

September 2018



Broadband Enhancement Plan

Riding Broadband to New Heights

Recommended by
Wyoming Broadband Advisory Council

Approved by
Wyoming Business Council



Wyoming ... A Place of Technology Utilization

- ▶ The Integrated Test Center (ITC) is a public-private partnership that brings together government, industry and cooperatives with the shared goal of developing commercially viable uses for carbon dioxide emissions from power plants.
- ▶ The Research Institute of Enhanced Oil Recovery (RIEOR) at the University of Wyoming (UW) uses technology to enhance its research in applied geology, reservoir development and applied chemical engineering.
- ▶ UW's High Bay Research Facility opened in 2017 to provide 90,000 square feet of traditional and high-bay research, laboratories and offices for improved oil recovery, geomechanics, and structural engineering studies.

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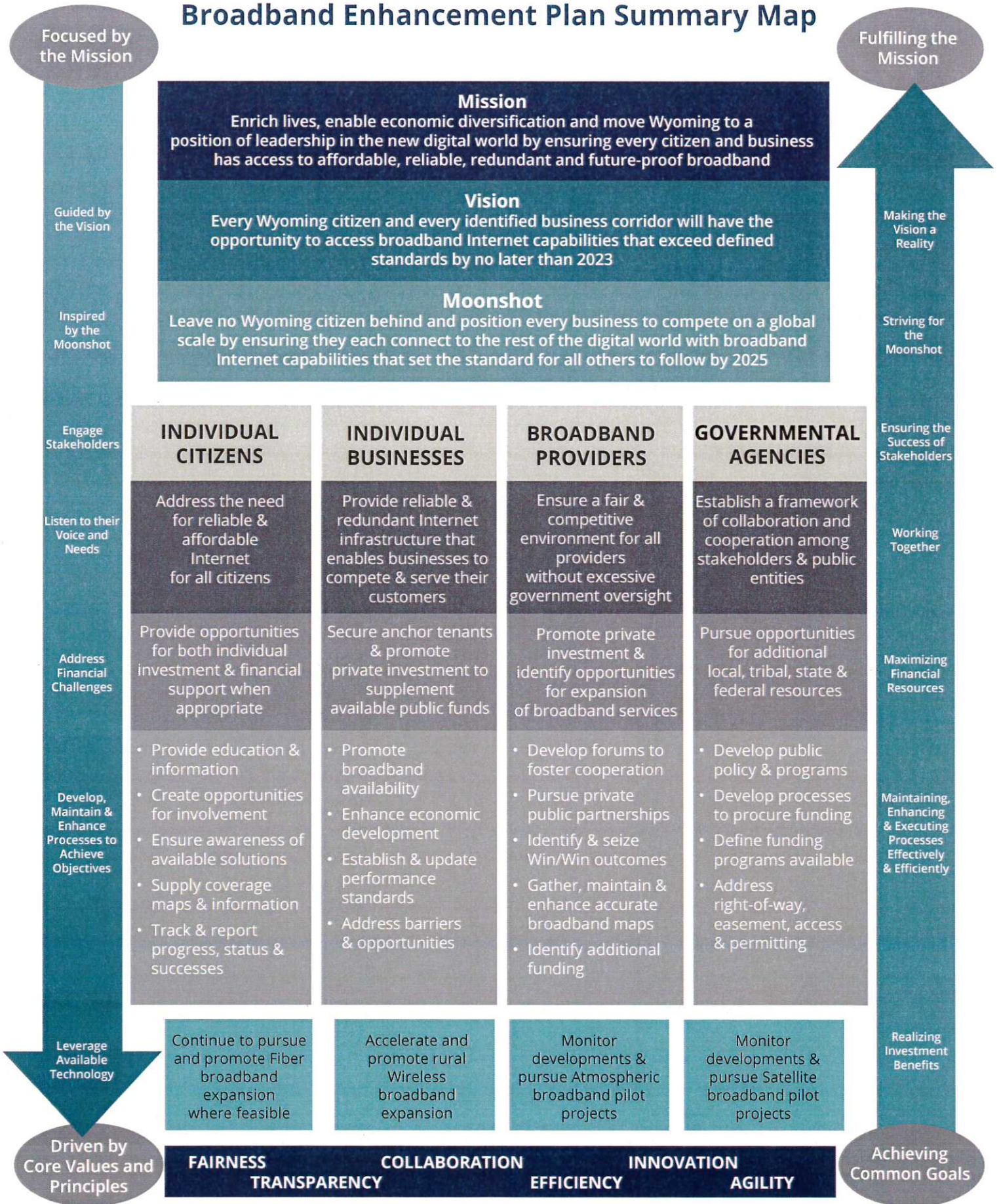
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Broadband Success Stories in Wyoming

- ▶ Broadband providers in Wyoming have invested millions in infrastructure, including developing innovative ways to serve difficult locations and increasing services within remote rural territories, connecting businesses and residences in many municipalities with Gig service.
- ▶ Several broadband providers have worked to increase backhaul capacity along the major arteries of the state, including the I-25 corridor.

Broadband Enhancement Plan Summary Map



Welcome Letter

Wyoming has always been a place of adventure, exploration and freedom. This lifestyle, which has traditionally included tourism, ranching, mining, manufacturing and agriculture is being modernized as the state officials prepare for emerging technologies to enter the market. Wyoming also has the lowest population density of the contiguous 48 states, according to 2015 United States Census Bureau estimates, making delivering broadband services a unique challenge.

The State of Wyoming and its broadband providers have been working diligently for several years in improving the existing infrastructure for the benefit of citizens and businesses with many successes. This Wyoming Broadband Enhancement Plan (Plan) will build on that foundation to further reach unserved areas and prepare for the future world that demands instant access to data and information both for individuals and automated devices. The Economically Needed Diversity Options for Wyoming (ENDOW) Executive Council's report on *Transforming Wyoming a 20-Year Economic Diversification Strategy* outlines several areas where broadband connectivity is critical to Wyoming's long term strategy for growth and economic prosperity. The Plan is created to compliment and drive Wyoming's aspirational goals in the ENDOW report.

To enable these advances, the Wyoming Business Council (WBC) and its partners are ready to take proactive measures to ensure that businesses and residents have the broadband services they need. In an increasingly digital society, they must work together so no one will be left behind because of where they live or work. These partners are focused on making Wyoming a technology leader by expanding services to support economic diversity and job growth.

In the upcoming years, the partners in this Plan should work to identify opportunities for broadband expansion, remove barriers, coordinate funding efforts and invite new technologies into Wyoming's economy. As broadband providers make significant investments into the state, our intent is not to overbuild. Industry should be challenged to help lift technology in all communities, while leveraging government resources to expand into unserved areas.

This Plan lays a framework for the future. It is aimed at enhancing the efforts of an already strong infrastructure to reach the most rural parts of the state. The Plan gives recommendations on how the WBC and its partners should proceed to accomplish these goals and rally around a common vision.

As members of the Wyoming Broadband Advisory Council, we join this effort and thank Governor Matthew Mead and the Wyoming State Legislature for convening us to develop these recommendations. We also invite our incoming governor to join this effort and help us work through these issues to connect Wyoming to a promising future.

Wyoming Broadband Advisory Council



Wyoming Broadband Advisory Council



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Introduction

The Wyoming Broadband Advisory Council (Advisory Council) has developed a mission to guide its decisions and a vision for Wyoming's future in 2023. The vision is focused on achieving minimum speeds of 25 megabits per second (Mbps) download and 3 Mbps upload for residences and one Gigabit per second (Gig) download and 100 Mbps for major business corridors. These speeds will be reviewed by the Advisory Council who will make recommendations to the WBC as needed. It has also set a moonshot goal to enlist its partners to push the limits of what is possible to ensure that Wyoming becomes a leader in broadband deployment and utilization.

<p>Mission Enrich lives, enable economic diversification and move Wyoming to a position of leadership in the new digital world by ensuring every citizen and business has access to affordable, reliable, redundant and future-proof broadband</p>
<p>Vision Every Wyoming citizen and every identified business corridor will have the opportunity to access broadband Internet capabilities that exceed defined standards by no later than 2023</p>
<p>Moonshot Leave no Wyoming citizen behind and position every business to compete on a global scale by ensuring they each connect to the rest of the digital world with broadband Internet capabilities that set the standard for all others to follow by 2025</p>

Address Stakeholder Needs

The mission, vision, moonshot are all focused on meeting the needs of stakeholders which are briefly outlined in the following table.

INDIVIDUAL CITIZENS	INDIVIDUAL BUSINESSES	BROADBAND PROVIDERS	GOVERNMENTAL AGENCIES
Address the need for reliable & affordable Internet for all citizens	Provide reliable & redundant Internet infrastructure that enables businesses to compete & serve their customers	Ensure a fair & competitive environment for all providers without excessive government oversight	Establish a framework of collaboration and cooperation among stakeholders & public entities
Provide opportunities for both individual investment & financial support when appropriate	Secure anchor tenants & promote private investment to supplement available public funds	Promote private investment & identify opportunities for expansion of broadband services	Pursue opportunities for additional local, tribal, state & federal resources

Structure Ongoing Priorities

SEA No. 0036 outlined a standard for coverage of at least 25 Mbps download and 3 Mbps upload speeds in residential areas and one Gig download speed and 100 Mbps upload speed in business corridors when disbursing funds for the State Broadband Infrastructure Grant Fund. These speeds should also be sought as a minimum in implementing other portions of this Plan.

The Advisory Council should evaluate these speeds to meet the statutory requirement to propose changes to the Wyoming Business Council (WBC) by March 1, 2020, as required by the statute.

After receipt of the recommendation from the Advisory Council, the WBC will engage in a rulemaking in accordance with W.S. 9-12-1508 to establish minimum business and residential upload and download speeds broadband projects must meet to qualify for funding.

The WBC and its partners should also work to gain coverage for prioritized areas of the state as defined by the legislation. Redundancy and reliability should also be a priority in the ongoing strategy.

This Plan gives an initial list of recommendations identified during the planning process, but the Advisory Council recommends that priorities should be continually reviewed and adjusted, which will require ongoing analysis and advocacy.

Future analysis should also track which activities can be accomplished within existing budgets and which items would need additional funding through the state or other sources.

Key Definitions

affordable • broadband rates comparable to those offered in urban areas by reference to standards published by the Federal Communications Commission

broadband • a high-capacity transmission technique using a wide range of frequencies, which enables a large number of messages to be communicated simultaneously

moonshot • a moonshot, in a technology context, is an ambitious, exploratory and ground-breaking project undertaken without any expectation of near-term profitability or benefit and also, perhaps, without a full investigation of potential risks and benefits

redundancy • a process through which additional or alternate instances of network devices, equipment and communication mediums are installed within broadband infrastructure. It is a method for ensuring broadband availability in case of a network device or path failure and unavailability; as such, it provides a means of network failover

rural • all areas outside of a metropolitan service area

served • defined in Wyoming Statute 9-12-1501(b)

underserved • speeds between Wyoming Statute 9-12-1501(b) and Wyoming Statute 9-12-1501(e)

unserved • defined in Wyoming Statute 9-12-1501(e)

Form a Winning Team

State Broadband Leadership

Following the 2018 legislative session, Governor Matt Mead signed into law SEA No. 0036, appointing the WBC a lead role in overseeing broadband planning and coordination efforts.

The legislation also created the Wyoming Broadband Advisory Council and appropriated \$10 million to establish a Broadband Infrastructure Grant Fund. WBC, in consultation with the Governor's Office and ENDOW Executive Council, was given funding to hire a Broadband Manager with telecommunications expertise to oversee those efforts.

The Broadband Manager will be a main point of contact and hub of information for all of the partners involved in this effort. The Broadband Manager should also work with national groups and advocate for stakeholders through official comments when necessary. WBC should evaluate the progress of this Plan on an annual basis and make funding recommendations to the Governor's Office and Wyoming State Legislature to continue these efforts.

Wyoming Broadband Advisory Council

The Advisory Council consists of eleven members. These members include the state chief information officer or designee; a representative from the Northern Arapaho or Eastern Shoshone tribes; and the remaining members are appointed from the public at large.

They should have geographic diversity and diverse interests, which may include economic development, state or local government, broadband providers, technology-related businesses, health care, education, library services and public safety.

The Advisory Council is also appointed one senator, appointed by the President of the Senate, and one representative, appointed by the Speaker of the House, to serve as legislative liaisons.

The Advisory Council should hold a quarterly in-person meeting and the Broadband Manager should report the progress made on this Plan to the WBC on a regular basis. The Advisory Council may also meet more frequently if needed.

Create a Portal for Information

The WBC should create a webpage so interested stakeholders can learn more about what the state is doing to improve broadband services. The depth and complexity of this website will be subject to funding.

Some recommended information for the site includes:

- ▶ Basic information on broadband (speeds, technologies, etc)
- ▶ Schedules and meeting minutes for the Advisory Council
- ▶ Links to the interactive mapping tool
- ▶ A speed test
- ▶ Information on applying for state and federal funding
- ▶ Policy issue information

The Advisory Council was given authority to provide advice and recommendations on the inventory and mapping of current broadband availability; recommend practices and technologies for providing broadband in the most efficient manner possible; develop state and local practices to encourage the development of broadband services; review applications received for the Broadband Infrastructure Grant Fund as requested by the WBC; propose a state Broadband Enhancement Plan to the WBC; and recommend changes to the WBC in the upload and download speeds specified in the definition of unserved areas, including unserved residential and business corridors by 2020.

Broadband Providers

Working with industry partners is vital to the success of this Plan. Understanding the various technologies, policy considerations and business models of these businesses will be important for the WBC and Advisory Council as they seek to collaborate on projects to improve services in Wyoming.

These providers are encouraged to attend Advisory Council and WBC meetings to give feedback on technical and policy issues. They have also been invited to participate in the mapping program. The Wyoming Business Alliance (WBA) has also convened a broadband provider working group to solicit industry input.

The Advisory Council and the WBC should utilize information from this working group, along with feedback from individual providers, to monitor their progress on implementing this plan.

Local Governments

City and county officials are essential partners to implement the recommendations in this Plan. Many policies that impact broadband deployment such as franchise agreements, rights of way, pole attachments and access to public structures are made on a local level. Local officials should work with the WBC and broadband providers to determine how to encourage deployment and be engaged in the local planning process.

Department of Enterprise Technology Services

The Unified Network, within the Department of Enterprise Technology Services (ETS), was created in

2012 to connect anchor institutions, including schools and Executive Branch state government facilities. The network is focused on leveraging the Wyoming education and government broadband demands to promote the expansion of broadband infrastructure utilizing private sector partners that can also provide services to local communities. The Unified Network is a member of the Advisory Council and will be a key partner in implementing this plan.

Wyoming Department of Transportation

The Wyoming Department of Transportation (WYDOT) has been a leader in working with the private sector to allow them to install fiber and conduit in highway rights-of-way.

The agency is also working with AT&T to deploy the FirstNet first responder LTE broadband network. Throughout the development of this plan, WYDOT provided information and feedback to the Advisory Council and will play an ongoing role as the Plan is implemented.

United States Department of Agriculture

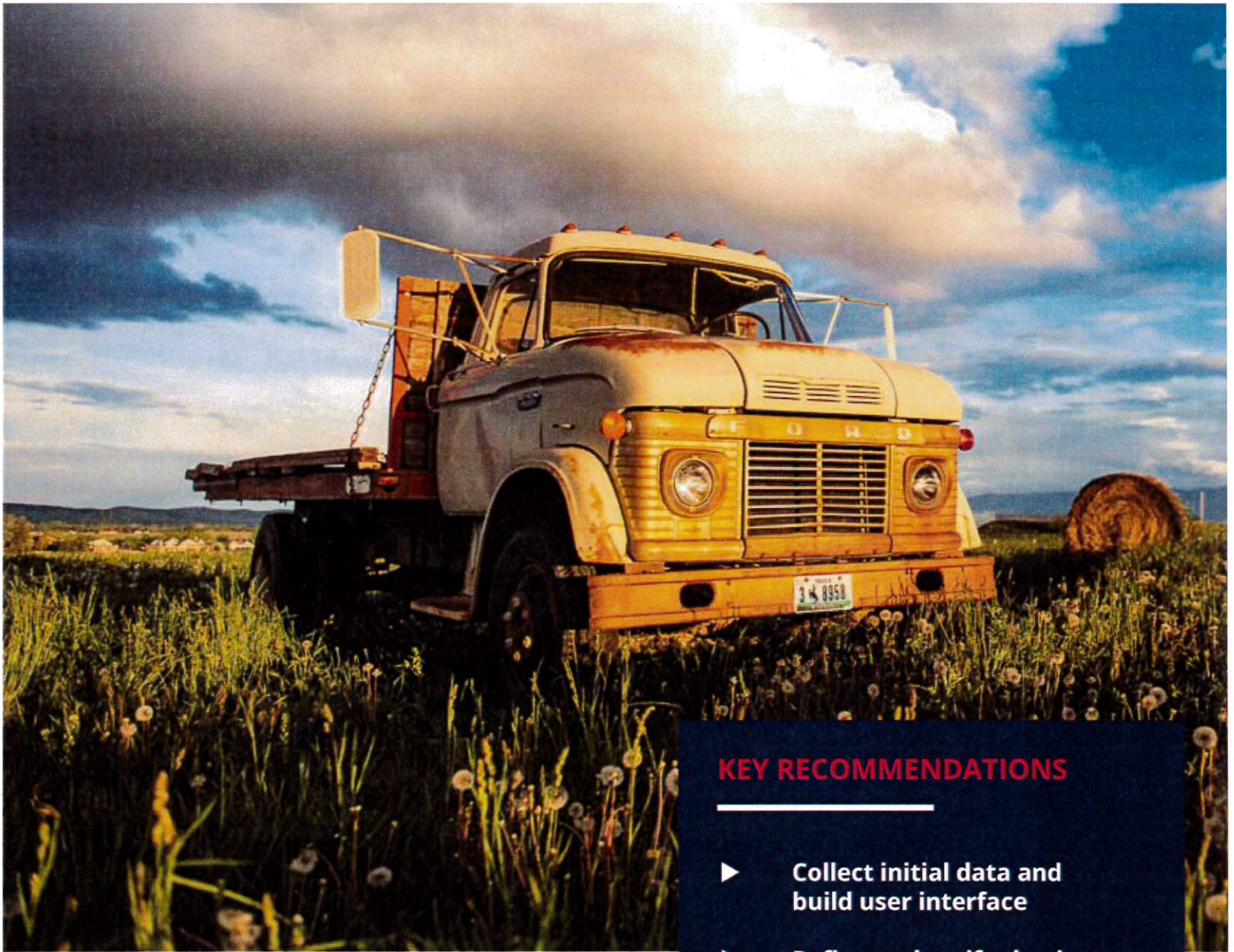
The United States Department of Agriculture (USDA) will be a key partner to the Advisory Council to assist with both the planning and funding strategy. USDA provides grants and loan guarantees to support ongoing projects and has funded several projects in Wyoming. The agency may also help the Advisory Council identify other sources of federal funding to support broadband buildouts.

Tribal Partners

Wyoming's tribes are important partners to help insure that tribal members gain access to the services they need. Since these tribes have sovereign governments and unique needs, WBC and the Advisory Council should convene a tribal working group that includes tribal leaders and Bureau of Indian Affairs (BIA) representatives to develop a tribal strategy.

They should assist providers in working with the tribes to more effectively to install, upgrade, enhance and move equipment as necessary. The Broadband Manager can help facilitate these conversations.

Develop a Mapping Strategy



A key component of this Plan is to develop a strategy to map current broadband data. SEA No. 0036 authorized the WBC to develop an “inventory and map of current broadband availability, as provided by voluntary submissions from broadband providers and derived from other resources, including the Federal Communications Commission (FCC).” The data will provide a foundation for the WBC to administer the Broadband Infrastructure Grant Fund and help the state, providers, and local communities identify the levels of service throughout Wyoming.

KEY RECOMMENDATIONS

- ▶ **Collect initial data and build user interface**
- ▶ **Refine and verify the data**
- ▶ **Create a sustainability plan for data updates**
- ▶ **Analyze and leverage the data**

The FCC collects broadband data from providers twice a year on a census block level. Large census blocks are problematic in western states because if one location is served, the entire block is shown as served.

According to data provided by the Wyoming Geographic Information Science Center, Wyoming's largest census block is 575 square miles. The percentage of census blocks greater than two miles is 11% but those census blocks cover 81,987 square miles or 84% of the state. This indicates further data and analysis is needed to determine coverage levels. The following table shows the size characteristics of census blocks throughout Wyoming.

FCC data will likely be sufficient in many of the more urban areas; however the larger census blocks need further analysis to determine their broadband needs. More granular data is needed for local planning and so the WBC can have a fair and accurate method to make disbursements from the Broadband Infrastructure Grant Fund. Cellular coverage data is also available from the FCC and should be utilized by the WBC as it assesses Wyoming's broadband needs.

This more refined data could also be useful to providers and other parties that wish to apply for federal funding because some of the programs will accept other sources of data beyond the FCC collection. Applicants should work with the WBC to demonstrate that additional areas should be eligible for these programs. The following framework provides a description of how the data should be collected:

Phase 1: Collect Initial Data and Build User Interface

The FCC collects data from broadband providers throughout the country but as a result of the size of this effort, processing and releasing the data is usually delayed. The current FCC data release is from 2016.



Consequently, the WBC should ask providers to provide a copy of their most recent Form 477 submission as a starting point.

This data also provides information on delivered speeds and technologies to demonstrate the level of coverage. The WBC should work with a mapping contractor to display the data on a user interface so stakeholders can access and utilize it.

Phase 2: Refine and Verify the Data

To refine the data, the WBC should utilize three main methods. These three methods were sent to the broadband providers for feedback and the responses indicated the options may be viable. Providers had different preferences based on their technical capabilities but all of the methods should be allowed

Wyoming Census Blocks

Block Size (Square Miles)	Number of Blocks	Percent of Blocks	Total Square Miles
1 mile and less	71,761	83%	8,528.22
1-2 miles	5,148	6%	7,292.88
2-3 miles	2,489	3%	6,081.97
3-4 miles	1,512	2%	5,240.75
Greater than 4 miles	5,295	6%	70,665.15
Total blocks	86,205	100%	97,808.97

to account for these differences. The state may also work with providers to find other ways to collect data if needed.

- Submit coverage data using standard GIS formats (KMZ, Shapefile, etc.)
- Utilize a data editing tool provided by the state to indicate covered areas (cells, small census blocks, road segments etc.)
- Submit FCC Form 477 data for small census blocks (under 2 square miles) and then work with the state to provide more refined information on larger census blocks

The WBC should serve as a main point of contact for data verification so that other stakeholders can report any potential inaccuracies. Verification will be particularly important in areas where applicants are applying for the Broadband Infrastructure Grant Fund.

The Broadband Manager and Advisory Council should also investigate ways to evaluate the reliability of the various technologies. In cases of dispute, the WBC should first work with the provider to make any necessary adjustments or submit any relevant evidence.

The WBC may also contact local officials to weigh in on the issue. If inaccuracies cannot be resolved between the parties and grant funding is involved, it may be necessary to hire a third party field verifier to verify the data. However, this final step should only be used at the WBC's discretion as a last resort.

The National Telecommunications and Information Administration (NTIA) also received \$7 million in 2018

The Department of Enterprise Technology Services has connected schools and other public facilities by partnering with private broadband providers

to help verify the FCC Form 477 data. The WBC and its partners should work with NTIA to provide feedback on these verification efforts.

Phase 3: Create a Sustainability Plan for Data Updates

The WBC should work with broadband providers to update the data to maintain its accuracy. Ideally the data should be updated twice a year. Feedback from industry indicated that collecting data in the fall and the spring would be preferable to align the data collection with construction seasons and FCC data submissions.

The WBC should inform the Governor's Office and Wyoming State Legislature on the broadband deployment progress being made.

Mapping data can be used as a tool to help evaluate broadband deployment progress. The WBC should also work with the executive and legislative branches to determine an ongoing funding mechanism to support these efforts.

Phase 4: Analyze and Leverage the Data

Broadband data, along with other relevant data sets, can help guide planning and policy decisions in Wyoming. Subject to funding, collecting location data on residences, businesses and other key facilities will help prioritize the states planning and funding efforts.

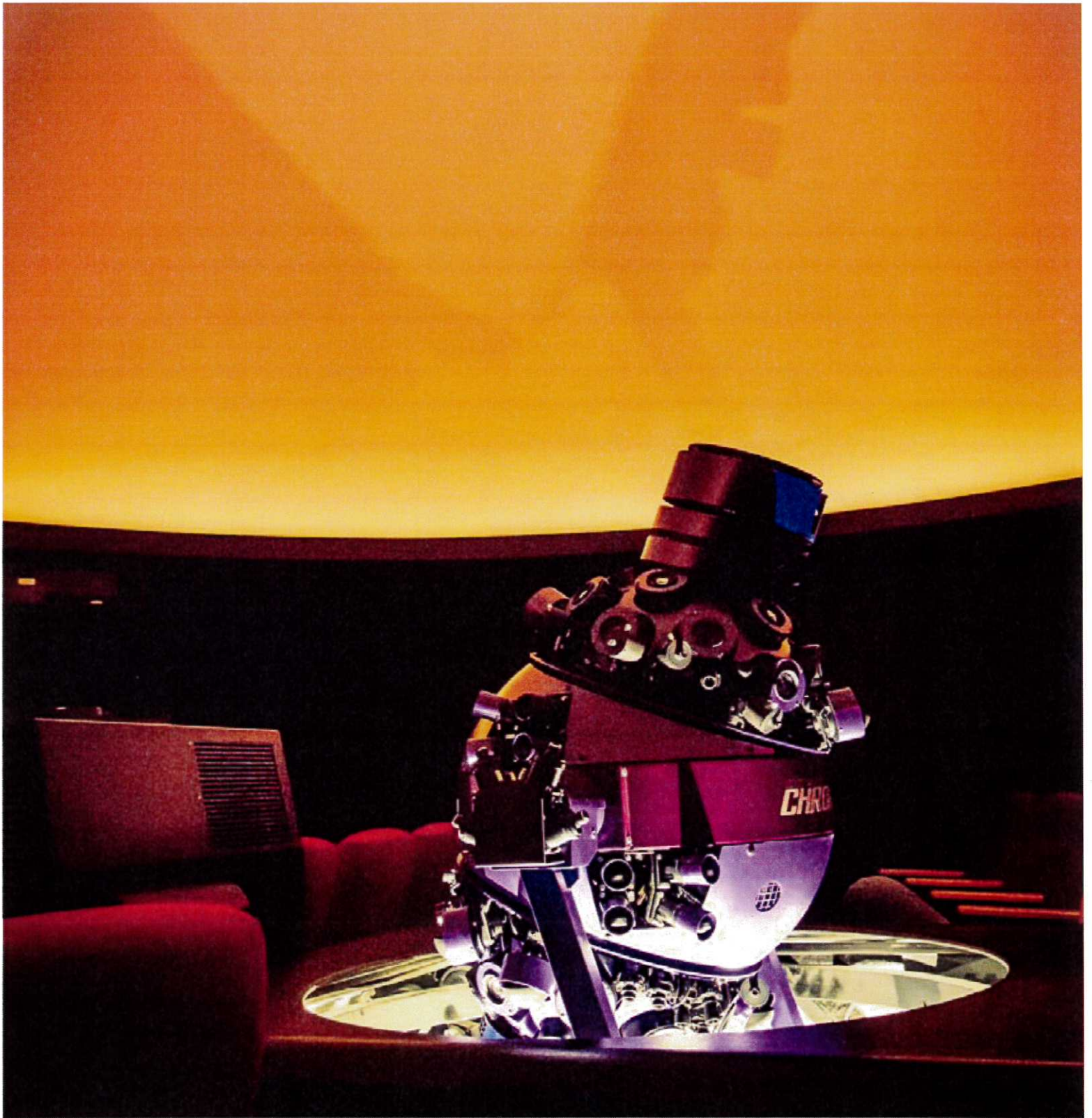
These efforts should include conducting a gap analysis to determine priority areas where upgrades to capacity and service are needed.

The WBC could work with city and county officials to collect additional data sets including subdivision data, parcel data, address data, census and household data, etc. to identify priority areas.

Data on upcoming projects would also be helpful for the state in determining planning and funding priorities. FirstNet plans to build a public safety broadband network for first responders, which according to their plan, will increase cell coverage in some key rural areas.

Mapping these areas as they are announced will help determine future coverage needs. Areas receiving Connect America Funds or other federal funding should be analyzed using existing federal data sets.

The WBC should work with providers to determine a reasonable method to learn about upcoming builds that takes into account how to handle proprietary information.



Subject to funding, information on tower locations, particularly publicly-owned sites may be useful in determining where fixed and mobile wireless coverage could be expanded. These data sets may include FCC data; data from the Department of Homeland Security (if available), data from WYDOT and other state partners, BLM-designated communications sites and tower information included in subdivision data.

Broadband-related data should be used to tell the story of Wyoming's evolving broadband landscape. This information could be useful in attracting businesses to the state and helping existing businesses with expansion plans. As areas are built out, these successes should be communicated both locally and to national partners who compare broadband access across states. These efforts should position Wyoming as a leader in utilizing innovation to reach hard-to-serve areas.

Leverage Public-Private Partnerships



KEY RECOMMENDATIONS

- ▶ **Form regional partnerships**
- ▶ **Connect roads and emergency facilities**
- ▶ **Connect anchor institutions**

Public-private partnerships should play a key role in Wyoming's future in unserved areas. These partnerships can take various forms including coapplying for funding, working with providers to create carrier neutral locations and towers, providing greater access to rights-of-way, working with private industry to connect anchor institutions and allowing the utilization of public resources such as conduit, tower sites and buildings for installations. These partnerships can lower costs, create efficiencies and accelerate deployment.

The WBC, Advisory Council, and local stakeholders should facilitate these partnerships when needed. The WBC can provide expertise and direction to the local stakeholders on how to create and maintain these partnerships. The local stakeholders can brief the WBC on current and planned partnerships so that best practices and success stories can be shared across the state.

The WCCA, WAM and the localities they represent will also be strategic partners in this effort. The following partnerships were identified during this planning process and the Advisory Council will find ongoing ways for the public sector to work with industry.

Conduct Regional Outreach

Many of the recommendations in this Plan require involvement by regional partners such as city and county officials, local broadband providers, businesses, and specialists in particular industries such as education, health care and public safety. The WBC's Broadband Manager should work with its Regional Directors to meet with local stakeholders to accomplish these goals.

This work could be accomplished through the WBC's economic development regions and be overseen by the Broadband Manager and Regional Directors.

As the scope and responsibilities of these efforts progress, the WBC can determine if additional funding and resources are needed. This outreach could include soliciting regional input, disseminating information from the WBC and providing trainings to local communities on how to encourage broadband development.

The WBC can meet with various groups of partners according to local needs but the Broadband Manager should work with local government officials and the Wyoming Association of Municipalities (WAM), Wyoming County Commissioners Associations (WCCA) and Wyoming Economic Development Association (WEDA) to encourage participation.

This strategy will encourage the development of local partnerships. By sharing information across regions through forums and other forms of outreach, they can help local communities develop governance structure models and guide them through the process of completing projects.

These stakeholders can help develop and share best practices, templates and/or model standards for key issues including access to rights-of-way, permitting, partnership agreements, and local small cell ordinances and franchises, which will help encourage reasonable and nondiscriminatory fees and promote timely processing.

These practices will encourage deployment and offer a greater degree of certainty for providers as they plan construction. A few ideas that might be explored by the WBC for policies related to local issues include:

- Reducing the cost of and providing equal access to local right of way. For unserved areas and new areas of development consider a local government policy of installing duct in the right of way and making it available at a reasonable cost on an equal access basis to carriers who are interested in serving. Cities and counties can also implement dig-once policies where providers are notified about upcoming construction projects and invited to install infrastructure while the trench is open.
- Revamping subdivision laws and permitting requirements to require subdivision developers to install equal access communications conduit at a reasonable cost to providers as part of the developer's subdivision permitting process and making it easier for communications facilities to be placed in the utility corridor of these subdivisions. In addition, the WBC should review local governments and subdivision practices which serve to exclude communications carriers from utility corridors on the grounds that they are not viewed as a public utility.
- Standardizing permitting for towers and antennas and modifying zoning restrictions, particularly for small cell installations, would allow providers to make quicker upgrades to mobile and fixed wireless equipment.
- Improving pole attachment policies would help providers install services more efficiently.
- Working with the Wyoming State Legislature to resolve county road classification issues would help providers deploy services within the rights of way without requiring adjacent land owner approval. This may include working with local governments, WAM and WCCA to develop practices and/or model standards.
- Working with carriers to establish provider neutral locations and towers to interconnect.

The WBC should work with the local stakeholders to conduct seminars and workshops to educate local governments on these issues.

Regular meetings organized by WAM and WCCA may be effective venues to conduct these workshops. WAM and WCCA may also be used as a resource to distribute information through their websites and social media channels.



Connect Roads and Emergency Facilities

In 2012, the Wyoming Department of Transportation (WYDOT) implemented its current dig once policy for interstate rights of way, which uses shared resource agreements for providers to place fiber optic conduits. This agreement allows broadband providers to install infrastructure in the highway rights of way safely and economically.

In early 2018, Governor Matthew Mead asked WYDOT to evaluate the best practices of other states and determine policies to facilitate private sector broadband deployment.

This included developing a plan to work with broadband providers to facilitate the installation of conduit as part of any highway construction and other projects. WYDOT's current policy recommends service providers meet with them for conduit and fiber expansion plans along their rights of way.

In May 2018, WYDOT issued the *Overview of Broadband Issues in Wyoming Report*. In the report, WYDOT recommended modifying its own right-of-way policies to include enhanced dig once and shared resource agreements. The agency also plans to establish a communications plan to improve notifications about upcoming projects and allowing opportunities for those providers to install infrastructure during construction. WYDOT should implement this recommendation in order to encourage more private investment.

WYDOT also assigned its Assistant Chief Engineer for Engineering and Planning and Telecommunications Program Manager to serve as the department's Co-Ombudsmen to work with the state's Broadband Manager, Advisory Council, broadband providers, and other state and local officials to support efficient broadband deployment.

This will be necessary to improve coordination, enhance communication, and facilitate successful resolution of utility permitting and other issues related to broadband and telecommunications.

WYDOT is also updating its policies to allow greater access for small cell sites in highway rights-of-way and on agency poles and structures. WYDOT should implement this strategy, which has also been recommended by several providers during the development of this Plan.

In its report, WYDOT determined that approximately 3,000 miles of highway rights of way lack conduit and fiber. This right of way needs further analysis to determine how much of it would be useful to support last mile connections to residents, businesses and other important locations. This may include prioritizing areas of the state that need infrastructure to improve capacity and redundancy. WYDOT has recommended that the Broadband Manager and Advisory Council assist this determination, which may include needs assessments, mapping support, determining costs and developing key partnerships to help improve services.

WYDOT is also the lead agency for FirstNet, which is a government/private partnership to provide broadband-based emergency communications network for first responders through its contract with AT&T. Wyoming was the second state to opt into the program and was the first state to purchase services, with approximately 150 subscribers to date.

The Wyoming portion of the FirstNet build includes constructing 13 additional cell phone towers, which should help with coverage in some rural areas of the state. WYDOT should work with the Broadband Manager and Advisory Council on any issues that may arise that could help improve cellular coverage in Wyoming.

Connect Anchor Institutions

ETS was successful in implementing the Unified Network that provides a 100 gigabit, redundant statewide network backbone. The network was built by partnering with broadband providers throughout the state.

ETS also works with schools to obtain E-Rate funding, which is a federal program that provides large discounts to connect eligible sites. As a result, school districts have gained Internet2 status and have experienced a 40-fold increase in broadband capacity. In fact, within six years, ETS was able to deploy broadband to 48 Wyoming school districts.

The network currently provides a minimum of 200 Kbps per student, placing Wyoming in the highest ranking category in the country, according to Education Superhighways.

ETS will be a strategic partner for the Broadband Manager and Advisory Council to provide solutions to connect strategic locations in Wyoming. These partners should find the best ways to leverage funding to support providers in building services to unserved communities.



KEY ACTION ITEMS

Form Regional Partnerships

- ▶ Share partnership best practices and success stories
- ▶ Improve access to conduit
- ▶ Implement dig-once policies
- ▶ Include telecommunications in subdivision plans
- ▶ Improve tower and antennae permitting
- ▶ Improve pole attachments
- ▶ Resolve county road classification issues

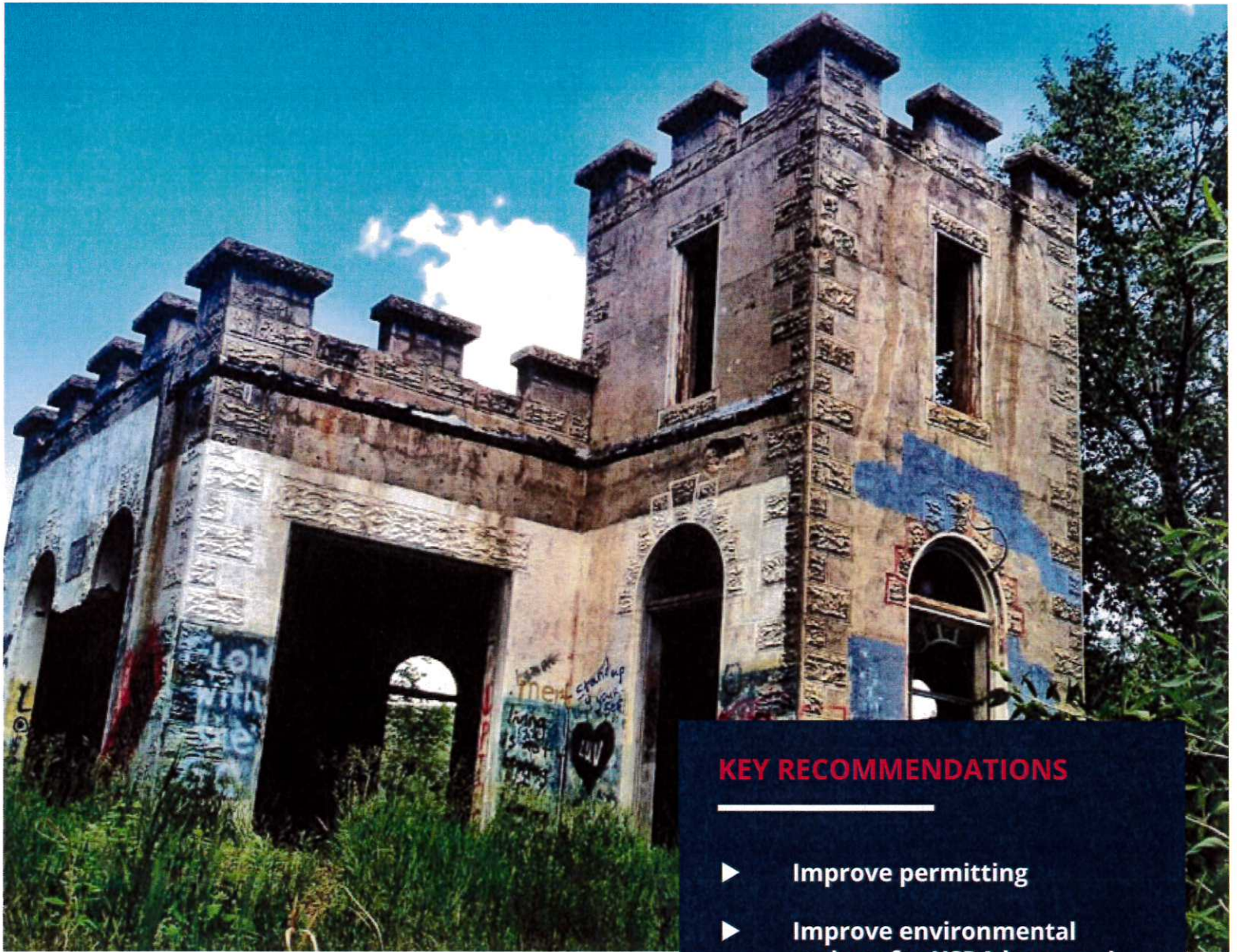
Connect roads and emergency facilities

- ▶ Continue to work with providers to install services during construction
- ▶ Coordinate with WYDOT telecommunications ombudsman
- ▶ Improve policies for small cell installations
- ▶ Prioritize highways that need telecommunications
- ▶ Continue to leverage partnership with FirstNet to improve services

Connect Anchor Institutions

- ▶ Continue to leverage funding to connect schools
- ▶ Connect anchor institutions to get services to unserved communities

Remove Barriers to Deployment



Understanding how policies impact broadband deployment is a crucial role for the WBC and the Advisory Council. The WBC should convene government, broadband providers and other partners to evaluate current and proposed statutes and policies to provide feedback through education and public comment. They should also engage with national industry groups such as USTelecom, the National Telecommunications Carriers Association (NTCA), Western Telecommunications Alliance (WTA), the Rural Wireless Association (RWA) and others so these groups are aware of how federal policies impact western states.

KEY RECOMMENDATIONS

- ▶ **Improve permitting**
- ▶ **Improve environmental reviews for USDA loans and grants**
- ▶ **Remove bonding requirements**
- ▶ **Clarify cultural survey expectations**
- ▶ **Improve tower siting**

They should coordinate with other states with less dense populations, difficult terrain, limited construction seasons and large percentages of federally managed land.

Involving the Wyoming Governor's Office will also be an important part of this process and ideally the WBC should have a designated Governor's liaison that can help advocate on federal broadband issues. The Governor's Office may also consider developing a working group to address federal barriers across diverse industries, which would include the Chairman of the Advisory Council, Broadband Manager and/or designee from the Advisory Council. The partners may also want to work with the Wyoming congressional delegation on pending legislative issues.

WBC and its partners are currently working with federal officials to enact policies which support broadband development. The following issues are initial priorities for the WBC and Advisory Council; however, these parties plan to continually identify and advocate for policies that will remove barriers and promote responsible infrastructure deployment across federal lands.

Improve Permitting Processes on Federal Lands

To install broadband infrastructure across federal lands, providers often experience delays that are the result of limited staffing and resources within land management agencies.

Staff working on broadband permitting projects are usually handling permits for other types of infrastructure, creating uncertain timelines. Providers are also working with multiple agencies and coordination among these parties can also contribute to delays. These timelines are especially problematic because Wyoming projects involve crossing difficult terrain during a limited seasonal construction period.

To address these issues, Representative John Curtis (R-Utah), introduced the Rural Broadband Permitting Efficiency Act of 2018. The legislation requires that projects be assigned a lead agency as a single point of contact. It also allows states to opt in to conduct environmental review responsibilities by delegating federal environmental compliance to them.

The bill is being cosponsored by nine members of Congress. If it passes, WYDOT should participate, which could provide more predictability in the permitting process. This participation may require statutory changes. The WBC and Advisory Council should follow this issue and work with state policy makers and the BLM on both a state and national level. They should also

encourage the Wyoming congressional delegation to support these efforts as they move through Congress by educating them on this issue and providing letters of support as needed.

Clarify Cultural Survey Expectations

As the BLM allows providers access to highway rights of way to install infrastructure, cultural surveys are required to ensure that these resources are evaluated and that impacts are mitigated. The WBC, the Advisory Council and several providers have expressed that these surveys should be conducted in a way that respects these resources but does not burden broadband providers with unnecessary paperwork and mitigation.

One issue that arose during the formation of this Plan was a question about how the 100 foot centerline survey within a highway right-of-way needs to be conducted and whether it needed to be an exhaustive ground survey. This policy was clarified by the Wyoming BLM who indicated specifically how the survey should be conducted. The BLM also indicated that surveyors should inform them of any cultural resources that fall on private land that can be seen but that surveyors are not required to enter private land to examine these resources

Questions have also surfaced regarding whether projects that involve upgrading services, for example replacing copper lines with fiber, should be considered maintenance or new construction. This distinction has a major impact on the overall cost and analysis that is required by broadband providers.

The Wyoming BLM office has indicated that upgrades that fall within the existing disturbance should be treated as maintenance and upgrades that require widening of the existing right-of-way should be treated as new construction. However, there may be additional requirements if the project area includes resources such as cultural materials or endangered species, etc.

Given these clarifications, the WBC and Advisory Council should encourage the BLM to examine these and other policies to ensure that in all situations, providers are not required to survey and mitigate areas that fall outside of the rights-of-way, have already been surveyed or will not be accessed during construction activities.

These issues also highlight a greater need for early coordination with federal agencies. The Broadband Manager should act as a point of contact to work with the BLM and industry on these issues. In cases of dispute, the WBC should work with all partners to ensure that discussions about expectations happen early in the process so that industry can comply with

necessary rules, while ensuring that they are not overburdened with unnecessary extra work. Providers should also work with the Broadband Manager if they have concerns about how rules are applied.

Remove Bonding Requirements

In 2016, the Wyoming Bureau of Land Management office implemented a new annual bonding requirement for all companies who have rights-of-way on federal lands. The rule was created after damage to Wyoming BLM rights of way by unrelated industries. The Wyoming BLM has not stated that communication providers have caused significant damage to BLM lands, nor that they have had significant problems with communication providers on BLM lands, but they have implemented a requirement that all providers post annual bonds for use of rights of way.

Some providers exchanged correspondence with and met with the Wyoming BLM office to attempt to rectify this new Wyoming BLM bonding requirement. The providers have also engaged the Wyoming congressional delegation and Wyoming Governor Mead to try to reverse this bonding requirement for communication facility right of way on BLM land. The BLM is evaluating this issue but a new national BLM director has not been confirmed by Congress and the existing bonding requirement has remained in place.

The WBC and Advisory Council should engage with the BLM both on a state and federal level to encourage the agency to remove bonding requirements for communications providers and deal with reclamation issues through fines or some other form of cost recovery if providers cause significant damage to BLM lands.

In the meantime, they should recommend that the BLM stay its right-of-way bonding policy for broadband providers until a national policy is in effect so that Wyoming stakeholders are not subject to requirements that are not being mandated in other states. They should also coordinate with communication provider organizations in other western states to inform federal legislative representatives on these policies and their implications.

Improve Environmental Review Processes for USDA Loans and Grants

As broadband providers apply for USDA funding, the agency requires that applicants conduct environmental, historical or other reviews to be considered. This

requirement creates a time burden and delays applications. These providers are spending resources with no reasonable guarantee that they will receive funding. To resolve this issue, the Advisory Council recommends that USDA allow providers to conduct environmental reviews after the funding is obligated as part of the conditional commitment following the obligation of federal loans or grants, but before any funds are dispersed.

USDA should also give applicants sufficient time to complete these reviews that are often lengthy as federal agencies have limited staffing resources. Altering this sequence will still ensure environmental compliance but will allow providers to apply more quickly, without conducting unnecessary reviews if they are not awarded projects. Although delaying the review until later in the process may introduce some risk, providers can use their expertise to determine which projects may cross sensitive areas and decide when it makes sense to conduct these reviews before they submit applications.

The Natural Resource and Energy Explorer (NREX), which was developed under an interagency agreement between UW's Wyoming Geographic Information Science Center and the Wyoming Governor's Office, and funded through the WBC, could be utilized to help provide an initial assessment of sensitivity concerns before providers submit applications to permitting agencies. NREX could also be enhanced to provide any broadband-specific data and analysis needs. The WBC and Advisory Council should track this environmental review issue and encourage the federal government to adopt this recommendation.

Working with the Wyoming congressional delegation and submitting official comments when opportunities arise, such as the comment period for the Omnibus Bill of 2018, will give Wyoming the opportunity to improve these processes for its stakeholders.

Improve Federal Tower Siting Processes

Access to towers is vital for both mobile and fixed wireless companies to deliver services. Many of these critical locations are managed by federal agencies and coordination with these agencies is vital to expanding services to the most remote parts of the state.

The WBC and Advisory Council should follow, recommend and support legislation and policies that will accelerate permitting processes. They should work with federal land management agencies and recommend shorter permitting times (preferably less than 90 days). They should encourage local offices to be consistent in timelines and procedures. For example, some offices do not process permits concurrently which can increase time frames and introduce uncertainty.



KEY ACTION ITEMS

Improve permitting processes on federal lands

- ▶ Evaluate laws and policies to provide feedback and official comments
- ▶ Engage with trade associations, other states, Governor's Office, Congressional Delegation
- ▶ Support legislation that allows WYDOT to conduct environmental reviews

Clarify cultural survey expectations

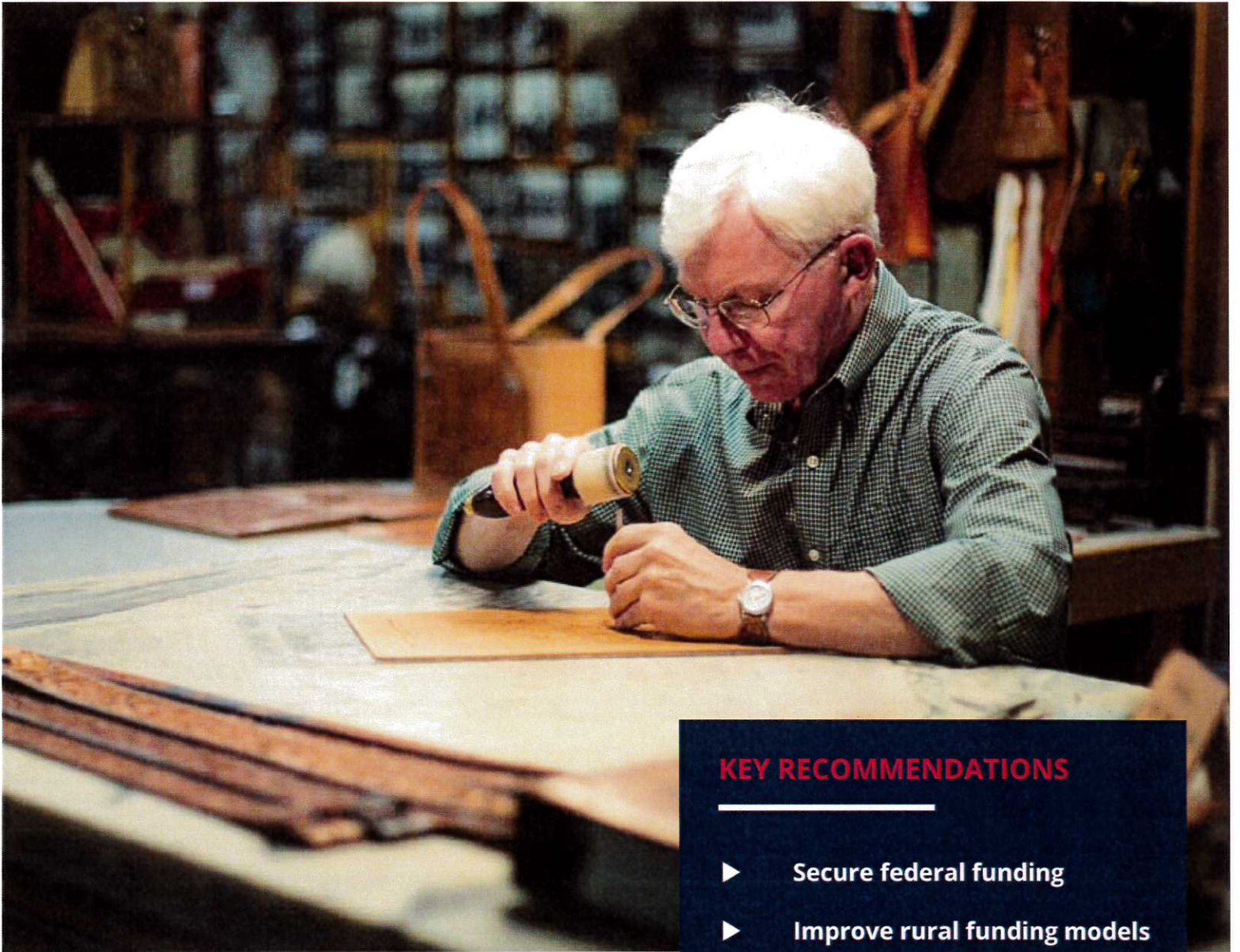
- ▶ Coordinate early with federal agencies
- ▶ Encourage consistency across local federal offices

Remove bonding requirements

Improve environmental review process for USDA loans and grants

Improve tower siting processes

Increase Access to Funding



Accelerating the deployment of broadband across Wyoming will require additional access to funding. The WBC should work with federal, state and local stakeholders to identify areas eligible for funding. The Governor's Office may also consider developing a working group to address funding barriers across diverse industries, which would include the Chairman of the Advisory Council, Broadband Manager and/or designee from the Advisory Council.

KEY RECOMMENDATIONS

- ▶ **Secure federal funding**
- ▶ **Improve rural funding models**
- ▶ **Broadband Infrastructure Grant Fund**
- ▶ **Revolving loan fund**
- ▶ **Matching Funds Strategy**
- ▶ **Universal Service Fund**

It may also be necessary for the WBC to provide feedback on current funding models so they can be more effective in accomplishing the goal of connecting all parts of the state.

Secure Federal Funding

Securing federal funding will be an important component of serving unserved and underserved residents and businesses. Several federal agencies have grant, loan or subsidy programs for infrastructure builds, planning, digital literacy and other broadband-related activities. These organizations include USDA, the FCC, Housing and Urban Development (HUD), the Economic Development Administration (EDA), the National Science Foundation (NSF) and NTIA, to name a few.

The WBC, Advisory Council and local stakeholders should work together to make potential grantees aware of programs, eligibilities and deadlines. The WBC should utilize its website, social media, blog posts, newsletters and emails to increase federal funding utilized by its partners. The state's mapping resources should be used to identify eligible areas.

Federal partners should provide trainings and report ongoing opportunities to the Advisory Council. The WBC should also work with state and local stakeholders to offer local trainings and technical assistance on opportunities and grant-writing practices. The state should also consider providing funding for a grant writer to assist in these efforts.

Improve Rural Funding Models

In 2015, the FCC offered \$1.7 billion to expand and support broadband service in rural areas where market forces alone cannot support broadband. During this process, price cap carriers were given an opportunity to accept funding on a state-by-state basis.

In states, including Wyoming, where this funding was not accepted, other carriers have been given the opportunity to serve these areas. Under the current rules, both rate-of-return and Alternative Connect America Model (A-CAM) carriers cannot use their regular funding models to finance builds into these areas. This significantly curtails the ability of these rural carriers to serve customers of the former price cap carrier who are near the border of their study area.

The WBC, via the Broadband Manager should work in conjunction with the rural carriers to determine how these FCC rules limiting rural carrier federal funding portability could be adjusted so that carriers can serve bordering residents using existing models, while still

ensuring that the new boundaries do not unintentionally leave remaining areas with no potential for future service. These issues are complex and should be the topic of ongoing study and advocacy.

In 2016, the rate-of-return funding model was also updated and rural carriers were given the opportunity to continue under a reformed rate-of-return funding model, or become A-CAM carriers.

Initial feedback from some carriers has indicated that building to every location in a census block is particularly cumbersome in Wyoming because of their size. The largest census block is 575 square miles. The level of support for these areas also has a carrier-specific Capital Investment Allowance per study area, even in very large census blocks that contain extremely remote locations. Using census blocks for funding determinations is also problematic because if even one location within the block is served, the entire block is considered ineligible for funding. Since these funding models are relatively new, ongoing study will be required to fully understand how effective they will be in serving rural areas within Wyoming.

In addition to working with the FCC and impacted carriers, the WBC and Advisory Council should also work with the Wyoming congressional delegation and states with similar geography and rurality to advocate for funding models that more closely meet the needs of rural states.

Evaluate the Reach of the Broadband Infrastructure Grant Fund

During the 2018 legislative session, Governor Matt Mead signed into law SEA No. 0036, which provided \$10 million to establish a Broadband Infrastructure Grant Fund. As the program disburses funds, it is important that the Governor's Office and Wyoming State Legislature understand how effective the current rules are in delivering services to unserved areas.

The WBC should provide them with a briefing after each funding round, including information on which types of projects were not funded. This briefing will allow state policy makers to assess how well the fund is accomplishing its goals.

A few areas that may be presented include the number of projects not funded due to monetary limitations, what types of technologies and speeds are deployed, whether the 50% match is a reasonable standard, in-kind match criteria, the effectiveness of the challenge process, verification standards, and whether the legislation and rules are creating unintended barriers to broadband deployment.

WYDOT has worked with providers to help facilitate the installation of conduit, fiber and other broadband infrastructure throughout the state highway system

Incorporate Broadband into Business Committed Projects

The Business Ready Community Grant and Loan Program, which is administered by the WBC provides financing for publicly-owned infrastructure projects to serve the needs of businesses and promote economic development within Wyoming communities.

Telecommunications projects are eligible under this program; however, the number of applications has been consistently exceeding the program's \$8 million quarterly limit. Projects are prioritized with a preference toward Business Committed projects that focus on recruiting businesses to the state. Broadband projects usually fit into the community development and enhancement category, which is a secondary preference.

The WBC and Advisory Council should study the feasibility of increasing priority on broadband-related projects or developing a strategy to incorporate broadband into the business committed projects, such as allocating infrastructure expansion funds as part of those projects.

Consider a Broadband Revolving Loan Fund

In addition to the Broadband Infrastructure Grant Fund, the WBC and Advisory Council should determine if a revolving loan fund would be a feasible tool to accelerate the deployment of Broadband in Wyoming. This strategy would involve working with the Governor's

Office and Wyoming State Legislature to determine an appropriate funding source. Obtaining commercial lending for broadband can be difficult because infrastructure is not typically considered collateral. The fund would be a companion program to the grant and could be used in situations where funding is needed but the applicant is not eligible for a grant.

These projects may include funding capital expenses in areas where there are enough customers to pay back the loan within a 20-year period. The loans may also be used as matching funds for applicants wishing to secure other funding. This strategy would also allow the state to generate income for future build outs.

Develop a Matching Funds Strategy

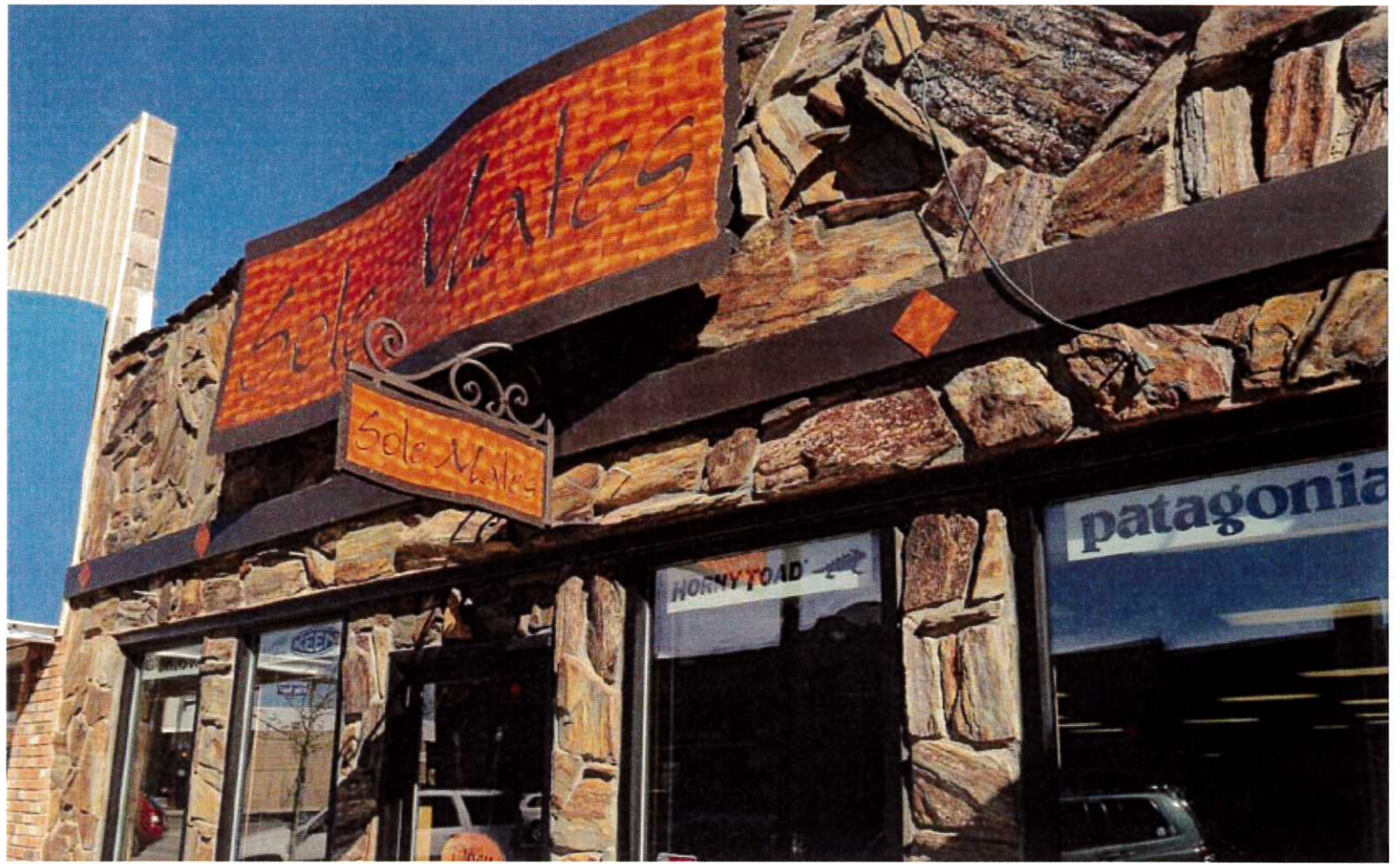
Many funding vehicles, particularly federal programs, require that applicants are able to secure matching funds. As the WBC and Advisory Council seek to increase funding options, they should evaluate all potential sources and work with state and local stakeholders to better understand what local funds could be used. Developing a master list of all potential sources, along with eligibilities can help applicants access these funds quickly to meeting application deadlines.

State and local funds may be potential sources, along with monetary and in-kind matches that may be available from state agencies for projects that further their mission. WBC and the Advisory Council should determine if statutory changes are necessary to further this strategy.

Engage with Wyoming Universal Service Fund Stakeholders

The Wyoming Universal Service Fund (WUSF) was authorized by the Wyoming Telecommunications Act of 1995 (Act). The purpose of WUSF is to assist local exchange carriers providing essential local telephone services in areas of Wyoming to customers who must pay relatively high rates for such services.

The Act and the fund are scheduled to sunset on July 1, 2019. A legislative committee is currently studying the sunset and has already requested the preparation of a bill. Revising the state USF to fund broadband is a very complex issue that would require a lot of study and significant legislative review, effort and time. The WBC and Advisory Council should work with all carriers and other stakeholders to study this issue in future legislative interims.



KEY ACTION ITEMS

Secure federal funding

- ▶ Identify eligible areas
- ▶ Publicize funding availability
- ▶ Provide trainings and technical assistance to potential applicants
- ▶ Evaluate the need for a state-wide grant writer and proceed as necessary

Improve rural funding models

- ▶ Assess impact of current and proposed funding models
- ▶ Provide feedback and/or official comments on funding models

Evaluate the reach of the Broadband Infrastructure Grant Fund

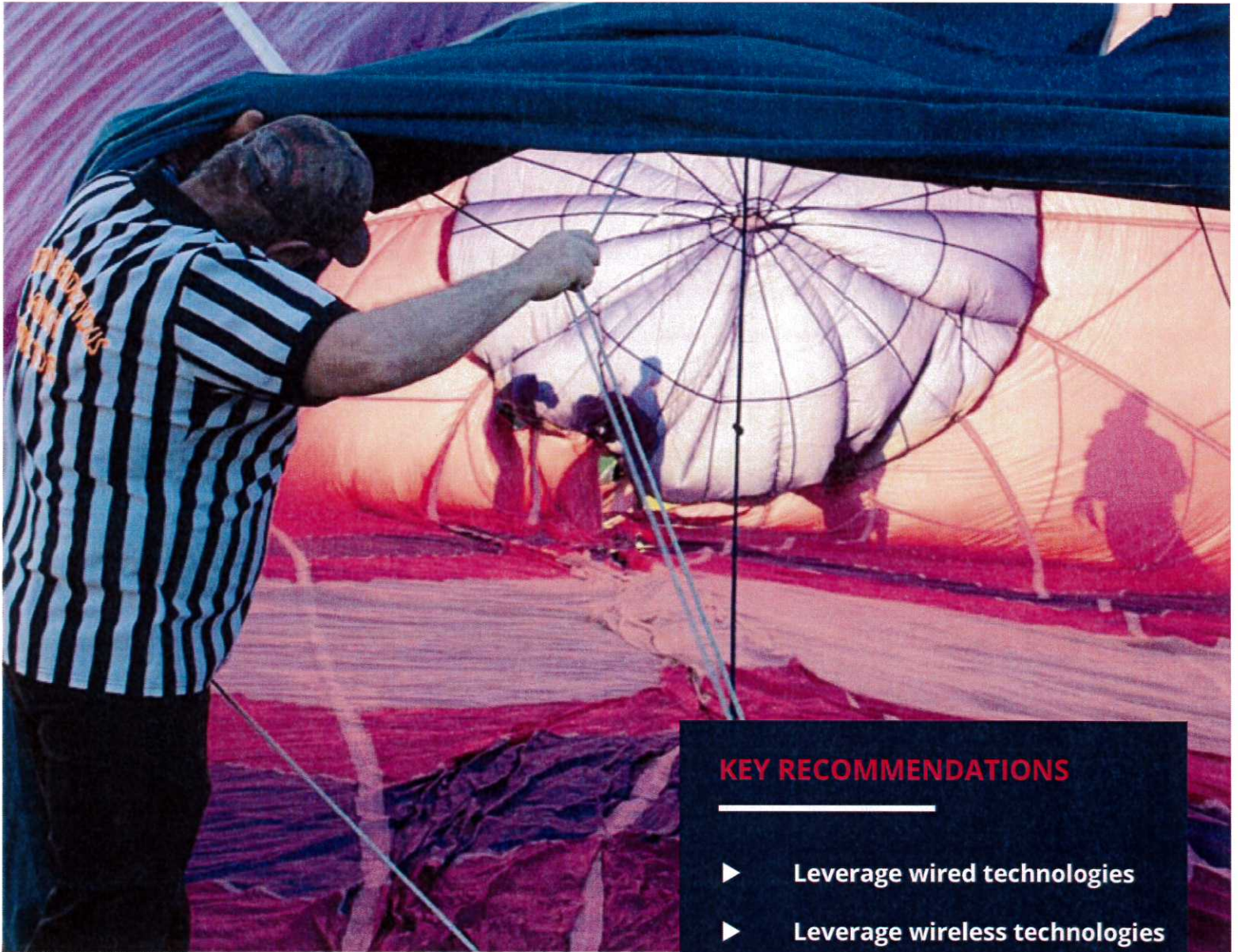
Incorporate broadband into Business Committed Projects

Consider a revolving loan fund

Develop a matching funds strategy

Engage with Wyoming Universal Service Fund stakeholders

Integrate Emerging Technologies



KEY RECOMMENDATIONS

- ▶ Leverage wired technologies
- ▶ Leverage wireless technologies
- ▶ Engage technology vendors
- ▶ Monitor emerging technologies

Because Wyoming has the lowest population density of the 48 contiguous states, the WBC and Advisory Council should follow emerging technologies that can serve its most remote communities and residents. Innovations in wired (fiber, cable, DSL), wireless (cellular, fixed wireless, Citizens Broadband Radio Space, TV white space, etc.), atmospheric (balloons, unmanned aerial vehicles, high altitude pseudo satellites) and satellite technologies (geostationary orbit, medium elliptical, low earth orbit) should be continually evaluated to determine how they could be incorporated into the state's ongoing plans.

Major corporations are making significant investments into some of these technologies. Alphabet, Google's parent company has announced Project Loon which is working to utilize high altitude balloons to create an aerial wireless network.

Facebook has announced plans to enter the broadband deployment industry by developing an internet satellite program to deliver broadband to unserved areas. Elon Musk's SpaceX has obtained FCC approval for a 4,425-satellite broadband network. OneWeb and Telesat are also working on satellite programs to increase coverage and speeds in hard to reach areas.

Fixed wireless and cellular technologies are also being innovated. In the next few years, 5G technologies and other fixed wireless solutions will be implemented to increase speeds, reduce latencies and serve customers more effectively.

Because the implications of these and other emerging technologies are still unknown, the WBC and Advisory Council should follow this four-pronged approach to determine how these technologies will be incorporated into Wyoming's ongoing broadband strategy.

Leverage Wired Technologies

Fiber, cable and DSL technologies have been delivering broadband to Wyoming residents and businesses since their inception. Fiber is also providing backhaul capacity for other wired and wireless technologies.

These technologies are key to Wyoming's ongoing strategy and the state should work with these providers to expand services into unserved areas, which also includes connecting anchor institutions and business corridors.

Leverage Wireless Technologies

Wireless technologies should also be part of Wyoming's ongoing plan. In some areas, wireless options may be the only economical solution to reach residences in remote, sparsely populated regions. The WBC should work with wireless providers as it looks to cover these areas.

The Broadband Manager and Advisory Council should educate themselves on these technologies, particularly so applicants applying for the Broadband Infrastructure Grant Fund can be fairly evaluated on speed, capacity, numbers of subscribers, latencies, spectrum and line of sight issues as funds are distributed. Providing wireless service has unique challenges because technologies are regularly changing and wireless service has not been considered in many realms of public policy.

Some of these areas include access to various bands of spectrum, Eligible Telecommunications Carrier (ETC) status, funding mechanisms, access to rights-of-way, tower siting, etc. Many of these companies are partnerships and proprietorships and some funding mechanisms only allow corporations to participate.

These companies are also deploying a range of technologies and equipment, which are frequently evolving, which makes policy considerations more complex. The WBC and Advisory Council should form a Fixed Wireless Working Group to better understand these issues and develop an ongoing strategy.

The state should also follow the deployment of emerging cellular technologies, particularly 5G services and work with state and local government agencies to develop strategies to support these deployment efforts.

Engage with Emerging Technology Vendors

Another strategy to position Wyoming as a partner to emerging technologies is to engage with these vendors and pursue ongoing collaborations. The WBC should position Wyoming as a key test bed location for vendors. The Broadband Manager and Advisory Council should pursue these relationships by inviting vendors to visit the state and meet with stakeholders to present recent developments.

They should consider developing incentives and/or competitions to attract these companies. They should also consider pursuing federal funding such as USDA funds as technologies become commercially available and pursuing National Science Foundation funds to encourage vendors to conduct research and development in Wyoming.

Conduct Ongoing Monitoring of Emerging Technologies

The WBC and Advisory Council should continue to monitor these and other technologies that are innovative and can disruptively enhance broadband service. They should follow news coverage of these technologies and attend forums and conferences that can educate them on these issues.

Attending broadband conferences and trade shows such as rural telecommunications meetings, Broadband Communities, Cable-Tec Expo, Wispaloosa, the Satellite Show, Space Symposium and the Space Tech Expo will help them stay informed. These events can provide a wealth of knowledge and perhaps face to face interactions with the entities that are pioneering these efforts.

Acronyms

Advisory Council	Wyoming Broadband Advisory Council
A-CAM	Alternative Connect America Model
Act	Wyoming Telecommunications Act of 1995
BIA	Bureau of Indian Affairs
EDA	Economic Development Administration
ENDOW	Economically Needed Diversity Options for Wyoming
ETC	Eligible Telecommunications Carrier
ETS	Department of Enterprise Technology Services
FCC	Federal Communications Commission
HUD	Housing and Urban Development
Gig	Gigabit
ITC	Integrated Test Center
Mbps	megabits per second
NREX	Natural Resource and Energy Explorer
NSF	National Science Foundation
NTCA	National Telecommunications Carriers Association
NTIA	National Telecommunications and Information Administration
Plan	Wyoming Broadband Enhancement Plan
RIEOR	Research Institute of Enhanced Oil Recovery
RBC	Regional Broadband Council
RWA	Rural Wireless Association
USDA	United States Department of Agriculture
UW	University of Wyoming
WAM	Wyoming Association of Municipalities
WBA	Wyoming Business Alliance
WBC	Wyoming Business Council
WCCA	Wyoming County Commissioners Association
WEDA	Wyoming Economic Development Association
WTA	Western Telecommunications Alliance
WUSF	Wyoming Universal Service Fund
WYDOT	Wyoming Department of Transportation
WYTA	Wyoming Telecom Association

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Broadband Enhancement Plan

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