

Larimer County, Colorado



Broadband Strategic Plan

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December 2021

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1. Executive Summary

1.1 Larimer County Strategic Plan

Larimer County's vision for expansion of high-speed fiber optic broadband is through partnerships allowing Larimer County to be one of the most connected areas in the country serving not only urban, but sub-urban and rural populations.

The work behind this Broadband Strategic Plan has been designed around the County's Strategic Plan, which identifies three goals that focus on improving the future of our community.

- Larimer County will work collaboratively to ensure adequate public infrastructure is available to support the needs of our growing community. Broadband/connectivity is part of this infrastructure goal.
- By the end of 2020, Larimer County will develop a comprehensive rural infrastructure strategy that defines the County's role, funding level, and targeted activities to expand broadband services within unincorporated areas.
- It is Larimer County's goal to explore and foster available options for broadband services in all communities; because ***Everywhere is Somewhere***.

The basis of this strategic plan is to leverage relationships with Connexion (City of Fort Collins), Pulse (City of Loveland), Platte River Power Authority (PRPA), Trailblazer (Estes Park) and Poudre Valley Rural Electric Association (PVREA) to accomplish the vision "*gig speed for everyone*" which can become a reality in Larimer County. This will be done by:

- Expanding municipal broadband networks currently operating and supported by municipal network operations, customer support and technical service.
- Targeting unserved areas of the County that have documented speed test data at numerous premises below the 25/3 Mbps.
- Providing a reliable, scalable and future proof solution built solely on fiber optic cable installation to proposed areas to be served.
- Designing an FTTP network that services rural routes across the County within a 3-mile buffer of electric service providers and primary travel routes.
- Providing options of equitable access to service and supporting long-term digital equity initiatives.

1.2 Opportunity

The opportunity to expand broadband into growth management area (GMA) and rural areas of the County is unique. Partnerships have been forming with municipal providers (Connexion and Pulse) and with rural electric associations (PVREA) to allow the networks to expand. Often, infrastructure initiatives such as rural broadband take hold when the timing is right around funding, need, and relationships.

Larimer County began its research and planning around fiber to the premise (FTTP) broadband initiatives in 2017. Columbia Telecommunications Corporation (CTC) was hired to perform a

Broadband Feasibility Study which was completed in December 2018. Since completion of the CTC Feasibility Report in 2018, the County has completed routine work to progress the broadband service conversation into unincorporated areas. With the onset of COVID-19 in 2020, the need for FFTP has been more prevalent to allow work from home, and provide telehealth, educational and other key community services to unserved areas.

Recently the County has been awarded Cares Act grant funding to possibly fund broadband initiatives. This funding has allowed the County to further research partnerships with municipal broadband service providers and rural electric associations to serve two distinct areas of the County. First, this plan evaluated opportunities to serve growth management areas (GMA) immediately adjacent to municipal boundaries already served by municipal providers. Second, this plan studied the ability for municipal broadband networks to be expanded to serve rural areas within a 3-mile boundary of rural electric infrastructure. Cost estimates and high-level network design were performed to understand the overall network infrastructure, size the network accordingly based on estimated service and prepare high-level cost estimates.

1.3 Costs and Funding

This strategic plan identified 19 areas within the Loveland and Fort Collins GMAs that could be potential broadband expansion projects totaling approximately \$91 million. Of these, 10 areas were included in a National Telecommunications and Information Administration (NTIA) grant application totaling over \$28 million in project costs. In addition to these sub-urban areas, this plan identified another 15 rural broadband expansion projects totaling approximately \$262 million in two priority groups. A detailed breakdown of each project, their scoring prioritization and cost can be found in **Appendix A**. While these costs are relatively prohibitive to expansion of any broadband network, there are individual projects within this plan that are achievable. The funding for any broadband network expansion would have to be from federal government grant sources as the municipal providers cannot support these capital expansion expenses. A brief summary of GMA priorities is shown below.

Priority No.	Area	Cost per Premise	Total Premises Passed	Total Cost (millions)
1.1	13	\$2,736	1,975	\$5.4
1.2	14	\$3,672	1,566	\$5.8
1.3	11	\$3,050	938	\$2.9
1.4	18	\$3,839	596	\$2.3
1.5	9	\$7,134	792	\$5.6
1.6	7	\$3,313	150	\$0.5
1.7	12	\$20,146	438	\$8.8
1.8	2	\$5,489	261	\$1.4
1.9	3	\$8,464	331	\$2.8

Priority No.	Area	Cost per Premise	Total Premises Passed	Total Cost (millions)
2.1	15	\$4,761	1,664	\$7.9
2.2	5	\$6,228	470	\$2.9
2.3	1	\$9,416	590	\$5.6
2.4	6	\$6,625	387	\$2.5
3.1	20	\$11,905	101	\$1.2
3.2	4	\$5,560	407	\$2.2
3.3	16	\$9,266	1,424	\$13.1
3.4	19	\$15,571	355	\$5.5
3.5	8	\$12,298	898	\$11.0
3.6	17	\$19,903	164	\$3.2
Totals			13,507	\$91 million

1.4 Implementation of Plan

The County’s goal of providing fiber optic broadband service to all unincorporated areas is a lofty one, and to do so, this plan has identified over \$350 million in projects. Each project is unique, has its own priority and serves a separate population. As each project has been prioritized, ranked and rated, the County has the data to progressively pursue projects that achieve their goals in a logical fashion. Recommendations spanning from this strategic plan include:

- Formalize relationships with municipal providers. Use tools such as memorandums of understanding and intergovernmental agreements to set the operating stage for expanding networks to sub-urban and rural areas.
- Analyze each project opportunity identified in this plan for timing and partnerships that leverage existing infrastructure, grant funding and installation opportunity. For projects that make sense to pursue, perform low-level design and refine each project cost.
- Leverage existing grant and ARPA funding to “kick start” high priority projects with Pulse and Connexion.
- Formalize relationship with PVREA and set pole lease rates, fiber lease rates and cost structure for long-term partnership.
- Continue to leverage grant funding opportunities. Translate information from this strategic plan into grant applications.
- Develop expansion plans to extend municipal broadband service to larger Larimer County towns such as Wellington, Timnath, Berthoud and others. Use these plans and partnerships as leverage in grant applications.

END EXECUTIVE SUMMARY

2. Introduction

Larimer County continues to develop its strategy around broadband development throughout the County. This work has been designed around the County's Strategic Plan, which identifies three goals that focus on improving the future of our community.

- Larimer County will work collaboratively to ensure adequate public infrastructure is available to support the needs of our growing community. Broadband/connectivity is part of this infrastructure goal.
- By the end of 2020, Larimer County will develop a comprehensive rural infrastructure strategy that defines the County's role, funding level, and targeted activities to expand broadband services within unincorporated areas.
- It is Larimer County's goal to explore and foster available options for broadband services in all communities; because ***Everywhere is Somewhere***.

One of the most essential components in broadband planning is forming strong collaborative partnerships with neighboring communities and the organizations that serve them. The effort undertaken with this *Broadband Strategic Plan* is meant to further the County's goals, establish and reinforce collaborative partnerships and develop a working plan to expand broadband to unincorporated areas of the County.

3. Purpose of the Study

Larimer County began its research and planning around fiber to the premise (FTTP) broadband initiatives in 2017. Columbia Telecommunications Corporation (CTC) was hired to perform a Broadband Feasibility Study which was completed in December 2018. CTC's overall recommendation stemming from the Feasibility Study was *"...we recommend the County not build costly infrastructure on speculation. Rather, we suggest the County continue to consider the feasibility of a future deployment and continue to pursue alternative options that would "move the needle" in specific, targeted areas where the economics make sense."*

Since completion of the CTC Feasibility Report in 2018, the County has completed routine work to progress the broadband service conversation into unincorporated areas. With the onset of COVID-19 in 2020, the need for FTTP has been more prevalent to allow work from home, telehealth, educational and other key community services to unserved areas.

Recently the County has been awarded Cares Act grant funding to possibly fund broadband initiatives. This funding has allowed the County to further research partnerships with municipal broadband service providers and rural electric associations to serve two distinct areas of the County. First, this plan evaluated opportunities to serve growth management areas (GMA) immediately adjacent to municipal boundaries already served by municipal providers. Second, this plan studied the ability for municipal broadband networks to be expanded to serve rural areas within a 3-mile boundary of rural electric infrastructure. Cost estimates and high-level network

design were performed to understand the overall network infrastructure, size the network accordingly based on estimated service and prepare high-level cost estimates.

Using the cost estimates and number of premises served, the County and its partners could then evaluate possible network build priorities and opportunities. From these priorities, a funding program could be developed. This strategic plan identified multiple funding options including programs that would provide revenue sharing or “payback” to the County for their initial capital investment in the broadband infrastructure. Each of these funding options was considered a Business Model. These are further discussed in Part 6 and provided in **Appendix A**.

3.1 Digital Divide

The digital divide is a term that refers to the gap between demographics and regions that have access to modern information and communications technology (ICT), and those that don't or have restricted access. This technology can include telephone, television, personal computers and internet connectivity. Well before the late 20th century, the digital divide referred chiefly to the division between those with and without telephone access. After the late 1990s, the term began to be used mainly to describe the split between those with and without internet access, particularly broadband.

The digital divide typically exists between those in urban areas and those in rural areas; between the educated and the uneducated; between socioeconomic groups; and, globally, between the more and less industrially developing countries. Even among populations with some access to technology, the digital divide can be evident in the form of lower-performance computers, lower-speed wireless connections, lower-priced internet use connections such as dial-up and limited access to subscription-based content.

According to studies and reports, the digital divide is still very much a reality today. In 2019, approximately 5 million rural American households and 15.3 million urban or metro areas still didn't have access broadband internet. Meanwhile, a study by the *Pew Research Center* noted that 24% of adults with household incomes below \$30,000 a year don't own a smartphone and 40% of those with lower incomes don't have home broadband services or a computer.

County leaders recognized the need to bridge the digital divide years ago and have been working diligently to assist its citizens in gaining access to broadband internet. Challenges exist across the County when considering installing broadband infrastructure. This strategic plan, addresses these challenges through thoughtful partnerships, design and appropriate budgeting.

- Rural Communities. Rural areas are planned to be served through use of rural electric providers pole network. This is the easiest and most cost-effective route to residents. Some residents in rural areas may own vacation property which may affect the number of customers served.
- Manufactured Homes. Most manufactured home communities are owned by separate landlords that own the land and lease spaces to each homeowner. When considering

access agreements to install broadband to these homes, the landlords must approve installation across their property to serve each home. Often, these landlords are not local, are difficult to reach and see little benefit to them in providing access to the service. Wifi mesh technology or other incentive solutions may prove useful to serve these areas.

3.2 County Goals

This strategic plan was specifically developed to help the County achieve its broadband initiative goals. The County sees itself as a convener and facilitator of broadband implementation, but recognizes its position is not to own, manage or provide broadband service. The County does not intend to compete in any way with other service providers, including municipal providers. It intends to work closely with municipal providers such as Pulse, Connexion and Trailblazer to further the County's goals of broadband service to unincorporated areas.

Goal: Larimer County will work collaboratively to ensure adequate public infrastructure is available to support the needs of our growing community. Broadband/connectivity is part of this infrastructure goal.

Action: The County has facilitated numerous meetings and partnerships that have resulted in intergovernmental agreements allowing broadband service to extend into unincorporated areas. This work has been taken in small steps, initially, but through this strategic plan, further expansion can be considered and implemented.

Goal: By the end of 2020, Larimer County will develop a comprehensive rural infrastructure strategy that defines the County's role, funding level, and targeted activities to expand broadband services within unincorporated areas.

Action: While 2020 provided numerous challenges to moving initiatives forward, the County has kept broadband at the forefront. In 2021, the County has developed a comprehensive plan, through this effort, to expand broadband services to unincorporated areas.

Goal: It is Larimer County's goal to explore and foster available options for broadband services in all communities; because *Everywhere is Somewhere*.

Action: This strategic plan maintains the target of this overall goal to provide options for broadband service in all Larimer County communities where service can be made available, reasonably.

3.3 Municipal Partnerships

A key to the County's strategy around the potential to provide broadband service to unincorporated areas is through partnerships with municipal broadband providers – specifically Pulse in Loveland, Connexion in Fort Collins and Trailblazer in Estes Park. This strategy involves the County as a funding partner, facilitator and collaborator providing a platform to leverage the municipal broadband networks, operations, customer service and support. These partnerships require a unique relationship where the municipal providers have a willingness and ability to extend their networks and service. The partnerships also require unique governance considering

the municipal providers act much like private enterprise where they set rates, compete and issue debt.

3.4 Governance

The County established a project team which comprised members of Pulse and Connexion to work through development of this strategic plan to ensure a cooperative approach to possible service to unincorporated areas of the County. This team met routinely to further conversations and develop parameters around how the municipal broadband expansion could function. These discussions led to establishment of an understanding of operational intent amongst the organizations. The parameters of this understanding have been outlined below. To complete the governance relationship, parameters in this strategic plan would then be translated to intergovernmental agreements between the municipal service providers and County to formalize the relationships.

3.4.1 Service Areas

The County, Pulse and Connexion agreed to honor service areas within the County predominately separated by CR30 and SH 392 with Pulse serving south of these roadways and Connexion north. Trailblazer has a set service area around Estes Park and does not overlap or compete with Pulse or Connexion. Predominately, as the actual service areas develop, each utility provider will continue to negotiate and refine the final, actual, service areas depending on network design and ability. Please see **Exhibit A** for a map of the service areas.

3.4.2 Funding

Funding for the potential expansion of municipal broadband networks throughout the County would primarily be reliant on federal grants or other potential grant sources that may be made available at the state and local levels. The County would provide a conduit to apply and administer the grants in partnership with Pulse and Connexion. Initially, in tangent with this strategic plan, the County applied for a National Telecommunications and Information Administration (NTIA) grant. This grant, if received, would provide a “launch pad” for the network expansion targeting the growth management areas of the cities of Fort Collins and Loveland. The County applied for \$27 million in NTIA grant funding which would not only start the network expansions, it would further a relationship with Poudre Valley Rural Electric Association (PVREA) allowing connections to their fiber network.

The County is also considering leveraging their \$60 million America Rescue Plan Act (ARPA) funds for broadband expansion. For broadband funding through this program to occur, this strategic plan is to show the need and costs related to network expansion to underserved areas. The County also desires to recover a certain amount of funding through user rates associated with network service. While the municipal providers agree a return to the County (revenue sharing) on their initial capital investment is possible, they have been clear that the money returned to the County needs to make business

sense while still keeping rates competitive and market driven. To achieve possible funding scenarios with revenue share-back to the County, this strategic plan prepared a number of sample financial business models that could form the basis of revenue sharing inside an intergovernmental agreement. The example business models are provided in the **Business Models** section of this plan and one case, FTTP service to Red Feather Lakes, is highlighted below in **Table 1**. This strategic plan did not finalize any specific model, rather the models have been provided as tools that the agencies can refine, finalize and use to establish a finished revenue sharing agreement.

Further, the municipal providers have stated that they would maintain ownership of the infrastructure assets, provide maintenance and operations to support the full FTTP network expansion. The providers would maintain control over rate setting and run the rural networks as part of their normal business operations. The municipal provider or County would execute agreements with PVREA or other electric associations to utilize their infrastructure (poles) to convey their fiber cabling likely under long-term lease arrangements. If the County maintains the lease agreement, it would simply sublease to the providers. As each service case is unique, this strategic plan is meant to be flexible in this regard to provide the best service solution.

Table 1
Business Case: Livermore to Red Feather (FTTP)

Income Model	Assumes County funds \$23 million cap ex with 10% subsidy			
Year	Net Provider Revenue	Net Income to County	Annualized ROI	Cost of Service per Premise
5	\$1,059,123	\$380,546	1.79%	\$110
Amortization Model	Assumes County funds \$23 million cap ex with 10% subsidy; amortized at 30 years, 1.0% interest; annual payments			
Year	Net Provider Revenue	Net Income to County	Annualized ROI (capped at 30-yrs)	Cost of Service per Premise
5	\$1,059,123	\$819,862	3.8%	\$110
Market Rate Model	Assumes County funds \$23 million cap ex with 10% subsidy; market rate applied to income			
Year	Net Provider Revenue	Net Income to County	Annualized ROI (capped at 30-yrs)	Cost of Service per Premise
5	\$516,741	\$172,745	0.82%	\$74.90

3.4.3 Operations

Operations of an expanded municipal broadband network would be the responsibility of Pulse and Connexion, the municipal providers. Part of the unique benefit of this partnership is the ability to expand an existing network to rural areas of the County without incurring the upfront cost of establishing a new utility. Pulse and Connexion already share a Network Operations Center (NOC) and work closely together on this operational component. Each provider also maintains 24/7 customer service representatives and have the ability to “roll” technicians to customers to address service calls. The County would not play a role in any network operations or customer service.

3.4.4 Rural Electric Partnerships

The County has previously participated in partnership arrangements with PVREA and Platte River Power Authority (PRPA) for communications to various facilities throughout the county. This strategic plan furthers those relationships, specifically with PVREA, to utilize existing infrastructure to extend municipal broadband networks. Initially, the County has agreed to fund a portion of feeder fiber to the Red Feather Lakes area in partnership with PVREA. This rural fiber build couples two needs:

1. The need for PVREA to have fiber communications to rural electric substations.
2. The need for the County, and in turn Connexion, to have feeder fiber as a main communications trunk to the Red Feather area.

Following on the feeder fiber installation to Red Feather, a distribution project would be needed to fully establish FTTP and bring high speed broadband service to the area. The costs for these projects have been estimated as part of this plan and each project prioritized based on a criterion of need.

The partnership between the County and rural electric providers (primarily PVREA) are planned to continue, and be strengthened, as part of this strategic initiative.

4. Outside Plant Network

This strategic plan builds upon the CTC study completed in 2018 and uses portions of this study's data to inform fiber feeder routes and population centers. However, this plan only looks at a 3-mile buffer area around proposed feeder fiber routes to establish premise counts and possible service scenarios. From this, cost estimates were prepared to understand the overall programmatic costs associated with expanding both the Pulse and Connexion outside plant networks.

4.1 Existing Facilities

To fully understand the ability to expand the municipal networks, this strategic plan evaluated the capacity and terminus points for both the Pulse and Connexion feeder routes. Then, as an initial step in evaluating network expansion, the plan evaluated service to various GMA priority areas as part of the NTIA grant application. Both Connexion and Pulse have extensive feeder fiber routes throughout their current municipal boundaries.

Connexion and Pulse are both implementing Fiber to the Premise (FTTP) networks. The network designs are Gigabit Passive Optical Network (G-PON) networks, with the capability to be upgraded to NG-PON2. The networks accommodate all residential and business premises within the respective service areas and can accommodate growth and expansion of the networks to serve unincorporated areas of Larimer County.

The GPON networks are designed utilizing passive 1x32 splitters placed inside an FDH or cabinet enclosure. Each 288 FDH will target to serve approximately 250 premises and be fed via distribution fibers routed from the Optical Line Terminal (OLT). FTTP design resembles a ring and tree architecture and will consist of active and passive components. The networks fan out throughout the communities along the roadways destined for the property line of prospective customers. At the final branches of the tree, customer drop cables are connected to the access network and fiber is connected to the preferred placement inside the home. At the intersection between the regional backbone and the access network are Fiber Huts. Network electronics are housed at these locations and may contain a variety of equipment (DWDM gear, Switches, Routers, OLTs, and FTPs).

4.1.1 Connexion

Fort Collins Connexion, initiated by a 2017 ballot measure, is the locally managed broadband service offering gigabit internet service to customers throughout Fort Collins. Their network relies on 100% spliced configuration (not connectorized) and is approximately 90% complete. Their network feeder route is shown in **Exhibit B**.

4.1.2 Pulse

Established in 2018, Pulse was formed specifically to provide gigabit internet service to the residents and businesses in Loveland. Their network consists of both spliced and connectorized systems to provide FTTP and is approximately 60% complete. The Pulse feeder network is shown in **Exhibit C**.

4.1.3 Poudre Valley Rural Electric Association (PVREA)

PVREA is an electric distribution cooperative owned by the members it serves. PVREA was founded in 1939 by its members to provide reliable electricity to Northern Colorado communities. Today, PVREA covers 2,000 square miles of service territory in Larimer, Weld, and Boulder counties and includes over 4,000 miles of overhead, underground and transmission lines combined; serving over 48,000 homes and businesses. The Larimer County partnership with PVREA is critical to reaching unserved customers in the middle and last mile areas of Larimer County. PVREA's fiber distribution and electrical power pole map can be found in **Exhibit D**.

4.2 Middle Mile

Middle mile is normally described as a fiber feeder network that will be designed and built to reach the furthest sections or areas of a network extending out the core network infrastructure. It is typically expensive to build and requires partnerships and grant funding to accomplish broadband service to these rural areas. Recently, the United States Federal Government has provided extensive amounts of grant funding for middle mile expansion through programs within the FCC, NTIA, and others. The goal of the various federal programs has been to bridge the "middle mile gap" getting fiber communications installed to key community anchor institutions in rural areas such as schools, fire and police stations, libraries and community facilities.

Larimer County has recognized the importance of serving its rural communities and desires, through this plan, to partner with municipal broadband networks to provide for long-term sustainability on a 100% fiber optic network. This not only creates immediate opportunity and long-term sustainability; it creates a launch pad for middle and last mile network installation to the rural areas of the county.

4.3 Network Design Approach

To appropriately provision for municipal outside plant network expansion, this plan designed a specific approach to service the prioritized areas of the county from GMA to last mile.

4.3.1 Growth Management Area (GMA)

Network design in the GMA immediately surrounding existing municipal fiber networks includes the ability to serve thousands of premises immediately adjacent to current municipal city limits. The network design approach to these areas allows the existing feeder networks to be simply extended to these areas of the county. At this time, no additional hut or active network improvements are expected to serve these areas. Ample fiber contingencies have been built into the outside plant network to accommodate these populations.

4.3.1.1 Middle Mile

Network design around the middle mile fiber network will utilize existing aerial utility pole infrastructure to extend feeder fiber further into rural Larimer County extending the reach of the existing municipal fiber networks. To extend broadband connectivity sufficiently into the last mile and provide access to the network to feed each premise, additional OLT shelters/huts will be required likely placed at the end of these middle mile feeder routes prior to distribution. This will require more network equipment and terminations. These costs have been included in the estimates for each project priority. Additionally, these middle mile routes will require “make ready” pole upgrades to carry the additional fiber optic cable loads. Make ready costs are also included in the project costs.

4.3.1.2 Last Mile (to the premise)

As middle mile fiber is built along existing primary utility distribution routes, the last mile network will follow existing overhead utility infrastructure to each premise. Rural service areas will be subdivided and served from FDH cabinets following the typical design rules for each municipal network for spare capacity and feeder fiber allocation. In rural areas, it is anticipated that a combination of aerial and underground service drop construction will be required.

5. Project Prioritization – Decision Model

To assist in prioritizing the broadband expansion projects across the County, this plan created a multi-criteria decision analysis (MCDA) model. The model established level of importance

criteria, then scored and ranked the elements to develop a full priority ranking. The MCDA was built in three parts to score and rank:

- Growth management areas (priority 1-3)
- Rural areas (priority 4) – overhead installation
- Rural areas (priority 5) – overhead installation

Each project within these parts was scored, ranked and prioritized. A map showing each of these areas is shown in **Exhibit E and Exhibit F**. The rating approach for each part was done using the criteria shown below in **Table 2**.

Table 2

Rating Criteria						
Cost Per Premise	Equity and Need	Total Premises Passed	Service Level/Service Need	Key Community Assets	Joint Funding Opportunity	Ability to Expand Network
\$	1-5	#	1-5	1-5	1-5	1-5

Each criterion was rated using a score from 1 to 5 with 5 representing a greater need, service opportunity, partnership opportunity or enhanced network expansion. From this step, the MCDA then weighted each category to develop a total score, summed to rank each part of the network expansion. Scoring weights are shown below in **Table 3**.

Table 3

Score Weight						
Cost Per Premise (\$)	Equity and Need	Total Premises Passed (#)	Service Level/Service Need	Key Community Assets	Joint Funding Opportunity	Ability to Expand
5	20	10	15	15	5	30

The MCDA then produced three charts to summarize the criteria score and total weight to develop a visual comparison of prioritization. These are shown in **Exhibits G, H and I**.

5.1 Prioritized Routes

From the MCDA model output, the routes were then prioritized in a graphical fashion on a map that illustrated the relative middle mile build opportunities across the County. This map is shown in **Exhibit F**. These routes represent the possible middle mile feeder fiber network expansions, based on priority, that could serve 55,700 premises throughout the County. Outside the GMA areas evaluated, all other routes would rely on overhead installation in partnership with PVREA. **Table 4** below summarizes each priority area/project, the cost per premise, number of premises passed and total cost.

Table 4

Priority No.	Area	Cost per Premise	Total Premises Passed	Total Cost (millions)
1.1	13	\$2,736	1,975	\$5.4
1.2	14	\$3,672	1,566	\$5.8
1.3	11	\$3,050	938	\$2.9
1.4	18	\$3,839	596	\$2.3
1.5	9	\$7,134	792	\$5.6
1.6	7	\$3,313	150	\$0.5
1.7	12	\$20,146	438	\$8.8
1.8	2	\$5,489	261	\$1.4
1.9	3	\$8,464	331	\$2.8
2.1	15	\$4,761	1,664	\$7.9
2.2	5	\$6,228	470	\$2.9
2.3	1	\$9,416	590	\$5.6
2.4	6	\$6,625	387	\$2.5
3.1	20	\$11,905	101	\$1.2
3.2	4	\$5,560	407	\$2.2
3.3	16	\$9,266	1,424	\$13.1
3.4	19	\$15,571	355	\$5.5
3.5	8	\$12,298	898	\$11.0
3.6	17	\$19,903	164	\$3.2
4.1	Drake	\$3,755	2,580	\$9.7
4.2	Pole Hill Road	\$5,778	1,473	\$8.5
4.3	Red Feather	\$5,512	4,271	\$23.5
4.4	West of Wellington	\$3,696	8,723	\$32.2
4.5	West Berthoud	\$2,437	10,701	\$26.0
4.6	Wellington	\$3,290	7,252	\$23.9
4.7	Buckhorn Road	\$9,054	1,310	\$11.9
4.8	CR27 E	\$4,403	2,005	\$8.8
4.9	Rist Canyon Road	\$4,938	2,260	\$11.1
5.1	Rustic	\$26,796	291	\$7.8
5.2	Glen Haven	\$3,800	528	\$2.0
5.3	CR180/82E	\$112,599	258	\$29.0
5.4	Rural Northwest	\$256,599	232	\$59.4
5.5	SH287 North	\$25,441	182	\$4.6
5.6	Red Mountain Road	\$22,612	136	\$3.1
Totals			55,709	\$353 million

5.2 Costs

Costs for priority areas 1, 2, and 3 (GMA areas) came from the Pulse build contract. These costs have been carefully tracked during the as-built work on the network, and are frequently compared to budget and industry trends. Costs for the entire Loveland build, including mainline construction, premise installation, hut placement, network electronics, premise installation, and materials were included to provide a complete picture of costs associated with the construction of outside plant fiber optic networks. These total costs were then compared to the total length of road centerline within the Loveland service area. Using centerline of road lengths in the priority areas with the cost per centerline foot previously calculated, new costs estimates were projected for the new priority areas.

For priority areas 4 and 5 (Rural areas), costs came from PVREA’s on-call cabling contractor as well as contracts set up for overhead work in the Pulse network. These numbers relate to the footages of installed cabling, as well as costs associated with make-ready work on existing power poles.

After the estimation of base costs for each priority area, the inclusion of contingencies was applied to develop an overall project budget for each route or area. **Table 5** displays the various contingencies with their respective percent values as applied to the cost of work.

Table 5

Contingency Category	%
Materials Cost Inflation	20.0%
Estimating Contingency	8.0%
Owner Contingency	18.0%
Engineering and Network Design	10.0%
Project Management	4.5%

Due to the extremely abnormal fluctuations in material costs associated with the current economy-wide supply chain, special attention was given to the potential for material cost increases in the coming years, which resulted in a relatively high percentage of contingency applied to material costs. Estimating contingency works to counter any potential changes from design assumptions to field-built networks, and owner contingency provides budgetary room to ensure potential construction costs and unforeseen conditions are accounted for. Finally, allowance is made for the costs of detailed design and project management.

6. Business Models

In order to understand the financial relationship between Larimer County as a facilitator of funding and the municipal providers, various financial models were developed in an effort to understand how the County might recover funds for capital expense of expanding the outside plant networks for Pulse and Connexion. Three primary models were developed.

▪ **Amortization Model**

The amortization model acts like its name. A financed amount for capital expense (cap ex) is amortized over a set period of time (30 years) at a pre-determined interest rate (1.0%). This model also assumed:

- Take rate ramp up to 50% of all customers within the 3-mile buffer
- Operational expense (op ex) based on typical municipal costs
- Inflation of op ex at 1.20% annually after year 6
- Subscription rate increases of 1.50% annually after year 6
- 1.0% loan rate
- Various pay back triggers based on gross revenue and op ex
- 33% reserve set aside of gross revenue to ensure operational sustainability

▪ **Income Model**

The income model was created to provide perpetual revenue back to the County for its cap ex investment. This model simply applies an income to the County as a % of Connexion's gross revenue for the area. At its most basic level, this model is simply a revenue sharing model. It includes:

- Take rate ramp up to 50% of all customers within the 3-mile buffer
- Operational expense (op ex) based on typical municipal costs
- Inflation of op ex at 1.20% annually after year 6
- Subscription rate increases of 1.50% annually after year 6
- 15% of gross income to County, annually
- Triggers for revenue sharing of >\$150,000 in ending balance after all costs are accounted for and revenue set aside is applied to ensure operational sustainability

▪ **Market Rate Model**

The market rate model is a derivation of the income model but applies a lower subscription cost to match that of the municipal areas. This model attempts to create equity across the customer base regardless of rural or urban location. However, it will ultimately create a second subsidy as the County's ROI is decreased recognizing that rural operations are more expensive. This model includes:

- Take rate ramp up to 50% of all customers within the 3-mile buffer
- Operational expense (op ex) based on typical municipal costs
- Inflation of op ex at 1.20% annually after year 6
- Subscription rate increases of 1.50% annually after year 6
- 10% of gross income to County, annually
- Triggers for revenue sharing of >\$150,000 in ending balance after all costs are accounted for and revenue set aside is applied to ensure operational sustainability

Each model assumes the County would contribute at least a 10% cap ex subsidy to the sample project. The sample project evaluated was both the feeder network and last mile installation for

the Red Feather Lakes area which included extending the feeder network from Livermore, serving Crystal Lakes, Red Feather and Glacier View. The total cap ex cost for this project is over \$23.5 million.

Each of the business models can be found in **Appendix A**.

6.1 Market Conditions

As noted in Section 5.2 of this plan, costs associated with building an extension of the outside plant networks are highly variable. Risk around estimating costs in the current market conditions is very high. Various construction materials, labor and equipment rates have increased as much as 10% per quarter over the past 12-14 months. This market condition competes directly with the County's goal of bridging the digital divide. The County and municipal providers should look to opportunities to leverage existing network locations, PVREA fiber and other existing infrastructure to further the digital divide goal without incurring extensive additional costs. An approach such as this requires regular planning and collaboration to maximize regional opportunities.

In addition to construction and material cost increases, the market rate for subscriptions remains relatively flat. Each provider must weigh the revenue from subscriptions, op ex and offerings to balance the business plan; ensuring take rate and sustainability. Often, as each municipal provider competes with the private sector, the viability of rural outside plant network expansion may be challenged by market conditions without significant subsidy by the County. County leaders should understand this market reality and how it translates to the real ability to expand municipal broadband networks. Each network expansion project should be weighed for its ability to serve customers and remain viable long-term.

7. Next Steps and Recommendations

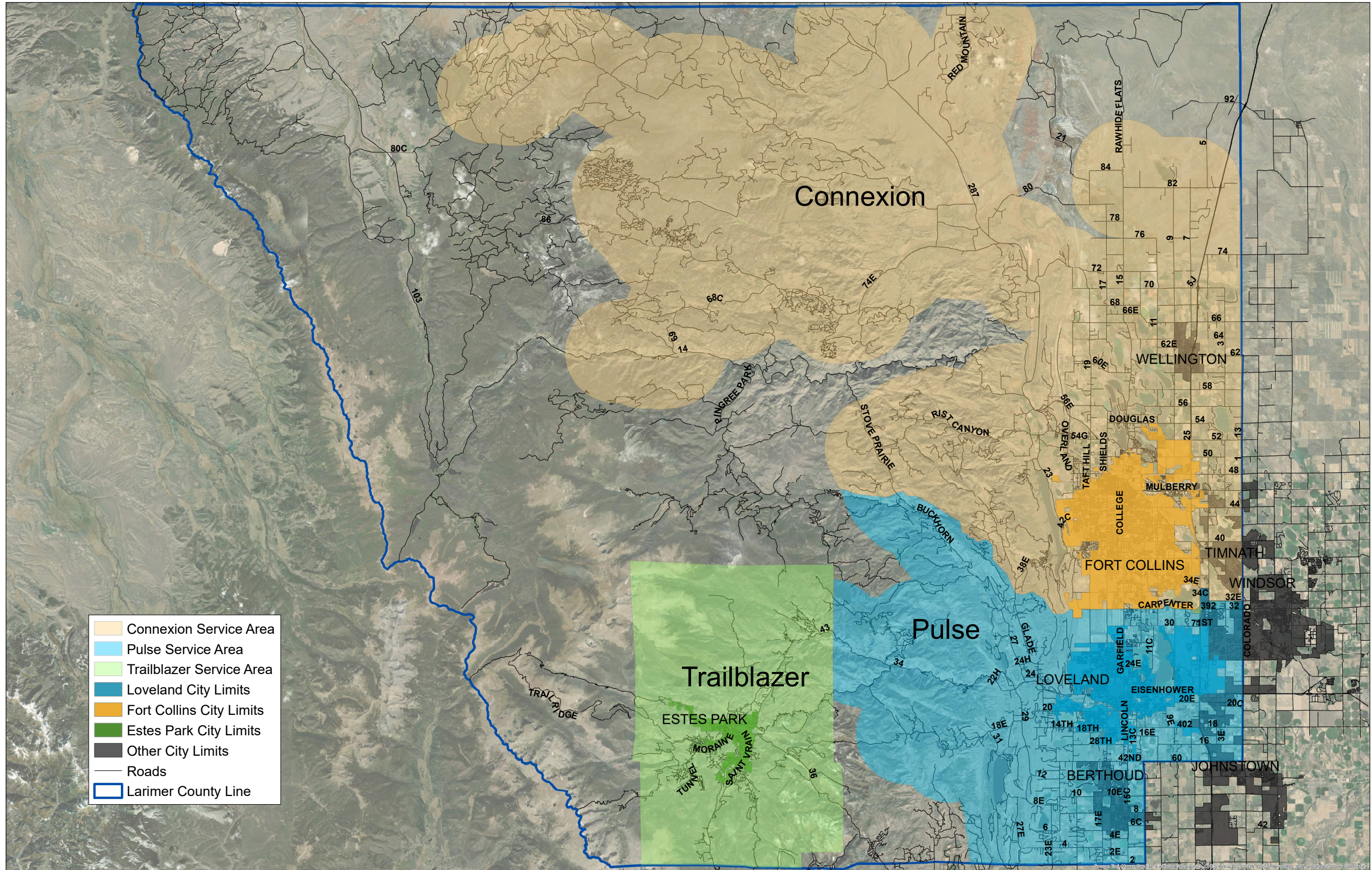
The County's goal of providing fiber optic broadband service to all unincorporated areas is a lofty one. To do so, this plan has identified over \$350 million in projects. Each project is unique, has its own priority and serves a separate population. As each project has been prioritized, ranked and rated, the County has the data to progressively pursue projects that achieve their goals in a logical fashion. Recommendations spanning from this strategic plan include:

- Formalize relationships with municipal providers. Use tools such as memorandums of understanding and intergovernmental agreements to set the operating stage for expanding networks to sub-urban and rural areas.
- Analyze each project opportunity identified in this plan for timing and partnerships that leverage existing infrastructure, grant funding and installation opportunity. Projects that make sense to pursue, perform low-level design and refine each project cost.
- Leverage existing grant and ARPA funding to "kick start" high priority projects with Pulse and Connexion.
- Formalize relationship with PVREA and set pole lease rates, fiber lease rates and cost structure for long-term partnership.

- Continue to leverage grant funding opportunities. Translate information from this strategic plan into grant applications.
- Develop expansion plans to extend municipal broadband service to larger Larimer County towns such as Wellington, Timnath, Berthoud and others. Use these plans and partnerships as leverage in grant applications.

Exhibit A

Exhibit A: Service Areas



- Connexion Service Area
- Pulse Service Area
- Trailblazer Service Area
- Loveland City Limits
- Fort Collins City Limits
- Estes Park City Limits
- Other City Limits
- Roads
- Larimer County Line

*Not printed to scale

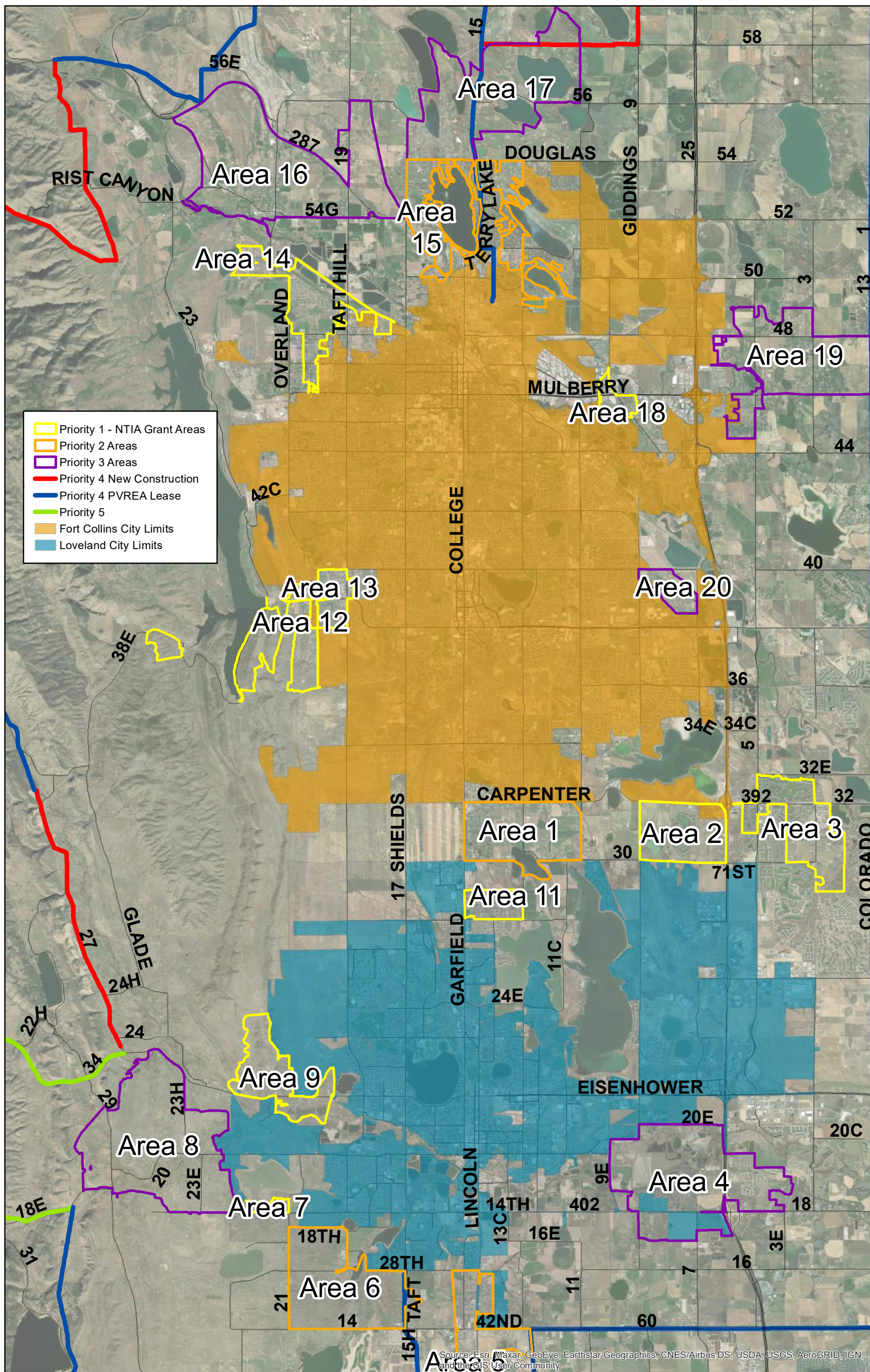
Exhibit B

Exhibit C

Exhibit D

Exhibit E

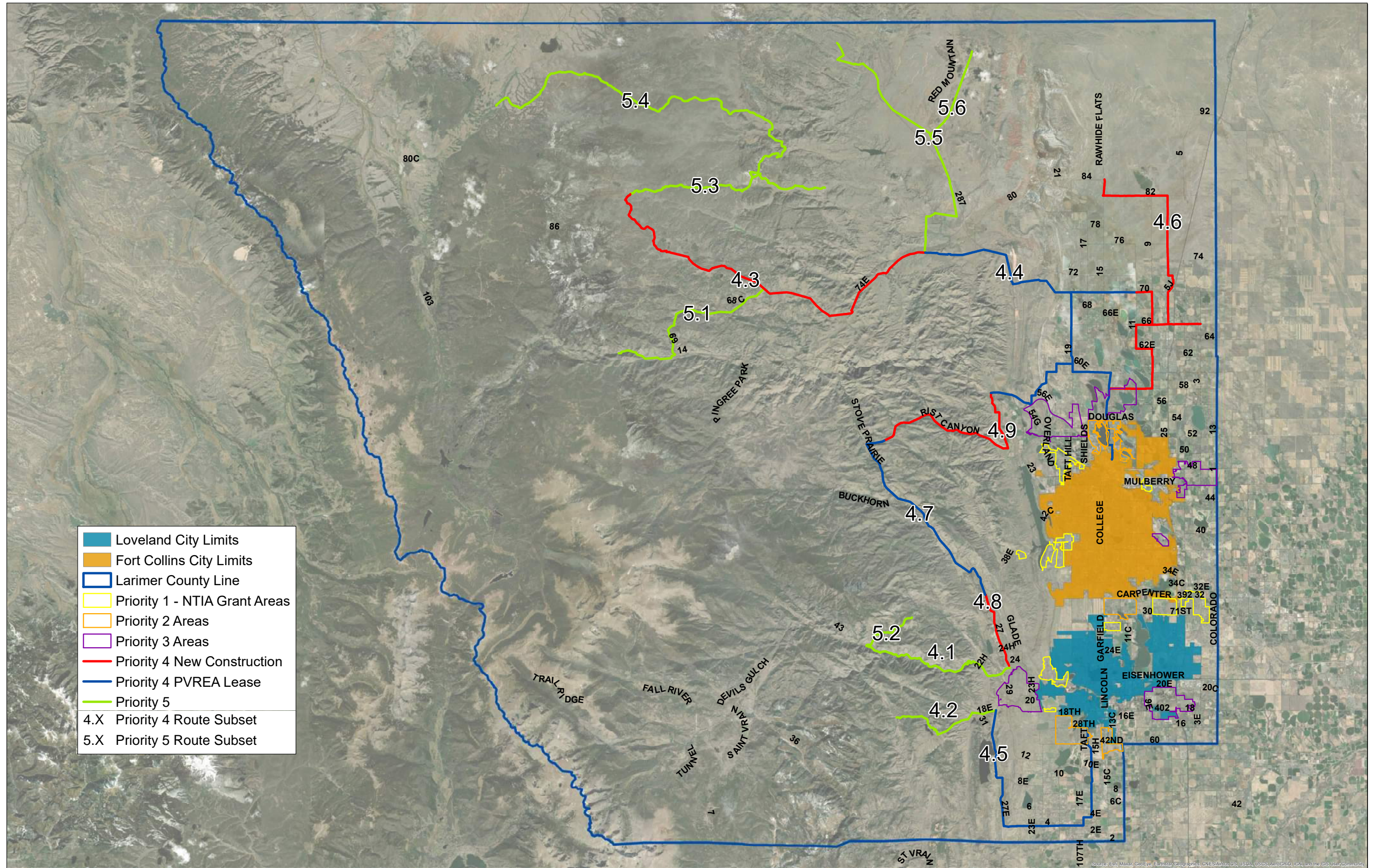
Exhibit E: Priority Areas



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Exhibit F

Exhibit F: Priority Routes



- Loveland City Limits
- Fort Collins City Limits
- Larimer County Line
- Priority 1 - NTIA Grant Areas
- Priority 2 Areas
- Priority 3 Areas
- Priority 4 New Construction
- Priority 4 PVREA Lease
- Priority 5
- 4.X Priority 4 Route Subset
- 5.X Priority 5 Route Subset

*Not printed to scale

Exhibit G

**Larimer County Broadband Strategic Plan
Project Priority Decision Model**

		Step #1: Assign each group a weight, according to its importance. The higher weight should correspond to the most important infrastructure category. The Group Weights should add to 100 and be placed in the gray cells	Step #2: Assign each subcategory a criteria weight within the category. The cumulative sum of the subcriteria cannot exceed the weight of the group weight. The total value will turn red if this is not met.	Step #3: Provide a score from 0 to 5 for each item. 0 begin the lowest priority, 5 being the highest priority. To include multiple evaluators, add each score together for each category and take the average. The average value will be input into the spreadsheet for calculation.							Step #4: Scores will be automatically calculated based upon the Criteria weight and Rating. Scores are tabulated in the graph below and on the following tabs.							
		Rating								Score								
Criteria Categories	Group Weight (not used)	Criteria Weight	Cost Per Premise (\$)	Equity and Need (1-5)	Total Premises Passed (#)	Service Level/Service Need (1-5)	Key Community Assets (1-5)	Joint Funding Opportunity (1-5)	Ability to Expand (1-5)	Cost Per Premise	Equity and Need	Total Premises Passed	Service Level/Service Need	Key Community Assets	Joint Funding Opportunity	Ability to Expand	Total Score	Total Cost
GMA Boundary Area (Priorities 1-3)										5	20	10	15	15	5	30		\$ 90,972,685
Priority 1	Area 13 (NTIA)		\$ 2,736	5	1975	5	3	3	5	100.92	400.00	219.90	300.00	225.00	100.00	600.00	1,946	\$ 5,403,600
	Area 14 (NTIA)		\$ 3,672	5	1566	5	3	3	5	98.18	400.00	193.73	300.00	225.00	100.00	600.00	1,917	\$ 5,750,352
	Area 11 (NTIA)		\$ 3,050	5	938	5	3	3	5	100.00	400.00	153.55	300.00	225.00	100.00	600.00	1,879	\$ 2,860,900
	Area 18 (NTIA)		\$ 3,839	5	596	5	3	3	5	97.69	400.00	131.67	300.00	225.00	100.00	600.00	1,854	\$ 2,288,044
	Area 9 (NTIA)		\$ 7,134	4	792	5	3	3	5	88.05	333.33	144.21	300.00	225.00	100.00	600.00	1,791	\$ 5,650,389
	Area 7 (NTIA)		\$ 3,313	4	150	5	3	3	5	99.23	333.33	103.13	300.00	225.00	100.00	600.00	1,761	\$ 496,950
	Area 12 (NTIA)		\$ 20,146	3	438	5	4	3	5	50.00	266.67	121.56	300.00	300.00	100.00	600.00	1,738	\$ 8,823,948
	Area 2 (NTIA)		\$ 5,489	3	261	5	3	3	5	92.87	266.67	110.24	300.00	225.00	100.00	600.00	1,695	\$ 1,432,629
	Area 3 (NTIA)		\$ 8,464	3	331	5	3	3	5	84.17	266.67	114.72	300.00	225.00	100.00	600.00	1,691	\$ 2,801,584
	Priority 2	Area 15		\$ 4,761	3	1664	3	3	2	5	95.00	266.67	200.00	150.00	225.00	50.00	600.00	1,587
Area 5			\$ 6,228	3	470	4	3	2	5	90.71	266.67	123.61	225.00	225.00	50.00	600.00	1,581	\$ 2,927,160
Area 1			\$ 9,416	3	590	4	3	2	5	81.38	266.67	131.29	225.00	225.00	50.00	600.00	1,579	\$ 5,555,440
Priority 3	Area 6		\$ 6,625	3	387	4	3	2	5	89.54	266.67	118.30	225.00	225.00	50.00	600.00	1,575	\$ 2,563,875
	Area 20		\$ 11,905	4	101	4	2	2	5	74.10	333.33	100.00	225.00	150.00	50.00	600.00	1,532	\$ 1,202,405
	Area 4		\$ 5,560	2	407	3	3	2	5	92.66	200.00	119.58	150.00	225.00	50.00	600.00	1,437	\$ 2,262,920
	Area 16		\$ 9,266	4	1424	4	3	2	4	81.82	333.33	184.64	225.00	225.00	50.00	300.00	1,400	\$ 13,194,784
	Area 19		\$ 15,571	3	355	5	3	2	4	63.38	266.67	116.25	300.00	225.00	50.00	300.00	1,321	\$ 5,527,705
	Area 8		\$ 12,298	3	898	4	3	2	4	72.95	266.67	150.99	225.00	225.00	50.00	300.00	1,291	\$ 11,043,604
	Area 17		\$ 19,903	2	164	5	3	2	4	50.71	200.00	104.03	300.00	225.00	50.00	300.00	1,230	\$ 3,264,092
Larimer County Middle Mile (Priority 4)		1																\$ 155,766,906
	4.1 Drake		\$ 3,755	5	2580	5	3	2	4	100.01	400.00	723.47	300.00	300.00	75.00	750.00	2,648	\$ 9,687,900
	4.2 Pole Hill Road		\$ 5,778	4	1473	5	3	3	3	99.61	300.00	441.07	300.00	300.00	100.00	600.00	2,141	\$ 8,510,994
	4.3 Red Feather		\$ 5,512	5	4271	5	3	5	4	76.76	400.00	131.53	300.00	225.00	100.00	600.00	1,833	\$ 23,541,752
	4.4 PVREA W of Wellington		\$ 3,696	5	8723	4	3	5	4	90.49	400.00	178.94	150.00	225.00	100.00	600.00	1,744	\$ 32,240,208
	4.5 PVREA West Berthoud		\$ 2,437	4	10701	4	4	4	4	100.00	300.00	200.00	150.00	300.00	83.33	600.00	1,733	\$ 26,078,337
	4.6 Wellington		\$ 3,290	5	7252	4	3	3	4	93.55	400.00	163.27	150.00	225.00	66.67	600.00	1,698	\$ 23,859,080
	4.7 PVREA Buckhorn Road		\$ 9,054	4	1310	5	4	4	3	50.00	300.00	100.00	300.00	300.00	83.33	300.00	1,433	\$ 11,860,740
	4.8 CR 27E		\$ 4,403	5	2005	4	2	3	3	85.14	400.00	107.40	150.00	150.00	66.67	300.00	1,259	\$ 8,828,015
	4.9 Rist Canyon Road		\$ 4,938	3	2260	5	2	3	3	81.10	200.00	110.12	300.00	150.00	66.67	300.00	1,208	\$ 11,159,880
Larimer County Middle Mile (Priority 5)		1																\$ 105,961,584
	5.1 Rustic		\$ 26,796	4	291	5	3	3	2	95.44	300.00	139.54	300.00	300.00	100.00	450.00	1,685	\$ 7,797,636
	5.2 Glen Haven		\$ 3,800	5	528	4	2	3	3	100.00	400.00	200.00	150.00	225.00	100.00	600.00	1,775	\$ 2,006,400
	5.3 CR180/CR82E		\$ 112,599	4	258	5	1	1	1	78.43	300.00	131.12	300.00	150.00	50.00	300.00	1,310	\$ 29,050,542
	5.4 Rural NW		\$ 256,041	4	232	5	1	1	1	50.00	300.00	124.49	300.00	150.00	50.00	300.00	1,274	\$ 59,401,512
	5.5 287 North		\$ 25,441	3	182	5	1	2	1	95.71	200.00	111.73	300.00	150.00	75.00	300.00	1,232	\$ 4,630,262
	5.6 Red Mountain Road		\$ 22,612	3	136	5	1	2	1	96.27	200.00	100.00	300.00	150.00	75.00	300.00	1,221	\$ 3,075,232

Group Weight Definition

Rating	Definitions
Cost per Premise	
Equity and Need	Economic need for affordable broadband,
Total Premises Passed	Total Premises to be served
Service Level/Service Need	Availability of High Speed Broadband Service
Key Community Assets	Key County or municipal assets to be served (WTP, Substations, Emergency Response Systems, etc)
Joint Funding Opportunity	Joint Funding Opportunity with other utility and infrastructure owners
Ability to Expand	Adjacent to existing municipal fiber service or other partner infrastructure

TOTAL \$ **352,701,175**

LC Broadband Growth Management Area Multi-Criteria Decision Analysis

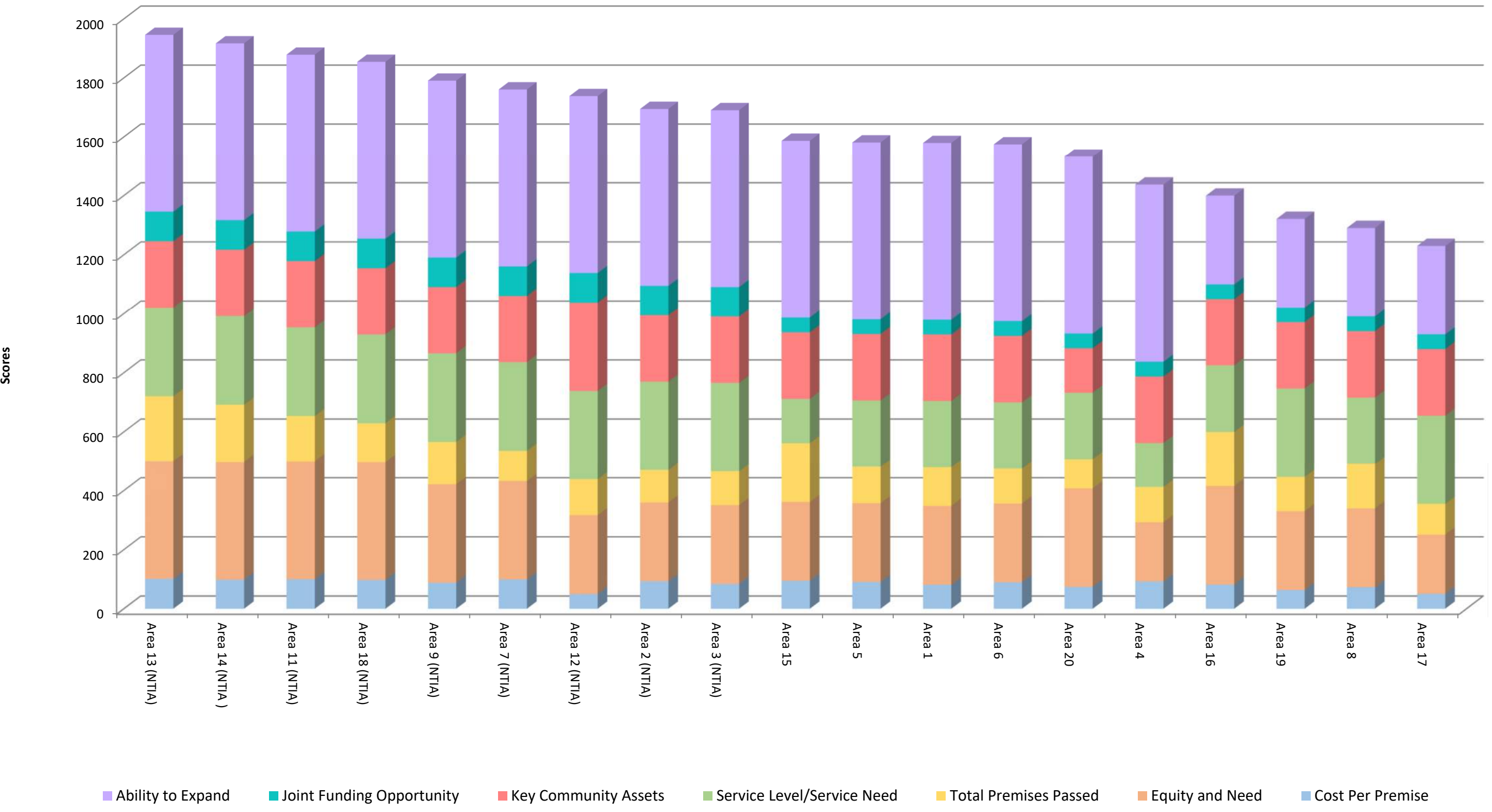


Exhibit H

LC Broadband Priority 4 Projects Multi-Criteria Decision Analysis

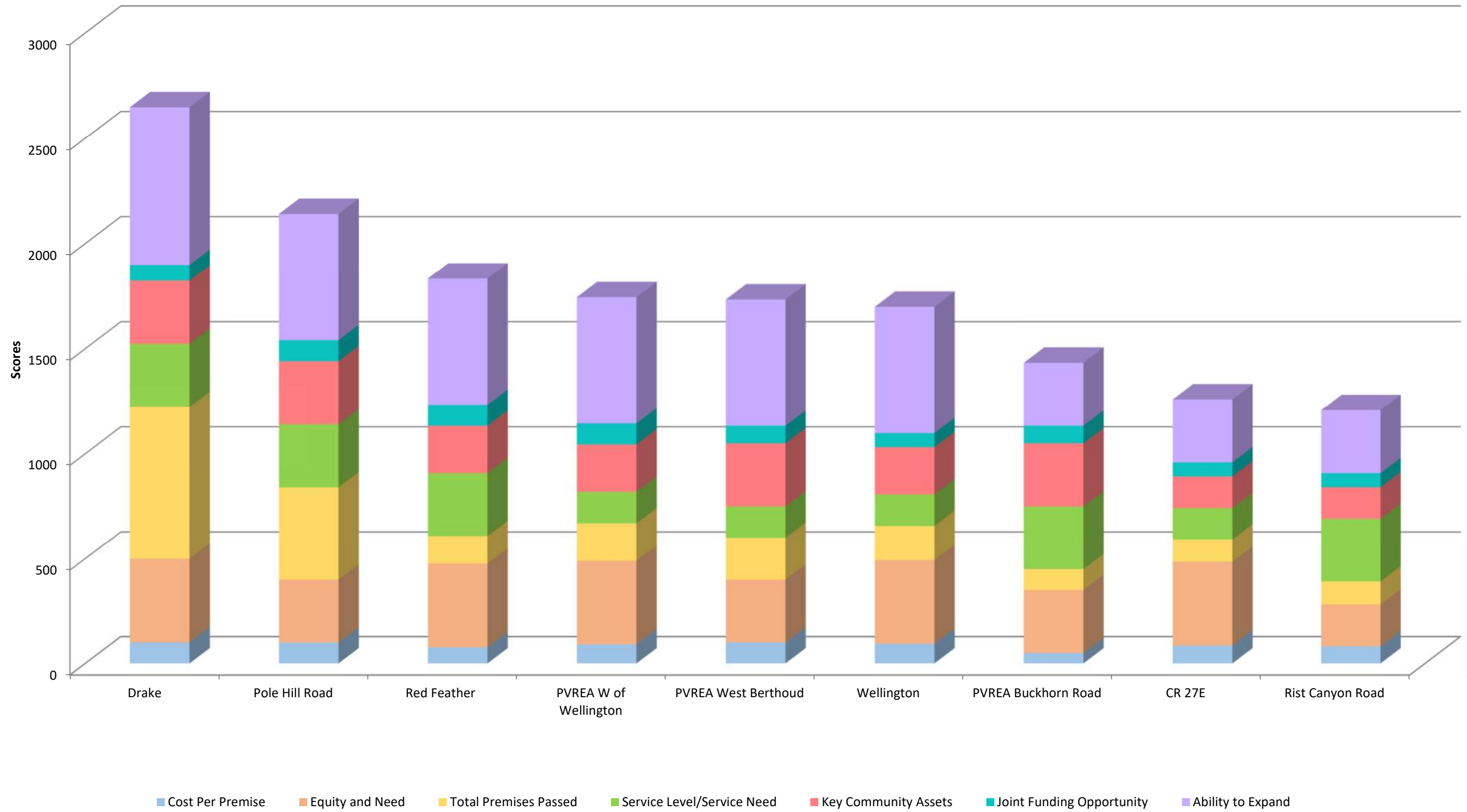
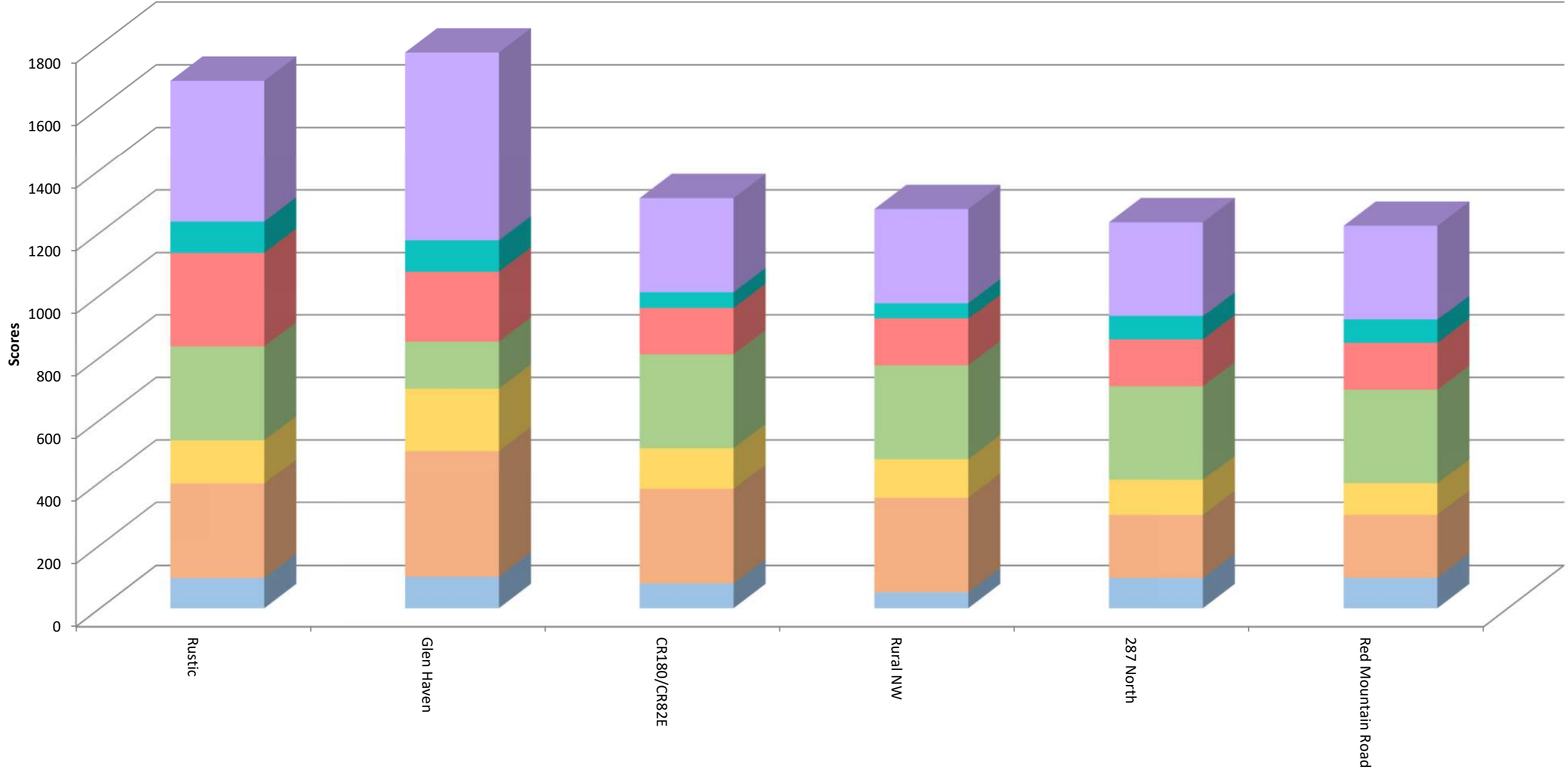


Exhibit I

LC Broadband Priority 5 Areas Multi-Criteria Decision Analysis



- Ability to Expand
- Joint Funding Opportunity
- Key Community Assets
- Service Level/Service Need
- Total Premises Passed
- Equity and Need
- Cost Per Premise

Appendix A



BUSINESS CASE:

LIVERMORE TO REDFEATHER
30-YEAR AMORTIZATION BUSINESS MODEL

INPUTS

Cap Ex	\$ 23,541,752	Premises Passed (3 mile buffer)	4271	Ramp Up Schedule for Take Rate	
Cap Ex Subsidy	\$ (2,354,175)	Premises Served at Year 6	2136	Year	
Inflation	1.20%	Take Rate Year 6 and beyond	50%	1	10%
Annual Service Rate Increase	1.50%	Monthly Subscription	\$ 110.00	2	18%
Loan Rate	1.00%			3	22%
Rate per month	0.08%	Connexion Business Model Year	5	4	35%
Term (years)	30	Estimated Premises Served	18,000	5	45%
Term (months)	360	Connexion Op Ex	\$ 6,000,000		
Monthly Payment	\$ (68,148)	Connexion Op Ex per Premise	\$ 333		
Annual Payment	\$ (817,771)	Crew Op Ex	\$ 589,876		
		Reserve as a % of Gross Revenue	33%		

Model Assumptions:

- Model assumes Connexion Op Ex costs per premise similar to that inside municipal boundaries.
- Model assumes County loan rate as shown above.
- Model assumes Yearly Op Ex only increases at rate of inflation after year 6.
- Model assumes the County will provide a minimum of 10% cap ex subsidy to the relationship.

Triggers:

- If gross annual revenue does not achieve \$1M; payment to County delayed till threshold reached.
- If \$1M annual threshold reached, Connexion makes annualized \$817k payment according to amortization schedule.
- If \$1M annual threshold is not reached in any calendar year, payment to County is not made.
- County will tally annual payments and collect up to 30 payments of \$817k if threshold is met.
- Agreement will term at year 30. If threshold not met and paid (30 payments of \$817k), debt is forgiven.
- No collateral or guarantee required. Operational risk on Connexion, capital risk on County.

Count	Year	Yearly Gross Revenue	Yearly Op Ex	Yearly Reserve Set Aside	Yearly Net Revenue	Annualized Debt Payments	Ending Balance	Monthly Cost per Premise
1	2023	\$ 563,772	\$ 142,367	\$ 186,045	\$ 235,361		\$ 235,361	\$ 110
2	2024	\$ 1,014,790	\$ 256,260	\$ 334,881	\$ 423,649		\$ 423,649	\$ 110
3	2025	\$ 1,240,298	\$ 313,207	\$ 409,298	\$ 517,793		\$ 517,793	\$ 110
4	2026	\$ 1,973,202	\$ 498,283	\$ 651,157	\$ 823,762		\$ 823,762	\$ 110
5	2027	\$ 2,536,974	\$ 640,650	\$ 837,201	\$ 1,059,123	\$ (817,771)	\$ 241,351	\$ 110
6	2028	\$ 2,818,860	\$ 711,833	\$ 930,224	\$ 1,176,803	\$ (817,771)	\$ 359,031	\$ 110
7	2029	\$ 2,861,143	\$ 720,375	\$ 944,177	\$ 1,196,590	\$ (817,771)	\$ 378,819	\$ 112
8	2030	\$ 2,904,060	\$ 729,020	\$ 958,340	\$ 1,216,700	\$ (817,771)	\$ 398,929	\$ 113
9	2031	\$ 2,947,621	\$ 737,768	\$ 972,715	\$ 1,237,138	\$ (817,771)	\$ 419,367	\$ 115
10	2032	\$ 2,991,835	\$ 746,621	\$ 987,306	\$ 1,257,908	\$ (817,771)	\$ 440,137	\$ 117
11	2033	\$ 3,036,713	\$ 755,581	\$ 1,002,115	\$ 1,279,017	\$ (817,771)	\$ 461,245	\$ 119
12	2034	\$ 3,082,263	\$ 764,648	\$ 1,017,147	\$ 1,300,469	\$ (817,771)	\$ 482,697	\$ 120
13	2035	\$ 3,128,497	\$ 773,823	\$ 1,032,404	\$ 1,322,270	\$ (817,771)	\$ 504,498	\$ 122
14	2036	\$ 3,175,425	\$ 783,109	\$ 1,047,890	\$ 1,344,425	\$ (817,771)	\$ 526,654	\$ 124
15	2037	\$ 3,223,056	\$ 792,507	\$ 1,063,609	\$ 1,366,941	\$ (817,771)	\$ 549,170	\$ 126
16	2038	\$ 3,271,402	\$ 802,017	\$ 1,079,563	\$ 1,389,823	\$ (817,771)	\$ 572,051	\$ 128
17	2039	\$ 3,320,473	\$ 811,641	\$ 1,095,756	\$ 1,413,076	\$ (817,771)	\$ 595,305	\$ 130
18	2040	\$ 3,370,280	\$ 821,381	\$ 1,112,192	\$ 1,436,707	\$ (817,771)	\$ 618,936	\$ 132
19	2041	\$ 3,420,834	\$ 831,237	\$ 1,128,875	\$ 1,460,722	\$ (817,771)	\$ 642,950	\$ 133
20	2042	\$ 3,472,147	\$ 841,212	\$ 1,145,808	\$ 1,485,126	\$ (817,771)	\$ 667,355	\$ 135
21	2043	\$ 3,524,229	\$ 851,307	\$ 1,162,996	\$ 1,509,927	\$ (817,771)	\$ 692,155	\$ 138
22	2044	\$ 3,577,093	\$ 861,522	\$ 1,180,441	\$ 1,535,130	\$ (817,771)	\$ 717,358	\$ 140
23	2045	\$ 3,630,749	\$ 871,861	\$ 1,198,147	\$ 1,560,741	\$ (817,771)	\$ 742,970	\$ 142
24	2046	\$ 3,685,210	\$ 882,323	\$ 1,216,119	\$ 1,586,768	\$ (817,771)	\$ 768,997	\$ 144
25	2047	\$ 3,740,488	\$ 892,911	\$ 1,234,361	\$ 1,613,216	\$ (817,771)	\$ 795,445	\$ 146
26	2048	\$ 3,796,596	\$ 903,626	\$ 1,252,877	\$ 1,640,093	\$ (817,771)	\$ 822,322	\$ 148
27	2049	\$ 3,853,545	\$ 914,469	\$ 1,271,670	\$ 1,667,406	\$ (817,771)	\$ 849,634	\$ 150
28	2050	\$ 3,911,348	\$ 925,443	\$ 1,290,745	\$ 1,695,160	\$ (817,771)	\$ 877,389	\$ 153
29	2051	\$ 3,970,018	\$ 936,548	\$ 1,310,106	\$ 1,723,364	\$ (817,771)	\$ 905,592	\$ 155
30	2052	\$ 4,029,568	\$ 947,787	\$ 1,329,758	\$ 1,752,024	\$ (817,771)	\$ 934,253	\$ 157
31	2053	\$ 4,090,012	\$ 959,160	\$ 1,349,704	\$ 1,781,148	\$ (817,771)	\$ 963,376	\$ 160
32	2054	\$ 4,151,362	\$ 970,670	\$ 1,369,949	\$ 1,810,742	\$ (817,771)	\$ 992,971	\$ 162
33	2055	\$ 4,213,632	\$ 982,318	\$ 1,390,499	\$ 1,840,816	\$ (817,771)	\$ 1,023,044	\$ 164
34	2056	\$ 4,276,837	\$ 994,106	\$ 1,411,356	\$ 1,871,375	\$ (817,771)	\$ 1,053,603	\$ 167
35	2057	\$ 4,340,989	\$ 1,006,035	\$ 1,432,527	\$ 1,902,428	\$ -	\$ 1,902,428	\$ 169
36	2058	\$ 4,406,104	\$ 1,018,108	\$ 1,454,014	\$ 1,933,982	\$ -	\$ 1,933,982	\$ 172
37	2059	\$ 4,472,196	\$ 1,030,325	\$ 1,475,825	\$ 1,966,046	\$ -	\$ 1,966,046	\$ 175
38	2060	\$ 4,539,279	\$ 1,042,689	\$ 1,497,962	\$ 1,998,628	\$ -	\$ 1,998,628	\$ 177
39	2061	\$ 4,607,368	\$ 1,055,201	\$ 1,520,431	\$ 2,031,735	\$ -	\$ 2,031,735	\$ 180
40	2062	\$ 4,676,479	\$ 1,067,864	\$ 1,543,238	\$ 2,065,377	\$ -	\$ 2,065,377	\$ 182



BUSINESS CASE:

LIVERMORE TO REDFEATHER
INCOME BUSINESS MODEL

INPUTS

Cap Ex	\$ 23,541,752	Premises Passed (3 mile buffer)	4271	Ramp Up Schedule for Take Rate
Cap Ex Subsidy	\$ (2,354,175)	Premises Served at Year 6	2136	
Inflation	1.20%	Take Rate Year 6 and beyond	50%	Year
Annual Service Rate Increase	1.50%	Monthly Subscription	\$ 110.00	1 10%
Income Rate (% of gross)	15.00%	Connexion Business Model Year	5	2 18%
		Estimated Premises Served	18,000	3 22%
		Connexion Op Ex	\$ 6,000,000	4 35%
		Connexion Op Ex per Premise	\$ 333	5 45%
		Crew Op Ex	\$ 589,876	
		Reserve as a % of Gross Revenue	33%	

Model Assumptions:

Model assumes Connexion Op Ex costs per premise similar to that inside municipal boundaries.

Model assumes County is paid a direct income perpetually at % of gross income.

Model assumes Yearly Op Ex only increases at rate of inflation after year 6.

Model assumes the County will provide a minimum of 10% cap ex subsidy to the relationship.

Triggers:

County is paid % of gross revenue annually as long as "ending balance" is > \$150k (after subtracting income to County).

If "ending balance" is not greater than \$150k after subtracting % payment to County, no payment is made.

Payments to County are perpetual unless agreement is renegotiated.

No collateral or guarantee required. Operational risk on Connexion, capital risk on County.

Count	Year	Yearly Gross Revenue	Yearly Op Ex	Yearly Reserve Set Aside	Yearly Net Revenue	Annualized Income to County	Ending Balance	County ROI (Cap Ex - Subsidy)	Monthly Cost per Premise
1	2023	\$ 563,772	\$ 142,367	\$ 186,045	\$ 235,361	\$ 84,566	\$ 150,795	0.40%	\$ 110
2	2024	\$ 1,014,790	\$ 256,260	\$ 334,881	\$ 423,649	\$ 152,218	\$ 271,431	0.72%	\$ 110
3	2025	\$ 1,240,298	\$ 313,207	\$ 409,298	\$ 517,793	\$ 186,045	\$ 331,749	0.88%	\$ 110
4	2026	\$ 1,973,202	\$ 498,283	\$ 651,157	\$ 823,762	\$ 295,980	\$ 527,782	1.40%	\$ 110
5	2027	\$ 2,536,974	\$ 640,650	\$ 837,201	\$ 1,059,123	\$ 380,546	\$ 678,576	1.80%	\$ 110
6	2028	\$ 2,818,860	\$ 711,833	\$ 930,224	\$ 1,176,803	\$ 422,829	\$ 753,974	2.00%	\$ 110
7	2029	\$ 2,861,143	\$ 720,375	\$ 944,177	\$ 1,196,590	\$ 429,171	\$ 767,419	2.03%	\$ 112
8	2030	\$ 2,904,060	\$ 729,020	\$ 958,340	\$ 1,216,700	\$ 435,609	\$ 781,091	2.06%	\$ 113
9	2031	\$ 2,947,621	\$ 737,768	\$ 972,715	\$ 1,237,138	\$ 442,143	\$ 794,995	2.09%	\$ 115
10	2032	\$ 2,991,835	\$ 746,621	\$ 987,306	\$ 1,257,908	\$ 448,775	\$ 809,133	2.12%	\$ 117
11	2033	\$ 3,036,713	\$ 755,581	\$ 1,002,115	\$ 1,279,017	\$ 455,507	\$ 823,510	2.15%	\$ 119
12	2034	\$ 3,082,263	\$ 764,648	\$ 1,017,147	\$ 1,300,469	\$ 462,340	\$ 838,129	2.18%	\$ 120
13	2035	\$ 3,128,497	\$ 773,823	\$ 1,032,404	\$ 1,322,270	\$ 469,275	\$ 852,995	2.21%	\$ 122
14	2036	\$ 3,175,425	\$ 783,109	\$ 1,047,890	\$ 1,344,425	\$ 476,314	\$ 868,112	2.25%	\$ 124
15	2037	\$ 3,223,056	\$ 792,507	\$ 1,063,609	\$ 1,366,941	\$ 483,458	\$ 883,483	2.28%	\$ 126
16	2038	\$ 3,271,402	\$ 802,017	\$ 1,079,563	\$ 1,389,823	\$ 490,710	\$ 899,112	2.32%	\$ 128
17	2039	\$ 3,320,473	\$ 811,641	\$ 1,095,756	\$ 1,413,076	\$ 498,071	\$ 915,005	2.35%	\$ 130
18	2040	\$ 3,370,280	\$ 821,381	\$ 1,112,192	\$ 1,436,707	\$ 505,542	\$ 931,165	2.39%	\$ 132
19	2041	\$ 3,420,834	\$ 831,237	\$ 1,128,875	\$ 1,460,722	\$ 513,125	\$ 947,597	2.42%	\$ 133
20	2042	\$ 3,472,147	\$ 841,212	\$ 1,145,808	\$ 1,485,126	\$ 520,822	\$ 964,304	2.46%	\$ 135
21	2043	\$ 3,524,229	\$ 851,307	\$ 1,162,996	\$ 1,509,927	\$ 528,634	\$ 981,293	2.50%	\$ 138
22	2044	\$ 3,577,093	\$ 861,522	\$ 1,180,441	\$ 1,535,130	\$ 536,564	\$ 998,566	2.53%	\$ 140
23	2045	\$ 3,630,749	\$ 871,861	\$ 1,198,147	\$ 1,560,741	\$ 544,612	\$ 1,016,129	2.57%	\$ 142
24	2046	\$ 3,685,210	\$ 882,323	\$ 1,216,119	\$ 1,586,768	\$ 552,782	\$ 1,033,986	2.61%	\$ 144
25	2047	\$ 3,740,488	\$ 892,911	\$ 1,234,361	\$ 1,613,216	\$ 561,073	\$ 1,052,143	2.65%	\$ 146
26	2048	\$ 3,796,596	\$ 903,626	\$ 1,252,877	\$ 1,640,093	\$ 569,489	\$ 1,070,604	2.69%	\$ 148
27	2049	\$ 3,853,545	\$ 914,469	\$ 1,271,670	\$ 1,667,406	\$ 578,032	\$ 1,089,374	2.73%	\$ 150
28	2050	\$ 3,911,348	\$ 925,443	\$ 1,290,745	\$ 1,695,160	\$ 586,702	\$ 1,108,458	2.77%	\$ 153
29	2051	\$ 3,970,018	\$ 936,548	\$ 1,310,106	\$ 1,723,364	\$ 595,503	\$ 1,127,861	2.81%	\$ 155
30	2052	\$ 4,029,568	\$ 947,787	\$ 1,329,758	\$ 1,752,024	\$ 604,435	\$ 1,147,589	2.85%	\$ 157
31	2053	\$ 4,090,012	\$ 959,160	\$ 1,349,704	\$ 1,781,148	\$ 613,502	\$ 1,167,646	2.90%	\$ 160
32	2054	\$ 4,151,362	\$ 970,670	\$ 1,369,949	\$ 1,810,742	\$ 622,704	\$ 1,188,038	2.94%	\$ 162
33	2055	\$ 4,213,632	\$ 982,318	\$ 1,390,499	\$ 1,840,816	\$ 632,045	\$ 1,208,771	2.98%	\$ 164
34	2056	\$ 4,276,837	\$ 994,106	\$ 1,411,356	\$ 1,871,375	\$ 641,526	\$ 1,229,849	3.03%	\$ 167
35	2057	\$ 4,340,989	\$ 1,006,035	\$ 1,432,527	\$ 1,902,428	\$ 651,148	\$ 1,251,279	3.07%	\$ 169
36	2058	\$ 4,406,104	\$ 1,018,108	\$ 1,454,014	\$ 1,933,982	\$ 660,916	\$ 1,273,067	3.12%	\$ 172
37	2059	\$ 4,472,196	\$ 1,030,325	\$ 1,475,825	\$ 1,966,046	\$ 670,829	\$ 1,295,217	3.17%	\$ 175
38	2060	\$ 4,539,279	\$ 1,042,689	\$ 1,497,962	\$ 1,998,628	\$ 680,892	\$ 1,317,736	3.21%	\$ 177
39	2061	\$ 4,607,368	\$ 1,055,201	\$ 1,520,431	\$ 2,031,735	\$ 691,105	\$ 1,340,630	3.26%	\$ 180
40	2062	\$ 4,676,479	\$ 1,067,864	\$ 1,543,238	\$ 2,065,377	\$ 701,472	\$ 1,363,905	3.31%	\$ 182



BUSINESS CASE:

LIVERMORE TO REDFEATHER
MARKET RATE MODEL

INPUTS

Cap Ex	\$ 23,541,752	Premises Passed (3 mile buffer)	4271	Ramp Up Schedule for Take Rate	
Cap Ex Subsidy	\$ (2,354,175)	Premises Served at Year 6	2136		Year
Inflation	1.20%	Take Rate Year 6 and beyond	50%		1 10%
Annual Service Rate Increase	1.50%	Monthly Subscription	\$ 74.90		2 18%
Income Rate (% of gross)	10.00%	Connexion Business Model Year	5		3 22%
		Estimated Premises Served	18,000	4 35%	
		Connexion Op Ex	\$ 6,000,000	5 45%	
		Connexion Op Ex per Premise	\$ 333		
		Crew Op Ex	\$ 589,876		
		Reserve as a % of Gross Revenue	33%		

Model Assumptions:

- Model assumes Connexion Op Ex costs per premise similar to that inside municipal boundaries.
- Model assumes County is paid a direct income perpetually at % of gross income.
- Model assumes Yearly Op Ex only increases at rate of inflation after year 6.
- Model assumes Monthly Subscription is 1G internet+phone at urban Connexion rate.
- Model assumes the County will provide a minimum of 10% cap ex subsidy to the relationship.

Triggers: County is paid % of gross revenue annually as long as "ending balance" is > \$150k (after subtracting income to County).
 If "ending balance" is not greater than \$150k after subtracting % payment to County, no payment is made.
 Payments to County are perpetual unless agreement is renegotiated.
 No collateral or guarantee required. Operational risk on Connexion, capital risk on County.

Count	Year	Yearly Gross Revenue	Yearly Op Ex	Yearly Reserve Set Aside	Yearly Net Revenue	Annualized Income to County	Ending Balance	County ROI (Cap Ex - Subsidy)	Monthly Cost per Premise
1	2023	\$ 383,877	\$ 142,367	\$ 126,680	\$ 114,831	\$ 38,388	\$ 76,443	FALSE	\$ 75
2	2024	\$ 690,979	\$ 256,260	\$ 228,023	\$ 206,696	\$ 69,098	\$ 137,598	FALSE	\$ 75
3	2025	\$ 844,530	\$ 313,207	\$ 278,695	\$ 252,629	\$ 84,453	\$ 168,176	0.40%	\$ 75
4	2026	\$ 1,343,571	\$ 498,283	\$ 443,378	\$ 401,909	\$ 134,357	\$ 267,552	0.63%	\$ 75
5	2027	\$ 1,727,449	\$ 640,650	\$ 570,058	\$ 516,741	\$ 172,745	\$ 343,996	0.82%	\$ 75
6	2028	\$ 1,919,387	\$ 711,833	\$ 633,398	\$ 574,156	\$ 191,939	\$ 382,217	0.91%	\$ 75
7	2029	\$ 1,948,178	\$ 720,375	\$ 642,899	\$ 584,904	\$ 194,818	\$ 390,086	0.92%	\$ 76
8	2030	\$ 1,977,401	\$ 729,020	\$ 652,542	\$ 595,839	\$ 197,740	\$ 398,099	0.93%	\$ 77
9	2031	\$ 2,007,062	\$ 737,768	\$ 662,330	\$ 606,963	\$ 200,706	\$ 406,257	0.95%	\$ 78
10	2032	\$ 2,037,168	\$ 746,621	\$ 672,265	\$ 618,281	\$ 203,717	\$ 414,564	0.96%	\$ 79
11	2033	\$ 2,067,725	\$ 755,581	\$ 682,349	\$ 629,795	\$ 206,773	\$ 423,023	0.98%	\$ 81
12	2034	\$ 2,098,741	\$ 764,648	\$ 692,585	\$ 641,509	\$ 209,874	\$ 431,635	0.99%	\$ 82
13	2035	\$ 2,130,222	\$ 773,823	\$ 702,973	\$ 653,425	\$ 213,022	\$ 440,403	1.01%	\$ 83
14	2036	\$ 2,162,176	\$ 783,109	\$ 713,518	\$ 665,548	\$ 216,218	\$ 449,331	1.02%	\$ 84
15	2037	\$ 2,194,608	\$ 792,507	\$ 724,221	\$ 677,881	\$ 219,461	\$ 458,420	1.04%	\$ 86
16	2038	\$ 2,227,527	\$ 802,017	\$ 735,084	\$ 690,427	\$ 222,753	\$ 467,674	1.05%	\$ 87
17	2039	\$ 2,260,940	\$ 811,641	\$ 746,110	\$ 703,189	\$ 226,094	\$ 477,095	1.07%	\$ 88
18	2040	\$ 2,294,854	\$ 821,381	\$ 757,302	\$ 716,172	\$ 229,485	\$ 486,686	1.08%	\$ 90
19	2041	\$ 2,329,277	\$ 831,237	\$ 768,661	\$ 729,379	\$ 232,928	\$ 496,451	1.10%	\$ 91
20	2042	\$ 2,364,216	\$ 841,212	\$ 780,191	\$ 742,813	\$ 236,422	\$ 506,391	1.12%	\$ 92
21	2043	\$ 2,399,680	\$ 851,307	\$ 791,894	\$ 756,479	\$ 239,968	\$ 516,511	1.13%	\$ 94
22	2044	\$ 2,435,675	\$ 861,522	\$ 803,773	\$ 770,380	\$ 243,567	\$ 526,812	1.15%	\$ 95
23	2045	\$ 2,472,210	\$ 871,861	\$ 815,829	\$ 784,520	\$ 247,221	\$ 537,299	1.17%	\$ 96
24	2046	\$ 2,509,293	\$ 882,323	\$ 828,067	\$ 798,904	\$ 250,929	\$ 547,974	1.18%	\$ 98
25	2047	\$ 2,546,933	\$ 892,911	\$ 840,488	\$ 813,534	\$ 254,693	\$ 558,841	1.20%	\$ 99
26	2048	\$ 2,585,137	\$ 903,626	\$ 853,095	\$ 828,416	\$ 258,514	\$ 569,902	1.22%	\$ 101
27	2049	\$ 2,623,914	\$ 914,469	\$ 865,891	\$ 843,553	\$ 262,391	\$ 581,162	1.24%	\$ 102
28	2050	\$ 2,663,272	\$ 925,443	\$ 878,880	\$ 858,950	\$ 266,327	\$ 592,622	1.26%	\$ 104
29	2051	\$ 2,703,221	\$ 936,548	\$ 892,063	\$ 874,610	\$ 270,322	\$ 604,288	1.28%	\$ 105
30	2052	\$ 2,743,770	\$ 947,787	\$ 905,444	\$ 890,539	\$ 274,377	\$ 616,162	1.29%	\$ 107
31	2053	\$ 2,784,926	\$ 959,160	\$ 919,026	\$ 906,740	\$ 278,493	\$ 628,248	1.31%	\$ 109
32	2054	\$ 2,826,700	\$ 970,670	\$ 932,811	\$ 923,219	\$ 282,670	\$ 640,549	1.33%	\$ 110
33	2055	\$ 2,869,101	\$ 982,318	\$ 946,803	\$ 939,979	\$ 286,910	\$ 653,069	1.35%	\$ 112
34	2056	\$ 2,912,137	\$ 994,106	\$ 961,005	\$ 957,026	\$ 291,214	\$ 665,812	1.37%	\$ 114
35	2057	\$ 2,955,819	\$ 1,006,035	\$ 975,420	\$ 974,364	\$ 295,582	\$ 678,782	1.40%	\$ 115
36	2058	\$ 3,000,156	\$ 1,018,108	\$ 990,052	\$ 991,997	\$ 300,016	\$ 691,982	1.42%	\$ 117
37	2059	\$ 3,045,159	\$ 1,030,325	\$ 1,004,902	\$ 1,009,931	\$ 304,516	\$ 705,416	1.44%	\$ 119
38	2060	\$ 3,090,836	\$ 1,042,689	\$ 1,019,976	\$ 1,028,171	\$ 309,084	\$ 719,088	1.46%	\$ 121
39	2061	\$ 3,137,199	\$ 1,055,201	\$ 1,035,276	\$ 1,046,722	\$ 313,720	\$ 733,002	1.48%	\$ 122
40	2062	\$ 3,184,257	\$ 1,067,864	\$ 1,050,805	\$ 1,065,589	\$ 318,426	\$ 747,163	1.50%	\$ 124