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Broadband Infrastructure Strategic Plan and Facilitation Study

Prepared for Pierce County, Washington
March 2021

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1 Executive Summary

This report is part of an ongoing effort by the Pierce County Council to understand broadband challenges in the community and identify strategies to support access to high-speed, affordable broadband, defined as service of at least 25 Mbps download and 3 Mbps upload (25/3), for all residents and businesses. Pierce County suffers from gaps in such service—an estimated 6,300 homes and businesses are unserved; as this report documents, those gaps potentially can be addressed through a robust strategy of engaging with current or potential future providers (both private and public), assisting them in seeking available federal and state grants, and perhaps providing County funds when allowed by law, or providing other assistance to make broadband deployment more feasible in the unserved areas.

1.1 Project background

Pierce County issued its request for proposals for a broadband strategic plan in 2019 and hired CTC Technology & Energy in early 2020. The context for this project changed significantly in the time since CTC began its work. The Covid-19 pandemic swept the globe, heightening the criticality of residential broadband to enable remote work and education and participation in civic life—and also altering the federal grant funding environment.

1.2 Significant new federal funding opportunities have emerged in recent months

The Federal Communications Commission (FCC) conducted the Rural Digital Opportunity Fund (RDOF) auction in late 2020 and made significant awards to CenturyLink and to SpaceX's emerging Starlink satellite service—with enormous potential impact on future deployments in rural Pierce County.

Additionally, within days of our submitting this updated report (March 19) we are expecting guidance on how $300 million in broadband infrastructure grants will be disbursed from the National Telecommunications and Information Agency (NTIA) to support state and provider partnership for rural broadband deployments.[1]

Most significantly, on March 11, President Biden signed the American Rescue Plan Act into law. Included in the $1.9 trillion package is significant funding that can be used to support expansion of broadband infrastructure. (More information on these opportunities is provided in Section 7 of this report.)

Given these timely shifts in the funding landscape—and of the potential providers who might be involved in solutions—this project was adjusted with County approval so that CTC could continue

[1] https://broadbandusa.ntia.doc.gov/ntia-common-content/overview-consolidated-appropriations-act-2021

supporting the County in 2021. CTC will continue working with Pierce County to determine how these opportunities can most effectively be leveraged to close the County's broadband gaps.

The County's strategic focus this spring will be aided by the data and recommendations developed in this report, which include an estimate of the numbers of unserved premises, an estimate of what it would cost to serve them with fiber-to-the-premises service, and the results of our initial outreach to providers who might fill those gaps.

1.3 Summary of project tasks

To develop the data and insights needed to support our analysis and recommendations, CTC performed the following tasks:

- Identified, at a high level, unserved areas of the County, based on data and maps provided by the County, other public data sets, and desk surveys[2]
- Prepared a high-level design and cost estimate for a fiber optic network deployment to fill the identified broadband gaps in the County
- Evaluated the relative merits of a fixed wireless approach in unserved areas of the County, and made a high-level determination that a wired solution would be preferable from both a technical and economic perspective
- Established an online speed test survey to gather additional data about residents' actual internet service speeds by address (but, at the direction of the County, deferred implementation of this process)
- Analyzed federal and potential state funding opportunities to identify sources of grants or loans (to the County or to internet service providers (ISP)) that might support the expansion of broadband services in unserved areas
- Analyzed implications of the outcomes in the Rural Digital Opportunity Fund auction for the County
- Discussed potential strategies the County could pursue to leverage grant funds to support the expansion of broadband service in currently unserved areas (a process that will continue in 2021)

[2] A desk survey is an analysis conducted using maps, databases, and street-level photography to identify the presence of fiber optic cables, equipment cabinets, and other network infrastructure; evaluate the availability of space on utility poles; and assess the right-of-way and overall terrain.

1.4 Key project findings

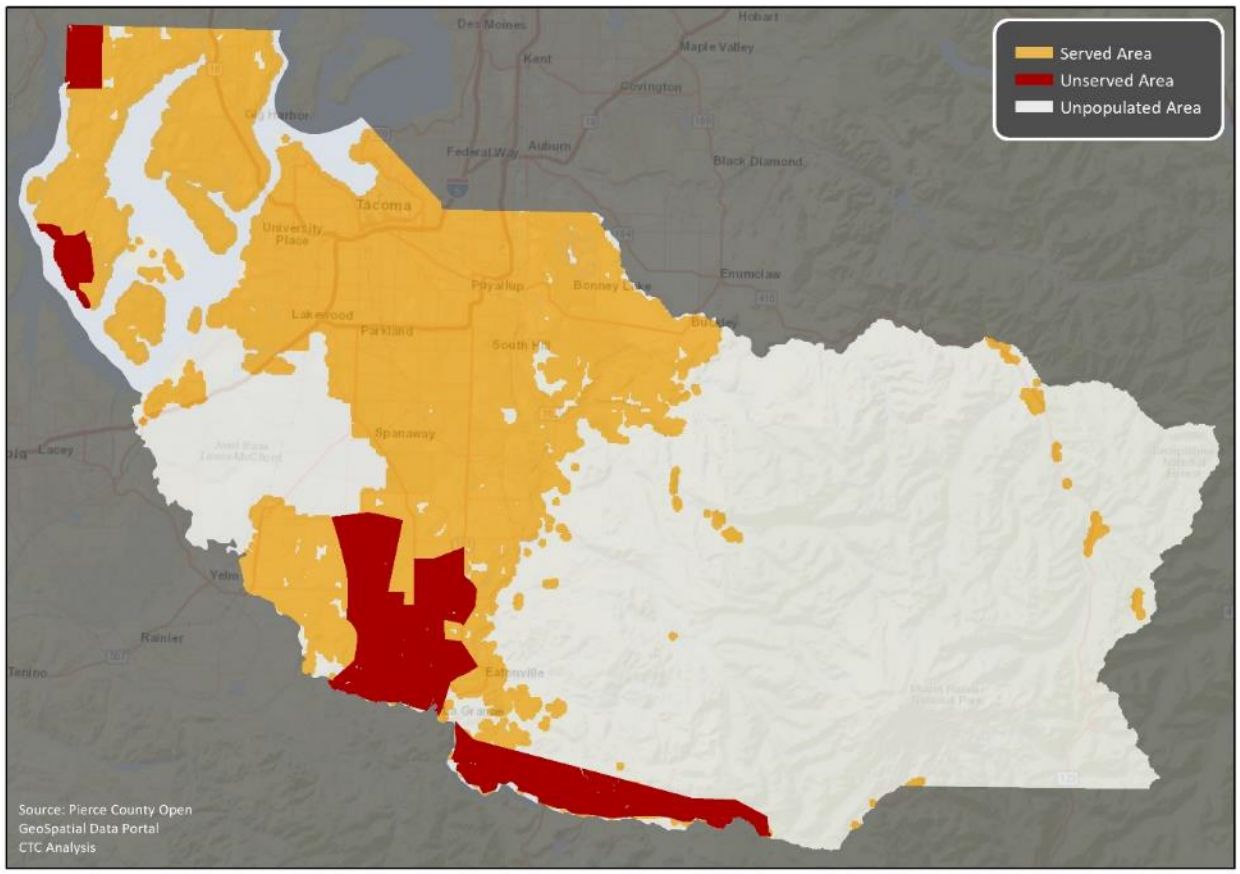
1.4.1 Pierce County suffers from severe broadband gaps in its more rural areas, where we estimate 6,300 homes and businesses are unserved in large contiguous areas

Pierce County suffers from severe gaps in the availability of broadband, formally defined as service of at least 25 Mbps download and 3 Mbps upload (25/3). (In fact, the pandemic demonstrated that even 25/3 is inadequate; this is a benchmark set for a world of downstream consumption, not a world of remote learning, remote work, and telemedicine that requires sustained and adequate symmetrical speeds for videoconferencing applications like Zoom and Teams.)

CTC reviewed the FCC's Form 477 data on broadband service availability in the County, performed an extensive desk review of existing infrastructure, and reviewed County-provided data from ISPs to produce maps of served and unserved areas. CTC identified an estimated 6,300 homes and businesses unserved by 25/3 service (Figure) that could be served by incumbent or new ISPs.

This map reflects contiguous unserved areas; it does not identify isolated clusters of unserved locations. Within the areas shown as served, there will still be certain remote roads that are not served because a local provider could not make a business case for extending service. There will also be individual premises with long driveways that cannot get broadband service because they would need to pay a provider a cost-prohibitive fee to construct a long "drop" from a network interconnection node to their home. (See Section 3 for an explanation of these scenarios.)

Figure 1: Contiguous Areas Served and Unserved by High-Speed Broadband



CTC developed an online speed test, called SpeedSurvey, which can provide a look at available speeds that is more granular than the FCC Form 477 data. CTC set up the website and delivered promotional materials to Pierce County. Although the County deferred implementation, this task could be reactivated for targeted areas in 2021. Speed tests can help identify small and isolated areas without service.

1.4.2 The economics of rural broadband limit internet service providers' interest in deploying broadband to unserved areas

Unserved portions of Pierce County face the same challenges as other rural communities in attracting broadband infrastructure investment. The economics of rural broadband mean there is no silver bullet to solve these problems; some form of subsidy is needed for broadband providers to make a business case.

Nationwide, even in the most affluent rural and semi-rural areas—including even the horse farms around Lexington, Kentucky, and the ski communities outside of Aspen and Telluride, Colorado—the business case simply does not exist for rural broadband deployment absent substantial government funding. Private sector ISPs will not build costly infrastructure to reach all homes

and businesses in low-density areas simply because the potential return on investment is insufficient. The challenging economics result primarily from the low development density. Large parcels of land with long driveways and setbacks from the road greatly increase the cost to deploy wired infrastructure to those homes.

While the same dynamics apply to virtually all types of rural infrastructure development, the issues are starker in the case of broadband because broadband is traditionally thought of as an area of private investment.

1.4.3 Providing all unserved residents and businesses in Pierce County with fiber-to-the-premises would cost an estimated $26.9 million

To get a sense of the scale of the challenge and the funds needed to attract private partners, CTC's engineers prepared a high-level network design for the deployment of a fiber-to-the-premises network to serve the unserved homes and businesses in the major contiguous areas. (The network would be gigabit-capable, meaning it could deliver service of 1,000 Mbps download and upload—much greater than the baseline definition of broadband.) We then estimated the cost for deploying that network, including a network backbone, assuming the construction would be performed by an entity that is not the incumbent telephone, power, or cable company. The County provided us with information about County-owned land, towers, and other assets that might prove useful to facilitate a private provider buildout.

The total estimated capital cost to construct a fiber-to-the-premises network to serve the contiguous unserved areas (described as "Category 1" unserved areas, as explained in Section 3)

is $26.9 million, assuming a take-rate—that is, the percentage of potential customers subscribing to the service—of 60 percent. Details are shown in Table 1.[3]

Table 1: Estimated Total Fiber Deployment Cost for Unserved Areas of Pierce County

Cost Component	Estimated Cost
Outside Plant	$20,300,000
Central Network Electronics	$1,500,000
Fiber Service Drop Installations	$3,200,000
Customer Premises Equipment	$1,900,000
Total Estimated Cost	*$26,900,000*

We estimated a cost per passing[4] by dividing the outside plant cost by the number of passings. This is the cost of constructing fiber alongside the roads in front of unserved homes and businesses, divided by the number of homes and businesses—essentially the cost of building a network independent of connections to any specific homes and businesses. We estimate the average outside plant cost per passing will be approximately $3,220 (Table 2).[5]

Table 2: Estimated Outside Plant Cost per Passing for Category 1 Unserved Areas[6]

Cost Component	Estimated Cost
Outside Plant	$20,300,000
Passings	6,300
Outside Plant Cost per Passing[7]	*$3,220*

[3] These numbers have been rounded. The take-rate affects the electronics and drop costs, but also may affect other parts of the network, as different design choices may be made based on the expected take-rate. A 60 percent take-rate is possible in environments where a new provider delivers service in a previously unserved area. Market research would be required to estimate a more accurate take-rate at assumed service costs.

[4] A "passing" is the infrastructure that "passes" a home or business along the public rights-of-way, but it does not include the "service drop"—the portion of the network that connects from the road to the home or business itself. The availability of a passing to a home or business is the universally understood definition of what is served, both within the industry and among the state and federal government entities that fund broadband expansion[4] and regulate communications services.

[5] In a joint grant application arrangement with a partner, the capital costs—and therefore the County's support—would be exclusive of drop costs and customer premise equipment. Unless it is a brand-new network (such as when a county decides to build and operate a broadband network), central network electronics are part of the capital costs. In joint grant partnerships, incumbents and non-incumbents will typically backhaul the new builds to one or more existing central core sites. A non-incumbent will have added costs for the backhaul link and backbone/middle-mile fiber connecting unserved areas; those costs often are not grant-eligible.

[6] Table is rounded; unrounded numbers were used in the engineering calculations.

[7] This is the average cost to construct the outside plant portion of the fiber-to-the-premises network for each home and businesses in the unserved areas.

The full analysis and cost estimate are presented in Section 3.

1.4.4 Fixed wireless is not an optimal solution from a technical or economic perspective

We also reviewed the feasibility of using a fixed wireless solution to fill the County's broadband gaps. To this end we obtained from the County a list of commercial and County towers and reviewed the distribution of these towers and the County's topography. We also drew on our experience conducting feasibility studies, including fixed wireless designs and cost estimates, in other rural jurisdictions in the United States.

We have generally discovered, in performing similar analyses across the country, that fiber is the most cost-effective broadband technology over the long run. For fiber, capital expenses are paired with low lifecycle replacement costs and maintenance, given that the fiber lasts at least 20 years. In contrast, a fixed wireless network requires relatively high maintenance costs, high tower lease costs, and almost complete network replacement every five years because the electronics essentially comprise the entire network.

We concluded that fiber-to-the-premises represents a better broadband solution than fixed wireless for the unserved areas of Pierce County. While fiber-to-the-premises has a higher capital cost than a fixed wireless solution, the total cost of operations of fiber-to-the-premises over time will be significantly lower.

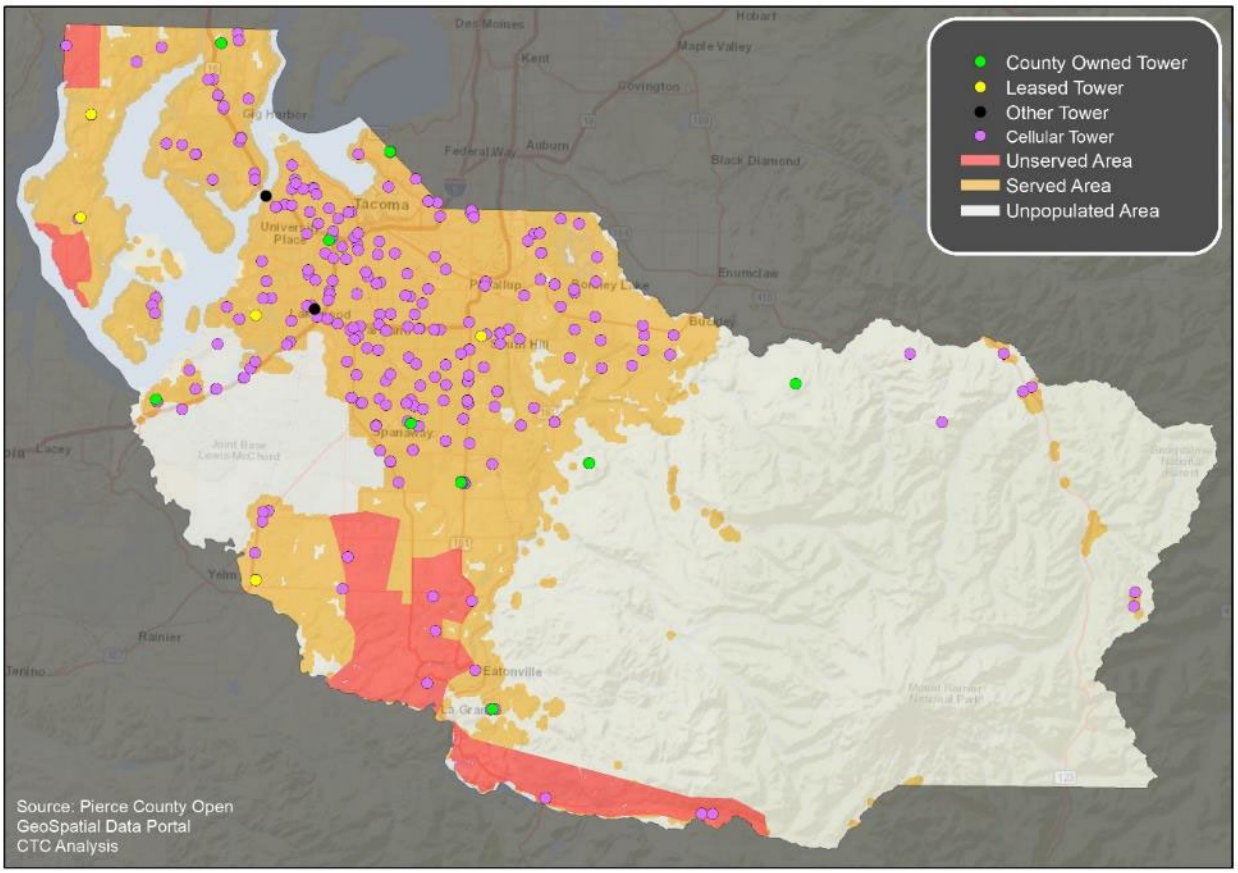
This reality is reflected in the decisions made by ISPs in Pierce County to date. According to Form 477 data, there are only a few isolated spots of the County now served by fixed wireless at speeds above 25/3. And CenturyLink—which reportedly may implement fixed wireless service in some areas of the United States[8]—has so far elected not to use fixed wireless technology to expand its network in Pierce County or bid with fixed wireless in the recent FCC auction for unserved eligible areas (see Section 1.4.6 for more details on the auction). While this does not preclude CenturyLink from using fixed wireless in the future, the choices by CenturyLink and others to date does suggest that fixed wireless is not the most effective or economical choice over the long term.

Additionally, most existing towers in Pierce County are leased or cellular towers, which could mean higher deployment costs for a fixed wireless network if the operator would need to pay lease fees for their antennas. (Tower locations are shown in **Error! Reference source not found.**.)

[8] Linda Hardesty, "CenturyLink counts 28 towers on its road map for fixed wireless," *Fierce Telecom*, May 9, 2019, https://www.fiercetelecom.com/telecom/centurylink-counts-28-towers-its-roadmap-for-fixed-wireless (accessed January 2021).

The reliance on commercial towers, or the need to build new ones, might contribute to a higher deployment cost of a fixed wireless solution in the County.

Figure 2: Tower Locations in Pierce County



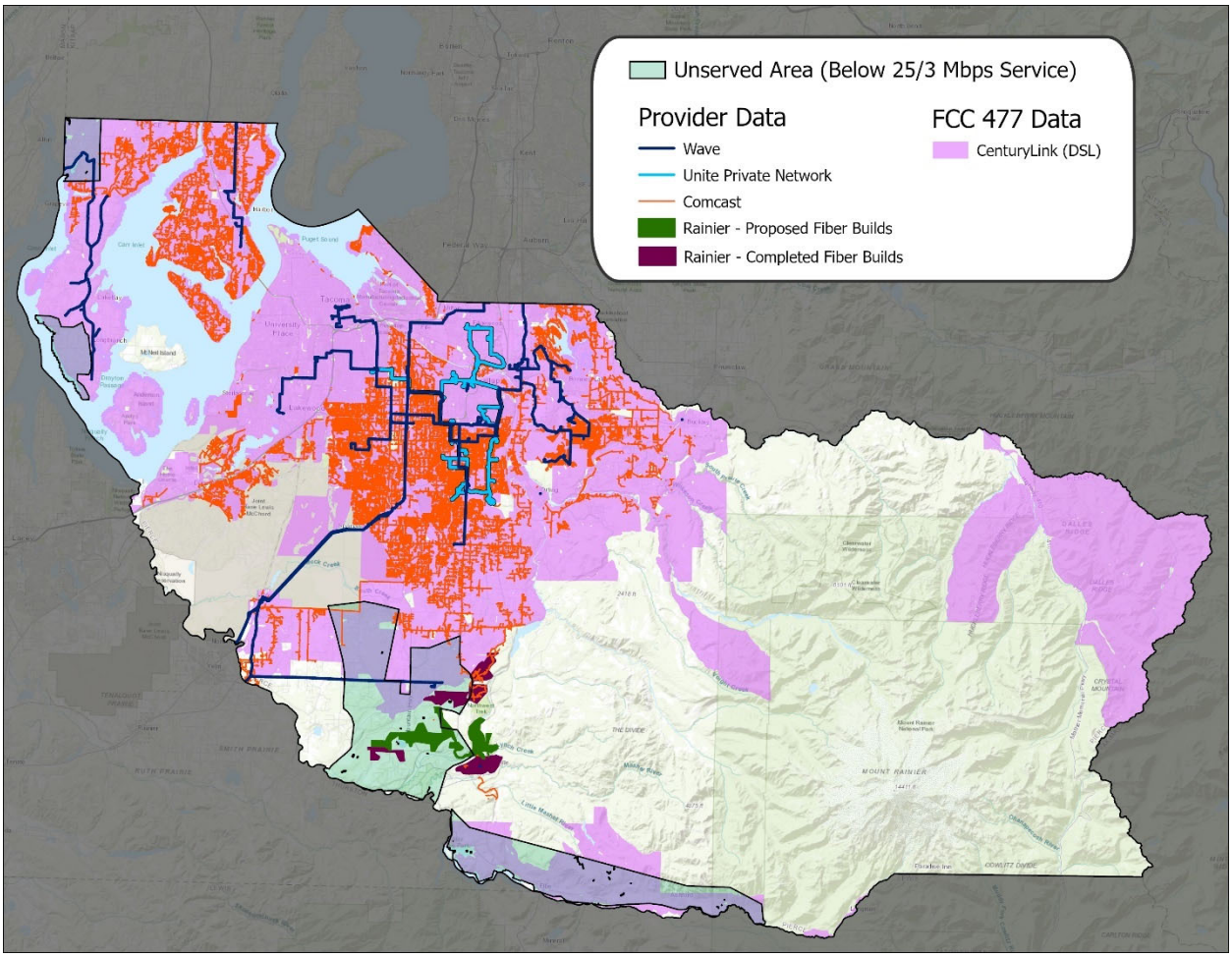
Fiber-to-the-premises would be the superior solution from a technical and long-term economic perspective, and the County has many potential partners and options to pursue fiber solutions. Performing a fixed wireless design and cost estimate would be more sensible if and when high-speed wireline solutions are determined to be cost-prohibitive in specific areas.

1.4.5 Existing providers offer a patchwork of service areas which could be expanded in Pierce County

CTC made efforts to determine the existing service areas of major wireline providers in Pierce County: CenturyLink, Comcast, Wave, and Rainier Connect. CenturyLink did not provide us with a map of their network routes; we mapped FCC Form 477 data; the majority of the coverage is DSL service. Comcast provided an image of their fiber and coaxial plant network, but no precise route data; our map is based on census blocks in the areas depicted in their image. Rainier did provide a map of their existing and proposed fiber builds, and Wave provided us with a map of

their fiber, but not coaxial, routes. The Unite network is also depicted, but it serves only enterprise and institutional customers. Figure 3 depicts all of these maps, overlaid on our map of served/unserved areas.

Figure 3: Existing Service Territories of Wireline Providers in Pierce County



The next figure shows CenturyLink's availability by technology type in the County. While most of the company's service is DSL, it also provides fiber service, and—as noted in the next section—the company was a major winner in the FCC's Rural Digital Opportunities Fund (RDOF) auction, positioning it to expand significantly in many areas of the county.

Figure 4: CenturyLink Availability by Technology Type

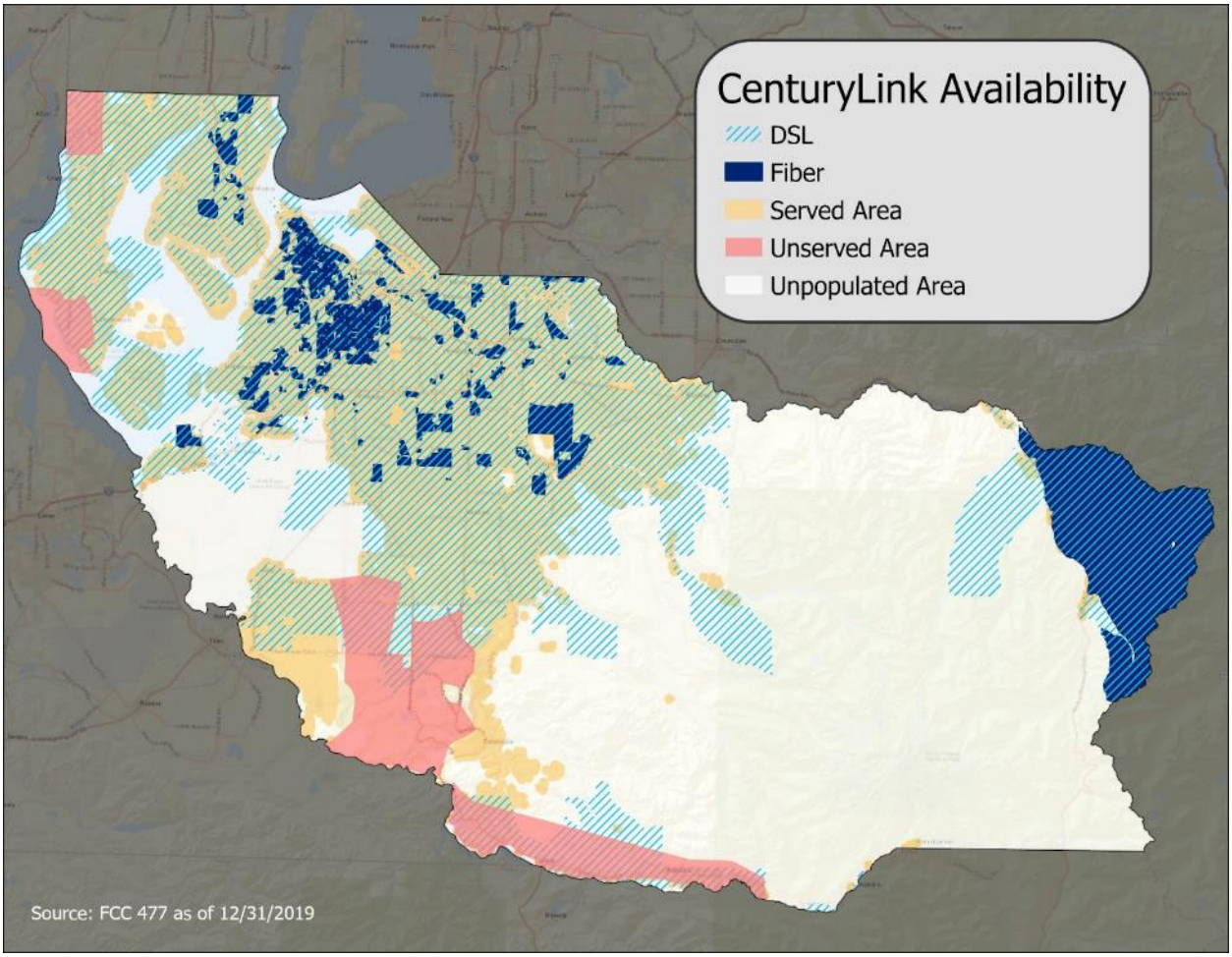
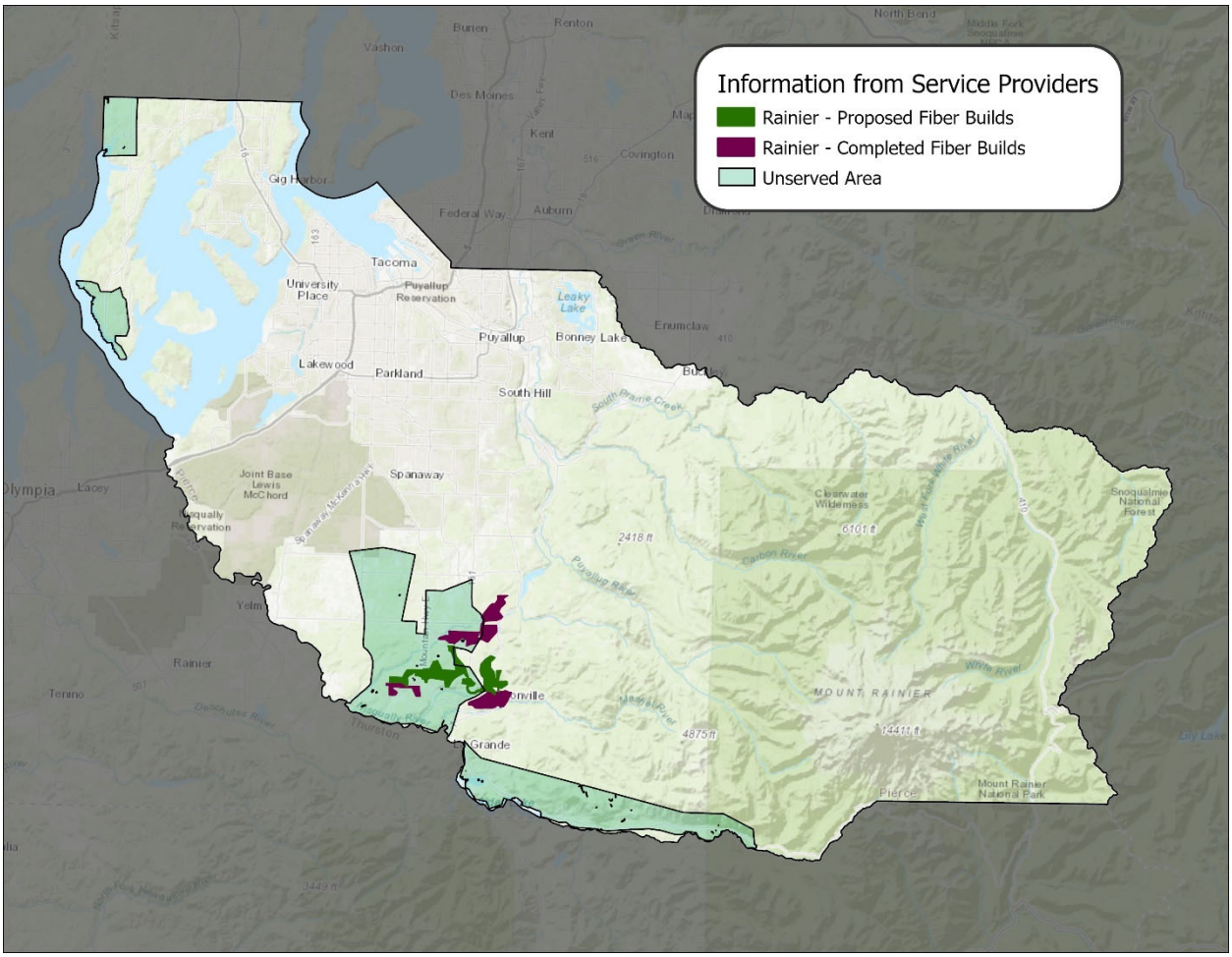


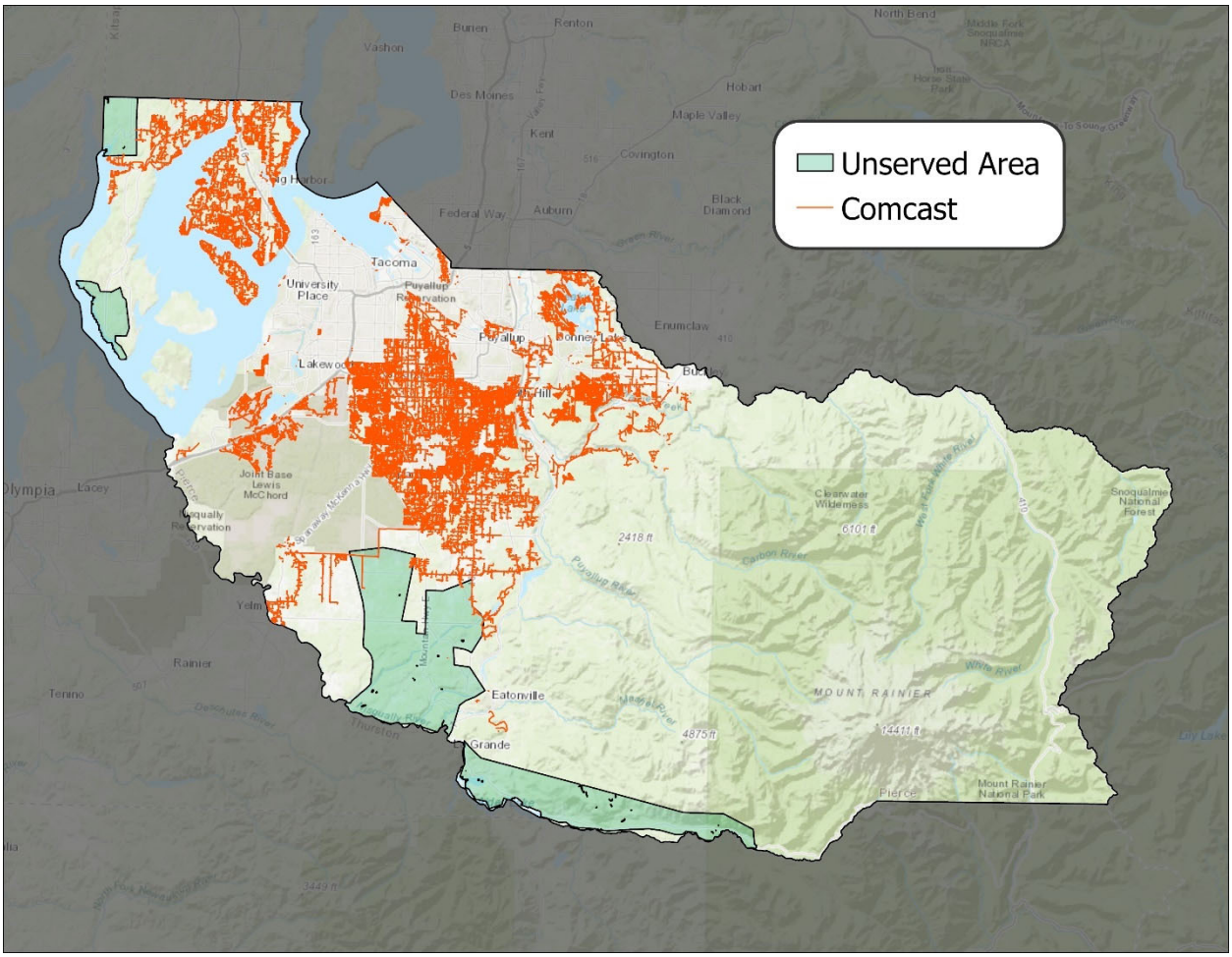
Figure 5 depicts Rainier Connect's recently completed and proposed fiber builds in the southern area of Pierce County.

Figure 5: Rainier Connect Recently Completed and Proposed Fiber Builds



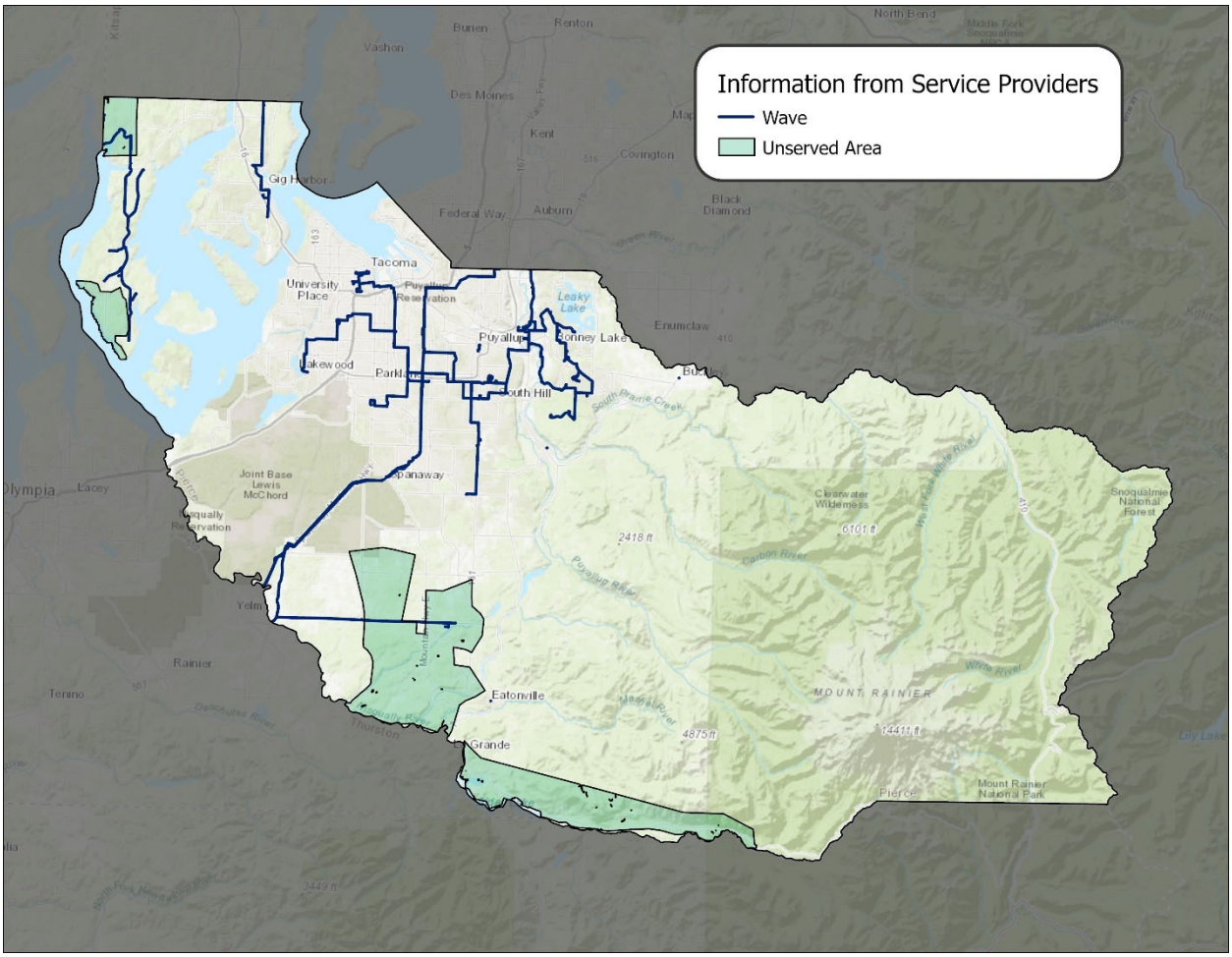
As noted above, Comcast sent us their fiber and coaxial routes, which are depicted in Figure 6.

Figure 6: Comcast Service Areas



Wave provided us with a map of their fiber routes, which generally indicates where they provide service. Figure 7 depicts these areas.

Figure 7: Wave Fiber Routes in Pierce County



1.4.6 Recent federal funding through RDOF will provide significant awards to CenturyLink and SpaceX and will support significant deployments in the County

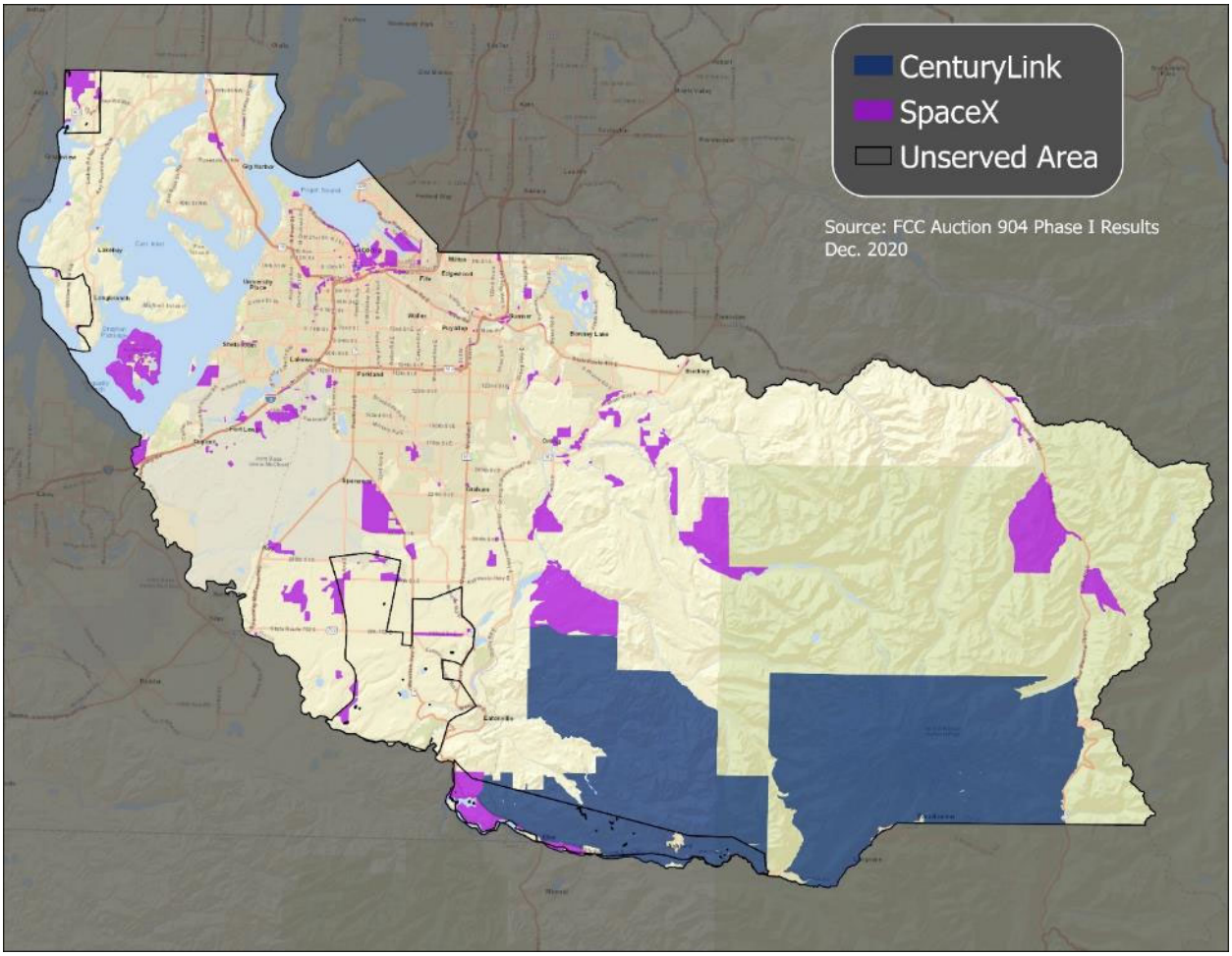
In November and December 2020, in the most significant broadband funding activity in years, the FCC conducted the Rural Digital Opportunity Fund (RDOF) auction and awarded $16 billion nationwide. The process, outcome, and impacts of the RDOF auction for Pierce County are presented in Section 5 of this report.

Pierce County had two winners: CenturyLink and SpaceX's new Starlink satellite service. CenturyLink took the southern and southeastern areas of Pierce County with a commitment to build gigabit fiber to all addresses in those areas—an optimal outcome for two areas of the County lacking nearby incumbents and limited options for future cooperative municipal electric utility fiber participation. SpaceX won all the remaining areas with its low-Earth orbit satellite service. Table 3 shows the results of the auction in Pierce County; Figure 8 maps the areas won by the companies.

Table 3: RDOF Winners in Pierce County

Winner	Locations	10-year Support
CenturyLink	749	$3,167,000
SpaceX	3,171	$2,695,000

Figure 8: Results of RDOF Auction in Pierce County



The unserved map we generated differs from the maps of RDOF-awarded areas. We do not know what methodology the FCC used to determine RDOF eligibility; some awards went to urban areas. In addition, Form 477 labels small areas across the County as unserved—and some of these were made eligible under RDOF—but we determined they are actually served. Some RDOF awards also appear to have gone to small unserved pockets in otherwise served areas. And some eligible areas are unpopulated, such as parks or wilderness areas.

1.4.6.1 CenturyLink's RDOF outcome

CenturyLink committed to building fiber in two unserved areas, and essentially "solves" the problem of unserved addresses—about 750—for these areas, according to the FCC. But CenturyLink's buildout obligations are over a six-year period. Under the terms of RDOF, CenturyLink will need to have constructed to 40 percent of its address locations on a statewide basis by year three. The clock starts on these obligations when the FCC approves "long form" RDOF auction submissions with detailed designs, project milestones, and proof of financial capability in the form of a letter of credit from a certified bank. Assuming the clock on these obligations starts in the fall of 2021, it still could take several years for many of the residents in those areas to actually get connected to high-speed broadband. In the coming months, it will be prudent to reach out to CenturyLink to discuss its projected timeline and ways the County might be able to help in speeding up implementation.

1.4.6.2 SpaceX's potential impact

SpaceX's impact could be substantial, but we do not yet know whether the company can deliver on its speed promises and whether its return on investment will be sufficient to properly maintain the network. We also do not know whether the SpaceX-won areas will be eligible for future grant funding. (In the past, federal grants typically only considered terrestrial fixed networks when determining eligibility.)

We believe, based on informal conversations with SpaceX staff, that SpaceX is likely to address the areas in and around King County (where it is headquartered) as one of its priority areas, given that it may already have much of the necessary satellite and terrestrial infrastructure in place). In a best-case scenario, a portion of residents in Pierce County will be able to receive broadband from the company.

But there are a number of outstanding questions to be addressed with SpaceX, including the buildout timeline SpaceX is anticipating for the County and whether other areas of the County would be covered beyond the RDOF-won areas. Additionally, customer activation and equipment may be fairly expensive. Starlink will reportedly charge users $99 a month initially, and customers will also need to pay $499 for a small satellite dish, mounting tripod, and router.[9] These prices may drop in the future, but pricing could be cost-prohibitive for some residents absent subsidies to lower these costs.

[9] https://www.forbes.com/sites/jonathanocallaghan/2020/10/27/spacex-reveals-monthly-cost-of-starlink-internet-in-its-better-than-nothing-betabut-is-it-too-expensive/?sh=7f6d0cdb4a83

1.4.6.3 Some losing bidders could be potential future partners for terrestrial fixed wireless investments

Losing bidders included the traditional satellite providers (Viasat and HughesNet), plus Consolidated Communications and Simple Networks. Consolidated, with gigabit fiber, only bid in a single census area with 19 locations east of Hart's Lake in Roy but bid at a higher support level than SpaceX in round 13 and therefore lost out. Had SpaceX not received favorable weight from the FCC, as explained in Section 5, Consolidated would have won that area. Simple Networks bid widely with fixed wireless at "above baseline" speeds (100/20) but gave up after Round 11.

1.4.7 Several other providers engaged by Pierce and CTC could fill broadband gaps, with Lewis County PUD, Rainier Connect, and Comcast defining projects and service areas

CTC and Pierce County engaged in conference calls with several potential partners including CenturyLink, Comcast, Lewis County Public Utility District (PUD), Rainier Connect, Peninsula Light, and Wave—all of which discussed potential areas of collaboration. We also mapped existing service areas of existing providers in Pierce County, to the extent the data they shared facilitated mapping. (Section 6 presents these maps and proposed projects in greater detail.)

1.4.7.1 CenturyLink, prior to RDOF, said it will build fiber-to-the-premises if it receives subsidies equal to 65 percent to 75 percent of the capital cost

CenturyLink representatives indicated they would be interested in partnering with the County on a fiber-to-the-premises project if the County were to define the areas and a subsidy or grant between 65 percent and 75 percent of the cost was provided. The company did not define specific areas, and the conversation took place before the RDOF award.

1.4.7.2 Comcast defined a potential service area for 525 premises on the Key Peninsula and a need for a $2 million subsidy

Comcast defined a potential service area on the Key Peninsula that would serve 525 premises but would require a subsidy of approximately $2 million, or approximately 60 percent of the capital cost, to become viable.

1.4.7.3 Lewis County PUD would need to extend a fiber backbone along Route 7 to Elbe and then to the Mt. Rainier park entrance to provide service in some southern parts of Pierce County

The Lewis County PUD defined a need for a $690,000 fiber backbone along Route 7 to Elbe to southern Pierce County, and a $550,000 fiber backbone from Elbe to the Mt. Rainier park entrance. This would put Lewis PUD in a position to provide fiber-to-the-premises service in certain areas along major routes at the southern edge of Pierce County, though a detailed design has not been made for fiber-to-the-premises in these areas.

We note that CenturyLink was awarded these areas in the RDOF auction; if it is approved by the FCC for award, and delivers on its buildout obligations, CenturyLink's buildout would undermine the business case for the PUD or County to invest in what would become a competing project.

1.4.7.4 Peninsula Light could become a broadband provider but did not discuss plans for doing so on the Key Peninsula

We conducted initial discussions with Peninsula Light, the cooperatively owned electric utility on the Key Peninsula. PenLight expressed interest in potentially providing broadband in its service area in the future. As of the writing of this report, PenLight had not shared any firm plans in this regard. A follow-up meeting would be prudent to further explore their interest, plans, and potential need for grant funding. We also spoke with the Peninsula School District, whose fiber vendor expressed interest in serving any County sites in the area if the County were to identify such sites.

1.4.7.5 Rainier Connect

We spoke with Rainier Connect and learned that it has defined five fiber-to-the-premises projects surrounding Eatonville that would provide service to 544 premises. These projects are on Rainier Connect's near-term development list and might benefit from grant funds to support some of the nearly $3.2 million capital cost of construction. A map of these areas and more detail is provided later in this report.

1.4.7.6 T-Mobile

We spoke with representatives of T-Mobile, which says it is developing a "home internet" service to augment its mobile service, but the company did not provide any more information about where or when this might become available in Pierce County. The various approaches for providing fixed wireless would require a large infrastructure investment. If this service becomes viable, it will most likely arrive first in densely developed areas. Given the high infrastructure cost, it is unlikely mobile providers will ever become a significant part of the solution for fixed residential broadband in the rural areas of most concern to Pierce County.

1.4.7.7 Wave

Wave proposed two potential line extensions to reach portions of underserved areas, one on the peninsula and the other near Eatonville. The first extension would be located along Whiteman Road in Longbranch. With a new node to facilitate the extension, Wave estimates that the project would require a grant of about $65,000. The second extension would be located along Mountain Highway East to Eatonville. Wave estimates this extension would require a grant of $1 million. As of March 19, 2021, CTC was awaiting information from Wave on how many homes could be served through these extensions without further subsidy.

2 Recommendations and Implementation Strategies

2.1 A partner selection strategy needs to be aligned to the outcome of the FCC's RDOF auction

Given the outcome of the RDOF auction, the County should consider CenturyLink an obvious partner for further expansion and engage in discussions to explore where partnerships could further extend their presence in unserved areas. CenturyLink engaged with the County and bid in the auction in several RDOF areas that constitute small parts of the County's overall unserved areas. Century link also has poles and other infrastructure it can leverage in almost all areas of the County, and it could therefore extend from its RDOF areas with relative ease.

The County should also engage with SpaceX to understand their timeline and coverage plans, and to confirm their pricing levels. Beyond CenturyLink and SpaceX, there are other entities that could fill gaps, as summarized later in this report.

2.2 The County should engage in a flexible request-for-proposals process

Now that the RDOF results are clear, we recommend Pierce County launch a more expansive request for proposals (RFP) process to identify multiple potential partners to target remaining unserved areas. Our provider outreach identified several potential projects—but more such projects could emerge from an RFP. The County could then seek to negotiate tailored service areas based on RFP responses and funding opportunities.

We recommend the County prioritize fiber as the most cost-effective solution over the long run, and also the solution best able to consistently deliver symmetrical speeds. We also recommend the County plan to assist in launching projects in as many areas as possible in order to establish fiber as the go-to solution for the County and avoid a patchwork of DSL, fixed wireless, and even satellite options that could provide a temporary fix but would prevent a federally grant-supported long-term solution.

When ranking RFP responses, we recommend giving higher scores to proposals that offer a larger share of matching funds from the vendor and for proposals that provide high-speed service at the largest number of addresses. The RFP could adopt the FCC's RDOF speed tier system with 1000/500, 100/20, 50/5, and 25/3 as the speed categories, or it can adopt an alternative demarcation that puts a premium on upstream speeds.[10]

[10] Fixed wireless and fiber are most flexible in regard to adjusting upstream speeds. Coaxial cable systems operating with the current DOCSIS 3.1 standard can theoretically accommodate higher upstream speeds than are offered in the U.S. today, but achieving that standard requires cable providers to replace passive amplifiers, splitters, and possibly some electronics. Cable companies typically max out at 35 Mbps upstream while a few can offer 50 Mbps.

2.2.1 Select private partners to fill rural broadband gaps through partial County funding, supplemented with potential federal and State funds

We recommend the County select, through a competitive process, one or more partners who are committed to working with the County to deploy broadband to unserved areas, including through collaborative efforts to secure federal grant support. Federal funding sources represent an important element of large-scale broadband deployments, though only for unserved areas where no broadband is currently available. While these programs tend to have restrictions that affect their potential breadth of impact, our analysis is that the programs have the potential to assist the County's efforts to greatly reduce the number of homes and businesses that are entirely unserved. The State of Washington also has two potential sources of broadband funding, through the Department of Commerce's Community Economic Revitalization Board (CERB) rural broadband grants and loans program, and the Public Words Board's (PWB) broadband program.

A competitive process would allow companies or other interested entities to bid on one or more of the unserved areas. Through the bid process, the companies would propose the communications infrastructure and technology of their choice and describe how they will address the unserved gaps based on their infrastructure choice and their capabilities. The County would then be in a position to select one or more potential partners with which to collaborate in applying for federal grants.

The County's process would be designed to enable the County to understand what its own financial commitment would have to be under a range of scenarios, including those in which different levels of federal funds can be secured, as well as the challenging scenario in which the County would be the only public entity providing funding to the private sector.

2.3 The County should consider a Broadband Partnership Fund

To the extent allowed by law, the County should consider establishing a Broadband Partnership Fund. This would allow the County to opportunistically take advantage of grants with matching requirements, and to exert leverage through such a program to steer investments toward sustainable high-speed broadband infrastructure. The recommended funding level is $1 million to $3 million annually.

3 Unserved Regions of Pierce County and Estimation of Costs to Build Fiber-to-the-Premises Infrastructure

3.1 Approach to determining unserved areas of Pierce County

We began our analysis by evaluating unserved areas where no wireline infrastructure capable of delivering services that meets the federal and state definitions of broadband passes[11] homes and businesses—meaning there is no cable or fiber plant in the right-of-way adjacent to the property.

We identified these unserved areas through reviewing the FCC form 477 data that broadband providers self-report their service territories. As part of this analysis of 477 data, we eliminated unpopulated areas of the County. We then overlaid the 477 data with the County's mapping data showing where broadband service as provided by the ISPs. We used this data to verify service and target areas that are unserved. Finally, we conducted a desk survey, in which a CTC outside plant engineer analyzed Google Earth Street View maps where available. We searched images of miles of County roadways for the presence (or lack thereof) of broadband infrastructure such as cable attachments on poles (for aerial construction) and handholes and pedestals (for underground construction) to validate our work in the previous iterations.

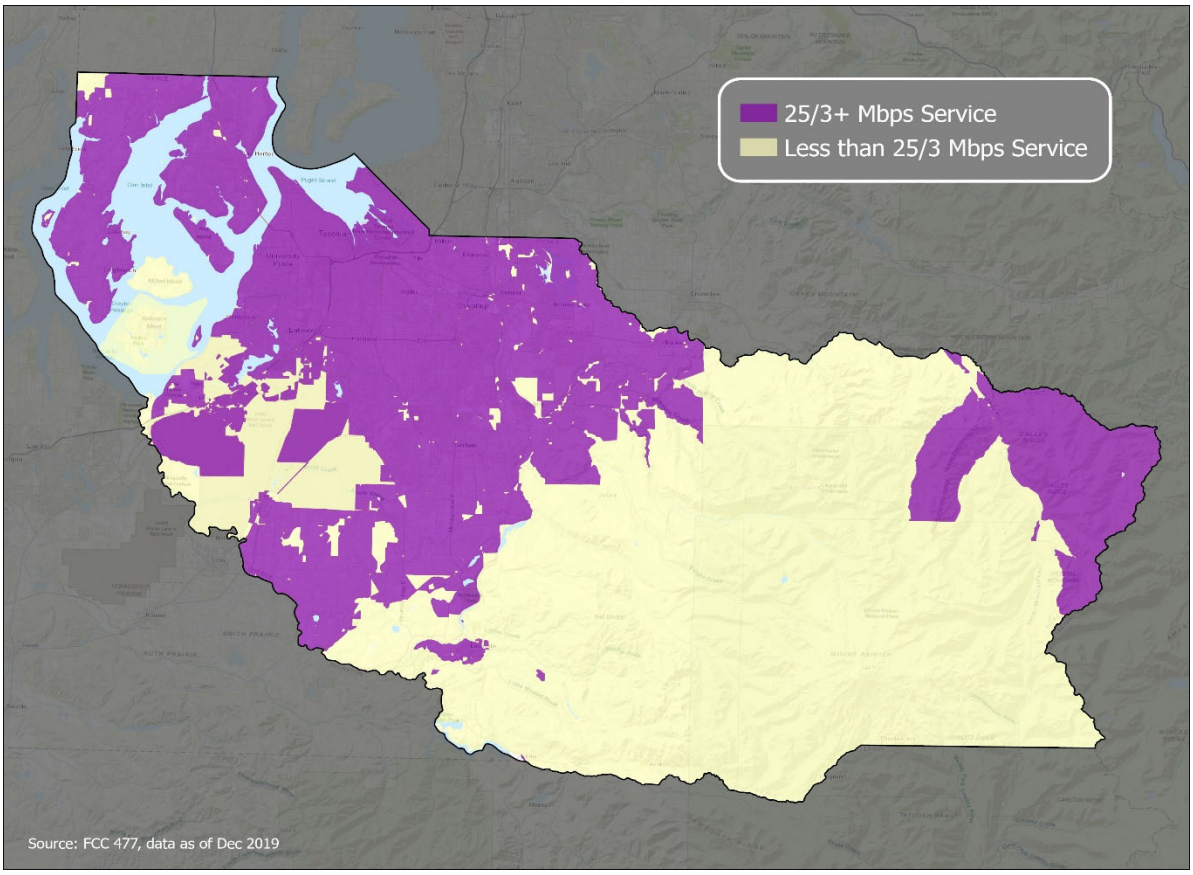
Our mapping and analysis identified approximately 6,300 homes and businesses unserved by wireline broadband infrastructure in contiguous unserved areas of the County (Category 1). A second group of unserved residents live at addresses on isolated unserved roads that are close to existing served areas (Category 2), which the exact number of homes this affects in the County is unclear.[12]

There is an additional category of locations within the County (Category 3) where homeowners struggle to get wireline service, despite the presence of broadband infrastructure passing the home: premises set so far back from the road that the ISP has no obligation to build the service drop from the road to the user's premises at no cost to the customer. Although these homes are effectively unserved because many homeowners find the drop construction cost unaffordable, the homes do not fit into the category of unserved for purposes of federal or state grant funding.

[11] A "passing" is the infrastructure that "passes" a home or business along the public rights-of-way, but it does not include the "service drop"—the portion of the network that connects from the road to the home or business itself. The availability of a passing to a home or business is the universally understood definition of what is served, both within the industry and among the state and federal government entities that fund broadband expansion and regulate communications services.

[12] We note that the category numbers do not indicate prioritization or emphasis in terms of the County's approach to filling its broadband gaps; the numbers are merely a convenient way to refer to the categories.

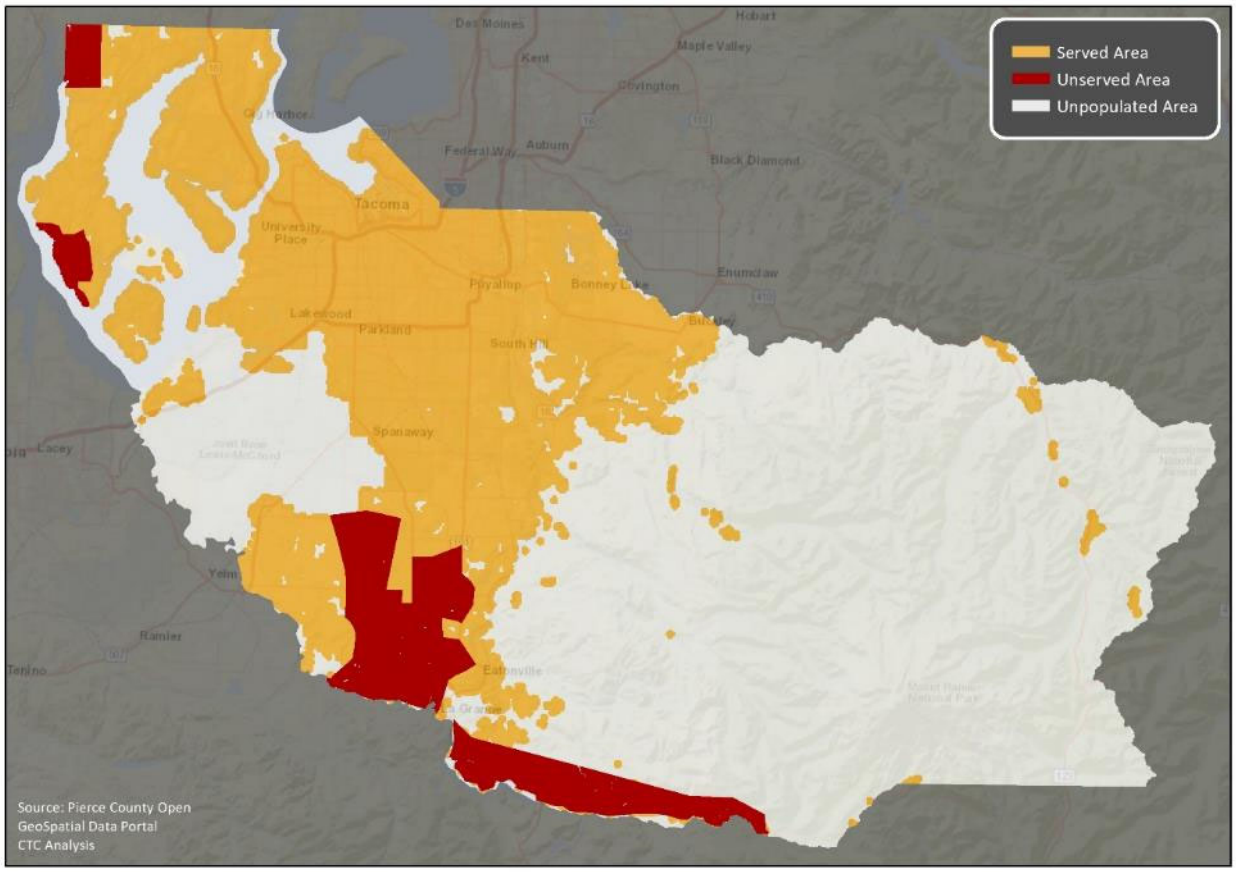
Figure 9: FCC Form 477 Data above 25 Mbps by 3 Mbps excluding Fixed Wireless



3.1.1 Unserved Category 1: contiguous geographic areas

Category 1 comprises contiguous geographic areas where our desk survey estimates there is no wireline infrastructure capable of delivering broadband speeds. Based on CTC's analysis of available data and our desk survey, we determined that the County has approximately 6,300 unserved locations in this category (Figure 10). This is the area we refer to as "unserved" throughout this report.

Figure 10: Category 1 Contiguous Unserved Areas



3.1.2 Unserved Category 2: addresses on isolated roads

Category 2 comprises the unserved premises located on isolated, low-density roads that fall within areas that are otherwise served. In other words, while the larger areas around these homes are generally served, the homes are on roads that do not have infrastructure.

The isolated unserved premises are typically on roads that are particularly long relative to the number of potential broadband customers on the road. Providers have not had business reasons to build infrastructure on those roads because their potential return on investment is not great enough to prompt an investment in reaching the potential customers who live there. Given the low density of houses, too, the cable companies are not obligated to build infrastructure on those roads under the terms of their cable franchise agreements with the County. Figure 11 is an example of Category 2 homes. Homes along Key Peninsula HWY S have service where service has not been extended to all the homes along Conwell RD KP N do not have service.

Figure 11: Example of Category 2 Homes

Other Category 2 locations include pockets of multiple unserved homes surrounded by served areas. For the residents on roads like these, which exist in locations in many parts of the County, this situation is particularly challenging; the cost of a cable company line extension down their road—which the residents would be required to pay in order to get service from those companies—can be high.

The County may be able to work with incumbent providers to seek grant funding to lower the cost to these providers for extending service to these isolated roads. A new broadband provider would likely not be as interested in serving these isolated roads because it would not have existing plant adjacent to the isolated roads.

3.1.3 Unserved Category 3: addresses with long driveways

In addition to the two categories of unserved residents, we also identified a third category of properties that do not have broadband service. These are customers for whom the cost of installation of the service drop—the connection from the right-of-way to the user's premises—is so high as to make service infeasible. This generally refers to locations where the home or business is more than 300 feet away from the road—that distance being the typical limit for cable franchisees' obligations to install a service drop at no cost to the customer. Figure 12 is an example of a long driveway on Cornwall RD KP N that, even after a line extension along the road, would still not get service unless the homeowner were to pay for a service drop.

Figure 12: Example of a Category Three Home

Although CTC and the County have not counted the number of properties in this category, and thus do not know whether the category comprises a significant number of homes, we recognize that this cause for lack of service could be a source of frustration. County residents with such long setbacks often cannot afford the cost of service drop installation that providers would assess. That means they are effectively unserviceable—even if service passes their property and they are considered to be "served with broadband" by the State and federal governments.

Service to these homes or businesses is a matter of the affordability of drop construction, not availability of infrastructure. Unfortunately, this is an area in which the County will not have a state or federal partner to solve that problem—because neither state nor federal grant funding applies to building service drops to these locations.

3.2 Building a fiber-to-the-premises network to serve the 6,300 unserved premises would cost approximately $26.9 million

Focusing on the "Category 1" areas as described above, as a candidate solution, CTC's engineers prepared a high-level network design for the deployment of a gigabit-capable fiber-to-the-premises network to serve the 6,300 homes and businesses in this area. We then estimated the cost for deploying that network, including a network backbone, assuming the construction was performed by an entity that is not the incumbent telephone, power, or cable company.

The total estimated capital cost for a non-incumbent to construct a fiber-to-the-premises network to serve the Category 1 areas is $26.9 million (assuming a take-rate—that is, the

percentage of potential customers subscribing to the service—of 60 percent); details are shown in Table 4.[13]

Table 4: Estimated Total Fiber Deployment Cost for Category 1 Unserved Areas

Cost Component	Estimated Cost
Outside Plant	$20,300,000
Central Network Electronics	$1,500,000
Fiber Service Drop Installations	$3,200,000
Customer Premises Equipment	$1,900,000
Total Estimated Cost	*$26,900,000*

We estimated a cost per passing by dividing the outside plant cost by the number of passings. This is the cost of constructing fiber alongside the roads in front of unserved homes and businesses, divided by the number of homes and businesses—essentially the cost of building a network independent of connections to any specific homes and businesses. We estimate the average outside plant cost per passing will be approximately $3,220 (Table 5).[14]

Table 5: Estimated Outside Plant Cost per Passing for Category 1 Unserved Areas[15]

Cost Component	Estimated Cost
Outside Plant	$20,300,000
Passings	6,300
Outside Plant Cost per Passing[16]	*$3,220*

These cost estimates—and the estimated operating costs described below (Section 3.6)—provide data relevant to assessing the financial viability of network deployment; they enable financial modeling to determine the approximate revenue levels necessary to service any debt incurred in building the network. They also provide a baseline against which to evaluate the cost of

[13] These numbers have been rounded. The take-rate affects the electronics and drop costs, but also may affect other parts of the network, as the County or its partner may make different design choices based on the expected take-rate. A 60 percent take-rate is possible in environments where a new provider delivers service in a previously unserved area. Market research would be required to estimate a more accurate take-rate at assumed service costs.

[14] In a joint grant application arrangement with a partner, the capital costs – and therefore the County's support – is exclusive of drop costs and customer premise equipment. Unless it is a brand-new network (such as when a county decides to build and operate a broadband network), central network electronics are part of the capital costs. In joint grant partnerships, incumbents and non-incumbents will typically backhaul the new builds to one or more existing central core sites. A non-incumbent will have added costs for the backhaul link and backbone/middle-mile fiber connecting unserved areas, that are often not grant eligible.

[15] Unrounded numbers are used in the engineering calculations; these are then rounded in the discussion.

[16] This is the average cost to construct the outside plant portion of the fiber-to-the-premises network for each home and businesses in the unserved areas.

incremental and non-fiber optic approaches, as compared to the cost of full coverage of the County's unserved areas with the highest-bandwidth technology.

3.3 Capital cost estimates

To develop and refine the range of assumptions that will have an impact on the network design and construction costs, a CTC engineer performed a desk survey of the County using Google Earth Street View. The engineer reviewed available green space and the presence and condition of utility poles. Based on this analysis, we developed customized estimates of per-mile costs for construction on utility poles and for underground construction where poles are not available.

Table 6 summarizes the conditions determined through our desk survey; the factors are described in detail below.

Table 6: Construction Cost Factors Developed in Desk Survey of Unserved Areas

Cost Factor	Finding in Unserved Areas
Aerial Construction	95%
Poles per Mile	22
Average Moves Required per Pole[17]	1
Poles Requiring Make-Ready	2%
Cost Per Move	$350
Poles Requiring Replacement	1%
Average Pole Replacement Cost	$7,000
Intermediate Rock Underground	2%
Hard Rock Underground	1%

Make-ready is the work required to create space on an existing utility pole for an additional attachment. Existing attachments often have to be moved or adjusted to create the minimum clearance required by code to add an additional attachment. Each move on the pole has an associated cost (i.e., for contractors going out to perform the move). When a utility pole is not tall enough to support another attachment or the pole is not structurally capable of supporting the attachment, a pole replacement is required. The pole replacement cost is then charged to the new attacher.

Where utility poles do not exist, underground construction is required. One of the challenging variables with underground construction is the prevalence of rock. Softer stones and boulders (intermediate rock) require the use of a specialized boring missile that is more expensive than

[17] The average moves per pole is the average number of existing attachments on the utility pole that need to be moved to create space and clearance in the communications space to support a new attachment for the fiber-to-the-premises network.

traditional boring. Hard rock requires even more specialized equipment such as rock sawing. The cost of boring through rock is added to the cost of traditional boring. We do not expect extensive hard or intermediate rock in the County, but some may be present, especially in the western parts of the County.

CTC's outside plant engineer noted that the quality of the poles and pole attachments in the County varied, as they do in many cities and counties—but that overall, most of the poles have space for an additional attachment. There is sufficient space on the existing electric utility poles to support an additional attachment.

In many parts of the County's Category 1 unserved areas, the telecommunications cables (i.e., telephone lines) are installed on short telecommunications poles, typically on the opposite side of the road from electric distribution cables, which are installed on taller electric utility poles. The cost estimate assumes the provider could attach to the utility poles in the communications space below the electrical cables. Based on our experience working in other jurisdictions, the County's utility pole lines appear more favorable for new pole attachment than the average utility pole—which will correspond to a lower-than-average aerial construction cost. In contrast, installing the fiber on the telecommunications poles would require substantial make-ready to make clearance for the attachment.

The figures below show samples of poles in various conditions in the County's Category 1 unserved areas. In Figure 13, for example, make-ready is required there make not be clearance however, the pole is tall enough that clearance can be achieved without needing pole replacement.

Figure 13: Utility Pole Requiring Make-Ready

Tree trimming is sometimes required to add an attachment on the utility poles. Tree trimming is also an important maintenance function necessary to keep the pole line clear of tree limbs that could break or damage the wires on a utility pole. In the unserved areas of the County tree

trimming is low, compared to other areas. In Figure 14 it shows a pole line with no tree trimming required.

Figure 14: Pole Line Where Tree Trimming Is Not Required

Figure 15 shows a pole line that has no existing attachment in the communications space on the power poles, which are also located on both sides of the street facilitating customers on both

side of the street. Where make-ready is low, as in this case, the cost of aerial construction is less than in high make-ready areas.

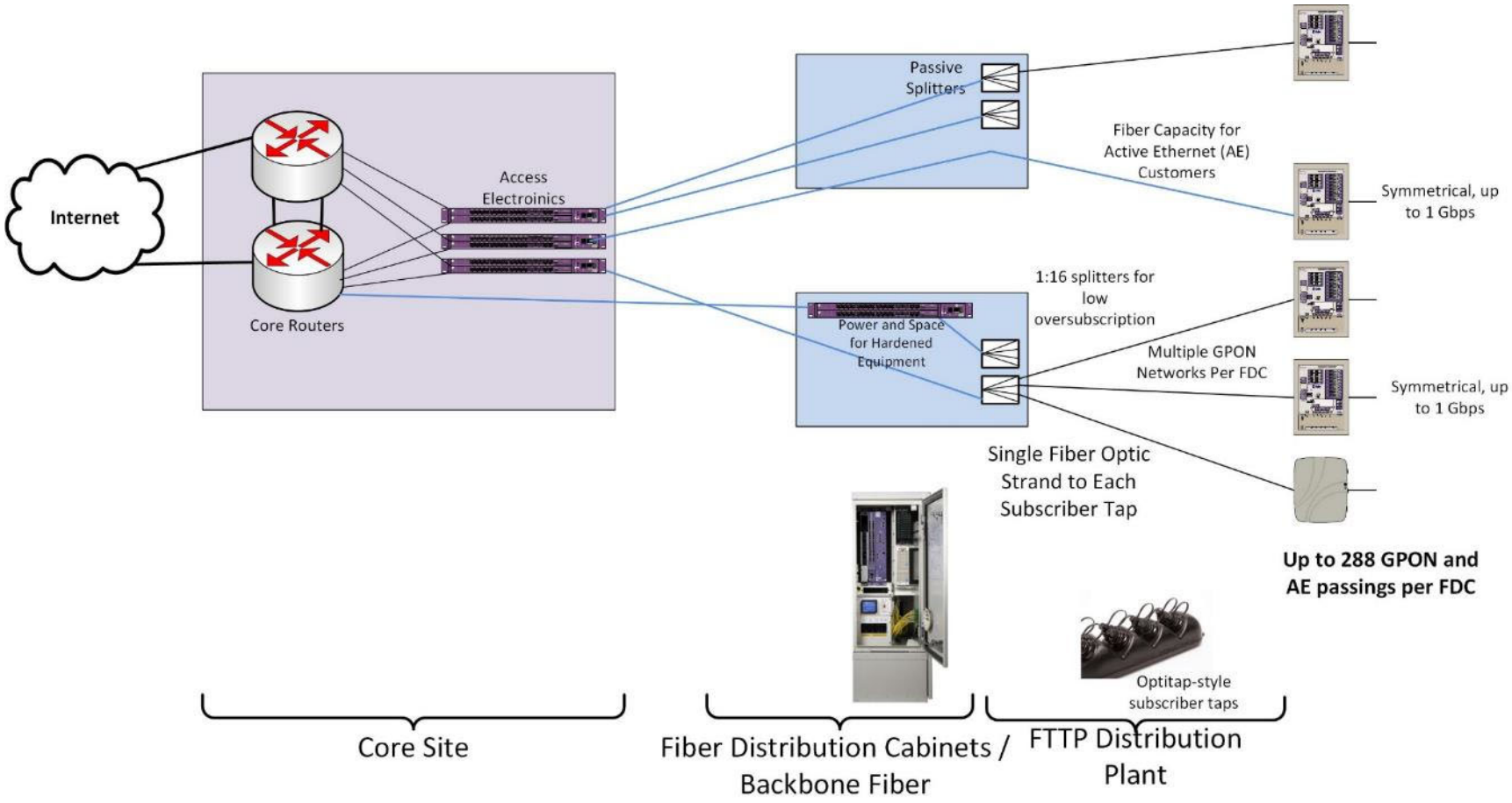
Figure 15: Low-Make-Ready Pole Line in Unserved Area

3.4 Network architecture

We developed a conceptual, high-level fiber-to-the-premises outside plant network design that is aligned with best practices in the industry and is open to a variety of electronic architecture options.[18] Figure 16, below, shows a logical representation of the fiber-to-the-premises network architecture we recommend based on the conceptual outside plant design.

[18] The network's outside plant is both the most expensive and the longest-lasting portion. The architecture of the physical plant determines the network's scalability for future uses and how the plant will need to be operated and maintained; the architecture is also the main determinant of the total cost of the deployment.

Figure 16: High-Level Fiber-to-the-Premises Architecture



This drawing illustrates the primary functional components in the fiber-to-the-premises network, their relative position to one another, and the flexibility of the architecture to support multiple subscriber models and classes of service.

The recommended architecture is a hierarchical data network that provides scalability and flexibility, both in terms of initial network deployment and its ability to accommodate the increased demands of future applications and technologies without requiring expensive new construction. The characteristics of this hierarchical fiber-to-the-premises data network are:

- **Capacity** – ability to provide efficient transport for subscriber data, even at peak levels
- **Availability** – high levels of redundancy, reliability, and resiliency; ability to quickly detect faults and re-route traffic
- **Failsafe operation** – physical path diversity in the network backbone to minimize operational impact resulting from fiber or equipment failure
- **Efficiency** – no traffic bottlenecks; efficient use of resources
- **Scalability** – ability to grow in terms of physical service area and increased data capacity, and to integrate newer technologies without new construction
- **Manageability** – simplified provisioning and management of subscribers and services
- **Flexibility** – ability to provide different levels and classes of service to different customer environments; can support an open access network or a single-provider network; can provide separation between service providers on the physical layer (separate fibers) or logical layer (separate Virtual Local Area Network (VLAN) or Virtual Private Network (VPN) providing networks within the network)
- **Security** – controlled physical access to all equipment and facilities, plus network access control to devices

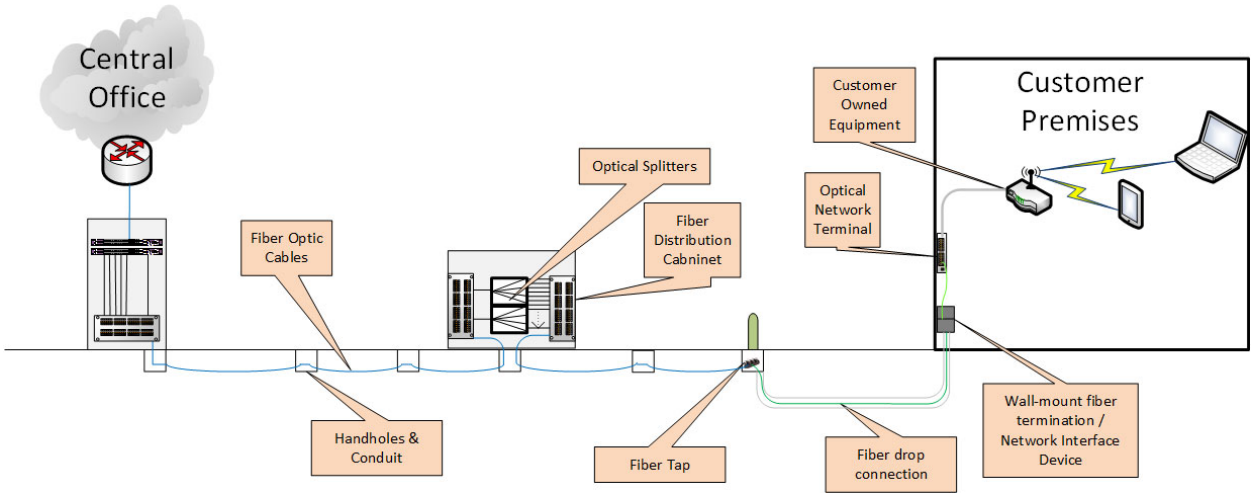
This architecture offers scalability to meet long-term needs. It is consistent with best practices for either a standard or an open-access network model to provide customers with the option of multiple network service providers. This design would support the current industry standard gigabit passive optical network technology. It could also provide the option of direct Active Ethernet services.[19]

[19] The architecture enables the network to provide direct unshared Active Ethernet connections to 5 percent of customers, which is appropriate for a select group of high-security or high capacity commercial users (e.g., banks,

The design is based on a Gigabit Passive Optical Network (GPON) architecture, which is the most commonly provisioned fiber-to-the-premises service—used, for example, by AT&T Fiber, Verizon (in its FiOS systems), Google Fiber, and Sonic.net. GPON supports high-speed broadband data and is easily leveraged by triple-play carriers for voice, video, and data services.

GPON uses passive optical splitting, which is performed inside fiber distribution cabinets (FDC), to connect fiber from the Optical Line Terminals (OLTs) to the customer premises where it connects to an Optical Node Terminal (ONT) on the outside or inside of the premise. With GPON service (Figure 17), the FDCs house multiple optical splitters, each of which splits the fiber link to the OLT between 16 to 32 customers. The GPON OLT uses single-fiber (bi-directional) modules called SFPs (Small Form Factor Pluggable) which consists of a laser transmitter and a receiver to support multiple (most commonly less than 32) subscribers, so each customer receives a fiber connection all the way to the premise.

Figure 17: GPON Fiber Network with a Buried Service Drop



The chief advantage of this type of architecture lies in the simple architecture and passive design which makes installation straightforward, and is very cost effective to operate, with few active pieces that can break. Even though the GPON platform is limited to 1.2 Gbps upstream and 2.4 Gbps downstream for the subscribers connected to a single PON (meaning the bandwidth available to the individual subscriber needs to be divided with others on the PON), operators have found that the variations in actual subscriber usage generally means that all subscribers can obtain 1 Gbps on demand (without provisioned rate-limiting), even if the capacity is aggregated at the PON. The platform has also proven to be versatile: many GPON manufacturers have developed technology to support up to 10 Gbps and faster speeds as user demand increases, and

wireless small cell facilities). In extreme cases, the network can provide more customers with Active Ethernet with the addition of electronics at the fiber distribution cabinets on an as-needed basis.

these are already implemented by many providers delivering business services.[20] In fact, part of the attraction of GPON technology is that much of the infrastructure can be upgraded in a relatively easy and cost-effective manner. Some OLTs already support the next generation PON technologies (such as XGS-PON and NGPON2), so much of the GPON investment can be reused, and upgrades can be done incrementally as needed.

The design assumes placement of manufacturer-terminated fiber tap enclosures within the public right-of-way or easements, providing watertight fiber connectors for customer service drop cables, and eliminating the need for service installers to perform splices in the field. This is an industry-standard approach to reducing both customer activation times and the potential for damage to distribution cables and splices. The model also assumes that the County or a partner obtains easements or access rights to private drives to access homes as needed.

3.5 Fiber construction cost assumptions

We used the following unit cost assumptions when developing our estimated fiber construction costs (Table 7). Cost estimates are based on other, similar fiber-to-the-premises projects.

Table 7: Unit Cost Estimate Assumptions

Description	Unit	Assumption
Placement of 2-inch conduit using directional boring	$/foot	$12.50
Pull-box placement, 24"x36"x36" Tier 22	each	$1,050
Aerial cable installation per foot	$/foot	$1.50
Traffic control and work area protection per foot	$/foot	$.25
Tree trimming	$/foot	$.25
Make-ready per foot	$/foot	$0.32
288-count cable	$/foot	$2.05
Aerial fiber installation materials	$/foot	$1.30

The network design and cost estimates assume the non-incumbent provider will:

- Place a new core facility (if needed) on existing County land or right-of-way. The cost estimate includes the facility costs with adequate environmental and backup power generators to house network electronics and provide backhaul to the internet.[21]

[20] Verizon, for example, is rolling out NGPON2 supporting 5G, as well as FiOS and business services. See https://www.lightwaveonline.com/fttx/pon-systems/article/14034625/verizon-full-speed-ahead-with-ngpon2-for-5g-mobile-support

[21] Any additional equipment, power, and backup will be on the provider. Existing providers, incumbents or non-incumbents, typically will not need any additional facilities, power, and backup generators from what they already have.

- Construct 55 miles of backbone network[22] to connect the unserved communities to the core via 25 fiber distribution cabinets. The fiber distribution cabinets will be located in the public right-of-way or on County-owned land that provides adequate space for the hosting and maintenance of the cabinet.

- Construct 371 miles of fiber optics from the fiber distribution cabinets to 6,300 homes and businesses (i.e., from termination panels in the fiber distribution cabinet to tap locations in the public right-of-way or on easements near the home or business).

- Obtain easements or access rights to private roads where public rights-of-way do not exist.

A new core site would not be needed for most operators who will backhaul to their existing network where they already have core equipment or—as in the case of incumbents such as Comcast—will simply extend the footprint of their existing architecture, including core sites. Should a new core facility be necessary, and County land not be available, the provider will typically pick an affordable location that makes sense for its own particular hub design (and that has access to power). Depending on it needs, the provider may locate close to other providers to secure additional backhaul or cross-connects with those providers. The size requirements for such a site are modest and could be as small as a traffic-signal enclosure.

The fiber-to-the-premises network design was developed with the following criteria based on the above assumptions and required characteristics of the hierarchical fiber-to-the-premises network:

- Fiber will vary between 12- and 288-count based on the projected need in the area.

- Fiber will be installed in the communications space of the electric utility poles where poles are present, and in newly constructed underground conduit in other areas.

- Fiber will be installed in the public right-of-way or in an easement on the side of the road.

- The network will target up to 288 passings per fiber distribution cabinet.

- Fiber distribution cabinets will support hardened network electronics and provide backup power and an active heat exchange.[23]

[22] The backbone construction costs are included in the cost of the fiber-to-the-premises network.

[23] These hardened fiber distribution cabinets reflect an assumption that the network's operational and business model will require the installation of provider electronics in the fiber distribution cabinets that are capable of supporting open access among multiple providers. We note that the overall fiber-to-the-premises cost estimate

- The network routes will avoid the need for distribution plant to cross major roadways and railways.

As with any utility, the design and associated costs for construction vary with the unique physical layout of the service area—no two streets are likely to have the exact same configuration of fiber optic cables, communications conduit, underground vaults, and utility pole attachments. Costs also vary by soil conditions, such as the prevalence of subsurface rock; the condition of utility poles and feasibility of aerial construction involving the attachment of fiber infrastructure to utility poles; and crossings of bridges, railways, and highways.

A key point to understand is that aerial construction (i.e., attaching fiber infrastructure to existing utility poles) could offer significant savings compared to all-underground construction but increases uncertainty around cost and timeline. Under some circumstances, costs related to pole remediation and make-ready construction can make aerial construction cost-prohibitive in comparison to underground construction. However, as discussed in Section 3, our desk survey found that the majority of poles likely have sufficient space and capacity, and that the amount of needed make-ready is low.

We assume the fiber will be strand-mounted in the communications space on the existing utility poles. Splice cases, subscriber taps, and drops will also be attached to the strand, which will facilitate maintenance and customer installation.

While generally allowing for greater control over timelines and more predictable costs, underground construction is subject to uncertainty related to congestion of utilities in the public right-of-way—which cannot be fully mitigated without physical excavation and/or testing. In the County, however, congestion of utilities appears to be reasonable for most areas, which makes underground construction more viable than is typically the case.

While anomalies and unique challenges will arise regardless of the design or construction methodology, the relatively large scale of this project is likely to provide ample opportunity for variations in construction difficulty to yield relatively predictable results on average.

We assume underground construction will be done using an industry-standard approach for this type of environment, which consists primarily of horizontal, directional drilling to minimize public right-of-way impact and to provide greater flexibility to navigate around other utilities. The design model assumes a single 2-inch, flexible, high-density polyethylene (HDPE) conduit over

would decrease if the hardened fiber distribution cabinets were replaced with passive fiber distribution cabinets (which would house only optical splitters) and the providers' electronics were housed only at the hub facility.

underground distribution paths, and dual 2-inch conduits over underground backbone paths to provide scalability for future network growth.

Costs for aerial and underground placement were estimated using available unit cost data for materials and estimates on the labor costs for placing, pulling, and boring fiber based on construction in comparable markets. The material costs were known, with the exception of unknown economies of scale and inflation rates and barring any shortages or supply disruptions restricting material availability and increasing costs. The labor costs associated with the placement of fiber were estimated based on comparable construction projects.

3.6 Fiber-to-the-premises cost components

3.6.1 Outside plant cost components

The cost components for outside plant construction include the following tasks:

- ***Engineering*** – includes system-level architecture planning, preliminary designs, and field walkouts to determine candidate fiber routing; development of detailed engineering prints and preparation of permit applications; and post-construction "as-built" revisions to engineering design materials
- ***Quality Control / Quality Assurance*** – includes expert quality assurance field review of final construction for acceptance
- ***General Outside Plant Construction*** – consists of all labor and materials related to "typical" underground or aerial outside plant construction, including conduit placement, utility pole make-ready construction, aerial strand installation, fiber installation, and surface restoration; includes all work area protection and traffic control measures inherent to all roadway construction activities
- ***Special Crossings*** – consists of specialized engineering, permitting, and incremental construction (material and labor) costs associated with crossings of railroads, bridges, and interstate / controlled access highways
- ***Backbone and Distribution Plant Splicing*** – includes all labor related to fiber splicing of outdoor fiber optic cables
- ***Backbone Hub, Termination, and Testing*** – consists of the material and labor costs of placing hub shelters and enclosures, terminating backbone fiber cables within the hubs, and testing backbone cables

The assumptions, sample designs, and cost estimates were used to extrapolate an outside plant infrastructure cost of $55,000 per mile.

The distribution plant covers 371 miles, leading to a total outside plant cost of approximately $16.8 million. This leads to an average outside plant cost per passing of approximately $3,220. Table 8 provides a breakdown of the estimated outside plant costs.

Table 8: Estimated Outside Plant Costs[24]

Cost Per Plant Mile[25]	Distribution Plant Mileage	Total Cost	Estimated Passings	Cost per Passing[26]
$55,000	371	$20.3 million	6,300	$3,220

The actual cost to construct fiber-to-the-premises to every unserved Category 1 premises in the County could differ from the estimate due to changes in the assumptions underlying the model. For example, if make-ready and pole replacement costs are too high, the network would have to be constructed underground—which could significantly increase the cost of construction. A non-uniform take-rate (i.e., the percentage of passed customers that choose to purchase a service) across different areas could also influence costs. A lower take-rate would not substantially affect outside plant and core equipment costs; it would only reduce the costs for drops and customer premises equipment.

Our estimated take rate of 60 percent is consistent with networks in similar markets and on the conservative end. Take-rates vary with a variety of factors: price points for services, the quality of customer service provided, and "level of desperation" for reliable broadband. The presence of an existing provider in the market—such as a fixed wireless service—could reduce take-rates because some subscribers will be happy with "good-enough" service. But if an existing low-speed internet provider underperforms or has pricing similar to the fiber-to-the-premises offering, then the fiber-to-the-premises operator could expect higher take-rates.

Further and more extensive analysis would be required to develop a more accurate cost estimate across the entire County.

Actual costs will also vary from this estimate due to factors that cannot be precisely known until the detailed design is completed, or until construction commences. These factors include costs of private easements; utility pole replacement and make-ready costs; variations in labor and

[24] Unrounded numbers are used in the engineering calculations; these are then rounded in the table and the discussion.
[25] The cost per plant mile is the average cost of constructing a mile of outside plant for the fiber-to-the-premises network.
[26] The cost per passing is the average cost to construct the outside plant for the fiber-to-the-premises network to pass each premises within the unserved areas.

material costs; and the operational and business model. We have incorporated suitable assumptions to address these items based on our experience in similar markets.

3.6.2 Central network electronics costs

Central network electronics equipment to serve the unserved area will cost an estimated $1,500,000, assuming a 60 percent take-rate.[27] (These costs may increase or decrease depending on take-rate, and the costs may be phased in as subscribers are added to the network.) The network electronics consist of the core and distribution electronics to connect subscribers to the fiber-to-the-premises network at the core and the fiber-to-the-premises access electronics located at the fiber distribution cabinets. Table 9 lists the estimated costs for each segment.

Table 9: Estimated Central Network Electronics Costs

Network Segment	Subtotal
Core and Distribution Electronics	$1,000,000
Fiber-to-the-Premises Access Electronics	$500,000
Total	*$1,500,000*

The electronics are subject to a seven- to 10-year replacement cycle, as compared to the 20- to 30-year lifespan of a fiber investment.

3.6.2.1 Core and distribution electronics

The core electronics connect the network to the internet. The core electronics consist of high-performance routers, which handle all the routing on both the network and to the internet. The core routers have modular chassis to provide high availability in terms of redundant components and the ability to "hot swap" line cards in the event of an outage.[28] Modular routers also provide the ability to expand the routers as demand for additional bandwidth increases.

The cost estimate design envisions running networking protocols, such as hot standby routing protocol, to ensure redundancy in the event of a router failure. Additional connections can be added as network bandwidth increases. The core sites would also tie to the distribution electronics using 10 Gbps links. The links to the distribution electronics can also be increased with

[27] The take-rate affects the electronics and drop costs, but also may affect other parts of the network, as different design choices may be made based on the expected take-rate. A 60 percent take-rate is possible in environments where a new provider delivers service in a previously unserved area. Market research would be required to estimate a more accurate take-rate at assumed service costs.

[28] A "hot swappable" line card can be removed and reinserted without the entire device being powered down or rebooted. The control cards in the router should maintain all configurations and push them to a replaced line card without the need for reconfirmation.

additional 10 Gbps and 40 Gbps line cards and optics as demand grows on the network. The core networks will also have 10 Gbps to ISPs that connect the network to the internet.

We estimate the cost of the core routing equipment to be approximately $1,000,000.[29] In addition, the network requires operations support systems, such as provisioning platforms, fault and performance management systems, remote access, and other operational support systems for operations. For a network of this scale, an operations support system costs approximately $100,000 to acquire and configure. (We have not included that cost in the totals above because the system might be the responsibility of the County's partner.)

3.6.2.2 Fiber-to-the-premises access electronics

The access network electronics at the fiber distribution cabinets connect the subscribers to the network by connecting the backbone to the fiber that goes to each premises. These electronics are commonly referred to as optical line terminals. We recommend deploying access network electronics that can support both gigabit passive optical network and Active Ethernet subscribers to provide flexibility within the fiber distribution cabinet service area. We also recommend deploying modular access network electronics for reliability and the ability to add line cards as more subscribers join in the service area. Modularity also helps reduce initial capital costs.

The cost of the access network electronics for the network is estimated at approximately $500,000. These costs are based on a take-rate of 60 percent and include optical splitters at the fiber distribution cabinets aligned to that take-rate. An alternative design places the optical line terminals at the core location, with the fiber distribution cabinets containing only splitters. As the County or its partner examines more closely the specific electronics architecture, this alternative may be a suitable approach—and would reduce the size of the fiber distribution cabinets and provide a small cost savings.

3.6.3 Per-subscriber costs

Each activated subscriber would also require a fiber drop cable installation and related customer premises equipment, which would cost on average roughly $1,360 per subscriber, or $5.1 million total—again, assuming a 60 percent take-rate.

Customer premises equipment is the subscriber's interface to the network; for gigabit passive optical networks, these electronics are referred to as an optical node terminal. For this cost estimate, we selected customer premises equipment that both terminates the fiber from the network and provides only Ethernet data services at the premises (however, there are a wide variety of additional customer premises equipment offering other data, voice, and video

[29] The purpose of this study is to understand very rough estimated that allows for a strategic analysis and gives County decision makers an understanding of the scope of the problem. For high level cost estimates, we use a multiplier based on passings for core equipment needs generated from previous studies and cost estimates.

services). The customer premises equipment can also be provisioned with wireless capabilities to connect devices within the customer's premises. Using the assumed take-rate of 60 percent, we estimated the cost for subscriber customer premises equipment and installation to be $500 per subscriber, or approximately $1.9 million systemwide.

The drop installation cost is the biggest variable in the total cost of adding a subscriber. A short aerial drop can cost as little as $250 to install, whereas a long underground drop installation can cost upward of $5,000. Based on the prevalence of aerial and underground utilities, and sample designs, we estimate an average of approximately $860 per drop installation (or approximately $3.2 million systemwide, assuming a 60 percent take-rate). The drop installation follows the existing utilities, so that if the existing utilities in the public right-of-way are aerial, the drop would be installed aerially and vice versa for underground. Average drop distances are extrapolated from sample designs developed for similar rural fiber-to-the-premises projects. Actual drop costs will vary for each premises.

The numbers provided in Table 10, below, are averages and will vary depending on the type of premises and the internal wiring available at each premises.

Table 10: Per-Subscriber Cost Estimates

Construction and Electronics Required to Activate a Subscriber	Estimated Average Cost
Drop Installation and Materials	$860
Subscriber Electronics (Optical Node Terminal)	$200
Electronics Installation	$200
Installation	$100
Total	*$1,360*

3.7 Annual fiber-to-the-premises operating costs

Some of the ongoing costs of operating a fiber-to-the-premises network include fiber maintenance, fiber locating, pole attachment fees, and equipment replacement. These estimates include costs directly related to the maintenance and operations of the physical and network electronics layers of the network but does not include costs associated with higher layer services and other fixed administrative expenses that would otherwise be incurred regardless of the technical approach to network transport.

Regular fiber maintenance includes any add, moves, and changes required of the network. For example, if a roadway is widened a pole line may be moved or undergrounded, requiring the relocation of fiber. We estimate that 1 percent of the total capital costs, or $200,000, is required annually for fiber maintenance.

Fiber locating includes the marking of underground utilities as part of the State's Call Before You Dig process. Each underground utility is responsible for locating and marking its infrastructure in the right-of-way. We estimate the cost at $1,800 per mile of underground construction annually for utility locates, or $35,000 annually for the estimated 19 miles of underground plant.

For every pole to which the fiber network attaches, the attaching party must pay the pole owner an attachment fee for maintenance of the utility pole line. We estimate a pole attachment fee of $20 per pole per year or a total of approximately $155,000 annually for approximately 353 miles of aerial plant at 22 poles per mile. Pole attachment fees are estimated and would be negotiated with the pole owners as part of the pole attachment process.

We also recommend establishing an equipment replacement fund, into which a portion of the necessary funds to replace the network electronics would be placed. We recommend planning on replacing the network electronics every seven years, requiring the placement of approximately $215,000 into the equipment fund annually.

Table 11: Estimated Annual Fiber-to-the-Premises Technical Operating Costs

Description	Annual Cost
Fiber Maintenance	$200,000
Fiber Locating	$35,000
Pole Attachment Fees	$155,000
Equipment Replacement Fund	$215,000
Total	*$605,000*

4 Fixed Wireless Is Not Currently a Suitable Solution for Pierce County

As noted above, we concluded that fiber-to-the-premises represents a better broadband solution than fixed wireless for the unserved areas of Pierce County. While fiber-to-the-premises has a higher capital cost than a fixed wireless solution, the total cost of operations of fiber-to-the-premises over time will be significantly lower. While there are some areas of the nation where fixed wireless makes better economic sense, the hilly topography and significant tree cover in much of Pierce County do not put the county in this category.

We also note also that CenturyLink has not used fixed wireless in Pierce County, according to Form 477, and did not propose to use this approach in its RDOF bidding.

4.1 Fiber-to-the-premises is a preferable technical solution with lower costs over time than a fixed wireless solution

Fiber optics, once constructed, is the highest-speed and most scalable technology. Current off-the-shelf technologies enable fiber-to-the-premises networks to provide capacity in excess of 1 Gbps to each subscriber, with new electronics making it possible to go to 10 Gbps or beyond in the coming years. Moreover, the fiber-to-the-premises network is not subject to interference from other signals or subject to line-of sight limitations. Over time, maintenance and repair costs of fiber optic cables are low—approximately 1 percent of construction costs annually. Equipment replacement occurs every seven years, but new equipment costs are only a very small percentage of the capital cost of a fiber-to-the-premises network. But as noted in the previous section, construction costs can be high and vary based on the availability of space on utility poles and in the right-of-way. Construction can be delayed by utility pole owners, other utilities on the poles, and by the requirement for permitting in the right-of-way (including on bridges, water crossings, and highway crossings).

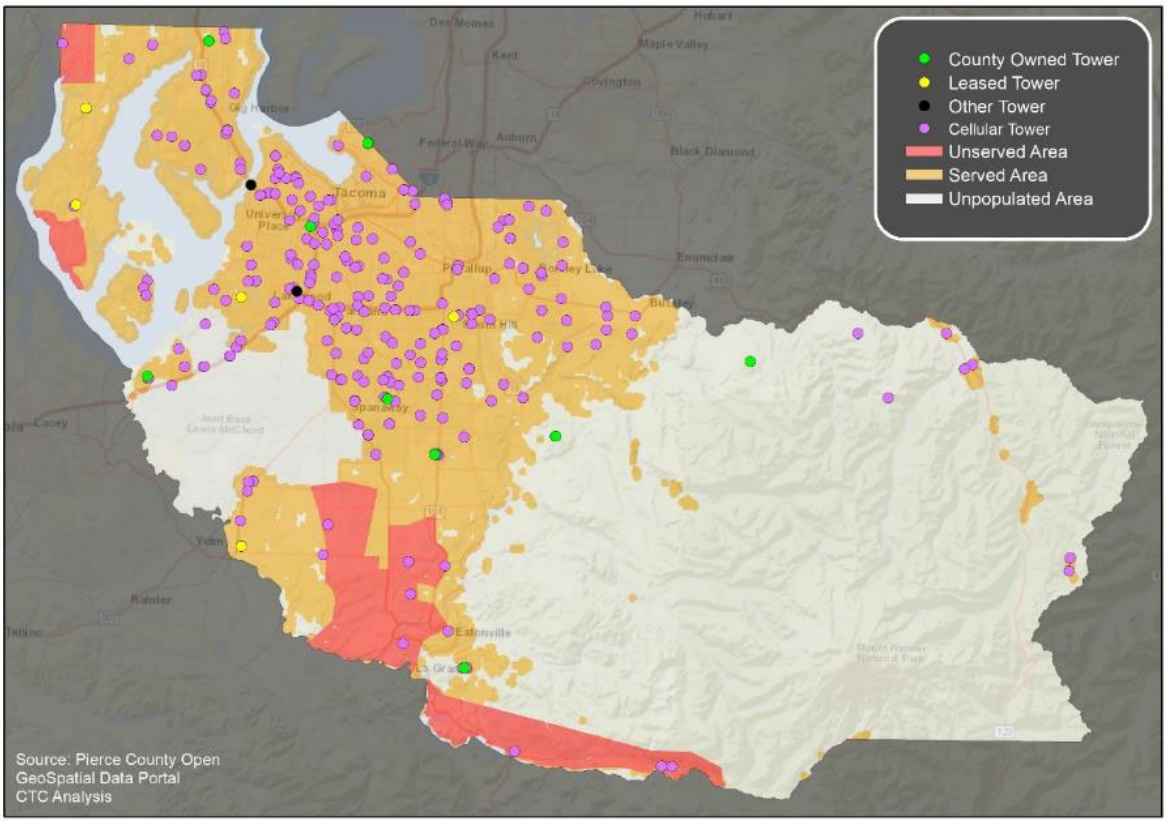
By comparison, fixed wireless technology provides significantly lower aggregate capacity between 100 and 250 Mbps. Using unlicensed and CBRS spectrum and innovations like higher-order multiple input, multiple output (MIMO) antennas, and the use of spatial multiplexing, these capacities will likely increase to as fast as 750 Mbps in the Pierce County environment. It is important to note, however, that this is the aggregate capacity out of a single antenna or antenna array; in a point-to-multipoint architecture, this capacity will be shared among all users connected to a single base station. Even so, in most of the unserved environments in Pierce County, download speeds in the tens or even low hundreds of Mbps per user may be possible. Additionally, wireless eliminates the need for new cable construction, significantly reducing the time to build and the complexity of construction. Wireless capital costs, especially where existing towers can be used as mounting structures, can be significantly lower than the cost of building new fiber optics (although capital costs for a wireless network are only a small part of its total cost).

However, the ongoing operating costs of fixed wireless can be high, relative to fiber. Leasing space on towers is costly. And upgrading a wireless network requires replacement of the radios at the antenna site and at the user premises. Electronics may need to be replaced at five-year intervals due both to technological obsolescence and wear and tear—and unlike a fiber network, the electronics comprise almost all of the capital cost of the network, thus significantly increasing the ongoing cost. Finally, permitting for new tower locations may require a public hearing process which may require months, and may be difficult to achieve if there is local opposition to the tower.

4.2 Hilly topography and tree cover in much of rural Pierce County makes fixed wireless more technically challenging

We reviewed tower locations in the topography of Pierce County. Hilly environments with significant tree cover will reduce line of sight and make fixed wireless more challenging. Given the limitations of spectrum, a wireless solution is not as scalable as a wireline solution. Homes and businesses that have substantial tree cover and terrain will get poorer performance than others. Adding these considerations to the more general ones involving a comparison of fiber to fixed wireless (as noted above), we conclude that fixed wireless is not a technically or economically preferable solution. Figure 18 shows tower locations in Pierce County.

Figure 18: Government and Commercial Tower Locations in Pierce County



4.3 5G is unlikely to solve the availability and affordability challenge in Pierce County

Despite considerable industry hype about next-generation "5G" wireless, it is doubtful that 5G will comprehensively solve rural broadband challenges. The economics of 5G deployment suggest that the highest-speed versions of this technology will extend primarily to densely populated areas, particularly in the initial years of deployment. As a result, 5G may serve to exacerbate rather than mitigate the existing broadband divides that already exist in Pierce County and throughout the country.

The exception to this may be that incrementally improved mobile service (which can occur with 4G and 5G) may serve to increase the number of very price-sensitive consumers who shift to mobile only and can make do with residential service using their mobile phone as a hotspot. It may also provide a solution for individuals who have a mobile signal but no wired broadband, but it is important to note that most mobile broadband services are metered services, with even "unlimited" services not available at broadband speeds after a maximum amount has been consumed. Therefore, we would not assume that, in the short to medium term, 5G will address the concerns about unserved and underserved populations that led to the commissioning of this study.

5 RDOF Results and Impacts on Pierce County's Efforts to Close Broadband Gaps

SpaceX and CenturyLink were the two winners of the FCC's late 2020 RDOF auction process, making them eligible for FCC subsidies over a 10-year period. This section explains the RDOF auction, analyzes the results, and explains how they may impact the shape of broadband buildouts in Pierce County.

5.1 The RDOF auction process

In November and December of 2020, the FCC conducted the RDOF auction. The FCC first determined which areas were unserved by 25/3 using Form 477 data. The auction format itself consisted of a series of rounds where providers bid on a progressively descending percentage of a predetermined support level (the "reserve price") for each eligible census area. Bidders were rated with weights based on the tier (speed) and latency they bid, with the lowest weight being zero for a gigabit, low-latency service, and the highest weight being 90 for a minimum speed (25/3 Mbps), high-latency service. The higher the weight, the more equivalent points were deducted from the calculated support a bidder could receive.

The auction was designed to target the highest possible speeds at the lowest feasible levels of support by giving advantages to higher-speed and low-latency services. In each round of the auction, the FCC compared the total of support levels implied in all the bids with the FCC's available budget. If the auctioned support exceeded the FCC's $16 billion budget, the auction continued. The round in which auctioned support was equal to or lower than the budget was called the "clearing round." For every area for which there was a lone bidder, winners were assigned locations accordingly. In census areas for which there were multiple bidders during the clearing round, the auction continued ("carried forward") into the next round, with one exception: the FCC prevented a "race to the bottom" propelled by satellite providers such as Viasat and HughesNet (which could have bid to the lowest support levels possible because their satellite technology already covers all areas of the United States and therefore entails no buildout costs). Rather than allow the auction to continue for all bidders in all contested areas, the FCC assigned locations and supports to bidders who were lone bidders with the lowest weight in each census area.

For this auction, the new satellite broadband service from SpaceX—called Starlink—was approved for participation. Unlike Viasat and Hughes, which have satellites at a high geostationary orbit, SpaceX's satellites occupy a low orbit which theoretically can yield low latency,[30] high speed communications. The FCC assigned SpaceX with Above Baseline (100/20), low latency scoring, giving it a combined weight of 20 – the same as cable coaxial technology.

[30] Latency refers to the variance of delays in data packets. High latency communications can be experienced as choppy and delayed sound and pixelated, low quality, and delayed video communications.

This had profound impact on the auction itself, which we have analyzed elsewhere.[31] The main effects, nationally, included

- Lower support levels overall, as SpaceX's bidding contributed to pushing the auction into a later round before the budget was cleared
- Causing some fiber providers that bid in rounds 11 and 12 to drop out of the auction prior to round 13. Had the auction cleared at the earlier rounds, these providers could have won outright with the lowest weights
- SpaceX winning outright against some fixed wireless providers who bid at baseline (50/5) in the clearing round
- SpaceX winning against other above baseline providers in areas where the competition continued after clearing with two or more bidders (SpaceX had an advantage since it had already budgeted for its buildout regardless of RDOF outcomes and therefore could bid aggressively at fairly low support levels)

5.2 SpaceX and CenturyLink were the only two winners in Pierce County

In Pierce County, the auction had only two winners: SpaceX and CenturyLink (see Table 12 and Figure 19). CenturyLink took the southern and southeastern areas with a commitment to build gigabit fiber to all addresses. This is an optimal outcome for those areas of the County, given the lack of nearby incumbents with fiber optic infrastructure and limited options for future fiber participation by municipal electric cooperatives. SpaceX won all of the remaining areas.

Table 12: RDOF Winners in Pierce County

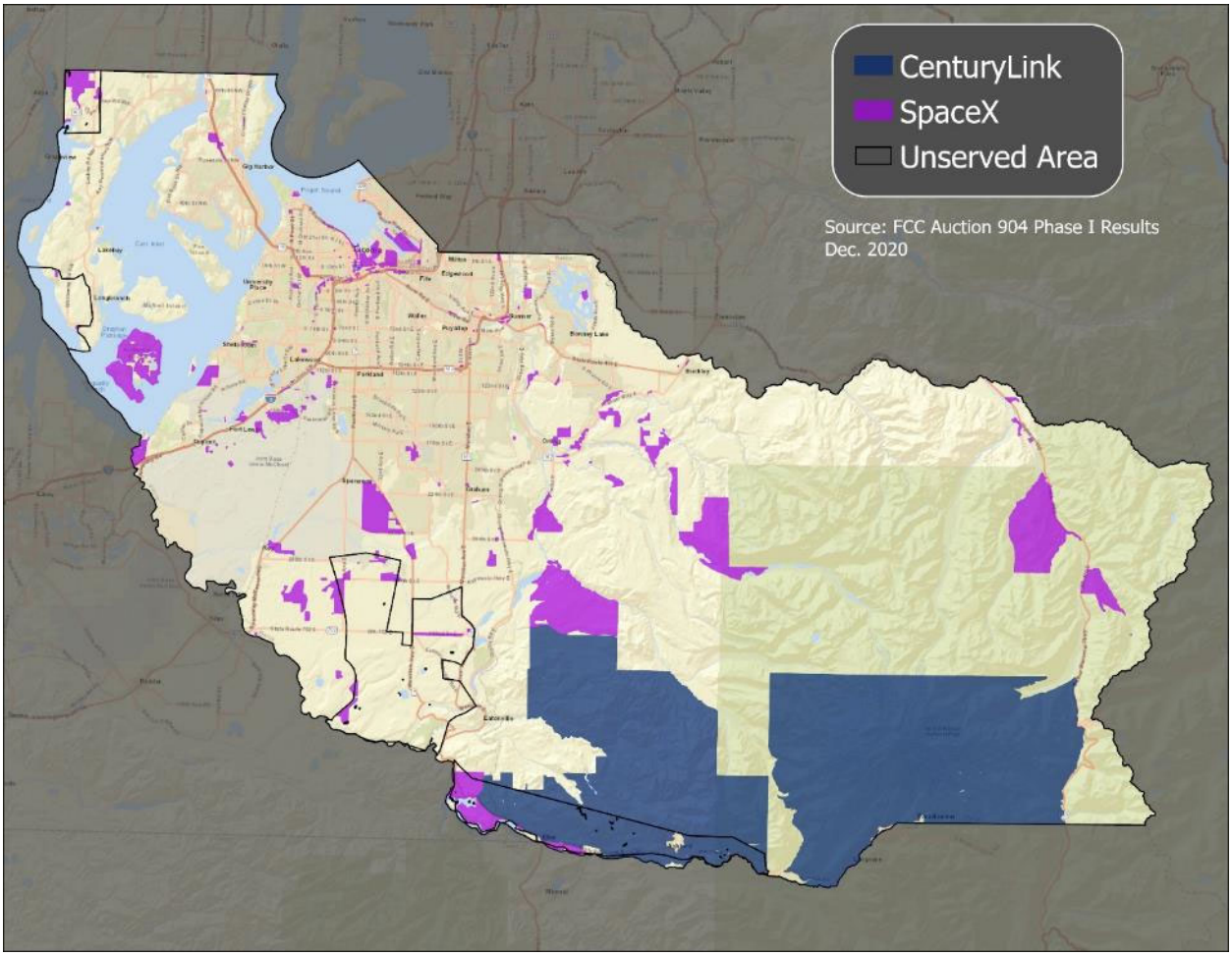
Winner	Locations	10-year Support
CenturyLink	749	$316,695.00
SpaceX	3,171	$269,510.86

Besides the high orbit geostationary providers, there were only two other bidders in Pierce County: Consolidated Communications and Simple Networks. Consolidated, with gigabit fiber, only bid in a single census area with 19 locations east of Hart's Lake in Roy but bid at a higher support level than SpaceX in round 13 and therefore lost out. Had SpaceX not received favorable weight from the FCC, Consolidated would have won that area. Simple Networks bid widely with fixed wireless at "above baseline" speeds (100/20) but gave up after Round 11. Had SpaceX not

[31] https://www.benton.org/blog/fccs-rural-digital-opportunity-fund-auction-was-supposed-significantly-reduce-americas-rural (accessed January 2021).

been allowed to bid with above baseline, low latency, Viasat would have picked up the remaining areas.

Figure 19: RDOF Winners in Pierce County



As noted above, we consider our map of served and unserved reliable. According to Form 477, there are small areas across the county that are labeled unserved—areas RDOF made eligible—yet we determined that they were actually served. Some blocks are counted as unserved because there are no homes and businesses there but there is cable plant nearby. As such, they are essentially served, or they are small unserved pockets in otherwise served areas. Other areas covered by RDOF are unpopulated, such as parks or wilderness areas.

The FCC's methods for determining eligibility are not always transparent. RDOF uses provider-submitted Form 477 data as one basis for eligibility but does not include all areas[32] and—for

[32] RDOF is supposed to ensure extension of service to "high cost" areas and exclude non-rural areas. In addition, areas for which estimated cost of service does not deviate substantially from urban counterparts (o they are not

reasons that the FCC does not disclose—it also includes some served areas, including some urban areas, in the auction.

5.2.1 CenturyLink

Figure 19 (above) depicts the two winners in the County. CenturyLink committed to building fiber in two key unserved areas, and essentially "solves" the problem of unserved addresses—about 750—for these areas, according to the FCC. It should be noted though that CenturyLink's obligations are over a six-year buildout period. Under the terms of RDOF, CenturyLink will need to have constructed to 40 percent of its address locations in Year 3. The clock starts on these obligations when the FCC approves long form submissions with detailed design, project milestones, and proof of financial capability in the form of a letter of credit from a certified bank. Assuming the clock on these obligations in the fall of 2021, it could take many years for the residents on those areas to actually get connected to high-speed broadband. We encourage the County to reach out to CenturyLink to discuss its projected timeline and ways the County might be able to help in speeding up implementation.

5.2.2 SpaceX

SpaceX won the remaining areas in the County, almost 3,200, all in the clearing round. SpaceX fared considerably better in the State than the national average (Table 13), and it was dominant in the County (Table 14). Not only did it grab 80 percent of all address locations, but it also grabbed a higher relative proportion of the available support because it managed to win the in the clearing round and did not have to bid further against competitors at lower support levels.

"high cost") are excluded. And conversely, areas that are too costly ("very high cost") are excluded as well. Lastly, some areas that have received prior funding are excluded as well.

Table 13: SpaceX Was Dominant in the State

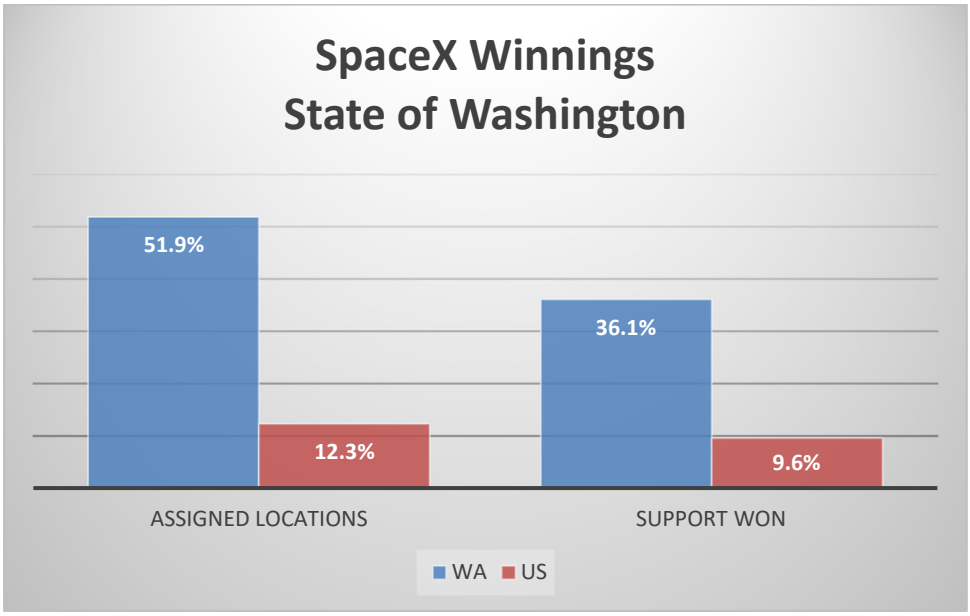
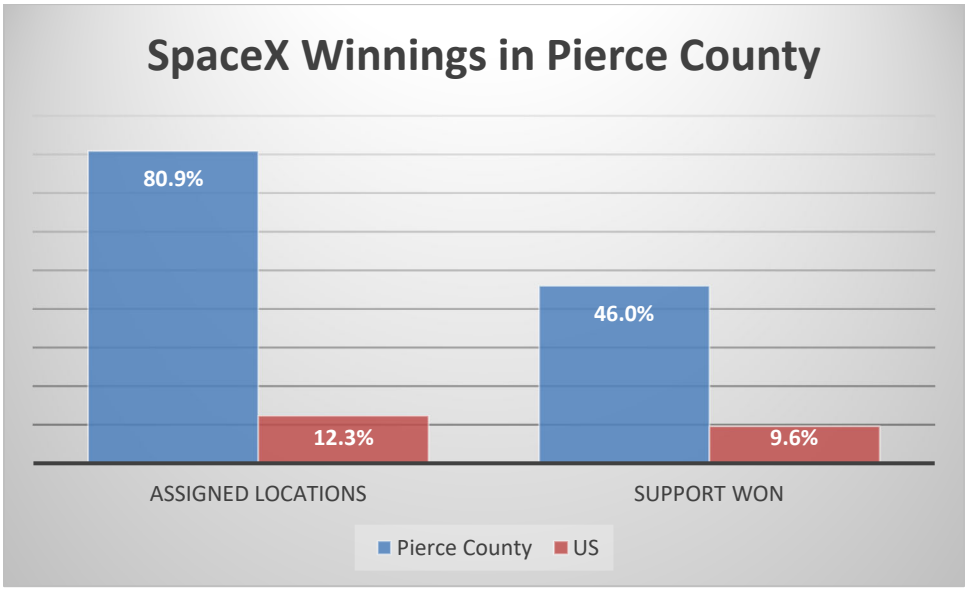


Table 14: SpaceX Was Even More Dominant in the County



SpaceX's impact could be substantial, but we have no idea if SpaceX can deliver on its speed promises and whether its ROI will be sufficient to properly maintain the network. We also do not know whether the SpaceX-won areas will be eligible for future grant funding. In the past, federal grants typically only considered terrestrial fixed networks when determining eligibility.

We believe—based on informal conversations with SpaceX staff—that SpaceX is likely to address the State of Washington, and the areas in and surrounding King County (where it is headquartered) as one of their priority areas and may have much of the satellite and terrestrial infrastructure in place already. In a best-case scenario, a portion of residents in the County will be able to receive broadband at good speeds by the standards of today.

But there are a number of outstanding questions to be addressed with SpaceX:

- What buildout timeline is SpaceX anticipating for the County—and when will it be operational?
- User-end activation and equipment is currently very expensive and could be out of reach for most residents. Does SpaceX have plans to lower prices for subscribers?
- What areas in the County will be covered beyond the RDOF-won areas?

In addition, the question of whether the RDOF areas will be eligible in future grants will likely be answered in the near future as NTIA and ReConnect publish their eligibility guidelines. In the past, satellite providers did not count as broadband for purposes of grant eligibility.

5.3 Providers that lost out or dropped out could be partner candidates for those areas

Round 11 is a reasonable comparison point for evaluating what could have been. With auction clock percentage at 80 percent, it is reasonable to calculate that some fiber providers with projected high construction costs and limited ability to raise capital for interested areas could see this as a reasonable subsidy level with anything under being difficult to justify. Providers with sufficient scale both have access to capital and other resources that allow them to take the long view on investments, including preventing potential competitors from getting a foothold near their service areas.

Local and smaller providers—especially fiber or very high bandwidth fixed wireless which requires substantial fiber assets as well—may need to rely on revenue to fund part of their expansion or have complex political considerations in raising debt burden (especially for government and member-owned entities). We have found rounds 11 and 12 to be those where some bidders fell off, prior to budget clearing in round 13. The table below summarizes the bidding in rounds 11 to 14 for Pierce County.

Table 15: Bidders in Pierce County – Rounds 11–14

Bidder	Technology	Max Speed	11	12	13	14
CenturyLink			7	5	3	
Consolidated Communications			1	1	1	
HughesNet			138	133	123	26
Simple Networks			128			
SpaceX			139	139	108	
Viasat			9	10	9	

A few things jump out from this table.

1) **CenturyLink could be a key County partner.**
   CenturyLink's bidding areas shrank from seven to three census areas between rounds 11 and 13. The company apparently calculated that some of those areas were not worth pursuing at lower support levels. Mapping those areas can gives us a sense of CenturyLink's willingness to expand further given sufficient support. Figure 20 shows the areas it bid on in round 11. It shows some of the very key unserved areas in the County where fiber would be a most welcome service option. In fact, the only unserved area in the County with significant RDOF areas CenturyLink did not bid on is the area between the joint base and La Grande. It is likely that CenturyLink could be interested in expanding into all the major unserved areas with sufficient incentive.

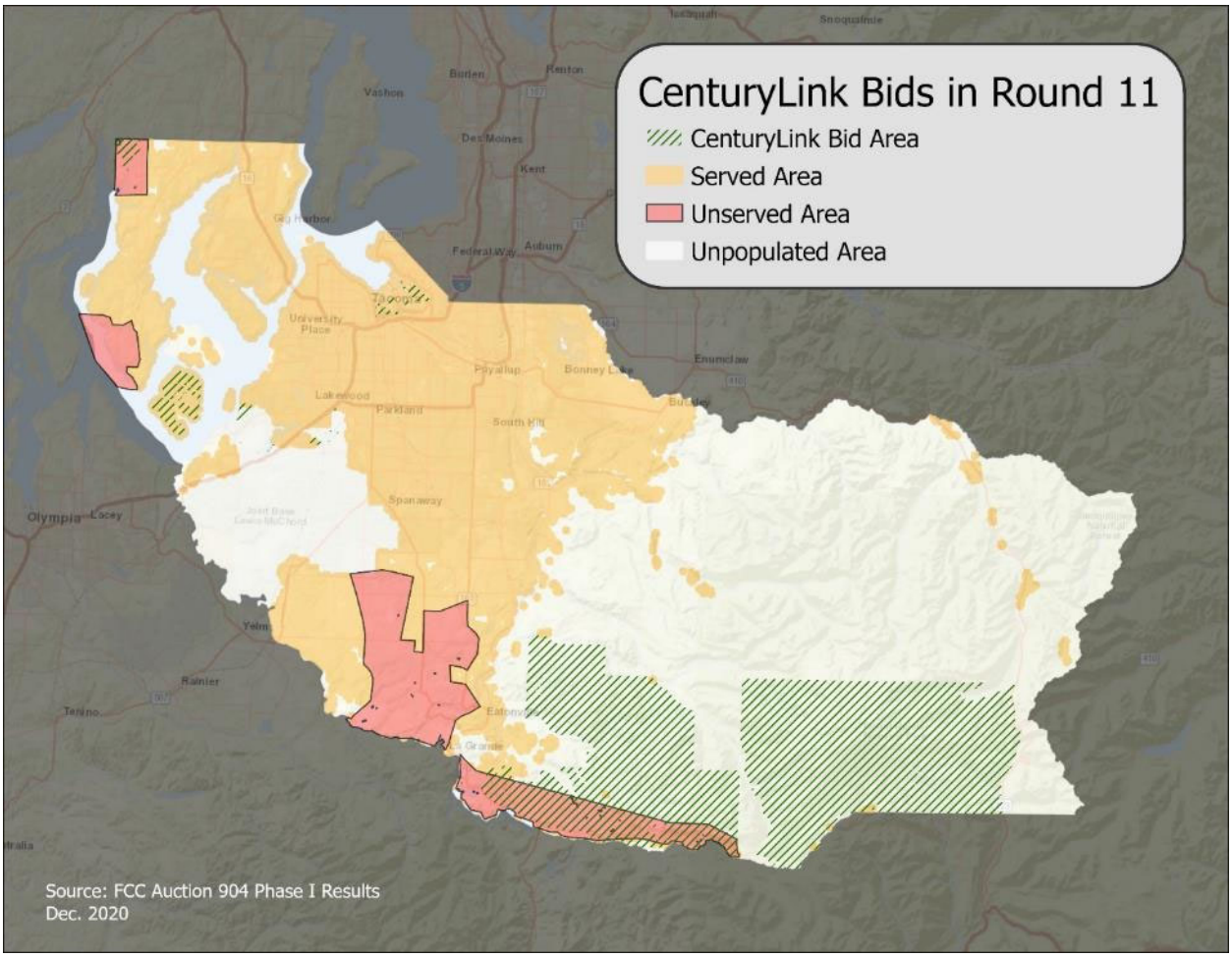
   To date, CenturyLink's DSL has typically not been deployed as broadband (i.e., minimum 25/3 speeds). CenturyLink merged with Qwest in 2010, which gave it access to poles and telecommunications lines that included old copper technology, but also some fiber. Because of the fiber backhaul routes and CenturyLink's extensive pole assets in the County with poles, CenturyLink would not need to go far from its existing infrastructure to expand to most areas of the County with high-speed broadband.

2) **Consolidated Communications seem to have limited interest in expanding its current footprint, but could partner on line extensions to isolated unserved clusters in its service area.**
   They only bid on a small census area with 19 address locations in an area that is otherwise largely served. These types of builds are called line extensions, small clusters of addresses far enough away from existing network infrastructure that building a line into that area does not present a sufficient return on investment, but if given support to cover the costs of the extension, could be worthwhile. Consolidated would therefore likely be open to partnering on filling such gaps in its otherwise served areas.

3) **Simple Networks bid aggressively with high speeds, but also quickly dropped out.**

Simple Networks bid extensively in the County with Above Baseline (100/20) speeds but dropped out already after round 11. That is a very early point to exit. It is possible that its high speeds rely on an extensive fiber infrastructure it concluded it needed to build out itself, and therefore could not justify the lower support levels. Simple Networks bid in several counties but did not win any in the State. Given their willingness to bid at higher support levels and willingness to bid broadly in the County, they could be a potential candidate for partnership with the County as a bridge solution should SpaceX plans require a lengthy implementation time with prohibitive activation costs.

Figure 20: CenturyLink Areas of Interest



5.4 Other potential partners

We conducted additional analysis to identify potential partner candidates. One logical place to look was to see if there were any winners just across the County boundaries that could expand into the County. In neighboring counties, Commnet Wireless received some RDOF awards. Commnet is close enough to potentially leverage planned tower locations to extend coverage to the County. But they could conceivably be an alternative to Simple Networks if the County desires

a fixed wireless partner. With that said, it is worth remembering that Commnet and Simple Networks are fixed wireless partners, and their solutions would be temporary, with no guarantee that they can serve all address locations to which they are committed. If the County wants to prioritize long-term, sustainable technologies—as recommended in this report—fiber optic providers provide the best option.

We therefore expanded our analysis to the State as a whole to identify possible fiber providers that could fill that role. "Disruptive" fiber providers can target areas far outside their network presence and drop in with long backhaul extensions from their existing service areas. They usually look for long-haul or metro fiber carriers that provide them with that connectivity. We examined rounds 11 to 14 to analyze gigabit bidders in the State (Table 16).

Table 16: Gigabit Bidders in State of Washington

Bidder	Round 11	Round 12	Round 13	Round 14
Charter/Spectrum	20	20	20	20
CenturyLink	82	82	69	56
LocalTel	81	81	81	81
Frontier	89	89	89	89
NRTC Phase I RDOF Consortium	1	1	1	1
St. John Telco	16	16	14	14
Wisper-CABO 904 Consortium	4	4	4	2
Consolidated Communications	6	6	7	4

We can eliminate cable companies that are not already serving the County. If they had interest in Pierce County, they would have bid at least as early as round 11. We can also eliminate those that clearly only targeted a very limited set of census areas across the State. St. John Telco falls into this category, targeting a specific geographic area in Whiteman County. This effectively leaves only LocalTel. LocalTel is a fiber optic provider based in Chelan County but it bid in Adams, Chelan, Douglas, Grant, and Lincoln counties and won three of them in round 14. Those are all contiguous, but it is conceivable LocalTel could be open to serve unserved areas if it can find suitable backhaul.

6 Private Provider Outreach Reveals Potential Projects by Comcast, Lewis County PUD, and Rainier Connect in Addition to RDOF Recipients

CTC and Pierce County engaged in discussions with private partners which might seek to launch or expand service in various areas of Pierce County. We asked the providers for as much detail as they could provide about their buildout plans to define potential project areas with as much detail as possible with maps, premises counts, and potential funding needs.

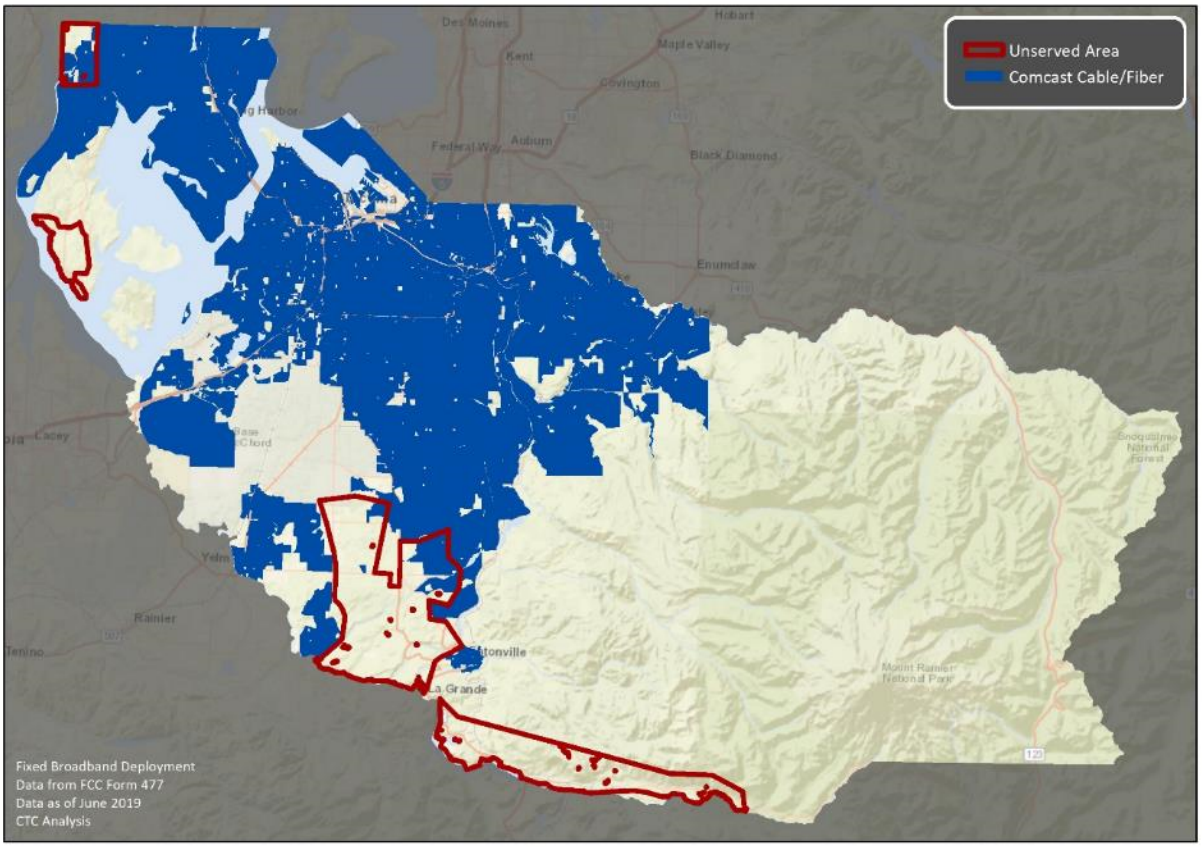
To this end we engaged in conversations with CenturyLink, Comcast, Lewis County PUD, Peninsula Light, Rainier Connect, T-Mobile, and Wave.

6.1 Comcast identified a specific project on the Key Peninsula and would discuss expansion around Frederickson if the County identified a service territory

Comcast serves regions surrounding Tacoma but has not expanded into the more rural and low-density areas of Pierce County. Comcast shared its fiber and coaxial cable plant map.

Figure 21 shows the unserved areas in comparison to the Form 477 data Comcast reported.

Figure 21: Comcast Service Areas in Relation to Unserved Areas of Pierce County



For Comcast to expand, the Comcast representative spoke generally about the need for streamlined and inexpensive pole attachment processes. He indicated that CenturyLink—as a pole owner—was easy to work with but that Comcast had experienced a variety of costly delays from others; in particular, the independent power companies, which he said needed to do a better job streamlining their processes, maintaining their poles, and performing post-inspections. He said that to facilitate deployment by Comcast, the power companies should maintain and replace their poles, make sure their poles are National Electric Safety Code (NESC) compliant, and ensure there was room in the communications space to make attachments.

The County expressed a desire for information about what the County could do to facilitate expansion and what sorts of investments would be required and said the two areas in question would make good case studies that the County could use as a planning tool. CTC asked Comcast to provide further details—meaning a defined service area and the magnitude of any subsidy required to fill the gap. On further discussion, the Comcast representative said there was a single project that it had defined, on the Key Peninsula.

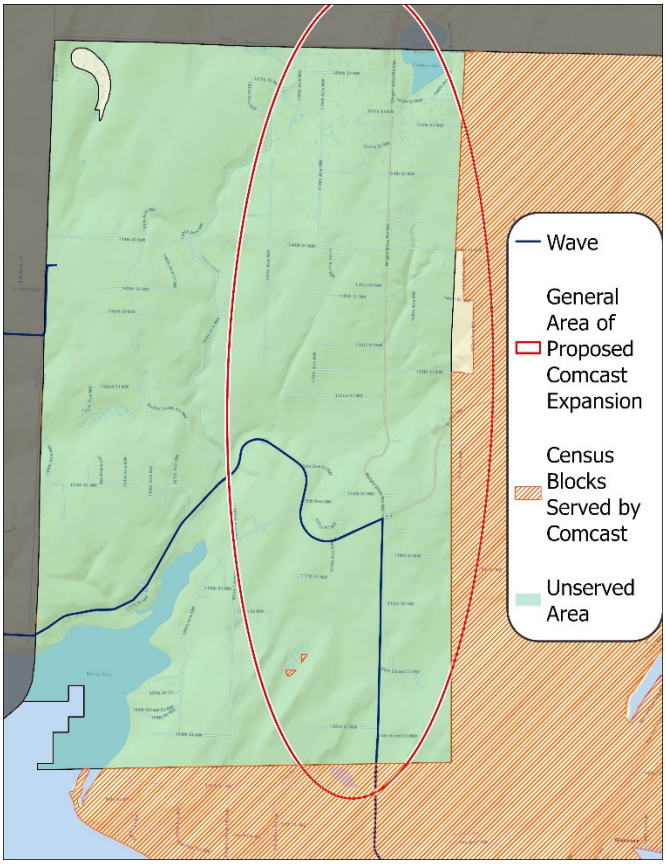
6.1.1 Comcast identified a potential buildout to 525 premises on the Key Peninsula that would require a $2 million grant

Comcast identified a potential area where it could expand further into the Key Peninsula if Comcast were to receive a grant of nearly $2 million. A Comcast representative said the company could not share a map publicly but that the project could serve 525 premises in an area generally between Vaughn and Carney Lake and would cost nearly $3.3 million. If the company received roughly $2

million—or approximately 60 percent of the cost—in the form of a grant, it could fund the remaining $1.3 million and build the project.

Figure 22 shows this general area.

Figure 22: General Area of Proposed Comcast Expansion



6.1.2 Comcast would need County input to better define a buildout area around Frederickson

The Comcast representative also said the company had performed a preliminary examination of the Frederickson area but not to the point where it was able to offer cost estimates, premises counts, or the magnitude of the required grant. The company representative said Comcast had looked at it 10 years ago but found that an ROI would be far from achievable given low density and long lateral runs into premises. The representative said that in order for Comcast to reopen this and spend time and resources looking at areas around Frederickson, the company would need a more specific request from the County about which areas it would want to explore and a sense of what grant monies would be available to fund the project.

6.2 CenturyLink, prior to the RDOF outcome, said it is willing to put 25 percent to 35 percent of capital cost for fiber buildouts in unserved areas if the remainder is subsidized

In a teleconference with CTC and Pierce County prior to the RDOF auction outcome, CenturyLink representatives indicated that they would be interested in partnering with the County if the

County took the lead and proposed areas that could serve as a demonstration project for a fiber-to-the-premises project that CenturyLink can then use as a model for other parts of the country to show how this can be done.

However, the company added that what they seek is for the County to put up the necessary funds in addition to any grant, so that between 65 percent and 75 percent of the capital costs would be covered, making CenturyLink's investment much smaller. The company representatives stressed that the economics of rural broadband are such that a subsidy and grant of that magnitude would be required. CenturyLink did not propose a specific area for such a demonstration project to occur. But CenturyLink expressed a willingness to put up between 25 percent and 35 percent of the capital cost of providing fiber-to-the-premises service in areas the company now serves.

6.3 Lewis County PUD defined a need for a $690,000 fiber backbone along Route 7 to Elbe and a $550,000 fiber route between Elbe and the Mt. Rainier park entrance

The Lewis County Public Utility District (PUD) is a community-owned, locally governed utility providing power services and telecommunications infrastructure to approximately 33,000 customers throughout most of Lewis County and adjacent communities. It primarily serves Lewis County, which is just south of Pierce County, but its service territory includes a section of Pierce County. In the spring of 2020, the District launched a broadband study and survey throughout its service territory to determine stakeholder interest in expanding broadband service to unserved and underserved areas. The survey had 3,673 respondents, only 23 percent of whom had download speeds of 25 Mbps or greater.

The District is exploring the feasibility of installing a 144-count fiber-optic backbone from the District's current colocation facility in Morton, WA (Lewis County) north along Route 7 to Elbe, in Pierce County. This backbone span would run approximately 17.5 miles using existing District electric distribution poles, and the District has estimated the engineering and construction would cost $690,000.00. The District is also exploring the feasibility of installing 144-county fiber-optic backbone from Elbe in Pierce County, eastward along Route 706 through Ashford in Pierce County, to the Mount Rainier National Park entrance. This would be 13 miles and use existing District electric distribution poles and cost an estimated $550,000 in engineering and construction. Figure 23 shows the first segment of this backbone (Morton to Elbe); Figure 24 shows the second (Elbe to park entrance).

We note that the RDOF auction resulted in CenturyLink being awarded these areas. If CenturyLink were to build fiber-to-the-premises it would likely make it infeasible for any other provider to build. If not, these areas may still remain an opportunity for Lewis County PUD.

Figure 23: Proposed Fiber Backbone from Morton to Elbe

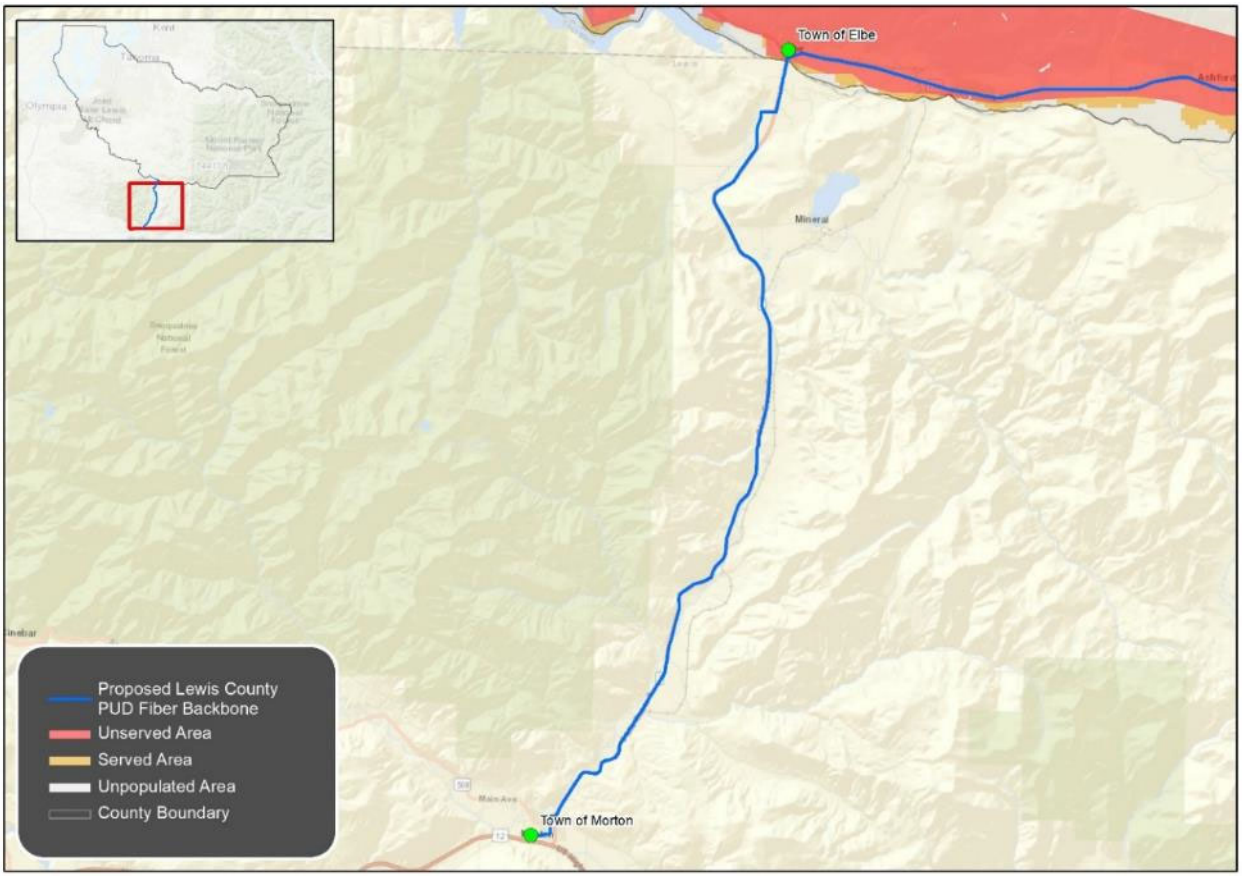
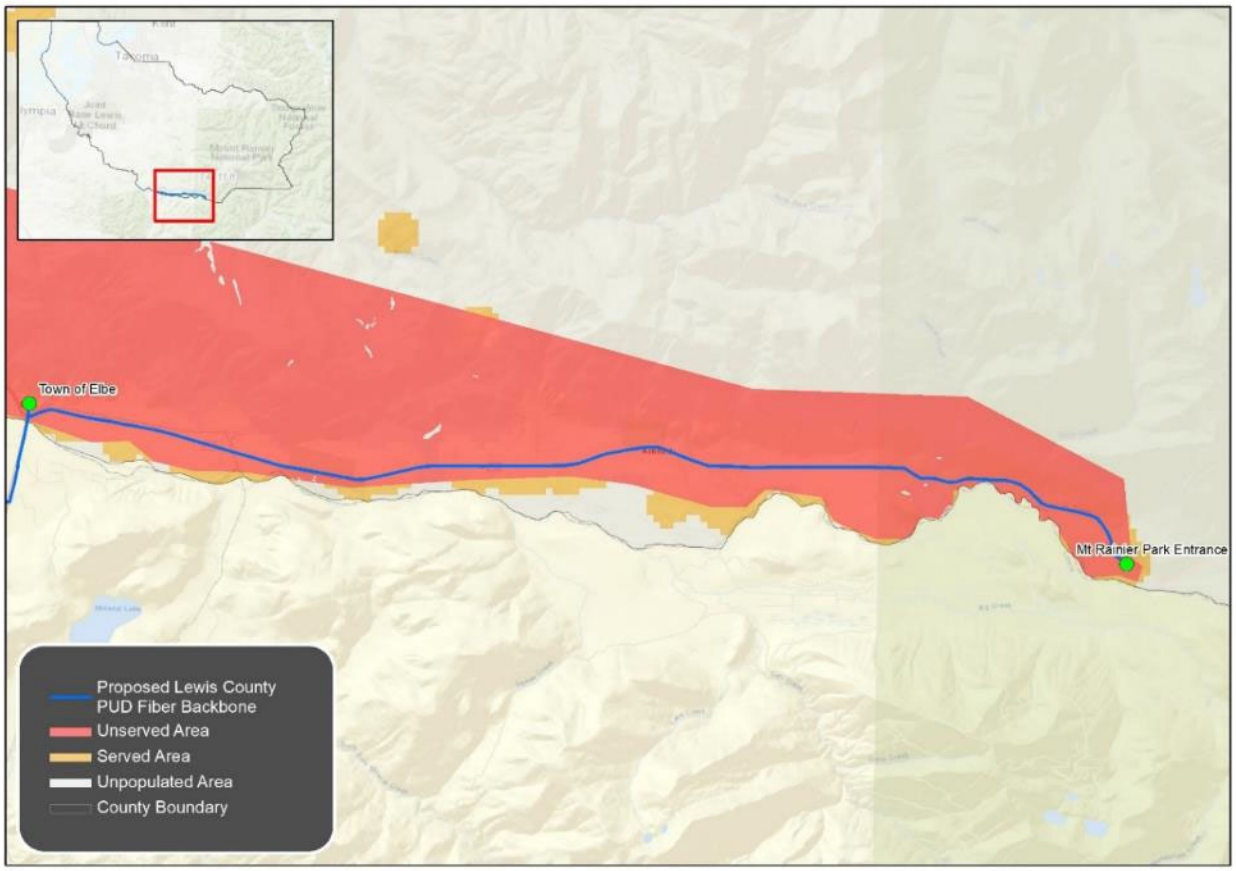


Figure 24: Proposed Fiber Backbone from Elbe to Mt. Rainier Park Entrance



The District is piloting fiber-to-the-premises in the Lewis County portion of the territory in a project that would serve up to 1,000 customers; the additional fiber in Pierce County, if it were funded and built, would mean the District could consider a fiber-to-the-premises buildout in Pierce County. There are 829 residential/business customers that could gain broadband access with the Morton-to-Elbe project, and 1,089 residential/business customers that could gain broadband access with the Elbe-to-Mt. Rainier park entrance project, which would be entirely in Pierce County. The fiber backbone could also have the capacity to serve customers beyond the District's service territory, including in the Eatonville and Graham areas, both in Pierce County. Local institutions would also benefit, including the park and local public safety, educational and medical facilities.

6.4 Peninsula Light engaged in a general discussion, but its willingness to enter the broadband business remains unclear

Peninsula Light Company or "PenLight" is an electric utility cooperative serving more than 30,000 homes and businesses covering 112 square miles in western Pierce County, from the Tacoma Narrows to the Kitsap County line. In the areas PenLight serves, CenturyLink only provides DSL service. Comcast serves some areas and has expressed interest in expanding if it can obtain a

grant. Like the Lewis County PUD, PenLight has considered entering the fiber-to-the-premises business but has not engaged in any formal study or made plans to do so.

Though the leap from electric-only business to a competitive broadband business is a significant one, the fact that PenLight owns poles and other infrastructure—and would face little competition for high-speed services in much of its territory—leaves PenLight in a relatively better position to enter the broadband business than other public entities might be. We recommend that the County have further talks with PenLight and potentially pursue grant opportunities that might assist PenLight in taking a further step toward evaluating its options.

CTC also participated in calls Peninsula School District and its contractor, Wanrack, which is building a 30-mile fiber network for schools on the peninsula. The company was interested in knowing if the County had any sites it might want to connect in the area with extra strands; if so, Wanrack could take on that project as a middle-mile project. The Wanrack representative indicated that it lays 12 fiber strands between each edge and hubs site. But on that same route if we lay 96 fiber, 12 are allocated to school district and excess fibers can be paid for out of pocket and can be used for other purposes.

6.5 Rainier Connect described the potential for fiber buildouts in unserved pockets around Eatonville

Rainier Connect representatives explained that the ISP is studying some shovel-ready fiber builds in the unserved areas around Eatonville. For its ILEC in the Eatonville area, it has 1,000 DSL subscribers and would like to convert as many as possible to fiber in the next five years.

The company identified five small potential projects, with 544 subscribers is total, all of which are in the unserved area outlined east of Eatonville, which taken together would provide coverage to roughly 20 percent of that area. These are projects that it has internally designed and identified. The company did not identify the magnitude of any subsidy required to complete these projects or expand beyond them. Table 17 shows the names, costs, and premises counts associated with these projects.

Table 17: Rainier Connect's Proposed Fiber Builds Near Eatonville

Cost Component	Estimated Cost	Homes
Ski Park/Orville/Meridian	$1,490,000	287
Stringtown/Eatonville Cut-Off	$980,000	152
Dean Kreger	$278,000	35
Silver Lake	$149,000	39
Lynch Creek	$187,000	31

Figure 25 shows Rainier Connect's current fiber and coaxial plant areas. Figure 26 shows the location of the proposed fiber-to-the-premises buildouts.

Figure 25: Rainier Connect Cable and Fiber Plant in Relation to Pierce County's Unserved Areas

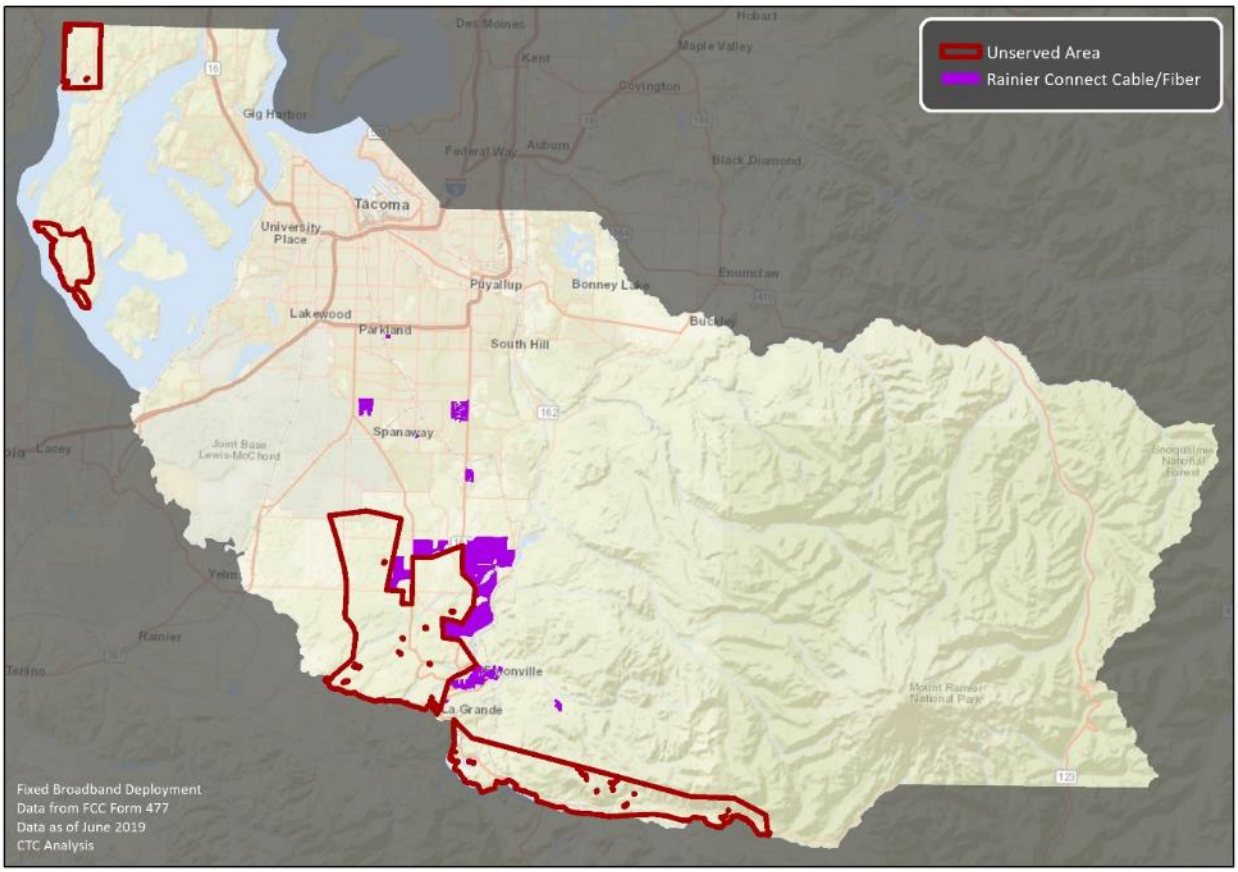
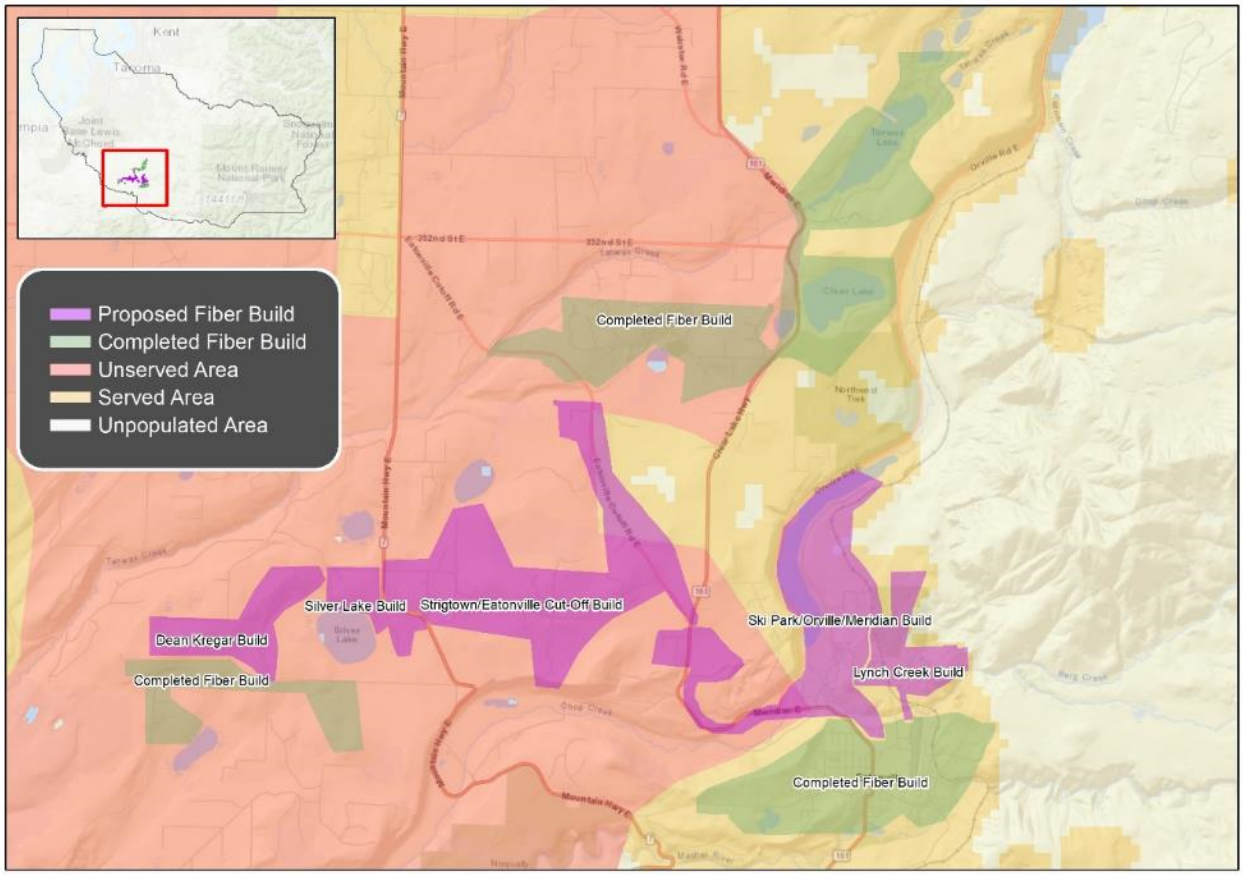


Figure 26: Rainier Connect's Proposed and Recent Fiber-to-the-Premises Builds Near Eatonville

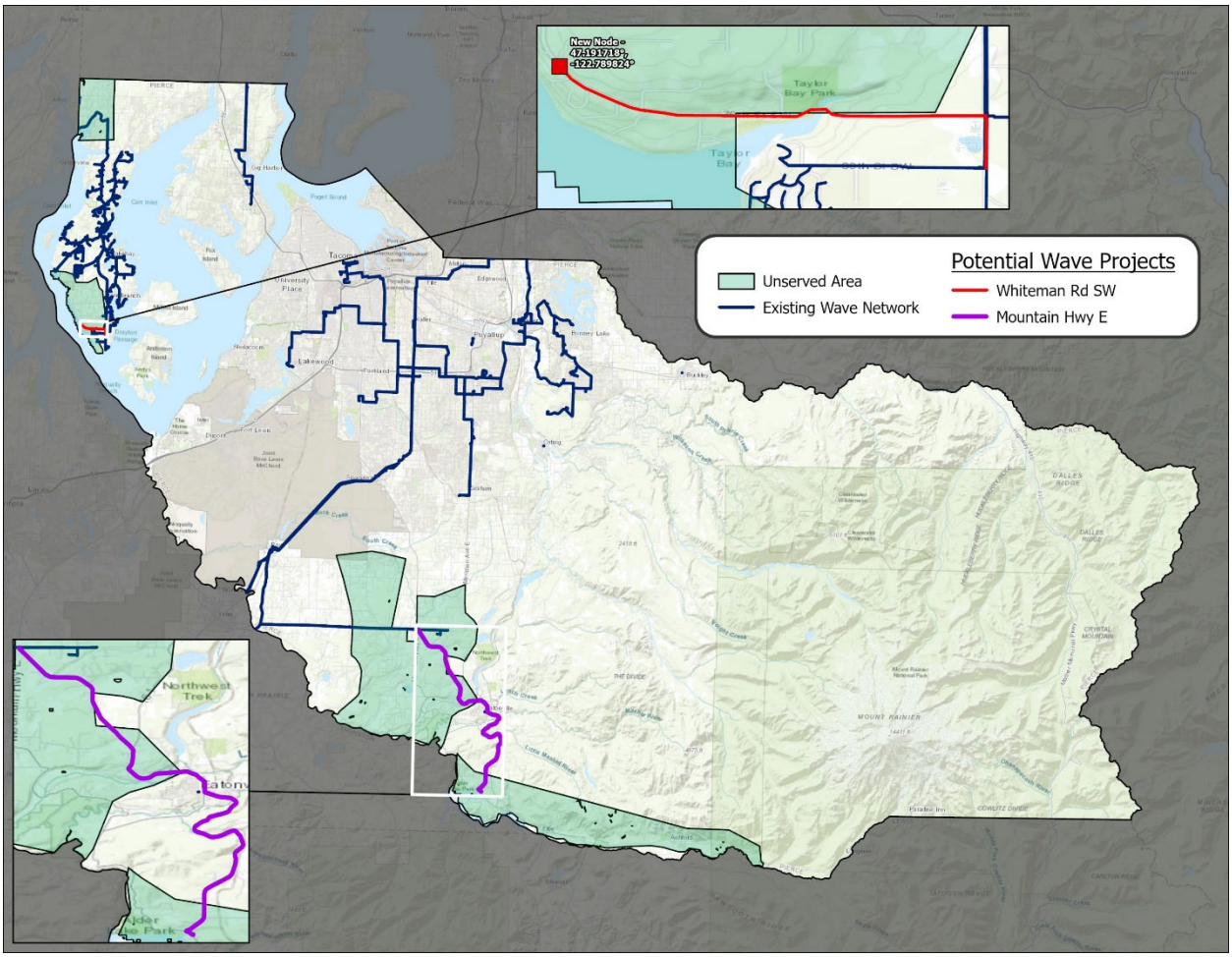


Rainier Connect indicated it is aware of RDOF and may participate in a second phase, but a lot will depend on if Congress adds a pool of funding on top of the funds already allocated. In terms of County facilitation, Rainier Connect expressed interest in knowing whether there is any opportunity to use abandoned facilities from water departments to get across highways or reach homes (through abandoned water or sewer lines), as this could save months in engineering costs.

6.6 Wave proposed two line extensions that could serve unspecified numbers of premises on the peninsula and near Eatonville

Wave is a national cable company recently acquired by RCN, making it the sixth largest in the county. Wave proposed two potential line extensions to reach portions of underserved areas, one on the peninsula and the other near Eatonville. The first extension would be located along Whiteman Road in Longbranch. With a new node to facilitate the extension, Wave estimates that the project would require a grant of about $65,000. The second extension would be located along Mountain Highway East to Eatonville. Wave estimates this extension would require a grant of $1 million. Figure 27 shows these proposals. As of March 19, 2021, CTC was awaiting information from Wave on how many homes could be served through these extensions without further subsidy.

Figure 27: Wave's Proposed Line Extensions



7 Federal Grant Opportunities

In addition to RDOF subsidies, we anticipate a range of federal funding opportunities for broadband in 2021 and beyond. The following sections offer insight into the just-passed appropriations package and other existing programs.

7.1 The new American Rescue Plan Act has the potential to address Pierce County's broadband gaps at a significant scale

In a significant escalation of federal broadband funding, on March 11 President Biden signed the American Rescue Plan Act into law. Included in the $1.9 trillion package is significant funding that can be used to support expansion of broadband infrastructure. Based on CTC's initial review of the new law, here are some of the key broadband-related funding provisions:

Economic Development Administration (Department of Commerce): *$3 billion* in additional funding to the Public Works and Economic Adjustment Assistance (PWEAA) program through September 2022

Coronavirus Capital Projects Fund (Department of the Treasury): *$10 billion* for "capital projects directly enabling work, education, and health monitoring, including remote options, in response to the public health emergency"; in addition to capital projects, eligible efforts include ancillary services (such as broadband mapping) to increase efficiencies of capital projects, and cost support efforts (such as subsidies)

Emergency Connectivity Fund (FCC): *$7.2 billion* for E-Rate support to reimburse schools and libraries for provision of eligible equipment and advanced telecommunications and information services during the pandemic, including for locations other than schools and libraries

Coronavirus State Fiscal Recovery Fund: *$219.8 billion* for investments in water, sewer, or broadband infrastructure

Coronavirus Local Fiscal Recovery Fund: *$130.2* billion for rural community development block grants (CDBG) ($45.6 billion), rural areas ($19.5 billion), and counties ($65.1 billion, population-based), including for investments in water, sewer, or broadband infrastructure

Local Assistance and Tribal Consistency Fund: *$500 million* (*$250 million* per year for 2022 and 2023) for Tribal use only "for any governmental purpose other than a lobbying activity"

CTC will continue working with Pierce County to determine how these opportunities can most effectively be leveraged to close the County's broadband gaps.

7.2 Broadband funding in 2021 appropriations package

The appropriations bill[33] signed into law on December 27, 2020, includes several funding streams for broadband, including a subsidy program to offset the cost of monthly internet service for low-income households, administered by the FCC, and three distinct grant programs to build new broadband infrastructure and purchase services, managed by the National Telecommunications and Information Administration (NTIA).

While the funds for the programs and the initial statutory requirements were included in the legislation, many program details have not yet been determined, because the federal agencies that will house the programs will develop implementation criteria over the first weeks of 2021. The initial statutory program structures and eligibility requirements are described below.

7.2.1 Emergency Broadband Benefit Program

The legislation establishes a $3.2 billion Emergency Broadband Benefit program,[34] housed within the FCC, to provide a monthly discount to eligible households for broadband service. Service providers must elect to participate in the program, and do not need to be considered eligible telecommunications carriers (ETC) by the FCC. While ETCs are automatically eligible to participate in the program, providers that are not ETCs will receive an expedited approval process for participation from the FCC.

Participating providers may verify household eligibility in one of three ways:

1. Based on the National Verifier or the National Lifeline Accountability Database
2. Based on an alternative method that is deemed sufficient by the FCC
3. Based on a school's determination of participation in the National School Lunch Program or the School Breakfast Program

Eligible households receive a monthly discount on broadband service of up to $50 (or $75 for households on Tribal lands). If the monthly cost to the household exceeds $50, the household is responsible for the difference. Providers cannot charge households for the discount amount, nor can they require a household to pay an early termination fee if the household entered into a contract in order to receive the service. Additionally, households cannot be subject to a waiting period to receive service based on having previously received service from the provider.

[33] "Consolidated Appropriations Act, 2021," December 21, 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf
[34] [34] "Consolidated Appropriations Act, 2021," December 21, 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf

To enact the benefit, a household must call its provider and inquire about eligibility. If the household is eligible, the participating provider applies the discount to the household's bill, and then requests to be reimbursed by the FCC. Providers may also be reimbursed up to $100 for providing one connected device to a household if the provider charges the household between $10 and $50 for the device.

7.2.2 Broadband Infrastructure Program

The Broadband Infrastructure Program[35] will fund $300 million in grants from NTIA for rural broadband buildout to provide fixed service that delivers at least 25/3 Mbps, with priority given to projects that deliver 100/20 Mbps. While NTIA has yet to develop programmatic requirements, preliminary guidelines for the program were outlined in the appropriations bill.

Grants will be available for eligible partnerships, which include a service provider and a state or a political subdivision of a state. Service providers do not need to be designated as an ETC. Eligible service areas are census blocks in which one or more households or businesses does not have broadband service, as determined by the FCC's Broadband Map.

Priority for awards will be given to the following projects, in decreasing order of priority:

- Projects that provide service to the greatest number of households in an eligible service area
- Projects that provide service in an eligible service area that is entirely within an area that is not either a county, city, or town with a population greater than 50,000, or an urbanized area contiguous and adjacent to such an area
- Projects that are the most cost-effective, with priority given to areas that are the most rural
- Projects designed to provide at least 100/20 Mbps service

NTIA will open applications in early 2021, and there will be a 90-day application window. NTIA will make funding decisions within 90 days of application receipt, and applicants will be given a chance to address any application deficiencies before an application is denied. Once an application is approved, funds will be made available to the awardee within 14 days, and the awardee will then have a year to use the funds.

[35] "Consolidated Appropriations Act, 2021," December 21, 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf

7.2.3 Connecting Minority Communities Pilot Program

The Connecting Minority Communities Pilot Program[36] will provide $285 million in grant funding to eligible recipients to purchase broadband or eligible equipment, or to hire and train IT personnel. The program will be administered by NTIA.

Entities eligible to receive grants through this program include:

- Historically Black colleges and universities (HBCUs)
- Tribal colleges and universities (TCUs)
- Hispanic-serving institutions (HSIs)
- Other minority serving institutions (MSIs)
    - Alaska Native-serving institution (ANSI)
    - Native Hawaiian-serving institution (NHSI)
    - Predominantly Black institutions (PBI)
    - Asian American and Native American Pacific Islander-serving institution (AANAPISI)
    - Native American-serving, nontribal institution (NASNTI)
- A consortium led by an HBCU, TCUs, HSIs or MSI, with minority business enterprises and/or nonprofit organizations in the anchor community

For higher education recipients, grants are intended to support instruction and learning, including remote learning. For minority business enterprises and nonprofits, grants are intended to support the operation of the organization. Educational institutions that receive a grant to support student connectivity must prioritize students that:

- Are eligible to receive the Pell Grant
- Receive need-based financial aid from the federal government, state, or the institution
- Qualify for the FCC's Lifeline program
- Earn less than 150 percent of the federal poverty line

[36] "Consolidated Appropriations Act, 2021," December 21, 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf

- Have been approved to receive unemployment insurance since March 1, 2020

Eligible equipment includes Wi-Fi hotspots; modem, routers, or combined modem/routers; laptop, tablet, or similar internet-connected device; and any other equipment used to provide broadband.

7.2.4 Tribal Broadband Connectivity Program

The Tribal Broadband Connectivity Program,[37] to be managed by NTIA, is the most significant infrastructure opportunity funded through the appropriations package, with $1 billion for grants to build broadband infrastructure on tribal lands and expand access to remote learning, telework, and telehealth resources. Entities eligible for awards through this program include Tribal governments, Tribal Colleges and Universities, Tribal organizations, and Native Corporations.

7.3 USDA's ReConnect program represents a unique rural funding mechanism

The ReConnect program is a robust source of rural broadband funding: $600 million was allocated to the initial pilot of the program in 2019, and $550 million (with an added $100 million as part of the CARES Covid-19 response package) was made available in 2020. We anticipate the next funding round will open at the end of the first quarter of 2021, with an application deadline 60 to 90 days later.

The program awards loans, grants, or a combination of the two for last-mile connections in rural areas—with priority given to private-sector applications and public-private partnerships. It is overseen by the Rural Utilities Service (RUS). The most recent round of grant applications opened on January 31, 2020, and closed April 16, 2020.

The recent round of the ReConnect program comprised three separate funding categories: 100 percent grants (covering up to 75 percent of eligible project costs, with a 25 percent match), 50 percent grants with a 50 percent loan or other form of match, and 100 percent loans. Funds will go to rural areas where 90 percent or more of the households lack access to broadband speeds of at least 10 Mbps download and 1 Mbps upload. (In Round 1, 100 percent of the households in the PFSA had to lack access to 10/1 Mbps broadband for 100 percent grant awards.) Applicants had to propose networks capable of providing access to every premises in the PFSA at minimum speeds of 25 Mbps downstream and 3 Mbps upstream.

Matching funds are a point of distinction. Awarded applicants for 100 percent grant awards will need to provide matching funds equivalent to 25 percent of the project's total cost—and that matching contribution must be expended first, followed by grant funds. For 50 percent grants with a 50 percent loan or other form of match, applicants could propose a cash alternative to the

[37] "Consolidated Appropriations Act, 2021," December 21, 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf

loan at the time of application. (For an awarded project in this scenario, all cash proposed must be expended first, followed by loan funds and then by grant funds.)

Generally, we anticipate that USDA will continue to prioritize private-sector applications and public-private partnerships, so it will be important for local governments to build a public-private partnership strategy for future rounds of this program. RUS will consider public networks that lack extensive experience to be startups and may disfavor their applications. Should the County decide to take the lead, it should partner only with entities with extensive experience as an ISP to compete for these funds. Any experienced ISP, whether public or private, will require the strong collaboration and support of its local (and state) government to present a compelling case for funding.

Applications to this program will require a detailed business plan and pro forma. RUS will grant application review points based on those plans, as well as many other factors. The rurality of the PFSA can earn almost 25 points alone. RUS will also award points to applications proposing to build networks capable of at least 100/100 Mbps. Additional points can be scored if the proposed area includes a healthcare center, education facility, or critical community facility. Furthermore, points will be awarded for projects in states with an updated broadband plan in the past five years.

We anticipate RUS will continue to make grant/loan combinations in the $3 million to $10 million range. This is quite a bit more than RUS's Community Connect grants—and, because the program's funding is considerably larger in total dollars, we anticipate that ReConnect will make more awards. Further, ReConnect does not have the low-income requirements of Community Connect, making it a more flexible program.

7.4 USDA's Community Connect program represents another, more modest opportunity

Community Connect is another program to which the County could apply with a partner. The USDA administers this modestly sized grant program for local and tribal governments; it targets broadband deployment to unserved (defined as speeds less than 10 Mbps download and 1 Mbps upload), low-income rural communities with fewer than 20,000 residents in a contiguous PFSA (*and* not adjacent to cities with more than 50,000 residents). To prepare the most competitive Community Connect grant application possible, we would recommend the County target the lowest-income portions of its unserved areas. The eligible areas for funding are therefore identical to the PFSAs developed for the ReConnect grant, but with an additional low-income requirement.

Grantees must ultimately offer service at the broadband grant speed (defined as 25 Mbps download, 3 Mbps upload) to *all* households and community institutions in the PFSA, with free service for at least two years to a community center.

The application process is rigorous and competitive (i.e., only about 10 percent of applicants receive an award) and once awarded, program requirements can be demanding (e.g., requiring last-mile service be available for all households in the service area). The program has been funded consistently since it was introduced in 2002 and represents an important opportunity for qualifying communities. The appropriations package that was signed by President Trump in December 2020 appropriated $35 million for the Community Connect program, to remain available until expended.[38]

Eligible applicants include local or state units of government, incorporated organizations, Indian tribes or tribal organizations, cooperatives, private corporations, and limited-liability companies organized on a for-profit or not-for-profit basis. Individuals or partnerships are not eligible. Any public or private applicant must have the legal capacity and authority to own and operate the proposed broadband facilities, to enter into contracts, and to otherwise comply with applicable federal statutes and regulations. Thus, awards cannot be granted to a local government entity that does not want to own or operate the broadband service.

Once awarded, projects must offer last-mile service at the broadband grant speeds (25 Mbps download and 3 Mbps upload) to *all* businesses, residents, and community facilities in the PFSA, with free service provided to all critical facilities,[39] and at least one community center (with weekend hours and two to 10 public computer access points) for at least two years from the grant award. Grants can be used to offset the cost of providing such service and to lease spectrum, towers, and buildings as part of the project design.[40] The lesser of 10 percent of the grant or $150,000 can be used to construct, acquire, or expand an existing community center.[41]

[38] Consolidated Appropriations Act, 2021, page 54, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf (accessed December 2020).
[39] Critical community facilities include public schools, public libraries, public medical clinics, public hospitals, community colleges, public universities, law enforcement, and fire and ambulance stations.
[40] Leasing costs can only be covered for three years.
[41] Note that additional funds can be used to provide the computer access points and their connection to the network. Applicants may use their own resources to cover costs exceeding this limit. The program historically required provision of at least 10 computer access points in a public community center; however, now requires only two such access points—with a *maximum* of 10 computers.

7.5 Department of Commerce economic development grants assist distressed communities

The Department of Commerce's Economic Development Administration (EDA) oversees the Economic Development Assistance program, which has delivered funds to distressed communities for many years. Public broadband projects in economically distressed communities are eligible for funding under the Public Works and Economic Adjustment Assistance (PWEAA) programs—which do not require that an area be unserved but do require that jobs be created or saved as a direct result of the proposed project.

While broadband funding to date through the EDA appears to be modest, both construction and technical assistance are clearly eligible. EDA's materials on Public Works funding explicitly mention broadband and EDA has already funded several broadband projects.[42] Moreover, applicants can apply existing federal funds toward the cost-share, which allows them to leverage available resources. Given this, we recommend the County consider this opportunity. Additionally, the program does not require proof of lack of service or poor service. Instead, a proposed project must demonstrate that it will positively affect the economic prospects of the area; generally, in the form of addition of or saving of jobs. A local community economic development plan that highlights a need for better broadband will be an essential first requirement.

Eligible applicants include city, township, county, or special district governments; state governments; federally recognized tribal governments; nonprofits, aside from institutions of higher education; private institutions of higher education; and public and state-controlled institutions of higher education.

The community must qualify as distressed to be eligible. Criteria for eligibility is established by providing "third-party data that clearly indicate that the region is subject to one (or more) of the following economic distress criteria: an unemployment rate that is, for the most recent 24-month period for which data are available, at least one percentage point greater than the national average unemployment rate; per capita income that is, for the most recent period for which data are available, 80 percent or less of the national average per capita income; or a "Special Need," as determined by EDA." Projects located in Qualified Opportunity Zones meet this special need eligibility criteria.

The program's 2020 funding opportunity included a determination that the economic impact of the coronavirus pandemic constituted a "special need" eligibility for the whole of the country. While it is possible that future appropriations will extend this sweeping eligibility, funding is

[42] "Broadband Funding Guide," U.S. Department of Commerce EDA, December 12, 2018, https://broadbandusa.ntia.doc.gov/sites/default/files/funding_eda_01_0.pdf (accessed December 2020).

competitive enough that applicants still need to demonstrate significant economic distress to receive an award. EDA has informed us that they will honor the 80/20 split on Covid-19-related need justifications, rather than the traditional 50/50 split on grant funding and matching funds.

The PWEAA Notice of Funding Opportunity (NOFO) emphasizes the importance of consulting with the appropriate regional EDA contacts.[43] Regional staff is available to review project proposals, assess proposed cost shares, and preview all application materials. Though optional, we believe such consultation to be essential if the County were to consider applying.[44]

[43] "Notice of Funding Opportunity – FY 2020 EDA Public Works and Economic Adjustment Assistance Programs," https://www.grants.gov/web/grants/view-opportunity.html?oppId=321695 (accessed December 2020).
[44] EDA regional contacts available online at: https://www.eda.gov/contact/ (accessed November 2020).

8 State Grant and Loan Opportunities

8.1 Community Economic Revitalization Board (CERB) rural broadband grants and loans

The State of Washington Department of Commerce's (DOC) Community Economic Revitalization Board provides low-interest loans and grants to qualified local governments and other public entities –including Public Utility Districts—and federally recognized Indian tribes within the State[45] for "financing the cost to build infrastructure to provide high-speed, open-access broadband service, to rural underserved communities, for the purpose of community economic development."[46] Funding can be used for the infrastructure to the point of service and applicants must partner with an internet service provider to be eligible. The program also provides limited support options related to rural broadband planning.

CERB has two separate core CERB programs for rural communities and counties: Committed Private Partner and Prospective Development.

In Pierce County, the CERB has designated rural communities within Pierce County as Buckley, Carbonado, DuPont, Eatonville, Edgewood, Fife, Fircrest, Gig Harbor, Milton, Orting, Roy, Ruston, South Prairie, Steilacoom, Sumner, and Wilkeson. There are no application deadlines, but the CERB reviews project proposals every two months[47] and makes awards on a first-come, first-served basis.[48] Funding amounts include a maximum of $2 million in low-interest loans per project (there is no option for loan forgiveness) and up to 50 percent of the total project award in grants, determined after an underwriting process that identifies a debt service coverage ratio (DSCR). Grant applicants are required to provide a cash match of 25 percent of the total project cost (not to be confused with the grant award) and must demonstrate overall project feasibility by providing a supporting study.

Any application should aim to satisfy the CERB's general priorities and should document the overall value of the project to the community with demonstrated support from businesses and government in the project area; the ways in which the proposed project will meet stated goals in published planning documents (such as local economic development plans, comprehensive plans, capital facilities plans, and any applicable state planning requirements); the availability of

[45] Generally, applicants must have jurisdictional authority over the property included in the proposed project. This removes Economic Development Councils on their own from being an applicant. Additionally, colleges and universities are not eligible for funding.

[46] See https://www.commerce.wa.gov/building-infrastructure/community-economic-revitalization-board/rural-broadband/ (accessed December 15, 2020).

[47] Applicants are required to attend the meeting at which their proposal is reviewed and generally come prepared with a presentation not to exceed 20 minutes.

[48] See http://www.commerce.wa.gov/wp-content/uploads/2019/06/cerb-2019-21-rural-broadband-program-policies-06172019-2019.pdf (accessed January 2021). Program Overview, page 4.

matching dollars; local participation in the project; and the overall readiness of the project to proceed.[49]

As these funds are meant to aid in economic development generally, any proposed project must demonstrate an intention to "encourage, foster, develop, and improve broadband within the State,"[50] with an emphasis on:

- Job creation, innovation, and expansion of markets for local businesses
- Serving the needs of local education systems, health care systems, public safety systems, industries and businesses, governmental operations, and citizens
- Improving accessibility for underserved communities and populations[51]

The CERB Rural Broadband Program goes beyond the basic eligible infrastructure and minimum speed requirements of familiar federal-level grants (e.g., FCC, USDA). Those programs generally require proposed infrastructure to deliver no less than 25 Mbps/3 Mbps regardless of proposed broadband infrastructure type; in contrast, the CERB program is specific about speed requirements for each medium of proposed broadband infrastructure:

Table 18: CERB Required Speeds per Technology

Proposed Broadband Infrastructure	Required Minimum Speeds (Down/Up)
Cable Modem	100 Mbps / 20 Mbps
Fiber	1 Gbps / 1 Gbps
Wireless (fixed wireless, Wi-Fi)	50 Mbps / 10 Mbps
4G Mobile Wireless	25 Mbps / 5 Mbps
Broadband over Powerlines (BPL)	100 Mbps / 100 Mbps
Microwave	100 Mbps / 20 Mbps

The CERB Program also has several notable eligibility restrictions. The program will not support any project that intends to foster eventual retail developments or gambling. Further, if a project is designed to attract businesses away from another jurisdiction in the State, it will be disqualified. Finally, the proposed project cannot provide equipment to a public entity that would then provide "retail telecommunications services" or any services that are not allowed by state

[49] See https://deptofcommerce.app.box.com/v/cerbrbworkshoppresentation (accessed January 2021). "Project Prioritization," Side 5. Shovel-ready projects are defined as satisfying four important criteria: 1) a committed partner ISP; 2) documented and executed partnership agreements; 3) a technical plan; and 4) a detailed business plan.
[50] See https://www.commerce.wa.gov/building-infrastructure/community-economic-revitalization-board/rural-broadband/ (accessed January 2021).
[51] See https://www.commerce.wa.gov/building-infrastructure/community-economic-revitalization-board/rural-broadband/ (accessed January 2021).

statute, and there is an absolute disqualification for a publicly owned backbone designed and implemented for the sole purpose of being competitive with incumbents currently in the area.

Additionally, applicants must provide proof that they have contacted incumbent service providers in the proposed project area to inquire whether those companies have any plans to upgrade services. Those letters are also an opportunity to seek interest from ISPs in partnering on the proposed project.

Once an award has been made, successful applicants are required to meet defined pre-contract requirements within six months of award. The Department of Archaeology and Historic Preservation (DAHP) must be contacted and a formal consultation initiated to review any potentially historically significant points of interest or concern in the project area. A tribal consultation may also be required if the project encompasses areas of concern for federally recognized Indian tribes.

Awardees will also be required to file quarterly progress reports with the CERB through the life of the project. CERB will seek project outcome information—including data regarding ISPs serving the area and number of passings and speeds of services for homes, businesses, and anchor institutions—for five years following project completion. Any facilities constructed with CERB support must be used for their original purpose for a minimum of 10 years.

Overall, this program boasts a relatively small allocation and the application process requires significant effort, including establishing a partnership with an incumbent provider in order to apply. As such, this program is likely to be highly competitive around smaller projects and not a good fit for larger projects with significant funding needs.

Notably, applicants who qualify for CERB grants would generally be eligible for two other federal programs, as well. One is the USDA ReConnect program, which has at least $550 million available in the upcoming funding round, with the funding window opening at the beginning of April; the second is the USDA Community Connect grant and loan program. While the USDA programs are competitive, and the application processes require significant effort, these programs are somewhat less arduous—and have potentially greater funding for strong applications. Additionally, the County might consider looking at the federal Department of Commerce Economic Development Administration grants. EDA funding is designed to help support and accelerate economic development throughout the country. In particular, the Public Works and Economic Adjustment Assistance Programs will support broadband projects that can demonstrate job growth/savings and economic development due to the completion and implementation of broadband infrastructure.

8.2 Washington State Department of Commerce Public Works Board

The State's Public Works Board offers assistance in a variety of local infrastructure projects, which has included broadband financing. In October 2020, the PWB approved $17.8 million in funding for broadband construction grants and loans. [52]However, the PWB Broadband Program is now reviewing the results and lessons learned. This may result in significant changes to future applications and scoring criteria. A further round of funding may occur in 2021, with new applications able to be made in July.

The PWB says it is also seeking responses to a survey[53] to help the PWB plan support for specific areas: feasibility, pre-construction planning, and construction. Results of the survey will help the PWB define overall need and communicate to the Legislature.

State law requires applicants for PWB Broadband Construction grants and loans to contact local ISPs near the proposed project area to request their plan to upgrade broadband service in the project area to speeds that meet or exceed the State's definition of broadband service within the time frame of the proposed project. This contact must be made a minimum of six-weeks prior to the submission of an application for funding from the PWB, and documentation of this interaction must be submitted with the application.

[52] More program information and a list of awards is available here: https://www.commerce.wa.gov/building-infrastructure/pwb-broadband/

[53] The survey instrument is available here: https://www.surveymonkey.com/r/BroadbandPlanningAssessment