Debt	A debt security whose return to the investor is subject to taxes at the local, state, or federal level, or some combination thereof. An investor trying to decide whether to invest in a taxable bond or tax-exempt bond should consider what they will have left in income after taxes are taken.
Telecommunications Act Of 1996	The Telecommunications Act of 1996 was the first significant overhaul of United States telecommunications law in more than sixty years, amending the Communications Act of 1934. The Act, signed by President Bill Clinton, represented a major change in American telecommunication law, since it was the first time that the Internet was included in broadcasting and spectrum allotment. According to the Federal Communications Commission (FCC), the goal of the law was to "let anyone enter any communications business – to let any communications business compete in any market against any other." The legislation's primary goal was deregulation of the converging broadcasting and telecommunications markets.
Telemedicine	The use of high-speed, high-capacity Internet to support long-distance healthcare services, patient and provider education and enhanced healthcare administration.
Tier 1, 2, 3	Classification indicating the size of a service provider. Tier 1 providers are the largest, such as AT&T, CenturyLink, Zayo, and Verizon, with network systems that span the globe. They can generally send data anywhere without having to pay transit fees, either because they own the network or they have peering agreements with other networks. A Tier 2 network "peers" with many networks, but also has to pay some transit fees. A Tier 3 service provider must pay transit fees to access the Internet.
Tribal Broadband Connectivity Program	The Tribal Broadband Connectivity Program is a $980 million program directed to tribal governments to be used for broadband deployment on tribal lands, as well as for telehealth, distance learning, broadband affordability, and digital inclusion. NTIA is continuing to review the more than 280 applications received during the application window, which closed on Sept. 1, 2021. The Tribal Broadband Connectivity Program will announce additional awards on a rolling basis as they go through NTIA's review process.
U	
Underserved	A location that, as determined in accordance with the broadband DATA maps, is (1) Not an Unserved location, and (2) Lacks access to reliable broadband service with a speed of not less than 100 megabits per second for downloads, 20 megabits per second for uploads, and a latency sufficient to support real-time, interactive applications.
Underserved Service Project	According to the BEAD Program, a project in which not less than 80% of broadband-serviceable locations served by the project are Unserved locations or Underserved locations.

Universal Service Fund	A central principle of the Communications Act of 1934 was that all Americans should have access to a basic level of telecommunications service—universal service—and many policies were enacted to carryout that goal. The Telecommunications Act of 1996 created the Universal Service Fund, a pool of money collected from telecommunications companies and used for building and maintaining telecommunications infrastructure and services in high-cost areas. Four programs are supported by the Fund: the High-Cost Program, Lifeline Program, Rural Health Care Program, and Schools and Libraries Program. Telecommunications companies may charge a Universal Service Fund fee back to customers to help recover some of their contribution to the program.
Unlevered Returns	The implied rate of return a company expects to earn without the effect of debt.
Unlimited-Tax General Obligation Pledge	Is similar to the limited-tax pledge. The only difference is that the local government is asked to increase property tax rates to necessary levels — up to a maximum of 100% — to cover delinquencies from taxpayers. Residents must first agree to increase property taxes to the necessary amounts required for the bonds.
Unsecured Debt	Debt that is not backed by an asset pledged as collateral.
Unserved	A broadband-serviceable location, as determined in accordance with the broadband DATA maps, that has no access to broadband service or lacks access to reliable broadband service with a speed of not less than 25 megabits per second for downloads, 3 megabits per second for uploads, and a latency sufficient to support real-time, interactive applications.
Unserved Service Project	According to the BEAD Program, a project in which not less than 80% of broadband-serviceable locations served by the project are Unserved locations.
Upload And Download	The direction of the data between the end user and the service provider. Something moving “upstream” or “uploading” is moving from the end user’s computer or device to the service provider, while data moving “downstream” or “downloading” is moving from the service provider to the end user. When referring to speed, “10 down” means data is moving downstream to the end user at a rate of 10 megabits per second or Mbps, while “1 up” means data is moving at a rate of 1 Mbps up from the end user. Downstream is important in applications like streaming video, while upstream is important for end users who need to send large files somewhere, for instance, to a customer or to a hospital.
W	
Wi-Fi	A technology that produces a wireless local area network allowing a computer or other device to connect to the Internet wirelessly. Equipment in the device communicates with the Wi-Fi router, which is connected to the network with some type of physical cable or wire. Depending on the system’s power, the area can be as small as a room or cover several square miles. Examples include the Wi-Fi router in a home, a hotspot at a coffee shop, or citywide Wi-Fi networks. Wi-Fi is a trademark of the Wi-Fi Alliance, an organization that certifies equipment for interoperability. A generic term is “wireless local area network.”

Wireless	A short name for fixed wireless (as opposed to mobile wireless). Fixed wireless technology transmits data between two fixed antennas using radio waves, including microwaves. Unlike Wi-Fi, the radio beams are often kept narrow to keep up the strength of the signal. Antennas are preferably set up high on buildings since line of sight is necessary.
WISP	An ISP that provides service through a wireless network.
Working Capital/ Net Working Capital	The difference between a company's current assets—such as cash, accounts receivable/customers' unpaid bills, and inventories of raw materials and finished goods—and its current liabilities, such as accounts payable and debts. A measure of a company's liquidity and short-term financial health.
Y	
Yield On Cost (YOC)	The percentage an unlevered broadband project pays out per year in EBITDA based on the initial cost of the project. This metric is useful to compare the potential return to investors across multiple geographic regions when all project assumptions are held constant.