

# Aleutian Broadband Scoping Study

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## Abbreviations

4K	Display resolution of 4,096 x 2160 pixels	HTS	High-Throughput Satellite
ACS	Alaska Communications, an Alaska corporation	ICC	Intercarrier Compensation
AIDEA	Alaska Industrial Development and Export Authority	ISP	Internet Service Provider
ALEC	American Legislative Exchange Council	KPU	Ketchikan Public Utilities
APICDA	Aleutian Pribilof Island Community Development Association	LEO	Low Earth Orbit (satellite)
ATA	Alaska Telephone Association	LTE	Long Term Evolution
AUSF	Alaska Universal Service Fund	Mbps	Megabits per second; 1,000,000 bits per second; 1,000 kilobits/second
BBTC	Bristol Bay Telephone Cooperative	MHz	Megahertz; 1,000,000 cycles per second
BDAC	FCC Broadband Deployment Advisory Committee	NMTC	New Market Tax Credit
BIAS	Broadband Internet Access Service	NTIA	National Telecommunications and Information Administration
BTOP	Broadband Technology Opportunities Program	P3	Public-Private Partnership
CAF	Connect America Fund	PDI	Pacific Dataport Inc.
CDE	Community Development Entity	RAN	Radio Access Network
CLIC	Coalition for Local Internet Choice	RCA	Regulatory Commission of Alaska
DSL	Digital Subscriber Loop	RFP	Request for Proposal
ETC	Eligible Telecommunications Carrier	RTT	Round Trip Time
FCC	Federal Communications Commission	RUS	Rural Utility Service (under USDA)
FTTH	Fiber to the Home	SBI	State Broadband Initiative
FWA	Fixed Wireless Access	SD	Standard Definition; display resolution of 720 x 480 pixels
Gbps	Gigabits per second	SWAMC	Southwest Alaska Municipal Conference
GCI	General Communications Inc.	TCP	Transmission Control Protocol
GEO	Geostationary Earth Orbit (satellite)	TDX	Tanadgusix Corporation
GHz	Gigahertz	TERRA	Terrestrial for Every Rural Region in Alaska
GSO	Geosynchronous Earth Orbit (satellite)	UHD	Ultra High Definition; display resolution of 3840 x 2160 pixels
HD	High Definition; at least 720p resolution, 1280 x 720 pixels	USAC	Universal Service Administrative Company
		USDA	United States Department of Agriculture
		USF	Universal Service Fund

WISP      Wireless Internet Service Provider

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## Executive Summary

The gap between urban and rural broadband use in the United States has been well documented and researched over the years (NTIA, 2016b; FCC, 2010a). Known as the “digital divide,” the lack of available minimum standards of broadband creates disadvantages to those who live in underserved, rural regions. These disadvantages include, but are not limited to, economic development, education, health care, public safety and others. Although the digital divide has been slowly closing across the U.S., over 24 million Americans still lack access to minimum broadband as of 2018 (FCC, 2018a). This scoping study looks at one of these long-standing underserved rural areas, the Aleutian-Pribilof region.

The study area of this report did not include the entire SWAMC region but focused on a geographic region bordered by Levelock to the east, Adak to the west, and the Pribilof Islands to the north. The study area’s population is just under 10,000 full-time residents, but seasonal fluctuations can increase the population to almost 13,000. State population forecasts show slow to no growth, or slight declines in the study area.

The lack of high-speed, high throughput, middle-mile backhaul is the primary barrier for accessing minimum standards of broadband, which is defined by the FCC as 25 Mbps download and 3 Mbps upload. All but one location in the study area, Levelock, currently utilize satellite technology for middle-mile backhaul. Levelock is connected to GCI’s TERRA network. There are various existing last-mile technologies deployed in the study area, including fiber (FTTH), DSL, cable and fixed wireless.

Future consumption of broadband in the study area is anticipated to follow patterns seen in other rural Alaska areas—that is, when higher-speed broadband has been introduced to previously underserved areas, the consumption of broadband per capita has been shown to

increase significantly. High cost remains a limiting factor for some, however.

Given that the lack of high-speed, high throughput, middle-mile backhaul is the barrier to broadband in the study area, there are several potential projects in various stages of development that may change the status quo. GCI and Quintillion are independently developing business cases for new subsea fiber networks in the study area. GCI completed a subsea survey of a northern route from Levelock to Unalaska and they are now studying a southern fiber route connecting Unalaska to Kodiak. Quintillion’s next phase of their master plan to build a subsea fiber from London to Tokyo through the Northwest Passage is to deploy fiber from Nome to Japan, and they are considering possible landing sites in the study area. In addition to fiber, there are several projects underway from consortiums of multinational companies that would deploy constellations of low Earth orbiting satellites to deliver broadband to rural areas across the globe. One of these companies, OneWeb, is planning to provide service to Alaska by the end of 2019. Using an Alaska-focused, geosynchronous satellite, Microcom’s Pacific Dataport subsidiary is working on a project, called Aurora IV, which they propose will deliver broadband across Alaska at a lower price point than terrestrial and subsea fiber networks.

Private telecom providers building large-scale, middle-mile networks in rural areas often require government supplemental funding programs (loans or grants) in order to achieve reasonable rates of return on their investment. Many current government funding programs that include middle-mile infrastructure are not scaled to what would be required to build out the study area in one project. But there are examples, like the 2009 federal American Reinvestment and Recovery Act (stimulus program) that funded projects of such magnitude.

Across the U.S. some local governments have taken it upon themselves to build municipally-

owned networks. There have been reported mixed results with these projects, but the analysis of the economics has also been controversial. Municipally-owned networks are relatively new, and thus longer-term results are still pending. In rural Alaska, broadband usage has increased over time after its introduction to underserved areas, so long-term projections of income can be challenging to accurately forecast, and the life expectancy of a fiber network can be significant. In addition to academic studies, there is much political debate surrounding municipally-owned networks. Nineteen states currently have regulations limiting such networks, while some other states have embraced municipally-owned networks.

Municipally-owned networks may be entirely owned and operated by the public entity, or the public entity can team with a private partner in what is known as a Public-Private-Partnership, or P3. There are several different forms a P3 may take, but the intent is to create a win-win scenario for all parties. Another option worth exploring is a broadband cooperative model that has been deployed in rural Minnesota and is being studied in Fairbanks.

As part of its desire to improve access to affordable broadband in the study area, SWAMC intends to issue a Phase II solicitation (this report is considered Phase I). This solicitation should identify a consulting firm with expertise in developing business cases for P3s, broadband co-ops, and/or municipally-owned networks in order to determine the feasibility and risks. This consultant should assess the multiple issues surrounding a municipally-owned network such as operations, financing, regulatory, backhaul negotiation, risks, etc.

# 1 Introduction

The Southwest Alaska Municipal Conference (SWAMC) is a non-profit regional economic development organization whose mission is to:

*...advance the collective interests of the Southwest Alaska people, businesses and communities. SWAMC helps promote economic opportunities to improve quality of life and influences long-term responsible development.*

The benefits of broadband infrastructure as they pertain to economic development, education, public safety and health care are well documented in academic and governmental literature (NTIA, 2016b; FCC 2018a). Known as the “digital divide,” there is a significant gap between demographics and geographic areas that have access to technology, including the Internet, and those who do not, or whose access is restricted (Council of Economic Advisers, 2016). Like many amenities that are taken for granted in urban Alaska areas, such as access to water and sewer utilities, affordable power, etc. such conveniences were neither inexpensive nor easily accomplished when first conceived, but were considered important enough to justify the investment.

The Federal Telecommunications Act of 1996 established the concept of “*universal service*,” stipulating that: “All Americans should have access to essential communications technologies, including phone and high-speed Internet at ‘just, reasonable and affordable rates’” (Falsey, 2017). Yet for many areas of rural Alaska, affordable broadband is not available due to high middle-mile costs and geographic isolation (Falsey, 2016). Many small rural markets often have little or no competition, and consumers historically have had few options but to pay high prices for slow and unreliable Internet service.

The single largest challenge in the delivery of broadband services to the Aleutian-Pribilof region is the cost of middle-mile transport. *Middle-mile transport* is defined as “the segment of a telecommunication network infrastructure linking a network operator’s core network to the

local network infrastructure.” In this study we will refer to the network operator’s core as the “Internet” and the local network plant that connects to the end user as the “last-mile.” The geographically remote nature of the Aleutian-Pribilof region creates economic challenges to constructing high speed, high throughput middle-mile broadband infrastructure that urban areas take for granted.

## 1.1 Background and Goals of this Report

For many years, SWAMC has taken a strong interest in improving the availability, quality, and affordability of quality broadband in the region. While other large-scale broadband infrastructure projects were being deployed in other regions of rural Alaska, there were no such projects being planned for the Aleutian-Pribilof region. In 2016, a public solicitation was issued by the Aleutian Pribilof Island Community Development Association (APICDA) to develop a study that:

- Identifies existing broadband infrastructure in the study area;
- Reviews current and potential technologies that would improve services in the study area;
- Identifies relevant funding programs;
- Explores ownership models of municipally-owned networks;
- Identifies lessons learned from other large-scale Alaska projects; and
- Makes recommendations for next steps

Meridian Management, Inc. (Meridian) was selected to complete this report, but the start date was put on hold while grant funding was finalized. Under contract to SWAMC, Meridian began the work in the fall of 2017. The hold on the schedule ended up being beneficial since several telecommunication providers were announcing potential broadband projects that would serve the study area.

## 1.2 Study Area

The region of focus for this report does not encompass the entire SWAMC region since portions of the SWAMC region have access to broadband. The study area for this report is confined by Levelock to the east (where General

Communications Inc.'s [GCI] Terrestrial for Every Rural Region in Alaska [TERRA] network changes from fiber to microwave), the Pribilof Islands to the north, and Adak to the west. The study area does not extend to Shemya, which is almost 400 miles to the west of Adak.

Figure 1. Report Study Area



(Map by James Burkhart, Meridian Management)

## 1.3 Demographics

Regional demographics are an important factor that service providers research when developing business plans and potential market penetration, including number of households, income, age, etc. Schools, health care facilities and industry types are other important data consumption factors considered since these often are able to receive government subsidies and thus become important revenue generating customers, known as “Community Anchor Institutions.”

### 1.3.1 Existing Population

The communities included in the study area are listed in Table 1 along with community population statistics taken from the U.S. Census Bureau 2010 survey. The next formal census

will be in 2020. Additional data for seasonal/transient population was obtained from NOAA Fisheries technical memorandums (Himes-Cornell et al., 2013a, 2013b).

The substantial seasonal population fluctuations in the study area (May–September) are primarily fisheries-related (processing plants, fishing vessels and transient support personnel), but may also include teaching staff, tourism-related workers, hunting guides and construction workers.

For additional insight into the SWAMC region’s economy and relationships to other regions, please refer to the report, “A Linked Economy: Southwest Alaska’s Economic Linkages to the State and Beyond,” prepared by Northern Economics on behalf of SWAMC (Northern Economics, 2016).

**Table 1. Study Area Communities by Borough**

Community	Borough	Local Exchange Carrier	Population*	Total Households*	Est. Transient Pop.**
Adak	Aleutians West	Adak Eagle Enterprises	326	93	186-206
Atka	Aleutians West	Alaska Communications (ACS) of the Northland, Inc	61	24	12
Nikolski	Aleutians West	ACS of the Northland, Inc.; GCI	18	13	unknown
Saint Paul	Aleutians West	ACS of the Northland, Inc	479	162	300
Saint George	Aleutians West	ACS of the Northland, Inc	102	42	0
Unalaska	Aleutians West	Interior Telephone Co Inc (TelAlaska)	4,376	927	2,500
Akutan	Aleutians East	HughesNet (Satellite)	1,027	40	900
False Pass	Aleutians East	ACS of the Northland, Inc	35	15	unknown
King Cove	Aleutians East	Interior Telephone Co Inc (TelAlaska)	938	181	400-488
Cold Bay	Aleutians East	Interior Telephone Co Inc (TelAlaska)	108	46	40-50
Nelson Lagoon	Aleutians East	ACS of the Northland, Inc	52	22	20
Port Heiden	Aleutians East	GCI	102	35	unknown
Port Moller	Aleutians East	Interior Telephone Co Inc (TelAlaska)	150	No Data	150
Sand Point	Aleutians East	Interior Telephone Co Inc (TelAlaska)	976	246	1,500
Ivanof Bay	Lake and Peninsula	Cellco Partnership DBA Verizon	7	2	0
Perryville	Lake and Peninsula	ACS of the Northland, Inc.; GCI	113	38	6
Chignik Lake	Lake and Peninsula	ACS of the Northland, Inc.; GCI	73	27	unknown
Pilot Point	Lake and Peninsula	ACS of the Northland, Inc.; GCI	68	27	1,825
Ugashik	Lake and Peninsula	Unknown	12	7	unknown
Egegik	Lake and Peninsula	ACS of the Northland, Inc.; GCI	109	29	4,000-5,000
Levelock	Lake and Peninsula	Bristol Bay Telephone Co-op; GCI	69	27	unknown
<b>TOTAL</b>			<b>9,201</b>	<b>2,003</b>	<b>11,839-12,957</b>

\* 2010 Census

\*\* NOAA Fisheries 2013 Data

### 1.3.2 Population Forecast

State of Alaska population projections show slow to no growth or declines in population in the Aleutians East Borough and Aleutians West Census Area (Alaska Department of Labor and Workforce Development, 2016). It is very difficult to accurately forecast far into the future due to economic and other variables

**Table 2. Population Forecasts**

	2015	2020	2025	2030
Aleutians East Borough	2,854	2,832	2,807	2,770
Aleutians West Census Area	5,649	5,637	5,616	5,584
<b>Subtotal</b>	<b>8,503</b>	<b>8,469</b>	<b>8,423</b>	<b>8,354</b>

(Source: Alaska Department of Labor, 2016)

## 2 Existing Technology & Infrastructure

### 2.1 Existing Demand

#### 2.1.1 Background

In January of 2015, the Federal Communications Commission (FCC) redefined fixed broadband speed to mean 25 Megabits per second (Mbps) download speed and 3 Mbps upload speed (referred to as 25x3). This represented a significant increase from the previous 4 Mbps download and 1 Mbps upload speeds (4x1). This change immediately characterized over half of rural Americans as “underserved.” Only one-third of Tribal lands and U.S. Territories were identified as meeting the 25x3 requirement at the time of this 2015 change (FCC, 2015a). This change also affected the study area, since many communities (then and now) relied on low speed satellite backhaul.

The FCC did not provide a substantial reason for raising the threshold from 4x1 to 25x3. The FCC’s Measuring Broadband America 2014 report noted that for basic web browsing (multiple users not withstanding), page load speeds did not see much, if any, increases beyond a 10 Mbps service (FCC, 2014a). The United Kingdom defines “super-fast” broadband as 24 Mbps or higher (UK, 2018). Popular streaming services like Amazon and Netflix recommend broadband speeds ranging from 3 Mbps for standard definition (SD), and up to 25 Mbps for Ultra-High Definition (UHD) 4K. 15 Mbps is sufficient to support two concurrent HD streams plus typical web services.

The single largest driver of consumer bandwidth today is video streaming. The more devices consuming video at the same time, and at higher resolutions (SD vs. HD vs. UHD), the greater the demand is on broadband infrastructure. In addition, demand for broadband capabilities is accelerating due to the relatively recent “cut the cord” movement, where consumers are moving away from traditional paid cable TV subscriptions and are opting for streaming media alternatives from their Internet service provider.

#### 2.1.2 Existing Infrastructure

This section of the report will focus on consumer infrastructure. Although some technologies included are viable for the delivery of commercial/institutional access, those services and maximum upload/download speed are often distinct to that business customer.

With the exception of Levelock, all of the communities in the study area currently use satellite services for middle-mile backhaul (described in more detail in Section 2.2). A mix of telecommunications companies and private businesses service the study area and in the majority of cases, there is only one provider who offers Internet access (not including cellular data). That list of providers by community is provided in Table 3.

Table 3. Service Providers by Community and Borough

Community	Borough	Provider A	Provider B	Provider C	Population (2010 Census)	Notes	Provider A Max Speed Down	Provider A Max Speed UP	Provider B Max Speed Down	Provider B Max Speed UP	Provider C Max Speed Down	Provider C Max Speed UP	Provider A Technology	Provider B Technology	Provider C Technology	RUS Eligibility <4Down<1UP	Provider A Middle Mile Technology	Provider B Middle Mile Technology	Provider C Middle Mile Technology	Provider A Included Usage	Provider A Overage Charges	Provider B Included Usage	Provider B Overage Charges	Provider C Included Usage	Provider C Overage Charges	#1 Cost Challenge
Atka	Aleutians West	ACS of the Northland, Inc - No Internet	GCI		61	ACS has copper plant but has no DSL or Internet product, no plans to deploy			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier				7 Gigabytes			Middle Mile Transport	
Saint Paul	Aleutians West	ACS of the Northland, Inc - No Internet		TDX	479	ACS has copper plant but has no DSL or Internet product, no plans to deploy. ACS providing middle mile satellite for TDX. TDX deploying last mile FTTH					768 Kbps	256 Kbps	FTTH													
Saint George	Aleutians West	ACS of the Northland, Inc - No Internet	GCI		102	ACS has copper plant but has no DSL or Internet product, no plans to deploy			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier				7 Gigabytes			Middle Mile Transport	
False Pass	Aleutians East	ACS of the Northland, Inc - No Internet	GCI		35	ACS has copper plant but has no DSL or Internet product, no plans to deploy - Hughesnet, Satellite may be available -GCI has legacy WISP service, no new customers, maintenance only			1 Mbps	256 Kbps			Satellite	Legacy WISP. No new Customers												
Nelson Lagoon	Aleutians East	ACS of the Northland, Inc - No Internet	GCI		52	ACS has copper plant but has no DSL or Internet product, no plans to deploy -GCI has legacy WISP service, no new customers, maintenance only							Legacy WISP. No new Customers													
Nikolski	Aleutians West	ACS of the Northland, Inc - No Internet	GCI		18	ACS has copper plant but has no DSL or Internet product, no plans to deploy - GCI Rural Internet			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier				7 Gigabytes			Middle Mile Transport	
Perryville	Lake and Peninsula	ACS of the Northland, Inc - No Internet	GCI		113	ACS has copper plant but has no DSL or Internet product, no plans to deploy			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier				7 Gigabytes			Middle Mile Transport	
Chignik Lake	Lake and Peninsula	ACS of the Northland, Inc - No Internet	GCI		73	ACS has copper plant but has no DSL or Internet product, no plans to deploy			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier				7 Gigabytes			Middle Mile Transport	

Community	Borough	Provider A	Provider B	Provider C	Population (2010 Census)	Notes	Provider A Max Speed Down	Provider A Max Speed UP	Provider B Max Speed Down	Provider B Max Speed UP	Provider C Max Speed Down	Provider C Max Speed UP	Provider A Technology	Provider B Technology	Provider C Technology	RUS Eligibility <4Down<1UP	Provider A Middle Mile Technology	Provider B Middle Mile Technology	Provider C Middle Mile Technology	Provider A Included Usage	Provider A Overage Charges	Provider B Included Usage	Provider B Overage Charges	Provider C Included Usage	Provider C Overage Charges	#1 Cost Challenge
Pilot Point	Lake and Peninsula	ACS of the Northland, Inc - No Internet	GCI		68	ACS has copper plant but has no DSL or Internet product, no plans to deploy			6 Mbps	2 Mbps				Rural Internet WISP		Yes		Satellite shared carrier				40 Gigabytes	\$0.0075 per Mb			Middle Mile Transport
Adak	Aleutians West	Adak Eagle Enterprises /Windy City Broadband			326	Adak Eagle=Adak Telephone Utility, Adak Cablevision, Windy City Broadband, Windy City Cellular	512 Kbps	256 Kbps					FTTH								4 Gigabytes	\$0.20 per Mb			Middle Mile Transport	
Ivanof Bay	Lake and Peninsula	Cellco Partnership DBA Verizon			7	No detail obtained. Assumption is cellular data only																				
Akutan	Aleutians East		GCI	Optim ERA	1,027	GCI has legacy WISP service, no new customers, maintenance only	256 Kbps						Legacy WISP No new Customers	WISP (Fixed Wireless) + Hotspots		No		Satellite shared carrier			7 Gigabytes	\$20 per Gigabyte			Middle Mile Transport	
Port Heiden	Aleutians East		GCI		102	Fixed Wireless	1 Mbps	256 Kbps					Rural Internet WISP			No		Satellite shared carrier			7 Gigabytes	\$20 per Gigabyte			Middle Mile Transport	
Egegik	Lake and Peninsula	ACS of the Northland, Inc - No Internet	GCI		109	ACS has copper plant but has no DSL or Internet product, no plans to deploy			1 Mbps	256 Kbps			Rural Internet WISP			No		Satellite shared carrier			7 Gigabytes	\$20 per Gigabyte			Middle Mile Transport	
Port Moller	Aleutians East			Optim ERA	150	Seasonal (cannery, ADF&G, airport)- No consumer product available									WISP (Fixed Wireless) + Hotspots											
Unalaska	Aleutians West	Interior Telephone Co Inc (TelAlaska)	GCI	Optim ERA	4,376	TelAlaska, GCI and OptimERA Wi-Fi	1 Mbps	512 Kbps	256 Kbps				DSL & Cable Modem	WISP (Fixed Wireless)	WISP (Fixed Wireless) + Hotspots	No	Satellite shared carrier	Satellite Fixed Assigned	Satellite Fixed Assigned	12 Gigabytes	\$0.01 per Mb	9 Gigabytes		5, 10, 20 or 50GB	Middle Mile Transport	
King Cove	Aleutians East	Interior Telephone Co Inc (TelAlaska)			938	DSL plant capable of being upgraded for higher speeds	1 Mbps	512 Kbps					DSL/ VLSL	NA		No	Satellite shared carrier			12 Gigabytes	\$0.01 per Mb				Middle Mile Transport	
Cold Bay	Aleutians East	Interior Telephone Co Inc (TelAlaska)	GCI		108	DSL plant capable of being upgraded for higher speeds	1 Mbps	512 Kbps					DSL/ VLSL	NA		No	Satellite shared carrier			12 Gigabytes	\$0.01 per Mb				Middle Mile Transport	
Sand Point	Aleutians East	Interior Telephone Co Inc (TelAlaska)			976	DSL plant capable of being upgraded for higher speeds	1 Mbps	512 Kbps					DSL/ VLSL	NA		No	Satellite shared carrier			12 Gigabytes	. \$0.01 per Mb				Middle Mile Transport	

Community	Borough	Provider A	Provider B	Provider C	Population (2010 Census)	Notes	Provider A Max Speed Down	Provider A Max Speed UP	Provider B Max Speed Down	Provider B Max Speed UP	Provider C Max Speed Down	Provider C Max Speed UP	Provider A Technology	Provider B Technology	Provider C Technology	RUS Eligibility <4Down<1UP	Provider A Middle Mile Technology	Provider B Middle Mile Technology	Provider C Middle Mile Technology	Provider A Included Usage	Provider A Overage Charges	Provider B Included Usage	Provider B Overage Charges	Provider C Included Usage	Provider C Overage Charges	#1 Cost Challenge
Ugashik	Lake and Peninsula	Unknown			12	DSL plant capable of being upgraded for higher speeds																				
Levelock	Lake and Peninsula	GCI	BBTC		69	GCI WISP, BBTC DSL	6 Mbps	2 Mbps	6 Mbps	1 Mbps			WISP	DSL	Rural Broadband		Terra Hybrid Fiber/Mi crowave			40 Gigabytes	\$0.0075 per Mb	40 Gigabytes	\$9.00 per Gigabyte			
<b>TOTAL</b>					<b>9,201</b>																					

Throughout the study area, various last-mile technologies have been deployed to provide customers with access to the Internet. Fixed Wireless or Wireless Internet Service Provider (WISP), Digital Subscriber Loop (DSL), Cable Modem, and Fiber to the Home (FTTH) are all used in various locations in the study area. Although you will find unique descriptions for

fixed wireless in Table 4, they are all a variation of standards-based Wi-Fi. Some providers offer only fixed access while others offer a mix of fixed access and community hotspots (described in more detail in Section 2.3). Any blank cells in Table 4 indicate the provider was not offering service as of the date of this study

**Table 4. Last-Mile Technology by Provider**

Community	Provider A	Provider B	Provider C	Provider A Technology	Provider B Technology	Provider C Technology
Atka	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
Saint Paul	ACS of the Northland, Inc. - No Internet	TDX		N/A	FTTH	
Saint George	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
False Pass	ACS of the Northland, Inc. - No Internet	GCI		N/A	Legacy WISP. No new customers	
Nelson Lagoon	ACS of the Northland, Inc. - No Internet	GCI		N/A	Legacy WISP. No new customers	
Nikolski	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
Perryville	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
Chignik Lake	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
Pilot Point	ACS of the Northland, Inc. - No Internet	GCI		N/A	Rural Internet WISP	
Adak	Adak Eagle Enterprises/Windy City Broadband			FTTH		
Ivanof Bay	Cellco Partnership DBA Verizon					
Akutan	GCI	OptimERA		Legacy WISP. No new customers	WISP (Fixed Wireless) + Hotspots	
Port Heiden	GCI			Rural Internet WISP		
Egegik	ACS of the Northland, Inc. - No Internet	GCI		Rural Internet WISP		
Port Moller	OptimERA			WISP (Fixed Wireless) + Hotspots		
Unalaska	Interior Telephone Co Inc. (TelAlaska)	GCI	OptimERA	DSL & Cable Modem	WISP (Fixed Wireless)	WISP (Fixed Wireless) + Hotspots
King Cove	Interior Telephone Co Inc. (TelAlaska)			DSL/VLSL		
Cold Bay	Interior Telephone Co Inc. (TelAlaska)			DSL/VLSL		
Sand Point	Interior Telephone Co Inc. (TelAlaska)			DSL/VLSL		
Ugashik	Unknown					
Levelock	GCI	BBTC		WISP	DSL	

Download speeds offered in the study area range from 256 Kbps to 6 Mbps with upload speeds ranging between 256 Kbps and 2 Mbps. The highest speeds were found in the eastern portion of the study area where providers were connected to GCI's TERRA network and were

not constrained by satellite backhaul. The maximum download speed with satellite backhaul was found to be 1 Mbps.

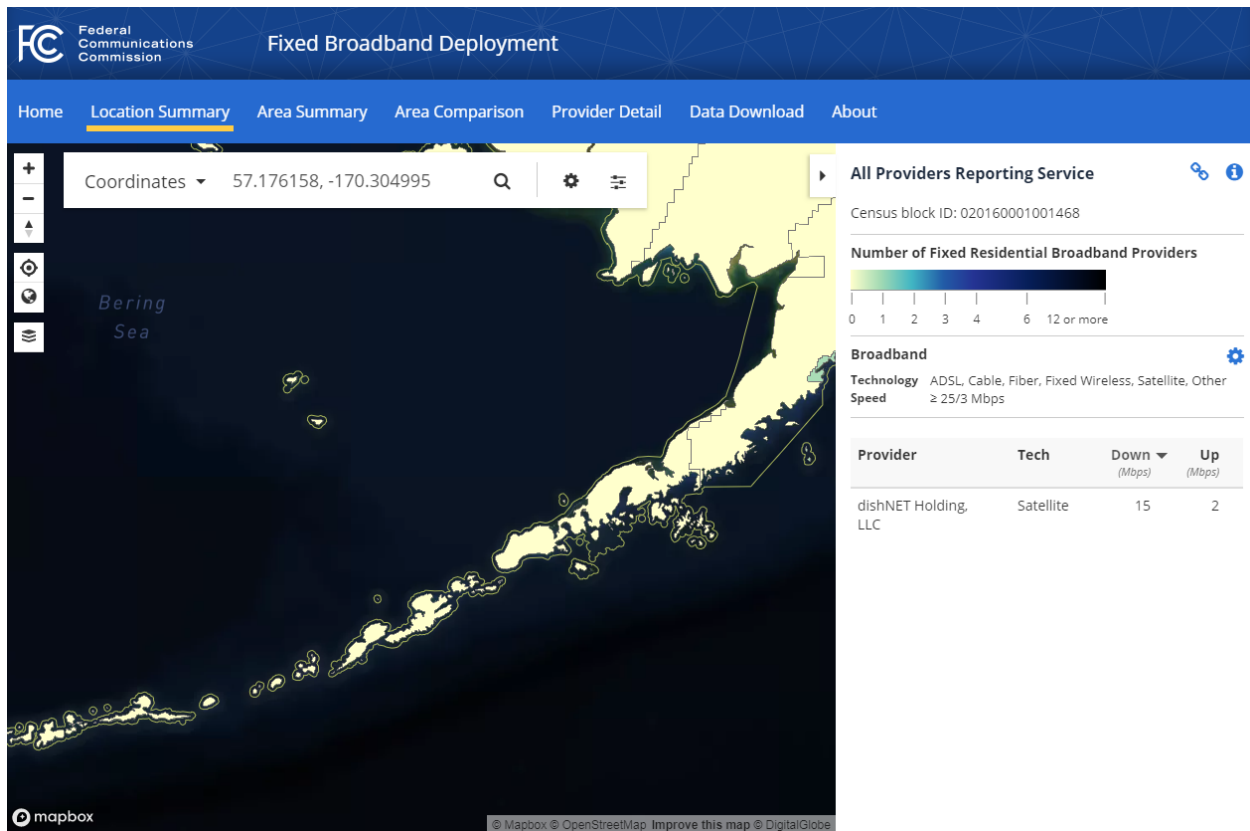
Table 5 lists the maximum upload and download speeds by community and provider.

**Table 5. Maximum Upload and Download Speeds by Provider**

Community	Provider A	Provider B	Provider C	Provider A Max Speed Down	Provider A Max Speed UP	Provider B Max Speed Down	Provider B Max Speed UP
Atka	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Saint Paul	ACS of the Northland, Inc - No Internet	TDX		N/A	N/A	768 K	256 K
Saint George	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
False Pass	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Nelson Lagoon	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	Unkn.	Unkn.
Nikolski	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Perryville	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Chignik Lake	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Pilot Point*	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Egegik	ACS of the Northland, Inc - No Internet	GCI		N/A	N/A	1 Mbps	256 K
Adak	Adak Eagle Enterprises/Windy City Broadband			512 K	256 K		
Ivanof Bay	Cellco Partnership DBA Verizon			Unkn.	Unkn.		
Akutan	GCI	OptimERA		256 K		Unkn.	
Port Heiden	GCI			1 Mbps	256 K		
Port Moller	OptimERA			Unkn.	Unkn.		
Unalaska	Interior Telephone Co Inc (TelAlaska)	GCI	OptimERA	1 Mbps	512K	256 K	Unkn.
King Cove	Interior Telephone Co Inc (TelAlaska)			1 Mbps	512 K		
Cold Bay	Interior Telephone Co Inc (TelAlaska)			1 Mbps	512 K		
Sand Point	Interior Telephone Co Inc (TelAlaska)			1 Mbps	512 K		
Ugashik	Unknown						
Levelock	GCI	BBTC		6 Mbps	2 Mbps	6 Mbps	1 Mbps

\*Note: GCI's website reported Pilot Point as having 6x2 service available. This was found to be an error and was reported to GCI.

Figure 2. FCC Broadband Map of the Study Area



(Source: FCC Broadband Map, [broadbandmap.fcc.gov](http://broadbandmap.fcc.gov))

The broadband speeds in Table 5 are consistent with the FCC’s Broadband Map ([www.broadbandmap.fcc.gov](http://www.broadbandmap.fcc.gov)), which shows no broadband providers reporting the minimum FCC broadband standard of 25 Mbps download and 3 Mbps upload speeds.

### 2.1.3 Consumer Internet

Internet usage in rural areas typically lags that of urban areas for several reasons (FCC, 2010a):

- The number of subscribers as a percentage of the local population is, on average, 10 percent fewer
- Median household income is lower, resulting in fewer households purchasing broadband services (i.e. lower “market penetration” from the providers’ perspectives)
- Higher speed data plans, which are often available in urban markets, are not available in rural areas or are more expensive due to supply and demand economics

- Lower density of high-speed, middle-mile fiber networks
- Historically, latency on middle-mile backhaul has limited performance with streaming services and certain applications
- Less-frequent use
- Using cellular data as an alternative

Data consumption trends in both rural and urban areas are still on the rise, but urban areas lead rural areas, with the gap between the two only closing slightly over the past 5-7 years (Perrin, 2017). When middle-mile and last-mile technologies are updated in rural communities, offerings begin to match urban markets in performance, and both consumption and demand increase. A recent example of this in Alaska is GCI’s TERRA network. Although the exact numbers are not publicly available, GCI’s Senior Director of Corporate Communications, Heather Handyside, stated “As GCI expands terrestrial connectivity into rural Alaska we see both an increased participation in the form of new subscribers and increased usage as higher speeds

and improved performance enable new opportunities for our customers” (Handyside, 2018).

#### **2.1.4 Business/Agency Internet**

Business and government agency Internet and data connectivity often play a key role in a service provider’s decision to bring Internet services to a community or region. GCI and Quintillion are currently developing business cases in the study area for subsea fiber deployments. Such Community Anchor Institutions in coastal Alaska communities typically include municipal governments, U.S. Coast Guard, NOAA and seafood processors, which are all large consumers of data and typically sign long-term service agreements. The length of the service agreement, and the price per data unit delivered (e.g. Kb or Mb), generally have an inverse relationship, that is, more bandwidth and a longer-term contract generally results in a lower cost per data unit from the service provider. Some business customers in the study area sign agreements with service providers who equip the customer with a dedicated satellite terminal, while others share a common infrastructure. This largely depends upon the availability of local last-mile transport options sufficient to carry the high-speed services required by the customer. Last-mile connectivity is typically microwave, DSL, T1 or fiber technologies.

#### **2.1.5 Schools and Libraries**

Substantial expansion of connectivity for schools and libraries in Alaska coincided with the formation of the federal E-Rate program under the Universal Service Administrative Company (USAC) in 1998 (refer to Section 4.1.3 for more information on USAC and the E-Rate program). Funding is made available to successful applicants for data transmission services and Internet access, voice services (ends in 2019), internal connections, managed internal broadband services and basic maintenance of internal connections (USAC, 2017a). Table 6 (Section 4.1.3) shows that the sum total received by eligible Alaska recipients under the E-Rate program was \$13.6 million in 1998. For fiscal year 2017, that amount had grown to just under \$94 million (e.g. Aleutians East Borough was

\$639,360). The primary reasons for the state’s funding increase over the years have been the increase in knowledge of the program’s benefits and the number of successful Alaska applicants. Funding amounts by applicant, year and location can be found on the USAC website (USAC, 2018d).

Demand for broadband by schools and libraries is strong when broadband is used in their curriculum (e.g. distance learning), especially in areas where schools and/or libraries have higher quality broadband. USAC has commented that “expenditure category two budget (dollars per student) are constantly under review and are expected to continue to rise as the cost to educate increases” (Hill, 2018).

#### **2.1.6 Health Care & Telemedicine**

Rural hospitals, clinics and wellness centers have also benefitted from USAC funding programs since 1998, and this success has continued to drive demand. The Rural Health Pilot Program (now Healthcare Connect Fund) and the Telecommunications Program brought approximately \$630,000 to the State of Alaska for newly established and or improved connectivity for Internet and telecom services in 1998. By 2011, this number increased to \$48 million, and in 2016 the number increased to \$119 million. Funding amounts by applicant, year and location can be found on the USAC website (USAC, 2018f). There is clear evidence that Alaskans and Alaskan companies benefit from these programs. Telecommunications providers are more likely to approve a business case to provide consumer broadband in locations where they can capture Community Anchor Institutions like schools, libraries and clinics.

Like any federally funded program, this program is subject to political approvals for continued funding.

## **2.2 Existing Middle-Mile Technologies**

As shown in Table 3, the study area, with the exception of Levelock, is currently served by satellite as the middle-mile transport. Although technology advancements over the past several

decades have increased efficiency of satellite-based delivery of Internet services, the underlying cost of capacity or “space segment” on satellite remains high in comparison to terrestrial technologies. However, deployment to isolated geographic regions like the study area is less challenging.

### **2.2.1 Satellite**

As noted, with the exception of Levelock, the study area is served by satellite middle-mile backhaul, and more specifically, geosynchronous Earth orbit (GSO) satellite service. GSO satellites can be located in various north-south fixed orbital locations relative to the equator, whereas satellites known as geostationary (GEO) are located over the equator. Both GSO and GEO satellites orbit the Earth in the same direction as the Earth turns, thus they pretty much stay in the same relative location relative to the surface of the Earth below. GSO and GEO satellites are in high Earth orbit approximately 22,300 miles above the Earth’s surface. Low Earth orbit (LEO) satellites are located from 99 to 1,200 miles above the Earth’s surface and are not stationary relative to the Earth’s surface like GSO and GEO satellites. There are currently no LEO satellites providing service in the study area, and these will be discussed in Section 3.2.2.

The majority of GEO satellites serving the study area are located between 115° and 127° West longitude. The satellites’ antennas are designed at the time of manufacture to maximize signal in specific targeted areas, often focused in areas of highest population density. Alaska has both a large geographical area and a relatively low population density. These satellites contain multiple transponders, each with a unique frequency and defined bandwidth. This bandwidth, in part, defines how much data can be transmitted to and from the satellite. Service providers typically buy or lease entire transponder(s) and provision services on a fraction-of or whole-transponder basis.

#### **2.2.1.1 Impacts of Distance in Data Communications**

In order to acknowledge a single message, a user must send that message to its destination and

then receive the response. In satellite communications systems like this, the message is travelling nearly 90,000 miles round trip. That distance alone accounts for nearly one half of a second -time that can have significant impacts on communications protocols associated with Internet access. That time is defined as latency, and is often described as one-way or round-trip. When analyzing round-trip time (RTT) and the associated impacts on Internet protocols (particularly Transmission Control Protocol or TCP), you find many studies showing the inverse relationship between latency and throughput. Simply stated, as latency increases, throughput decreases.

GSO, high Earth orbit, satellite backhaul for middle-mile is currently the mechanism of choice in the study area. Other options like terrestrial microwave or undersea fiber have significantly higher initial costs to construct, as well as higher maintenance costs over time. Rural terrestrial alternatives without subsidies are often only cost effective in larger communities, and likely will still require operational subsidies or require offsets as part of a larger network or project. Satellite is currently the easiest and least costly to deploy and maintain in the study area, but it is limited in several ways:

- Overall throughput due to the bandwidth constraints of the satellite transponders
- Performance degradation due to the high round trip delay and associated impacts on Internet Protocols
- Twice yearly sun-outages
- Weather related degradation or outages (e.g. snow in the dish or high winds)
- Other less common occurrences such as solar storms or ground-based interference, which can degrade service or cause complete outage

Satellite space-segment or transponder space is quite expensive and the cost each middle-mile provider pays can vary depending upon the amount of space they own or lease and the term or duration of their contract. Depending upon the satellite used, the application and the ground-station technology used, each 1 MHz of satellite transponder space will net different

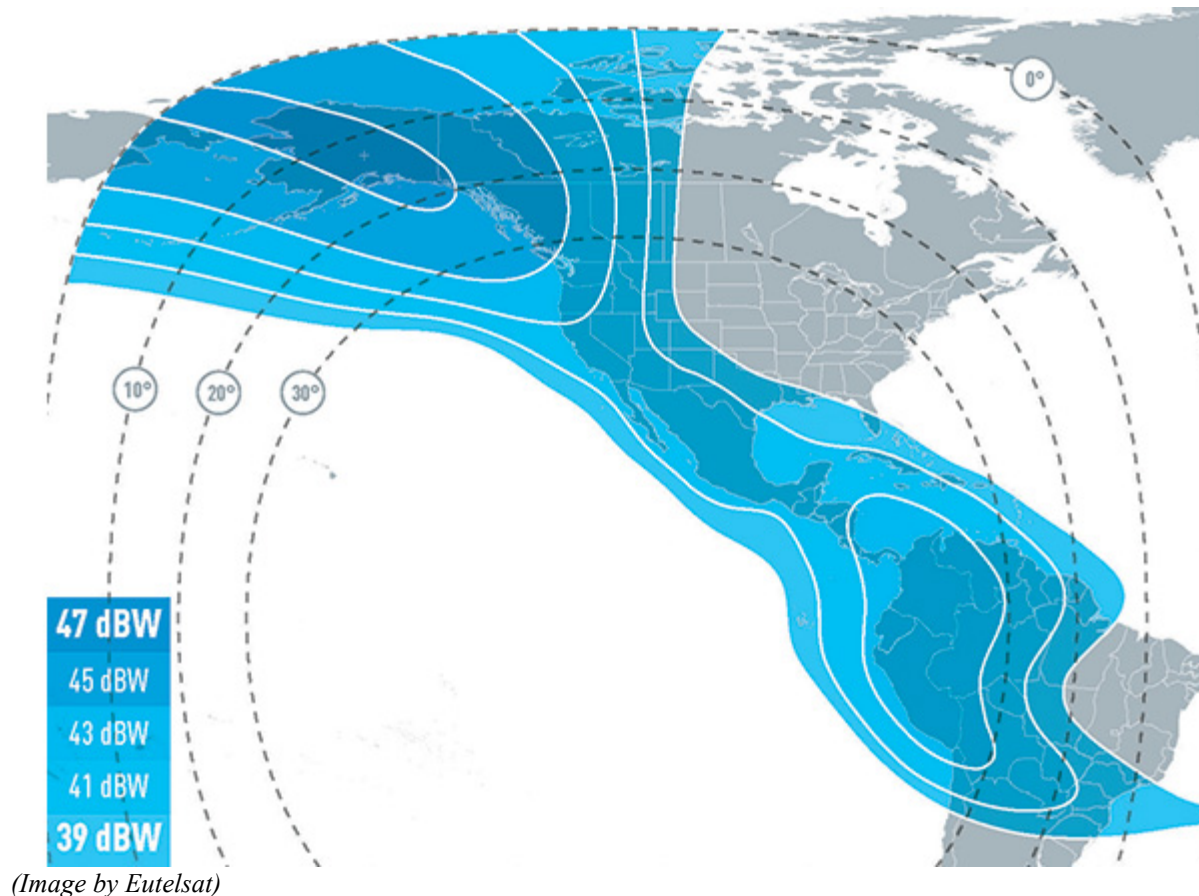
usable Internet bandwidths and thus impact the economics. In Alaska, the cost to deliver a 10x1 service is estimated to range between \$9,000 and \$13,000 per month for transponder space only. This includes none of the operations and maintenance of the village-based satellite Earth-station and equipment or the centralized Earth-station that connects them to terrestrial Internet. One would need to nearly triple those numbers to provide the 25x3 service required to not be designated as “underserved” per the FCC’s definition. The question then becomes “how many subscribers can share that connection and still receive reasonable performance?” In this regard, this report will not discuss the many ways to oversubscribe a middle-mile network since there are far too many variables to consider -one variable being usage patterns, or the way people use the Internet, which is constantly evolving. It will suffice to say that the larger the subscriber base, the higher the opportunity for oversubscription or efficiency (Gaye, 2015).

Alaska Communications (ACS), GCI, TelAlaska and AT&T Alaska all own or lease satellite capacity and provide middle-mile satellite transport for themselves and other business partners in the study area as well as other parts of Alaska.

### 2.2.1.2 Alaska Communications Satellite

In November of 2017, ACS announced it had entered into an agreement with Eutelsat Americas, a subsidiary of Eutelsat Communications, to lease transponder space on one of their newest satellites, 115 West B (ACS, 2017b). With this announcement, ACS became a middle-mile satellite provider for the entire State of Alaska. ACS also announced it will be offering satellite middle-mile backhaul service to the Tanadgusix Corporation (TDX) on St. Paul Island. TDX is the Alaska Native village

Figure 3. C-Band Downlink Coverage for Eutelsat’s 115 West B Satellite that ACS Uses



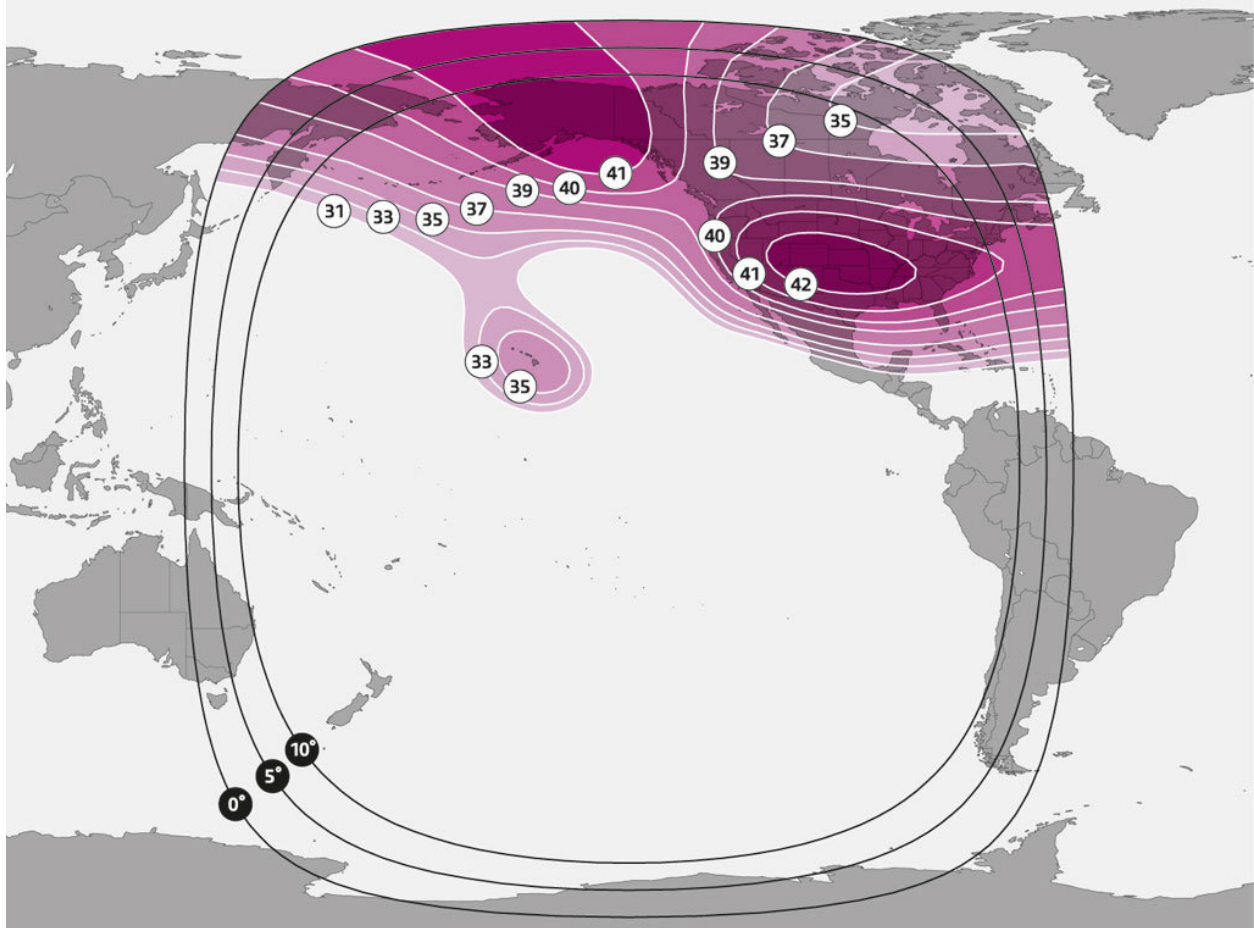
corporation from St. Paul and provides telecom services to the island through its subsidiary, TDXNet LLC. Another TDX subsidiary, Bering Sea Eccotech, replaced St. Paul's coax (last-mile) plant with microfiber in a multi-year FTTH project that finished in 2014 (ISE Magazine, 2016).

ACS will be utilizing Eutelsat's satellite 115 West B for their service offerings. This geostationary satellite was built by Boeing Defense and Space and was launched in January of 2015. It has an expected lifespan of 15 years. This satellite provides coverage in both the Ku-band (12-18 GHz) and C-band (4-8 GHz), but will serve Alaska in the C-band as shown in the coverage map in Figure 3.

### 2.2.1.3 AT&T Alascom Satellite

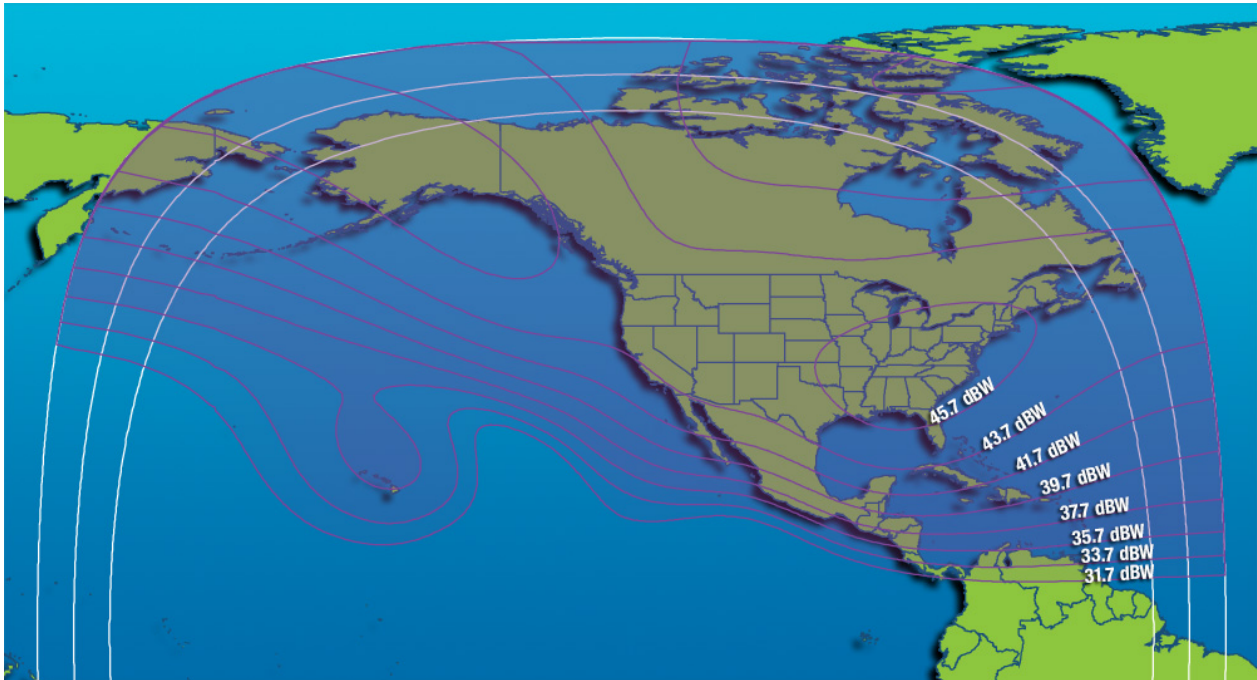
AT&T Alascom provides satellite data services on the Aurora-III portion of AMC-8 satellite. This is a geostationary C-band-only payload with coverage of both Alaska and the continental United States. It is located at 139 degrees west longitude. Manufactured by Lockheed Martin, the satellite was launched in 2000 with a design life of 15 years. This satellite is currently past its design life and will soon be decommissioned. As of July 1, 2017, there were no plans to put another satellite in the same orbit as AMC-8. Although the Luxembourg company, SES, the communications satellite owner and operator of the AMC satellites, operates many satellites with coverage of Alaska, no information was available on the planned replacement of AMC-8.

Figure 4. C-Band Downlink Coverage for SES AMC-8 (Aurora III) 139 West Satellite Used by AT&T Alascom



(Image by SES)

Figure 5. C-Band Downlink Coverage for Intelsat Galaxy 18, 123 West Satellite that GCI Uses



(Image by Intelsat)

#### 2.2.1.4 GCI Satellite

In 2008 GCI transitioned all rural satellite services to Intelsat Galaxy 18 (GCI, 2008). This geosynchronous satellite features twenty-four C-band and twenty-four Ku-band transponders allowing for increased power and flexibility for video and data transmissions. Built by Space Systems/Loral, the Galaxy 18 satellite was the 42<sup>nd</sup> spacecraft added to Space System's fleet and has a design life of 14 years. GCI provides C-band services to the study area on the Galaxy 18 satellite. Examples of service include Unalaska and restoration for GCI's TERRA network.

GCI also uses another Intelsat geostationary satellite, Horizons-1, also known as Galaxy 13. It was built by Boeing and commissioned in 2003 with a life expectancy of 15 years. Galaxy 13 provides Ku-band services for delivery of "shared-carrier Internet." Using shared-carrier technologies like those employed by HughesNet, GCI and others, the provider is able to improve the per-subscriber economics by utilizing the same carrier in multiple communities. It is like

creating a local network in the sky where the system intelligently allocates bandwidth to each subscriber.

As can be seen by the footprint in Figure 6, the Ku-band services do not extend to the western portion of the study area. Relatively large dish sizes of around 2.4 meters are required with Galaxy 13, even on the eastern portion of the study area. Both HughesNet's Generation 2 direct-to-consumer service and GCI use the same Galaxy 13 satellite.

Figure 6. Ku-Band Downlink Coverage for PanAmSat/JSAT Horizons1 (Galaxy 13) 127 West Satellite



(Image by Intelsat)

## 2.2.2 Fiber

Commercial fiber optic network technology has been around since the 1970s and the first trans-Atlantic fiber was laid in 1988. Since that time, fiber technology and its use has grown significantly. Fiber has many benefits as a technology including significant bandwidth, speed (i.e. low latency), reliability and insusceptibility to weather or the sun's position. On the downside, fiber has a high cost of initial installation in rocky, mountainous and marine environments. The fiber signal also needs amplification over long distances. For example both Quintillion and GCI recently constructed fiber from Deadhorse to Fairbanks and placed amplifiers approximately every 60 miles. Quintillion's new subsea fiber from Nome to Prudhoe Bay (see Figure 14) installed amplifiers every 30 km (18.6 miles).

Although there are some communities in the study area such as Adak and St. Paul that utilize fiber for last-mile delivery, Levelock is currently the only community in the study area that uses fiber optic cable for middle-mile backhaul. Levelock is the easternmost community in the study area. As shown by the yellow segments in

GCI's TERRA map (Figure 7), Levelock is the current terminus of GCI's fiber on its TERRA network, and fiber extends east from Levelock to Igiugig, then through Lake Iliamna to the Williamsport Road and across Cook Inlet to Homer. The TERRA network uses microwave network technology beyond Levelock to the west and south, as indicated by the red segments in Figure 7.

Currently, two companies, GCI and Quintillion, are studying the feasibility, costs and risks associated with extending undersea fiber to the study area from their existing fiber networks (see Section 3).

## 2.2.3 Microwave

Currently there is no microwave technology deployed in the study area for middle-mile backhaul. Although hybrid fiber-microwave does exist beyond Levelock (e.g. Dillingham, King Salmon and Naknek), it is part of the existing TERRA network. GCI's TERRA network at Levelock is recognized as a potential connection point for future networks in the study area. Please refer to Section 3.



speeds of 25x3, the systems could be upgraded with moderate capital investment.

ACS of the Northland Inc. does not currently offer DSL Internet service in its service areas and has indicated it would more likely deploy some type of fixed wireless Internet should it decide to offer Internet service.

The highest speed DSL service offered in the study area is from BBTC in Levelock at 6 Mbps down and 1 Mbps up (6x1). As noted earlier, Levelock is located on the GCI TERRA network where fiber backhaul is available, while all other DSL served locations in the study area utilize satellite backhaul for middle-mile connectivity.

The relatively small size of the communities in the study area results in short loop-lengths in the network—that is, the distance from the provider’s central office equipment to the subscriber. Such short loop lengths are beneficial to DSL technologies because, in general, the shorter the loop length, the higher the achieved speeds.

### **2.3.2 Cable Modem**

Cable modem technology was found deployed in one location in the study area. TelAlaska offers consumer cable modem Internet in Unalaska when packaged with its Eyecom television service. TelAlaska also just completed a year-long project to replace older analog equipment with new digital equipment (TelAlaska, 2018).

Cable delivery is popular in urban environments and can deliver voice, video and data services on the same system. In smaller rural communities, cable delivery is usually only found where existing cable infrastructure exists for delivery of cable television. The technology is generally more expensive to install, grow and maintain than fixed wireless or DSL. When no other cable infrastructure exists, new wired infrastructure for voice, video and data services would likely consist of FTTH technology like that installed on Adak and St. Paul.

### **2.3.3 WISP (Wi-Fi)**

Wi-Fi, or “fixed wireless,” is currently the preferred mechanism to deliver consumer broadband in rural Alaska. This is evident from

examining the recent upgrades and new services found in the study area, as well as statements from last-mile providers. Small community size and ease of installation are two factors that make wireless broadband delivery attractive. The nearly ubiquitous application of this technology continues to drive development in increased speeds and lower cost per bandwidth delivered. The majority of locations in the study area (57 percent) were found to be serviced by some form of fixed wireless or combination of fixed wireless and Wi-Fi hotspots.

Fixed wireless requires equipment to be installed in the subscriber’s location and only works within that space, while Wi-Fi hotspots allow subscribers to use a mobile device, tablet or notebook anywhere hotspots are installed. As an example, OptimERA says it has over 1,000 hotspots installed in Unalaska but offers a fixed wireless option as well. The hotspot option is very attractive to transient populations like those found in the fishing industry.

Over the past several years, GCI has upgraded most of what it calls its Legacy WISP (Wireless Internet Service Provider) product in the study area to a next generation Wi-Fi-based fixed wireless platform called Rural Internet. That same Rural Internet platform, once connected to a higher speed and lower cost terrestrial network, converts to Rural Broadband by increasing the speeds offered. False Pass, Nelson Lagoon and Akutan have legacy WISP platforms provided by GCI but no new customers are being added on those systems.

### **2.3.4 Fiber to the Home**

Two providers in the study area have deployed FTTH solutions: TDX in St. Paul and Windy City Broadband in Adak. While last-mile FTTH solutions offer the ability to deliver fast broadband speeds in these communities, bandwidth is still constrained by the high cost of middle-mile satellite connectivity. Even though Adak has one of the most capable last-mile systems in the study area, Windy City Broadband offers one of the lowest maximum downlink speeds at 512Kbps. These two providers are well positioned to deliver urban quality broadband service should their middle-mile economics improve in the future.

### 2.3.5 3G/4G and LTE

Service providers continue to install and/or upgrade cellular networks throughout rural Alaska. While current cellular technology is not being viewed as an alternative for broadband as defined by the FCC, the quality gap between rural and urban cellular service in Alaska is getting smaller. Data performance on rural cellular systems with satellite backhaul is measurably lower than the urban product. This is primarily due, once again, to the lack of bandwidth and satellite latency. Alaska has been seeing more 3G and 4G Long Term Evolution (LTE) deployments rural Alaska. This is, in part, due to the FCC Tribal Mobility Fund (see Section 4), which brought \$49 million to Alaska in 2014 for new and expanded cellular and broadband services. Cellular data is certainly beneficial to rural communities, even if the speeds are far from that of the FCC's minimum broadband standards. For some individuals, cellular is their only connection to the Internet. As speeds and performance improve, 4G LTE may meet the needs of many consumers in rural Alaska. Basic web browsing, e-mail and e-commerce are certainly acceptable on modern cellular networks. Satellite backhaul continues to be a performance limiting factor, however.

When considering LTE service using satellite backhaul, GCI's website (GCI, 2018) states:

*“LTE over Satellite is different from LTE in places like Anchorage or Fairbanks where LTE traffic travels over the fiber network; LTE over Satellite travels over limited satellite backhaul – which means this LTE will be slower than what customers have come to expect in fiber serviced areas, however, LTE over Satellite will be faster than standard 2G network speeds.”*

At the time of this report, there are no known cellular providers in Alaska utilizing high-throughput satellites (HTS) optimized for 4G LTE backhaul. Manufacturers are designing new satellites that are optimized for next generation 5G networks. These new satellites will mesh with terrestrial networks in efforts to make global 5G a reality (ARTES, 2016). Refer to Section 3.3.1 for additional discussion on 5G.

### 2.3.6 Satellite Direct-to-Consumer

There have been a host of direct-to-consumer satellite services available in Alaska for over 15 years, such as Excede and HughesNet. However, the availability of those services in the study area has been reported to be limited to just their commercial product. There are anecdotal reports of HughesNet's commercial product being used in Pilot Point, but no consumer product. Starband Internet was once available as far northwest as St. Paul, but that system was discontinued in 2013.

In March of 2017 HughesNet announced a Generation 5, FCC-compliant product able to deliver 25x3 to the continental U.S and parts of Alaska (Telecompetitor, 2017). Unfortunately, at the time of this publication, the satellite being used for this service does not cover the study area. HughesNet does provide a Generation 2 service that has limited coverage to the eastern portion of the study area near King Salmon that may require a larger antenna for acceptable performance.

ViaSat (Exede) offers comparable services with speeds up to 25 Mbps and has plans to deliver speeds as fast as 100 Mbps once ViaSat 3 is operational in 2019. Unfortunately, neither this service nor the proposed service is available in the study area. For comparative purposes, this service and HughesNet retail between \$50 and \$100/month, have various contractual requirements and require the placement of a satellite antenna at the customer location.

## 3 Future Technology & Infrastructure

### 3.1 Future Demand

As noted in Section 1.2 of this report, future population of the study area is currently anticipated to be flat for the foreseeable future. However, data consumption per capita is anticipated to grow once the technology is available to the region. Such has been the case with the introduction of GCI's TERRA network to communities that were previously only served by satellite middle-mile service.

It has been shown that people will consume any bandwidth that you provide to them. However, in most, if not all, of the rural Alaska communities, two primary factors limit consumption:

- Bandwidth availability—being limited by what the middle-mile provider can afford to provide in a subsidized or non-subsidized environment.
- Price—being what the consumer can afford to expend on a monthly basis. This is often compounded by fees or penalties for exceeding the defined monthly data caps defined in the consumer's data plan.

North American trends for IP traffic are forecasted to continue to grow at a 20 percent annual rate across all types (fixed Internet, managed IP, mobile data) (Cisco, 2017). Available infrastructure is a major factor in that growth.

### 3.2 Future Middle-Mile

This section looks at current initiatives that the author team was aware of at the time of this study.

In the recent past, the Connect Alaska final report from 2015 (Connect Alaska, 2015a) included concepts with associated cost estimates for building middle-mile infrastructure to various regions of Alaska, including the study area. These estimates were completed by Scenarios Network for Alaska and Arctic Planning at the University of Fairbanks.

Connect Alaska's conclusion regarding the Aleutian chain and Pribilof Islands was that the region could be served by undersea fiber or next-generation satellite. As shown in the conceptual network in Figure 9, fiber to Unalaska covered 927 households and 73 businesses and would cost \$72.4 million. Figure 10 shows a fiber spur connection from Unalaska to St. George and St. Paul that would cover 162 households and 10 businesses. This was estimated to cost \$31.4 million (Connect Alaska, 2015a).

Although not explicitly noted in the Connect Alaska report, according to a presentation to the Task Force by one of the members, Mr. Chris Brown, the cost modeling was conservative, and actual costs would vary. Mr. Brown noted that performing route-specific engineering "would cost millions and likely take more than one year" (Connect Alaska, 2018d). A draft document regarding the cost modeling used stated the estimates were "reckoned to be +/- 50% in total" (Connect Alaska, 2012). It is clear from the figures that the segments were conceptual in nature since there appeared to be multiple path issues, including line of sight and optimistic distances over water.

Figure 8. Connect Alaska Report

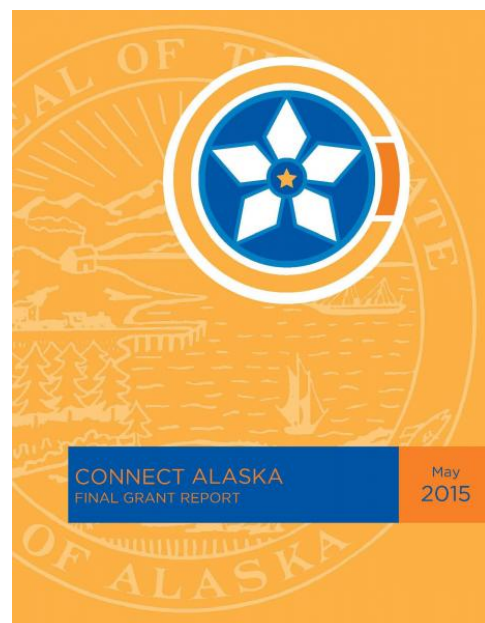
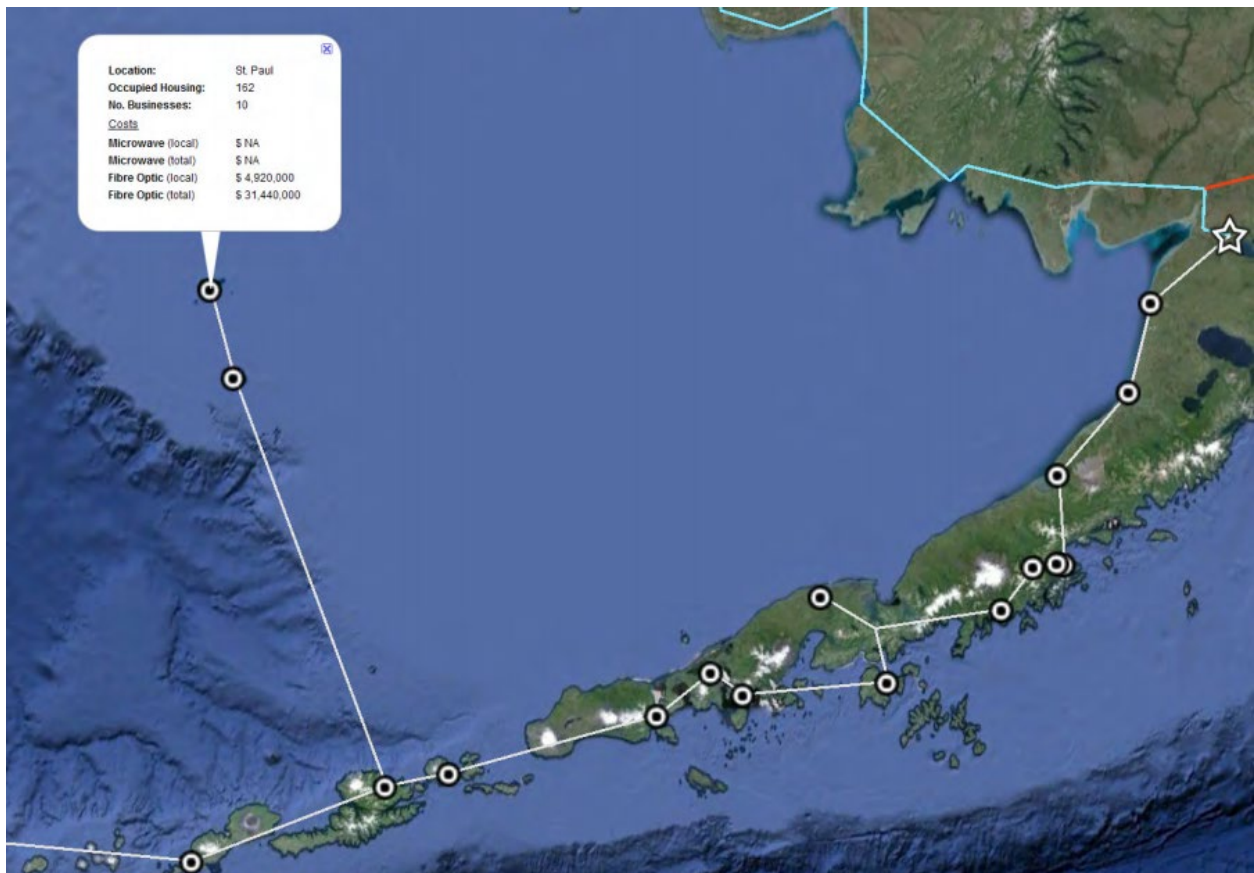


Figure 9. Broadband Infrastructure Cost Model to Unalaska



(Source Connect Alaska Final Grant Report, May 2015)

Figure 10. Broadband Infrastructure Cost Model to St. Paul



(Source Connect Alaska Final Grant Report, May 2015)

### 3.2.1 Subsea Fiber

#### 3.2.1.1 GCI TERRA-Aleutian Fiber Project

##### Northern Route

GCI, is a publically traded corporation based in Anchorage, Alaska. It was announced in April of 2017 that would be acquired by the Colorado-based media conglomerate, Liberty Ventures Group for \$1.12 billion (ADN, 2017b).

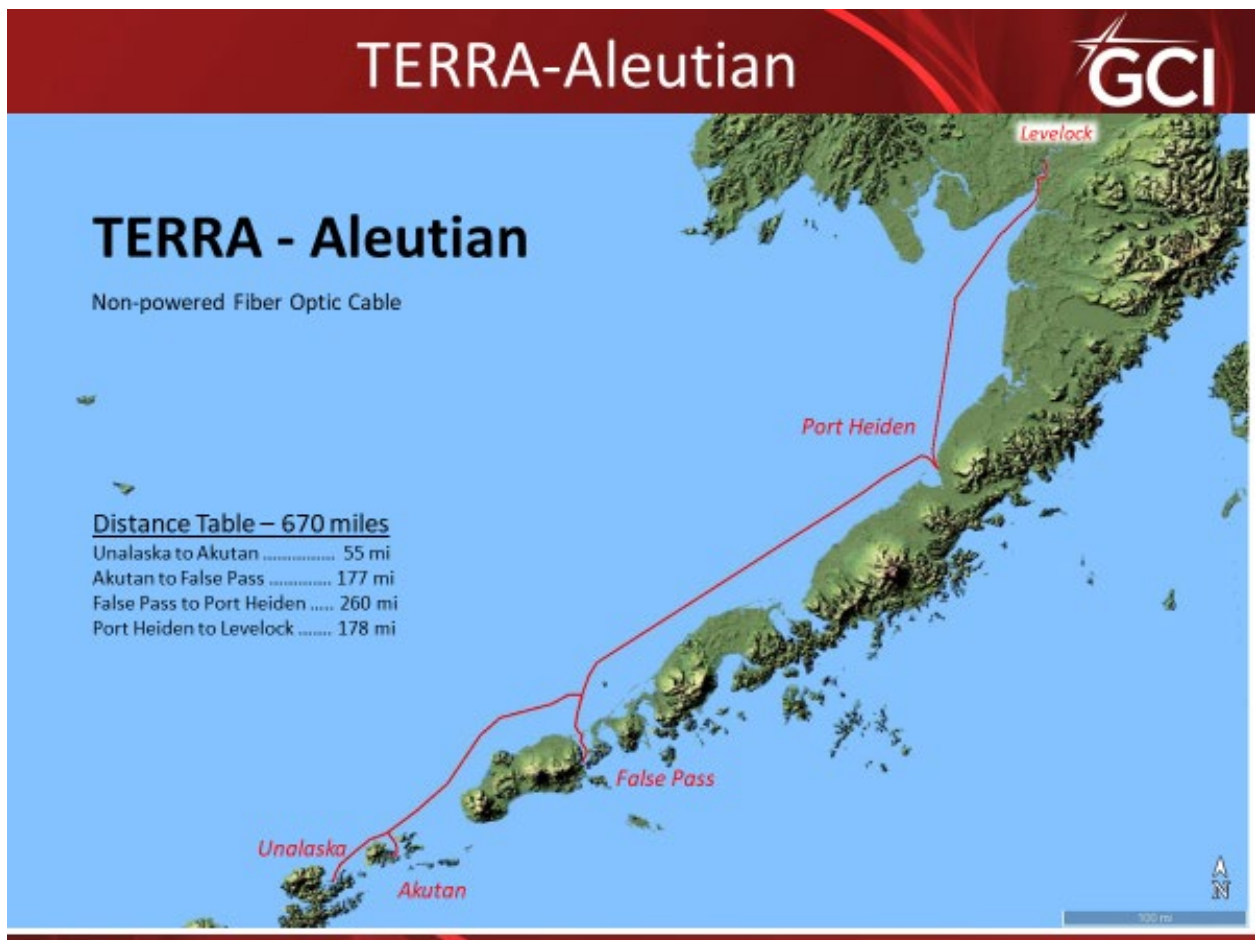
In August of 2016, GCI began seafloor surveys in the study area from Levelock to Unalaska as part of a study to determine the feasibility of building a subsea fiber. The proposed project included landing sites at Port Heiden, False Pass, Akutan and Unalaska, as well as undersea branching units for potential future fiber links (see Figure 11). The project was estimated at around \$40 million and would be completed in the third quarter of 2020 if approved.

A future project could include building subsea fiber eastward from False Pass to Cold Bay, King Cove and Sand Point.

As part of its feasibility planning and business case, GCI has been seeking commitments from local businesses for services. GCI stated that local support would be key in a project like this and support appeared strong with local governments, communities and businesses.

The roughly \$2 million undersea survey was completed and the route was identified. Permitting for the project began and landing station applications were submitted. In addition to the proposed fiber network, GCI's last-mile network in Unalaska was proposed to be upgraded and new fixed wireless networks would be added at Port Heiden, False Pass and Akutan.

Figure 11. TERRA-Aleutians, Conceptual Northern Fiber Route



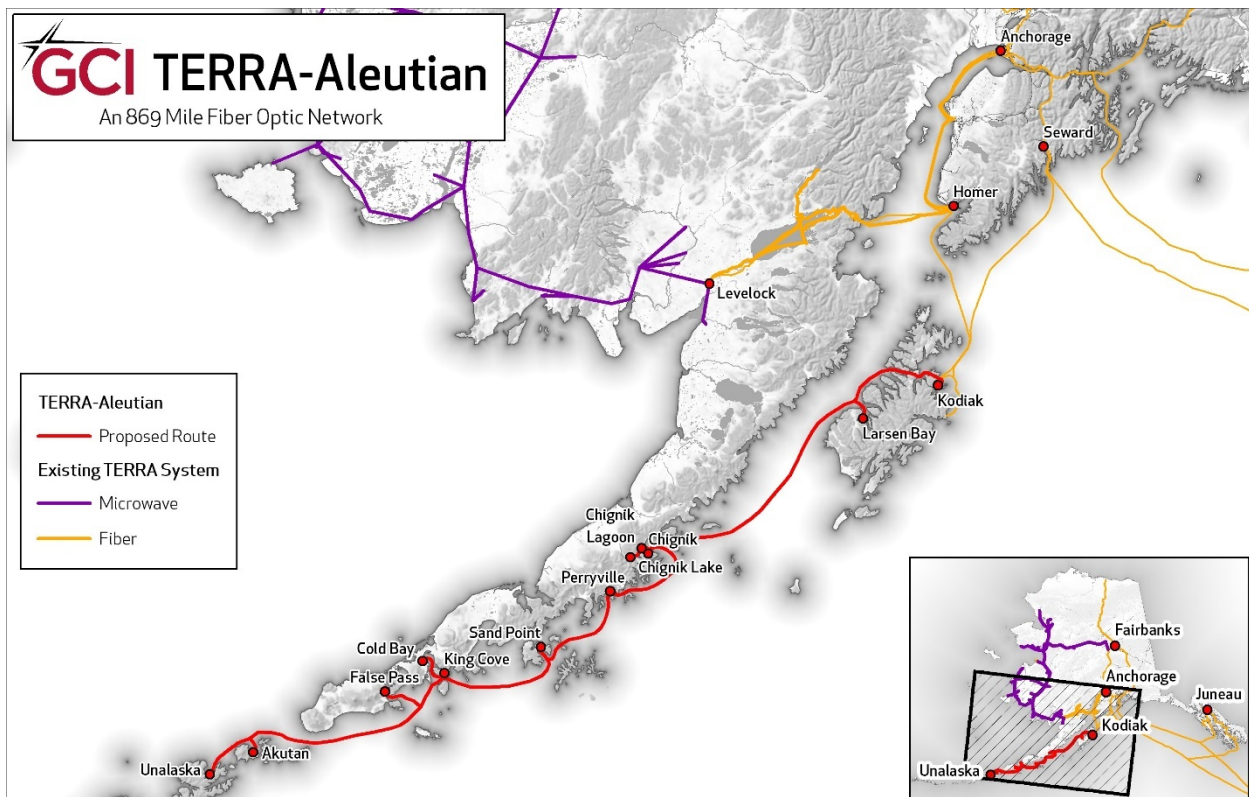
(Image provided by GCI)

### Southern Route

While studying the proposed northern route from Levelock to Unalaska, GCI started investigating an alternate route to Unalaska that originates from Kodiak. This proposed southern route would connect Larsen Bay, Chignik, Chignik Lagoon, Chignik Lake, Perryville, Sand Point, King Cove, Cold Bay, False Pass, Akutan and Unalaska via fiber on the south side of the Alaska Peninsula. This proposed path would connect more communities than the proposed

northern route and would connect to the GCI-owned Kodiak Kenai Fiber Link fiber network in Kodiak. TERRA Aleutian’s Vice President and General Manager, Dan Boyette stated “As we continued looking into the best way to extend broadband to Unalaska, and in addition to the rest of the communities on the Alaska Peninsula and Eastern Aleutians, the southern route began to appear much more positive. Consequently, it is the route that we are primarily focused on at this point” (Boyette, 2018).

Figure 12. TERRA-Aleutians, Conceptual Southern Fiber Route



(Image provided by GCI)

### 3.2.1.2 Quintillion Networks

Quintillion Networks was incorporated in Alaska in 2012, and it was going to be the firm responsible for building the Alaska portion of a larger London-to-Tokyo fiber project proposed by a Canadian (Toronto-based) company called Arctic Fibre. Arctic Fibre’s plan was to lay the first fiber optic cable through the Northwest Passage, which would shorten existing London-to-Tokyo networks by 24 milliseconds, which

would be important for stock traders. In May of 2016, it was announced that Quintillion Subsea Holdings had acquired the assets of Arctic Fibre, and the goals of the London-to-Tokyo project remained unchanged (Woolston, 2016).

Like Arctic Fibre, Quintillion is a privately owned company and not publicly traded. It has been reported by several sources that Cooper Investment Partners, a private investment firm from New York, is the majority investor

(Woolston, 2016; FCC, 2016c; Pierson, 2018). Alaska Native corporations, Arctic Slope Regional Corporation (ASRC) and Calista, have identified themselves as investors (ASRC, 2018; Futaris, 2014; Summers, 2016). Quintillion is different than other providers such as GCI, ACS and AT&T in that they are a wholesaler and do not provide retail products directly to the public. Instead, Quintillion sells bandwidth on its fiber network to other providers who then compete in the same markets.

Quintillion began installing subsea fiber in the summer of 2016 (Summers, 2016; Falsey, 2016) and completed installations in Nome, Kotzebue, Point Hope, Wainwright, and Barrow (now Utqiagvik) that year. In October of 2017, the final 40-mile segment between Utqiagvik and Prudhoe Bay was completed. Prior to the 2017 construction season, Quintillion successfully tested and operated its network from Nome to Utqiagvik without any issues (Woolston K., 2017). In 2017 Quintillion also completed its terrestrial fiber build from Prudhoe Bay to Fairbanks. Quintillion announced service availability of the entire 1,400-mile network on December 1, 2017 (Quintillion, 2017a; Alaska Journal of Commerce, 2017). There has been speculation in the press that the construction-to-date in Alaska (Phase 1) is around \$250 million (Ellis, 2016).

Nome Public Schools switched over to Quintillion's network in the spring of 2018 through a contract with DRS, and claims faster speeds and lower costs (Nome Nugget, 2018). Cost savings under DRS have been reported at \$155,000 per month (KNOM, 2018).

Although Quintillion does not currently have any infrastructure in this report's study area, their new network is applicable to this report because there may be possible future expansions into the study area in their Phase 2. Its website states that "Phase 2 – Asia, is planned to extend the backbone cable from the Nome branching unit west to Asia, with options for additional branches into Alaska" (Quintillion, 2018). According to Quintillion, it has been working on developing the business case for potential Phase 2 landings and exploring additional funding and outside investment options (Woolston, 2017). As of the date of this report, it had not yet made any public announcements regarding Phase 2 plans.

**Figure 13. Alcatel Lucent Cable Laying Vessel Passing Through Unalaska**



*(Source KUCB)*

Figure 14. Quintillion Network Plan



(Source: Quintillion Networks)

### 3.2.2 Satellite Broadband Constellations

The concept of a large number of Low Earth Orbiting (LEO) satellites that are constantly moving (as compared to static GEO or GSO satellites) that deliver broadband services across the globe has been around since the 1990s when Bill Gates helped fund an unsuccessful project called Teledisc. Satellite constellations have been around since the late 1970s, such as GPS, which had 32 satellites in medium Earth orbit in 2016. Google made news in 2013 when it began efforts to explore using high-altitude balloons in the stratosphere to deliver broadband in underserved regions via LTE (“Project Loon”). Although there are currently eight companies working to develop LEO broadband constellations (Satellite Constellation, 2018), two companies, SpaceX and OneWeb, have

received most of the media attention since 2015 when they unveiled their plans.

OneWeb and other LEO satellite constellation providers claim that the much lower geosynchronous orbits of between 99 and 1,250 miles above Earth will provide improved propagation delay (the time it takes for the signal to go from the satellite to Earth and vice-versa) as compared to higher GSO satellites that are around 22,300 miles from Earth. Most people call this propagation delay “latency.” OneWeb’s previous general manager, Scott Sprague, said latency for its LEOs should be less than 50 milliseconds as compared to a geostationary satellite at around 600 milliseconds (Sprague, 2017). Pacific Dataport (see Section 3.2.3) has a white paper on its website (Pacific Dataport, 2018) that states that overall network performance, and not just physical propagation delay, should be

considered when discussing latency. The paper notes that most Internet traffic, including video, is not significantly impacted by latency issues, and it is the cost of the delivered service that is more important to rural consumers than latency.

One intriguing possibility is using constellation satellites as a replacement middle-mile technology for existing service providers. This could allow a local service provider to replace or augment its current middle-mile transport with higher-speed and lower-latency at a lower-price. Consumers could realize reduced prices and increased performance utilizing the same last-mile technology installed today. Some of the savings on middle-mile transport these providers would realize could be redirected into local infrastructure upgrades. As of the time of this report, neither SpaceX, nor OneWeb has publicized pricing models.

### 3.2.2.1 SpaceX

SpaceX, the company known for its popular CEO, Elon Musk, and his trailblazing projects in the aerospace industry, submitted FCC regulatory filings in 2017 to launch just under 12,000 satellites by the mid-2020s (Messier, 2017). Their constellation program is called Starlink and is based in Redmond, Washington. In recommending SpaceX's application for approval, FCC chairman Ajit Pai said, "To bridge America's digital divide, we'll have to use innovative technologies. Satellite technology can help reach Americans who live in rural or hard-to-serve places where fiber optic cables and cell towers do not reach" (Shields, 2018).

SpaceX launched its first two prototypes, named Microsat-2a and 2b (also called Tintin A & B), on February 22, 2018, utilizing their previously launched and recovered first stage rocket. If the prototypes function as planned, SpaceX will begin its five-year launch campaign of 4,425 LEO satellites (Ka and Ku-band) in 2019 (Henry, 2017b). SpaceX is looking to begin providing services with an initial 800 satellites around the 2020–2021 timeframe. The schedule to launch an additional constellation of 7,518 VLEO (very low Earth orbit) satellites operating in the V-band has not been announced.

SpaceX is well positioned in the satellite constellation industry because it develops, owns and launches its own rockets, whereas other constellation companies will rely on third-parties to launch their satellites. There is commentary that SpaceX is pursuing this venture to generate future income to fund its programs associated with building an outpost on Mars.

### 3.2.2.2 OneWeb

OneWeb, formerly called WorldVu, plans to begin launching its initial constellation of 882 LEO satellites (Ka and Ku-band) in 2019. This first round of production is being called generation one, and OneWeb is exploring building an additional 2,000 LEO and MEO (Medium Earth Orbit) satellites for future deployments (Henry, 2017a).

OneWeb has partnered with the European aerospace company, Airbus (whose CEO also sits on the OneWeb board of directors), to mass produce the modular satellites in a new \$85 million factory that is nearing completion near the Kennedy Space Center in Florida (OneWeb, 2017). The goal is to complete three satellites per day once the facility is at full capacity. The initial satellites would be built in France by Airbus while the Florida factory is being built (Airbus, 2017). The 330-pound satellites are described as being about the size of a washing machine. Each of these small satellites will be capable of delivering between 17 and 23 Gigabits per second (Gbps) total for an end-user experience planned at up to 200 Mbps download and up to 50 Mbps upload.

**Figure 15. Initial OneWeb Satellites Being Built in France Prior to Florida Factory Opening**



(Source: Twitter: #OneWeb)

Qualcomm is another major partner, and it will build the chipsets in the user terminals. The terminals are designed to work with Wi-Fi, LTE, 2G and 3G wireless technologies and the terminals can be powered with relatively little power, including power from solar panels.

SoftBank Group from Japan became a major OneWeb partner with a \$1 billion investment. Softbank will purchase 100 percent of the first generation satellite's capacity for 10 years, and will also be responsible for establishing the third-party distribution rights, whose holders will then sell to customers (U. S. Securities and Exchange Commission, 2017, and noted in Pacific Dataport, 2017). There were plans for OneWeb to merge with Intelsat in a \$14 billion deal in 2017, but that deal fell through.

Another OneWeb partner, Hughes Network Systems, announced in March of 2018 that it had begun delivery of the gateway earth stations that will be able to seamlessly hand-off 10,000 user terminals per second as the gateway connects to the different OneWeb satellites in orbit (Hughes, 2018). OneWeb anticipates 55 to 75 earth stations would be deployed globally to support their constellation.

OneWeb's core launch contract is with Arianespace for a minimum of 21 launch orders, which would be done on Russian-made Soyuz

rockets launched from Kazakhstan (Clark, 2015). Each Soyuz rocket will carry between 32 and 36 satellites. OneWeb also has 39 launch contracts with Virgin Galactic (1–3 satellites per launch on their LauncherOne modified Boeing 747) and 6 launches with Blue Origin (Jeff Bezos' aerospace company) using its reusable New Glenn rocket

OneWeb's plans are of particular interest for the study area since the first orbits that will go into service will be over Alaska in 2019. According to Mr. Sprague, the first launch of ten satellites will be in the second quarter of 2018, and OneWeb is targeting service beginning in Alaska by the end of 2019.

On May 25, 2017, ACS announced it had signed a non-exclusive memorandum of understanding (MOU) to become the first OneWeb broadband reseller in Alaska (Alaska Communications, 2017b). OneWeb's MOU with ACS is non-exclusive because OneWeb's model works at a wholesale level and while the company is not planning to sell direct to customers, it will sell to other service providers (like ACS) who will then provide those services direct to customers.

OneWeb, similar to SpaceX, also has a popular entrepreneur involved, Richard Branson, founder of the Virgin Group, who sits on the OneWeb board of directors.

**Figure 16. OneWeb's \$85 Million Satellite Facility under Construction**



(Source: Space News, 8-8-17)

Figure 17. Proposed OneWeb User Terminal



(Source: OneWeb)

### 3.2.3 High Throughput Satellites

Ka-band HTS utilize a high number of small beams designed to target specific areas and have an aggregate capacity measured in several to hundreds of gigabits per second. These satellites, like ViaSat-2 that was launched in mid 2017, are already designed to hit or exceed 300 gigabits per second. Next generation systems planned for launch in 2019 or 2020 are being designed to support a minimum of 1 terabit per second. Industry analysts at Northern Sky Research believe that HTS will supply at least 1.34 Tbps of capacity by 2020 (Bettinger, 2012). This will be a driving power for the global satellite backhaul market, which is expected to triple in value -jumping from 2012 annual revenue of about \$800 million to \$2.3 billion by 2021 (Ruble, 2012).

HTS have applicability in both middle-mile and direct-to-consumer markets. The primary advantages for middle-mile applications are lower cost per megabit, smaller antennas, and higher throughput. These factors will positively impact the business case for establishing new markets or entering existing markets. As the economics improve, the benefit to the consumer is advanced. Higher throughput equals lower cost per megabit, higher number of customers

served, and higher end-user data rates and usage limits.

#### 3.2.3.1 Pacific Dataport Inc. - Aurora IV HTS Satellite

Pacific Dataport Inc. (PDI) was incorporated in June of 2017. It is owned by Sateo Inc. (dba Microcom), which is an Alaska-based firm, incorporated in 1987. The leadership team for PDI includes the long-time owners and operators of Microcom, Sandra Blinstrubas, Chuck Shumann, and Tom Brady.

The Aurora IV HTS is planned to be a next-generation geostationary Ka-band satellite utilizing multiple high-powered spotbeams, whose footprint will cover 99 percent of the State of Alaska, including the study area. The satellite manufacturer selection is slated for early 2018 with a targeted launch and commencement of service in 2020 (Pacific Dataport, 2017).

Having multiple spotbeams on one satellite allows for much higher total data throughput than traditional geostationary satellites servicing Alaska today. The design goal for Aurora IV is a minimum of 20 Gbps. These high data rates for HTS satellites are achieved through a combination of next-generation transponder

technology and cellularization (spot beams) allowing reuse of frequencies on the same satellite. It would be like having multiple traditional satellites in one package, but with smaller, focused beams. These beams would also allow for small user terminals (antennas) on the ground while maintaining a quality service. User terminal stations are anticipated to be around \$350/each (Pacific Dataport, 2017).

Available end-user data rates are planned to meet or exceed the FCC's definition of Broadband Internet Service (25x3) and come with a minimum of 150 Gb. Senior adviser for Pacific Dataport, Mary Ann Pease, spoke at the Juneau Chamber of Commerce on January 25, 2018 and stated the 25 Mbps service goal is anticipated to be priced at less than \$100 per month (McCarthy, 2018).

Two to four gateway Earth stations would be required for operation and connectivity to terrestrial Internet providers. Vendors exist today who are well versed in providing this type of service. As of October 2017, gateway operations vendor(s) had not been chosen.

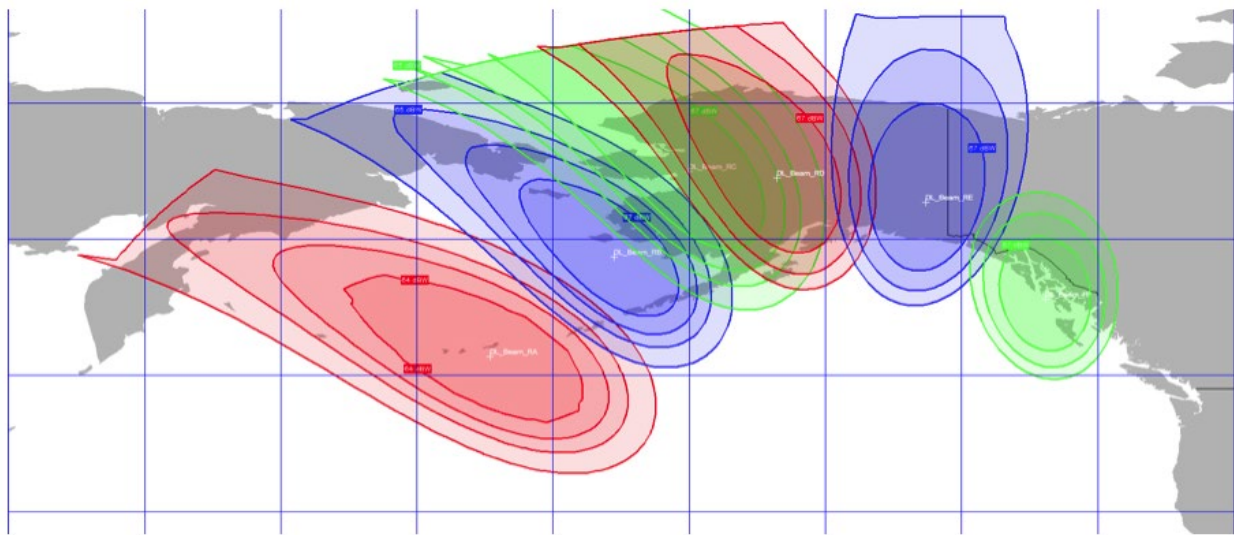
The Aurora IV system deployment is estimated to cost less than \$40 million and would be

financed by a combination of private equity from established U.S. satellite owner/operators, Alaskan investors, prepaid capacity commitments, debt from sources such as Export Credit Agencies, Alaska-based lenders and other sources.

The Aurora IV core business opportunity focuses are:

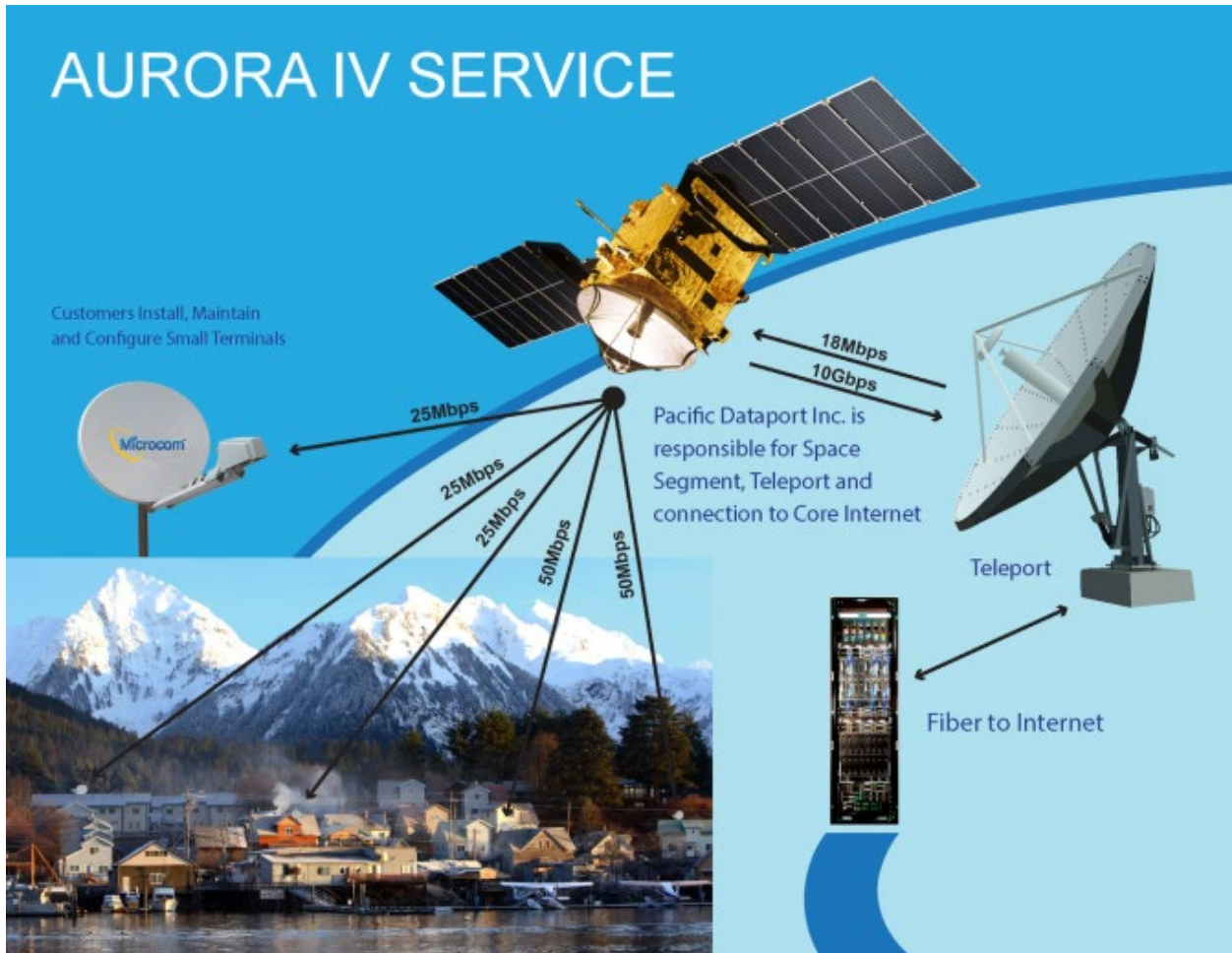
- Gigabit satellite capacity for carrier and Internet service provider (ISP) transport service in Alaska
- Backup and full-time IP data service for businesses, organizations, schools, and government operations. This includes distance learning, telemedicine, training, and internal communications
- Direct-to-home broadband service to consumers in Alaska.

Figure 18. Planned Satellite Footprint for the Aurora IV HTS Ka-Band Satellite,



(Image by Pacific Dataport)

Figure 19. Pacific Dataport's Service Schematic



(Image by Pacific Dataport)

### 3.2.4 DRS

Leonardo DRS (DRS) is a U.S. firm involved internationally in numerous sectors including telecom and military defense. Its parent company, Leonardo, is a publicly-traded, global technology company headquartered in Italy whose focus is aerospace, defense and security. DRS serves its Alaska telecom clients from offices in Anchorage, Fairbanks and Polson, Montana. Within the study area, DRS is the broadband provider for the Aleutians East Borough School District and the Lake & Peninsula School District. It operates and maintains enterprise-grade satellite networks, integrating with third-party satellite providers for middle-mile backhaul for these school districts.

Outside of the study area, DRS provides broadband for the Nome School District that

backhauls on Quintillion Network's new subsea fiber. DRS also has 550 miles of microwave network in the Interior that serves the Tanana Chiefs Conference health clinics and the Yukon-Koyukuk School District. It also provides broadband to the Yukon Flats, Kuspuk and Iditarod School Districts.

DRS did not have any information it could share about future capital investment in the study area.

### 3.2.5 FirstNet

The First Responder Network, or FirstNet, was a result of a recommendation from the 9/11 Commission that there be a dedicated public safety spectrum to support first responders in emergency situations. FirstNet was created in 2012 as part of the Middle Class Tax Relief and Job Creation Act of 2012. Under this program, each state, including Alaska, will be required to

have a Radio Access Network that will connect to the FirstNet core network. States were allowed to opt-in to have the FirstNet contractor design, license, build, operate and maintain the Radio Access Network for them, or opt-out and undertake this effort themselves. If a state were to develop its own network, it would still need to meet the same requirements and schedule.

On January 13, 2016, a Request for Proposal (RFP) solicitation for a public-private partnership (P3) was issued to build and manage the FirstNet system nationwide. In March of 2017 it was announced that AT&T was the successful partner, and the federal government would pay AT&T \$6.5 billion over the next five years and provide it 20 MHz of the 700 MHz spectrum (Band 14). AT&T announced it would spend \$40 billion over the life of the FirstNet contract and estimated 10,000 jobs would be created in the first two years (AT&T, 2017).

The deadline for states to opt-in or opt-out was December 28, 2017, and by this date, all 50 states had opted in. Some states, such as California, voiced last-minute concerns over unviable options for opting out and said at that time the FirstNet plan did “not address all our State’s needs” according to California Governor Brown (Mayberry, 2017). California’s director of the Governor’s Office of Emergency Services outlined several issues they wanted to have addressed in the partnership, including having all FirstNet applications be interoperable across all carriers especially during the multi-year rollout (AT&T said this would be the case, but this was not a FirstNet requirement), security improvements to AT&T’s core network, additional back-up power and redundant backhaul (Mayberry, 2017). As with any P3, such items can be negotiated between the parties, and it will be in AT&T’s best interest to get as many public-safety agencies to subscribe to FirstNet as possible.

Although 100 percent of the states have decided to opt-in, the original legislation allowed for public safety agencies to have the option to subscribe to FirstNet, use an alternate provider or use none at all (Jackson, 2018). Given the intent to avoid an unfunded mandate, this flexibility opened the door to competing networks, and in August of 2017, Verizon

announced it would build its own dedicated LTE first responder network. Verizon said it will make available devices that will provide access to the Band 14 FirstNet spectrum that include first response features (Verizon, 2017). Although Verizon elected not to submit on the California FirstNet RFP, it said it was open to working with FirstNet and AT&T on the interoperability of its first responder network and the AT&T FirstNet network. However, there is ongoing debate regarding connecting multiple providers’ first response networks (Wendelken, 2017; Jackson, 2018).

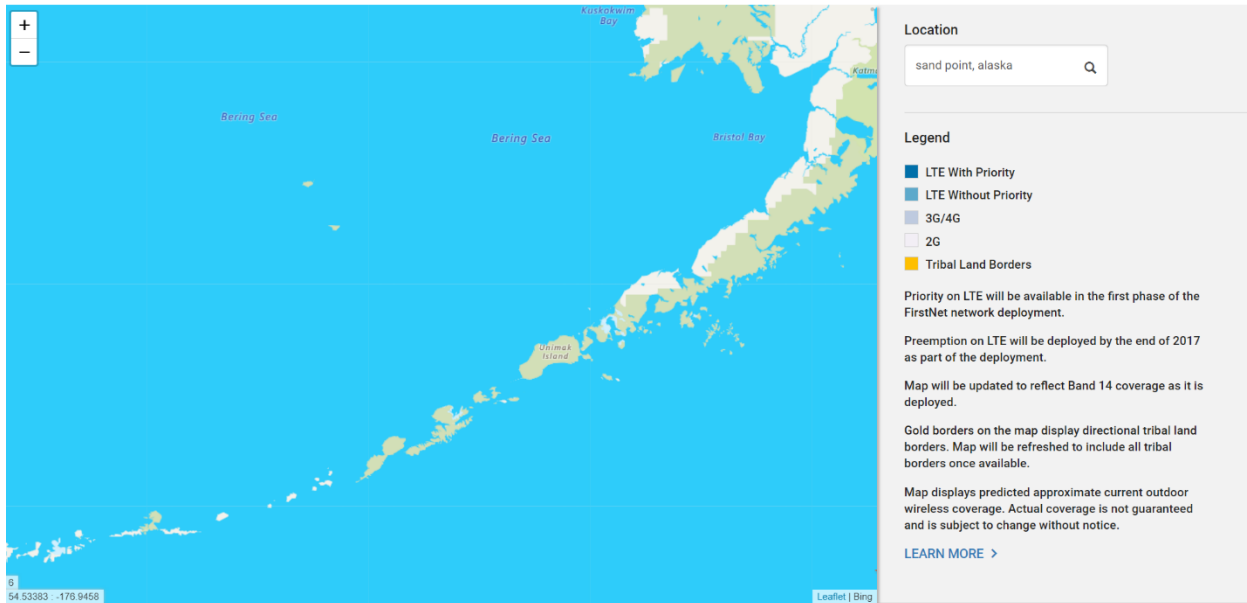
Looking ahead, some future FirstNet target milestones, as set forth in the publicly available FirstNet RFP, but subject to change based on execution dates of Task Orders, include:

- March 30, 2019 – 60 percent of the Band 14 coverage and 50 percent of device connections are to be completed. There are also quality and operability benchmarks for the LTE network
- March 30, 2020 – 80 percent of coverage goals achieved
- March 30, 2021 – 95 percent of coverage goals achieved
- March 30, 2022 – 100 percent coverage goals achieved as well as security, integration and site hardening goals completed
- March 30, 2042 – FirstNet contract expires

Notably, the FirstNet program allows deployable equipment to be used to meet the requirements in rural areas, but it is well known that logistics and weather in the study area can significantly delay such deployables.

Even though \$6.5 billion of public money is being spent on FirstNet, many aspects of the program are considered “proprietary” and unavailable to the public, including the actual terms between FirstNet and AT&T, how much of the FirstNet spectrum will be utilized (Catalano, 2017), and specific plans for new infrastructure. When Meridian asked FirstNet about spending amounts or plans for new infrastructure specific to this report’s study area, we were told this was proprietary information and FirstNet referred us to AT&T.

Figure 20. FirstNet Coverage Map of Study Area.



*Maps Will Be Updated as FirstNet is Deployed – [www.firstnet.com/coverage](http://www.firstnet.com/coverage)*

AT&T’s Director of External Affairs for Alaska, Shawn Uschmann, told Meridian that AT&T does not have any immediate plans for new middle-mile construction as it pertains to the FirstNet network deployment in Alaska (Uschmann, 2017). He noted that AT&T has existing middle-mile infrastructure in Alaska that meets the FirstNet performance requirements, but AT&T is looking at partnering opportunities with other existing service providers for deploying the FirstNet LTE Radio Access Network (RAN) network infrastructure where AT&T does not already have such infrastructure. A hypothetical example would be the partner deploying the RAN equipment and connecting back to the AT&T FirstNet core using existing middle-mile facilities. Mr. Uschmann added that the FirstNet program is a large undertaking that AT&T is diligently working on and they are hoping to beat the milestone dates.

### 3.2.6 OptimERA

OptimERA is an Internet service provider headquartered in Unalaska. OptimERA began providing local Internet service in 2005. OptimERA differs from other fixed wireless providers in that it has chosen to blanket communities with Wi-Fi and sell access to the network on a usage basis. This gives users the flexibility to connect to the Internet outside their

homes. Although OptimERA offers standard fixed wireless service with equipment placed in the home, the majority of customers choose the hotspot product (Fitch, 2018).

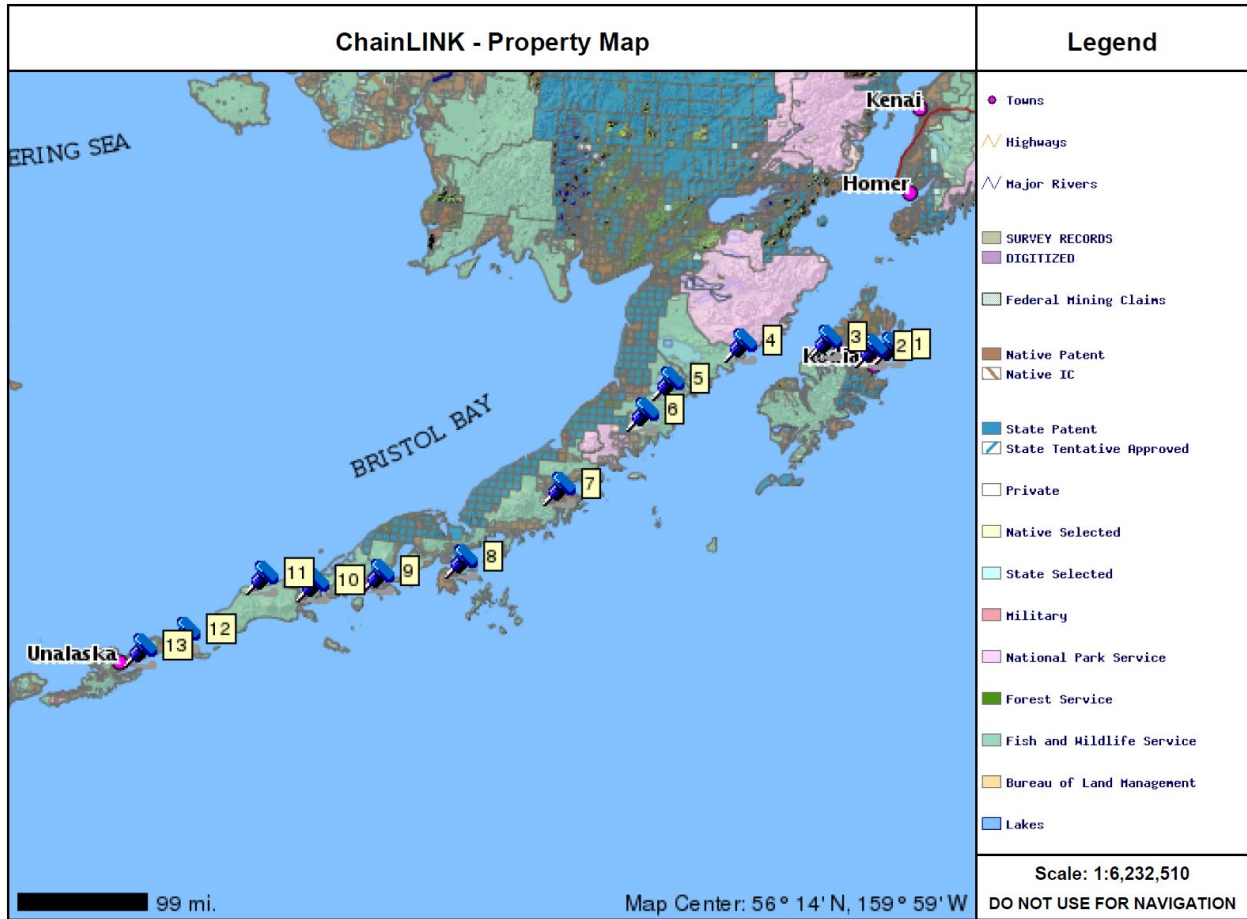
#### 3.2.6.1 OptimERA Wi-Fi

According to Emmet J. Fitch, OptimERA’s Founding Partner and CEO, in 2015 OptimERA began to offer a Wi-Fi data service in Unalaska through a network of 1,000 hotspots (Fitch, 2018). More recently, installations of OptimERA’s hotspot product have been implemented in Akutan and Port Moller, the first of a long list of installations the company plans to undertake. Per Mr. Fitch, this expansion signals the beginning of OptimERA growing out of Unalaska and expanding its product offerings to other areas of Southwest Alaska. Expansion of coverage, providing service from Unalaska to Sand Point, is planned by the end of the summer of 2018.

#### 3.2.6.2 OptimERA ChainLINK (Microwave)

OptimERA has completed a preliminary regional microwave design and says they have received pre-approval from the Department of Fish and Wildlife for a proposed gigabit microwave system connecting communities between Unalaska (#13 in Figure 21) and

Figure 21. Proposed ChainLINK Microwave System



(Image Provided by OptimERA)

Perryville (#7 in Figure 21). The system, which OptimERA calls ChainLINK, would incorporate mountaintop repeaters as well as spur connections to the nearest communities, not unlike what has been successfully implemented on the TERRA network by GCI. First round attempts for capital through Broadband Connect were not successful, but efforts continue according to Mr. Fitch.

Additional sites connecting Perryville northeast to Kodiak would put the proposed system within reach of GCI’s existing KKFL fiber network.

### 3.3 Future Last-Mile Technologies

With the exception of locations that have existing DSL, cable, and FTTH infrastructure in place, wireless last-mile delivery is often seen as the preferred solution. As was shown in Table 4,

both GCI and OptimERA maintain modern Wi-Fi based fixed wireless and Wi-Fi.

#### 3.3.1 5G Fixed Wireless

5G Fixed Wireless Access (FWA) is yet another wireless technology that is currently being demonstrated and heading toward mainstream adoption and deployment. As with any technology, the rate of adoption helps drive the economics for equipment manufacturers and service providers. There are some large-scale 5G FWA deployments planned for 2018 to include five U.S. cities, and there were some highly-publicized marketing trials conducted at the Winter Olympics in Pyeongchang.

This technology retains the key benefit of current fixed wireless deployments in cost and ease of deployment. The chief advantage of 5G is the ability to deliver fiber-like speeds over a wireless network. 5G has the benefit of being able to utilize higher frequency bands than

current 4G networks, which opens up more available spectrum for use. 5G FWA operators will also gain the benefit of established infrastructure when 5G mobile networks start becoming a reality around 2020.

Conversely, 5G FWA services will be able to take advantage of 5G mobile infrastructure should mobile be deployed first. Samsung, Intel, and Ericsson are just a few of the large names working to make 5G FWA a reality. Providers with experience in delivering cellular mobility networks would be the most likely to adopt and deploy 5G FWA.

It is important to note that all last-mile technology performance has a direct relationship to the type and amount of middle-mile bandwidth available to the platform.

### **3.3.2 TV White Space**

TV white space technology, sometimes referred to as “Super Wi-Fi,” is a wireless last-mile technology that is different from Wi-Fi in that TV white space utilizes VHF and UHF frequencies below 700 MHz (as compared to 2.4 GHz for Wi-Fi). These spectrum bands have traditionally been used for broadcast television. The benefits of this television spectrum are that it can propagate long distances and is better at penetrating walls and obstructions as compared to cellular and Wi-Fi spectrum bands. It is claimed that TV white space frequencies can be transmitted up to 10 miles from fixed radio transmitters (Microsoft, 2017). Microsoft has been a big proponent of this technology, especially in rural, underserved areas since there is more TV white space spectrum available in rural areas as compared to urban areas.

Microsoft’s involvement with TV white space began in 2002, and it published its initial research in 2003. It ran test projects in 19 countries that connected more than 185,000 rural residents (Microsoft, 2017). Back in the U.S., Microsoft was working through regulatory issues to promote this technology and the FCC started seeking comments from the public on the possibility of permitting unlicensed devices to operate in these frequency bands in December of 2002. In 2010, the FCC adopted final rules to allow unlicensed radio transmitters to operate in

TV white spaces. The FCC has outlined rules and regulations for TV white space, which is available to the public (FCC, 2012).

Microsoft rolled out its “Rural Airband” initiative on July 10, 2017, including a formal presentation, media kit, and white paper, which are currently available online (Microsoft, 2017). It also announced its latest pilot program to undertake 12 projects in 12 U.S. states in the following 12 months. None of the pilot projects were in Alaska. As part of this Rural Airband initiative, it called on the FCC to make available, without cost, at least three unlicensed UHF channels in every community in the U.S. This did not sit well with the National Association of Broadcasters (2017) and others who have significant existing investments from previous public spectrum auctions.

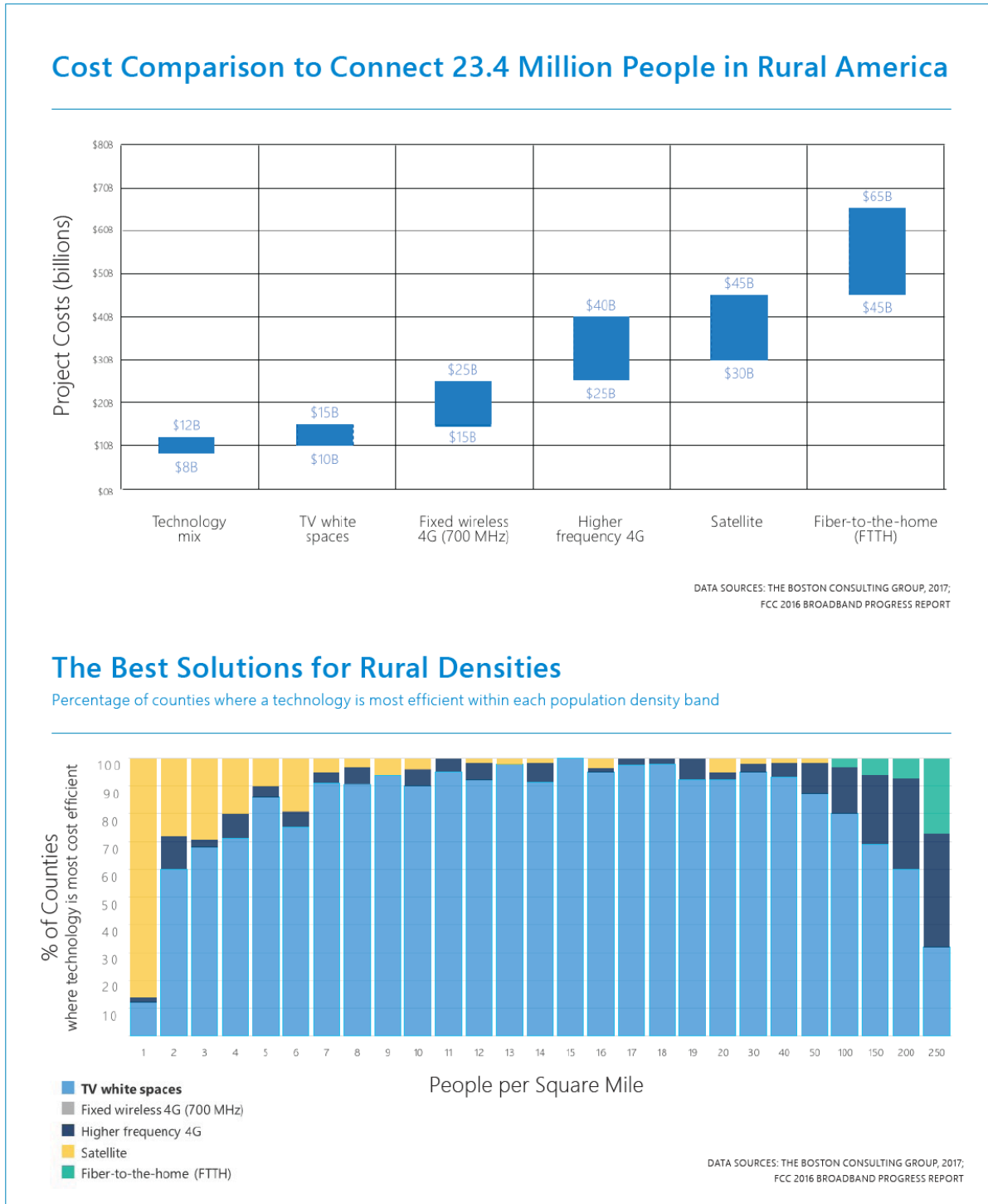
Microsoft claims the U.S. rural broadband gap could be eliminated in five years (by July 2022) by covering 80 percent of underserved areas with TV white space and the remaining 20 percent with satellite. This would account for two-million rural broadband users. Microsoft claimed a TV white space, last-mile deployment would cost 80 percent less than FTTH and 50 percent less than LTE deployment. It was not clear under what circumstances and how this would translate to the study area.

Microsoft commissioned a study by the Boston Consulting Group, whose conclusions were included in a white paper that stated TV white space was the most cost-effective last-mile broadband solution for rural populations with densities between 2 and 200 people per square mile, and satellite was the most efficient delivery for population densities less than 2 people per square mile. For population densities greater than 200 people per square mile, LTE fixed wireless was the most cost-effective. Using these technologies, Boston Consulting Group claimed the national rural broadband gap could be closed for roughly \$10 billion (Microsoft, 2017). Although not an apples-to-apples estimate, the Connect Alaska report estimated it would cost \$1.2 billion to bring broadband to Alaska alone (Connect Alaska, 2015a), although the Connect Alaska report used 100x100 Mbps speeds instead of FCC’s defined minimum broadband standard of 25x3 Mbps.

Although trials have been completed outside the U.S., we found no publication of existing commercially available equipment (end-user hardware). Availability of low-cost equipment is a success factor on how quickly technology is adopted by consumers. When more equipment is

manufactured, typically the per-unit retail price of the equipment comes down due to demand, but if the unit cost is at a relatively high price point, this curtails demand. This creates a “chicken and egg” situation between cost and availability.

Figure 22. Comparison of Rural Last-Mile Costs



(Source: Microsoft/Boston Consulting Group, 2017)

## 4 Funding Programs

A number of federal and state funding programs and mechanisms exist for funding broadband projects. This section discusses current, recent and proposed grant, subsidy, tax credit, and loan guarantee programs, beginning with federal programs, followed by State of Alaska, and “Other.” The section concludes with a discussion of bonds.

### 4.1 Federal Programs

#### 4.1.1 FCC

*Since my first day as Chairman of the FCC, I've said repeatedly that my number one priority is closing the digital divide and bringing the benefits of the Internet age to all Americans.*

*- FCC Chairman Ajit Pai (FCC, 2018c)*

Although the FCC has historically been seen as a regulatory agency, Section 706 of the Telecommunications Act of 1996 gave it authority to help accelerate deployment of “advanced telecommunications capability” in areas where deployment lags. The FCC’s webpage “Bridging the Digital Divide for All Americans” (FCC, 2018c) is a good resource to see current efforts the FCC is undertaking to help close the digital divide.

The FCC is not immune to political shifts in leadership, and thus changing perspectives on implementation strategies on how best to bridge the digital divide. The President of the United States designates one of the five FCC commissioners as Chairman. Commissioners serve a five-year term (each staggered by one year) and are appointed by the President and are confirmed by the U.S. Senate.

##### 4.1.1.1 National Broadband Plan

Although not a funding vehicle, The *National Broadband Plan*, released on March 17, 2010, was a 376-page document that identified multiple broadband initiatives to “stimulate economic growth, spur job creation and boost America’s capabilities in education, health care, homeland security and more” (FCC, 2010b).

The document was a roadmap, but did not in itself give the FCC jurisdiction to carry out the plan or the funding to do so. The plan set a goal to have 100 million U.S. homes have affordable access to at least 100 Mbps download and 50 Mbps upload speeds (100x50) by the year 2020. This was later updated to 25x3 in 2015.

A key document issued by the FCC, called the “Broadband Action Agenda,” outlined 64 actions to implement the recommendations from the National Broadband Plan (FCC, 2010c). This along with the original National Broadband Plan, documents on broadband network cost models, broadband performance, mobile broadband, broadband adoption and use in America, and more can be found at the FCC’s website, [broadband.gov](http://broadband.gov).

##### 4.1.1.2 Tribal Mobility Fund

As part of the 2011 Universal Services Fund (USF)/ Intercarrier Compensation (ICC) – Transformation Order, the FCC created the Tribal Mobility Fund (FCC, 2011). This broad order’s goal was to comprehensively reform and modernize USF/ICC compensation systems to ensure that robust, affordable voice and broadband service, both fixed and mobile, were available to all Americans.

In 2013 the FCC released a public notice and intent to award up to \$50 million in one-time Tribal Mobility Fund (Phase I) subsidies. The subsidies were awarded to companies that agreed to build 3G or 4G mobile broadband networks on underserved Tribal lands. The FCC circulated a list of potentially eligible areas and Tribal lands without mobile broadband service and asked the public to comment on the accuracy of the list (Connected Nation, 2013).

Alaska far outnumbered all other states in the number of potentially eligible locations, with nearly one third of the total underserved area. Of the total \$49,806,874 awarded by the FCC, Alaska received \$41,566,542. Only four other states, out of the 25 states identified as potentially eligible, received any funds. Copper Valley Wireless and GCI were the only two

companies to receive funds under the program. Altogether, 62 unique geographical blocks were identified in Alaska receiving funds ranging from around \$230,000 to over \$4 million (FCC, 2015b).

The FCC adopted a framework in March of 2017 for Mobility Fund Phase II, a decade-long program with \$453 million to be made available annually (Frappier D. and C. Cook, 2017). This is different than the \$340 million total allocated for Tribal Mobility Fund Phase II. It is expected that Alaska will, once again, benefit from these programs, and communications companies will apply for and receive funding that will help expand broadband in rural Alaska.

#### **4.1.1.3 Connect America Fund – Alaska Plan**

Technically part of the USAC High Cost program, the Connect America Fund (CAF) – Alaska Plan, adopted in 2016 by the FCC, is based on a proposal submitted by the Alaska Telephone Association (ATA). This plan will maintain, extend, and upgrade broadband service throughout Alaskan areas served by rate-of-return carriers and their wireless affiliates (FCC, 2016). Participating Alaskan carriers will have the option of receiving fixed amounts of support over the next 10 years to deploy and maintain fixed and mobile networks, facilitating broadband expansion to as many as 111,302 fixed and 133,788 mobile customers by the end of the 10-year period (FCC, 2016; ATA, 2018).

The CAF is capped at \$2 billion nationally. The Alaska Plan dedicates approximately \$150 million dollars annually to support both fixed and wireless broadband services across Alaska. Annual funds of just over \$54 million are allocated to wireline projects distributed among 13 Alaskan communication providers ranging between approximately \$39,000 to \$18.7 million annually. Adak Telephone Utility, Bristol Bay Telephone Cooperative Inc., Interior Telephone Company Inc. (TelAlaska), and ACS are named recipients who operate wireline systems within the study area. Funds of \$73.9 million annually are planned for distribution to nine wireless providers throughout Alaska. GCI, TelAlaska Cellular, ACS Holdings Inc., Windy City Broadband (Adak), and Bristol Bay Cellular

Partnership are all named and are known to operate wireless systems within the study area. Another \$22 million in funding is allocated for unserved area and is to be awarded via reverse auction.

The Alaska Plan aims to improve broadband performance in rural communities by allowing providers to utilize funds for middle-mile, whereas current high-cost support models focus on the local network only.

The plan also defined several middle-mile triggers:

- Performance plan updates in Year 4 for all participants
- Middle-mile network maps for new fiber and/or microwave deployment
- Mandate to offer broadband service and revise performance plan when new middle-mile becomes available
- Retention of documentation of support spent on capital and operations for companies limited to satellite backhaul and biennial review of performance plans by FCC staff

According to a 2016 presentation by the ATA to the RCA, “Over the next 10 years thousands of Alaskans in rural and remote area will have new access to broadband service due to support from the Connect America Fund” (ATA, 2017).

It should be noted that the Alaska Plan was approved by a rare 3-2 vote by FCC commissioners (Anchorage Daily News, 2017a). One of the dissenters was the now current FCC Chairman, Ajit Pai. Mr. Pai issued a four-page written dissent where he claimed \$365 million, or nearly one-quarter of the Alaska Plan, was wasted payments, and those funds should have been directed at construction of new middle-mile infrastructure in rural Alaska (Pai, 2016).

ACS advocated for a new non-profit agency, administered by the State of Alaska, to be created to deploy a municipally-owned middle-mile network, called the Alaska Middle Mile Network. The network would be funded by redirection from other federal programs in the amount of roughly \$65 million per year for 10 years (FCC, 2016a; page 24). The FCC declined

ACS's plan due to potential conflicts with other USAC programs and the significant level of effort to implement.

ACS served customers in non-contiguous areas and did not support ATA's Alaska Plan with respect to mobile carriers. ACS elected to receive \$19.7 million per year for the 10-year plan (through 2025). Their request was approved in October of 2016 (FCC, 2016b).

USAC payments to different service providers under the Alaska Plan can be found at <https://www.usac.org/hc/tools/detail-disbursement-data/default.aspx>

#### **4.1.2 U.S. Department of Agriculture, Rural Utilities Service**

The United States Department of Agriculture (USDA) offers a number of funding programs under its Rural Utilities Service (RUS) Telecommunications Program.

##### **4.1.2.1 USDA Community Connect Grants**

This program helps fund broadband deployment into rural communities where it is not yet economically viable for private sector providers to deliver service (USDA RD, 2018a). It is available to most state and local governments, federally recognized tribes, non-profits and for-profit corporations. Fiscal year applications have typically been accepted until March of each fiscal year (May 14 for FY2018), and awardees must fund a minimum of 15 percent from non-federal sources, which can be applied to capital construction or operating costs. Grant amounts for FY2018 are between \$100,000 and \$3 million. Grant funds may be used for the following purposes:

- The construction, acquisition, or leasing of facilities, spectrum, land or buildings used to deploy broadband service for:
  - All residential and business customers located within the Proposed Funded Service Area
  - All participating critical community facilities (such as public schools, fire stations, and public libraries)

- The cost of providing broadband service free of charge to the critical community facilities for two years
- Less than 10 percent of the grant amount or up to \$150,000 may be used for the improvement, expansion, construction or acquisition of a community center that provides online access to the public

No applicant information is available for FY 2018 at the time of this report, but grants in excess of \$33 million have been awarded to various organizations under the 2016–17 programs. Applicants submitted proposals to aid in the construction of fiber to the premises, wireless broadband, and other broadband connectivity (USDA RD, 2018a).

Between 2002 and 2016, Alaska received a little over \$8.8 million for 11 projects across the state, ranging between \$60,000 and \$2.9 million, covering locations from Ketchikan to the North Slope to St. Paul Island. Projects focused on establishing new or improved broadband service to communities through infrastructure upgrades. In 2012, TDX received \$554,000 to aid in the construction and upgrade of an FTTH system connecting residents and businesses on St. Paul Island.

Other communities including Ruby, Angoon, Kake, Nuiqsut, Anvik, Hughes, Kasaan, Tatitlek, Glacier View, Chickaloon and Point Hope Alaska were beneficiaries of the program from as early as 2002 (USDA RD, 2015).

##### **4.1.2.2 USDA Telecommunications Infrastructure Loans & Loan Guarantees**

This USDA program provides financing for the construction, maintenance, improvement and expansion of telephone service and broadband in rural areas (USDA RD, 2018d). Funds are available to most entities that provide telecommunications in qualified rural areas, including state and local governmental entities, federally recognized tribes, non-profits (including cooperatives, and limited dividend or mutual associations) and for-profit businesses (must be a corporation or limited liability company). Funds may be used to finance broadband capable telecommunications service

improvements, expansions, construction, acquisitions (in certain cases) and refinancing (in certain cases).

Applications are accepted year-round and must be submitted online via USDA's RDAApply website (USDA RD, 2018e).

In Alaska, there are currently six approved loans, with four ranging from \$174,680 to \$88,140,762 (two others approved, but no data). Loan recipients include Copper Valley Wireless, LLC (two communities); Supervision, Inc.; United Utilities, Inc.; Matanuska Telephone Association, Inc.; and Arctic Slope Telephone Associative Co-op, Inc.

#### **4.1.2.3 USDA Farm Bill - Broadband Loans & Loan Guarantees**

The Rural Broadband Access Loan and Loan Guarantee Program (Broadband Loan Program), administered by the RUS, furnishes loans and loan guarantees to provide funds for the costs of construction, improvement, and acquisition of facilities and equipment needed to provide broadband service in eligible rural areas. The current program was included in the 2014 Farm Bill, which will expire on September 30, 2018, and the renewal of the Farm Bill will include consideration of the Broadband Loan Program (USDA, 2018c).

Applications for this program are only received in certain windows of time for each federal fiscal year as announced by RUS and included in the Federal Register. For example, the second window for FY2017 was from July 25 to September 30. For FY2017, RUS had \$115.2 million available, and loans were available from \$100,000 to \$20 million. To be eligible for a broadband loan, an applicant has to be either a non-profit or for-profit organization in the form of a corporation, limited liability company (LLC), cooperative or mutual organization, state or local unit of government, or Indian tribe or Tribal organization. Individuals or partnerships are not eligible.

#### **4.1.2.4 USDA Distance Learning & Telemedicine Grants**

The Distance Learning and Telemedicine (DLT) program helps rural communities connect to each other and to the world, overcoming the effects of remoteness and low population density. For example, this program can link teachers and medical service providers in one area to students and patients in another (USDA RD, 2018b).

Eligible applicants include most entities that provide education or health care through telecommunications, including most state and local governmental entities, federally recognized Tribes, non-profits, for-profit businesses, and consortia of eligible entities.

Grant funds may be used for the following purposes:

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

Similar to the USDA RUS Broadband Loan Program, there are certain windows of time when applications are accepted. Award information on the program website goes back to 2010. The latest awards from FY2017 include distance learning grants to the following Alaska school districts: Northwest Arctic Borough, Alaska Gateway, Lower Yukon and Iditarod. The Alaska Native Tribal Health Consortium was the largest awardee for Alaska with a \$484,632 grant for telemedicine equipment. In FY 2015, Eastern Aleutian Tribes was awarded

a grant for video conferencing equipment and modern CPR mannequins (USDA RD, 2018b).

### 4.1.3 Universal Service Administrative Company

The Universal Service Administrative Company (USAC) is an independent not-for-profit entity that has been designated by the FCC to administer the Universal Service Fund (USF). It is funded from required contributions by telecommunications companies under the Telecommunications Act of 1996. USAC provides almost \$10 billion in annual funding to expand universal service (USAC, 2018a). In accordance with FCC policy, USAC collects and disperses broadband and connectivity funding to fill the gaps in access to achieve universal service. The four USAC programs are E-Rate, Rural Health Care, Lifeline, and High Cost. These will be discussed in the following subsections:

#### 4.1.3.1 Schools and Libraries (E-Rate) Program

First adopted in 1998, the E-Rate program provides discounts (subsidies) for telecommunications and Internet services through the USF mechanism to eligible schools and libraries, which must meet specific statutory definitions (USAC, 2018b).

The E-Rate program funds five service types in two categories (FCC, 2018b):

- Category 1 - Data transmission services and/or Internet access
- Category 1 - Voice services (FY2018 is the last year for voice services)
- Category 2 - Managed internal broadband services
- Category 2 - Basic maintenance of internal connections
- Category 2 – Internal connections

Discounts were updated in the 2014 Modernization Orders (discussed in the next section) and are calculated based on the school district’s student population that participates in the National School Lunch Program (free or reduced lunch), and whether the school district is considered urban or rural. All areas in the study area are considered rural (USAC, 2018j). The matrix in Figure 23 is used to determine the discount level, ranging from 20 to 90 percent of the costs of eligible services.

Eligible schools, school districts, and libraries may apply individually or as part of a consortium. Demand aggregation under a consortium model may facilitate negotiation for lower prices. The school or library must also provide additional onsite resources such as end-user equipment (computers, telephones, etc.), software, professional development, electrical

Figure 23. E-Rate Discount Matrix

INCOME Measured by % of students eligible for the National School Lunch Program (NSLP)	CATEGORY ONE (C1)		CATEGORY TWO (C2)	
	URBAN Discount	RURAL Discount	URBAN Discount	RURAL Discount
Less than 1%	20%	25%	20%	25%
1% to 19%	40%	50%	40%	50%
20% to 34%	50%	60%	50%	60%
35% to 49%	60%	70%	60%	70%
50% to 74%	80%	80%	80%	80%
75% to 100%	90%	90%	85%	85%

(Source: USAC, 2018k)

power, and any other required elements to access the provided connectivity (USAC, 2018c).

*Examples of E-Rate subsidies from the study area from FY2017 for data transmission and/or Internet access include: Aleutians East Borough School District received \$639,360; the Aleutian Region School District (Adak, Atka and Nikolski) received \$939,600; and the Pribilof School District Consortium received \$302,400 (USAC, 2018d). Table 6 shows the total USF funding commitment for Alaska by year and the representative percentage of total national funding. As can be seen, Alaska's share of the national available funding has been growing incrementally over time.*

*The E-Rate program has grown in popularity since its inception. It has also created a demand for consultants, IT managers, regulators, and other individuals who can navigate the government processes and strict deadlines. Within the larger Alaska telecommunications companies, there are individuals who specialize in the USAC programs (e.g. E-Rate) to help their companies profit from these programs.*

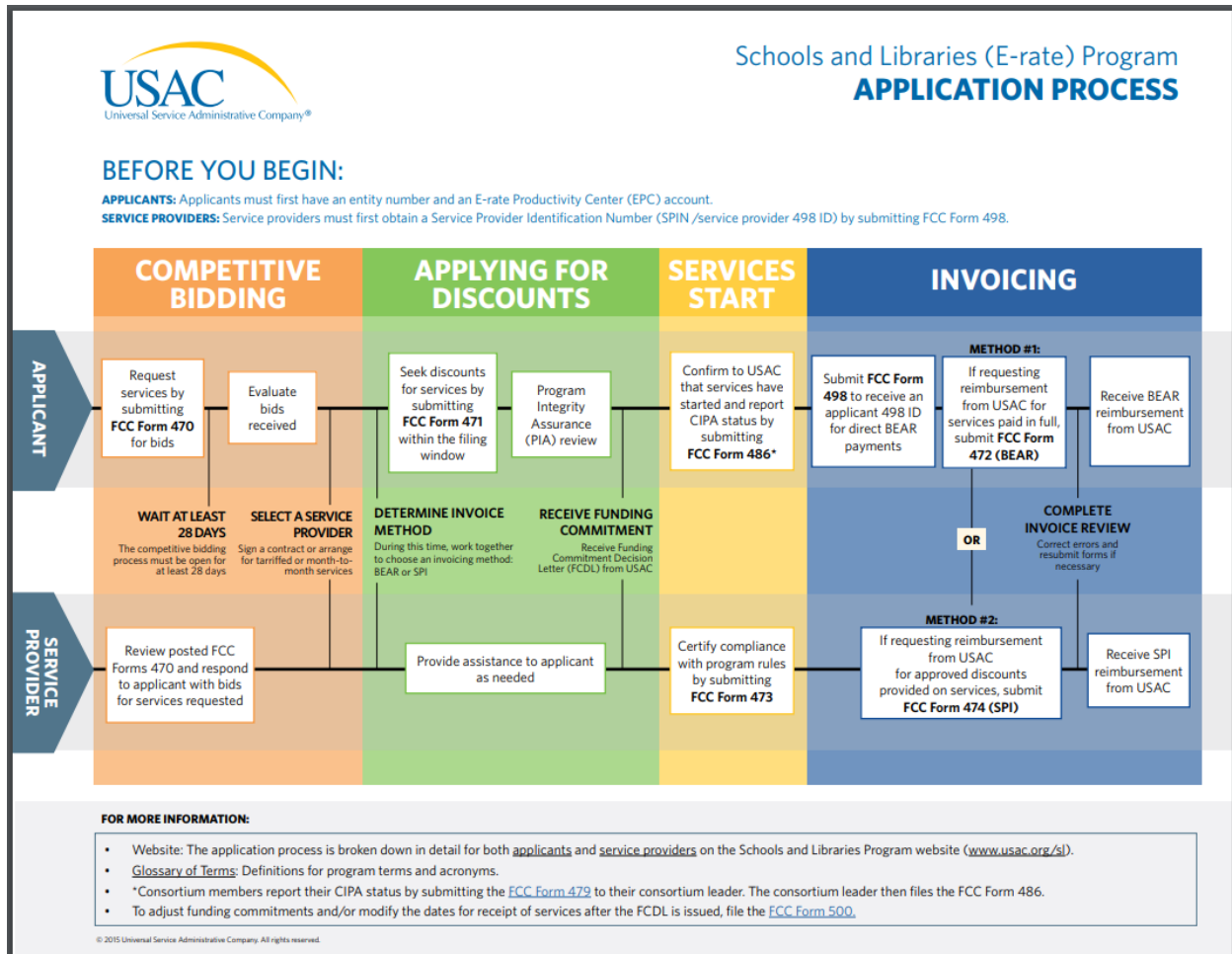
Figure 24 illustrates the complexity of just the application and invoicing process of the E-Rate program from the applicant's perspective. This USAC figure was from 2015.

**Table 6. USAC E-Rate Funding Commitments for Alaska by Year**

Funding Year	State Total	National Total	% Nat. Total
2017	\$95,135,280.04	\$2,156,398,969.60	4.4%
2016	\$86,045,969.55	\$2,862,998,427.25	3.0%
2015	\$86,212,722.13	\$3,228,448,333.28	2.7%
2014	\$63,835,491.17	\$2,344,830,347.87	2.7%
2013	\$59,746,881.83	\$2,198,854,669.96	2.7%
2012	\$49,966,106.69	\$2,952,067,926.16	1.7%
2011	\$42,999,416.07	\$2,669,211,963.56	1.6%
2010	\$31,852,269.78	\$3,000,617,109.06	1.1%
2009	\$27,027,496.94	\$2,807,350,047.85	1.0%
2008	\$26,010,030.28	\$2,373,965,286.76	1.1%
2007	\$21,875,513.86	\$2,355,062,407.49	0.9%
2006	\$18,435,922.67	\$1,948,187,627.47	0.9%
2005	\$18,528,051.88	\$2,006,881,221.66	0.9%
2004	\$19,938,689.42	\$2,033,589,021.42	1.0%
2003	\$15,848,419.74	\$2,518,418,354.86	0.6%
2002	\$14,291,919.30	\$2,114,180,609.78	0.7%
2001	\$11,156,493.86	\$2,169,324,133.76	0.5%
2000	\$12,607,698.57	\$2,078,025,558.79	0.6%
1999	\$12,358,924.38	\$2,145,649,871.00	0.6%
1998	\$13,577,805.81	\$1,699,085,515.30	0.8%

*(Source: E-Ratecentral.com: State Funding Commitment Overview -Alaska)*

Figure 24. E-Rate Application Process



(Source: USAC)

#### 4.1.3.2 2014 E-Rate Modernization Order

USAC’s E-Rate program was updated by two modernization orders in 2014. The first order was adopted by the FCC on July 11, 2014, followed by a second order on December 11, 2014. Summaries of each of these orders can be found on the FCC website (FCC, 2014b; 2014c).

There were several significant changes in these modernization orders:

- Increased the annual spending cap for the E-Rate program from \$2.4 billion to \$3.9 billion on top of the previously approved \$1 billion/year, bringing spending up to \$4.9 billion (Connect Alaska, 2015b).

- Expanded funding for internal, Category 2, Wi-Fi networks by \$1 billion. According to Education Week, applications for discounts for internal Wi-Fi equipment and services increased 92 percent after the modernization orders (Education Week, 2015).
- Phased out discounts for the Category 1 “voice services” line item. This included local and long distance wired telephone services, satellite telephone, interconnected VOIP (able to receive calls that originate from public switched telephone networks) and cell phone services. Discounts were phased out by 20 percent each year and would be discontinued at the end of FY18. Schools will now need to pay for these services with their own budgets.

- Improved the application process. It should be noted in hindsight that USAC came under sharp criticism in May 2017 when Chairman Pai brought to light that the new \$19 million E-Rate Productivity Center, which was supposed to streamline applications, was over budget by \$30 million and growing. The USAC CEO at that time resigned several weeks later (Lestch, 2017).
- Required that all recipients of its high-cost program, the Connect America Fund (CAF), respond to E-Rate applicants' request for high-speed broadband services and in those responses offer service at rates, terms, and conditions that are "reasonably" comparable to offerings in Community Anchor Institutions in urban areas through a competitive bid process (Connect Alaska, 2015b).
- Updated the definition of "urban cluster" when designating a school district as either urban or rural. The new definition shifted dollars from more affluent urban areas to rural lower income areas. Under the original definition, rural Alaska communities such as Kodiak, Nome, and Bethel were considered "urban" (Connect Alaska, 2015b).
- Included "special fiber construction" provisions that allowed rural schools and libraries or service providers to access E-Rate funds for constructing fiber networks when this is the most cost-effective option. The modernization order also allowed for leasing lit fiber (being operated by a provider) or dark fiber (fiber in place but not being operated). State funding could be included in the construction, and the order clarified how this would affect E-Rate funding. This provision began in FY2016.

### **Using E-Rate Funds for Construction of Middle-Mile Networks**

As noted above, the 2014 Modernization Orders included provisions for "special fiber construction" and opportunities for state funding to be incorporated into building middle-mile fiber networks for schools and libraries. More specifically, in the second order (December 2014), USAC defined "special fiber construction" as a Category 1 cost under "self-provisioned networks" and included costs for design & engineering, construction and project management.

It must be shown that self-provisioning is the most cost-effective option through competitive bidding, including life-cycle costs. Applicants issue RFPs and post their FCC Form 470 to solicit broadband services, which typically include construction as well as alternatives such as lit and dark fiber. A variety of speeds and corresponding rates are typically included in the solicitation. There are consultants and online resources to assist schools and libraries in completing their RFPs and Form 470s (Education Superhighway, 2018a; E-Rate Central, 2018).

Under the special construction program, USAC will only fund the deployment of those fibers lit (i.e. made operable) in the designated fiscal year. Typically, when a fiber network is constructed, additional fibers are installed for future use, or for leasing by others (dark fiber). The material cost of the fiber is often a relatively minor component of the overall project, which includes design, management, labor, trenching equipment, etc. There needs to be close attention paid, and detailed documentation developed, when additional strands of fiber are installed, and allocate those incremental costs only to those fibers to be lit under the program (Education Superhighway, 2018b).

The special construction program has had reported challenges with applications receiving slow reviews, being denied, and being heavily scrutinized by the FCC (SHLB, 2018; Education Week, 2017). The timing of receiving funding and when the funding runs out (i.e. June 30) has also been an issue, which is very relevant for

Figure 25. E-Rate Special Fiber Construction Funding Scenarios

Total Cost of Broadband Construction Project (Eligible)	Applicant E-rate Program Initial Discount Rate	Applicant Initial E-rate Program Discount	State Funding % of Total Special Construction Cost	State Funds Available for Special Construction	Additional Special Construction Program E-rate Match%	Additional E-rate Match Discounts Special Construction	Total E-rate Program Discount with Matching	Total E-rate Discount	Applicant Effective Project Discount Rate	Applicant's Share of Costs	Applicant's Share %
\$ 250,000	40%	\$ 100,000	20%	\$50,000	10%	\$25,000	50%	\$125,000	70%	\$75,000	30%
\$500,000	60%	\$300,000	7%	\$35,000	7%	\$35,000	67%	\$335,000	74%	\$130,000	26%
\$1,000,000	80%	\$800,000	15%	\$150,000	5%	\$50,000	85%	\$850,000	100%	\$0	0%
\$50,000	20%	\$10,000	15%	\$7,500	10%	\$5,000	30%	\$15,000	45%	\$27,500	55%
\$800,000	90%	\$720,000	10%	\$80,000	0%	\$0	90%	\$720,000	100%	\$0	0%
\$3,250,000	80%	\$2,600,000	15%	\$487,500	5%	\$162,500	85%	\$2,762,500	100%	\$0	0%
\$1,500,000	50%	\$750,000	50%	\$750,000	0%	\$0	50%	\$750,000	100%	\$0	0%
\$9,000,000	80%	\$7,200,000	10%	\$900,000	10%	\$900,000	90%	\$8,100,000	100%	\$0	0%
\$100,000	20%	\$20,000	5%	\$5,000	5%	\$5,000	25%	\$25,000	30%	\$70,000	70%
\$100,000	40%	\$40,000	10%	\$10,000	10%	\$10,000	50%	\$50,000	60%	\$40,000	40%
\$100,000	50%	\$50,000	15%	\$15,000	10%	\$10,000	60%	\$60,000	75%	\$25,000	25%
\$100,000	60%	\$60,000	20%	\$20,000	10%	\$10,000	70%	\$70,000	90%	\$10,000	10%
\$100,000	80%	\$80,000	2%	\$2,000	2%	\$2,000	82%	\$82,000	84%	\$15,000	16%
\$100,000	90%	\$90,000	4%	\$4,000	4%	\$4,000	94%	\$94,000	98%	\$2,000	2%
\$100,000	20%	\$20,000	0%	\$0	0%	\$0	20%	\$20,000	20%	\$80,000	80%

(Source SETDA, 2015)

Alaska, given short construction seasons and time-consuming logistics to roadless regions. The FCC allows for a one-year extension on delivering service when there are “unforeseen” issues (SHLB, 2018; FCC, 2018e – Question #3).

How much an applicant can be reimbursed under these provisions depends on the E-Rate discount and how much state funds can be applied, since E-Rate will match state dollars up to 10 percent. Under this scenario, it could be possible for the applicant to not pay anything if their E-Rate is 80 percent, the state contributes 10 percent and the E-Rate program matches that 10 percent. Unfortunately, as of the date of this study, Alaska is not listed on the FCC’s website as a state with eligible matching funding (USAC, 2018m). If Alaska had matching funds, special construction funding examples are shown in Figure 25 (SETDA, 2015).

**4.1.3.3 Rural Health Care Program**

The Rural Health Care program supports health care facilities in bringing modern medical care to rural areas through increased connectivity (USAC, 2018e). It provides up to \$400 million annually in reduced rates (discounts) for broadband and telecom services. There are two subprograms in the program: the Health Care Connect Fund program, and the Telecommunications (Telecom) Program. The Health Care Connect Fund provides a 65 percent discount on broadband expenses and network equipment. The Telecom Program provides a

discount based on urban-rural telecom price differences for the target area.

Amounts paid under this program can be found online. For example, the Iliuliuk Family & Health Services in Unalaska was awarded \$1.15 million for services provided by Alaska Communications in 2017 (USAC, 2018f).

**4.1.3.4 Lifeline**

The Lifeline program provides a service subsidy (discount) to qualifying families for voice or broadband (USAC, 2018g). Eligibility is based on income (135 percent or less of federal poverty guidelines) or participation in Supplemental Nutrition Assistance program, Medicaid, Supplemental Security Income, Federal Public Housing Assistance, Veterans Pension & Survivors Benefit, and Tribal programs (for those living on federally-recognized Tribal lands, including Alaska Native regions). There is a limit of one discount per household, which can be used for either phone or Internet, but not both.

Service providers can join the Lifeline program through designation as an Eligible Telecommunications Carrier (ETC) by their state regulatory commission or, in some cases, the FCC (USAC, 2018h). Upon receiving authorization, ETCs must meet all Lifeline program requirements. Providers that offer only broadband (no voice service) can receive Lifeline Broadband Designation, a type of ETC. This process is currently undergoing revision. In states that do not designate Lifeline ETCs, carriers must apply directly to the FCC for

designation. This also applies to carriers serving Tribal residents on Tribal lands. Tribally-owned service providers that are exempt from state regulatory jurisdiction can apply directly to the FCC for designation as an ETC.

#### **4.1.3.5 High Cost Program – Connect America Fund**

The High Cost program’s mission is to ensure that voice and broadband services (fixed and mobile) are available nationwide at a reasonable cost, especially in areas that are remote, geographically challenging, or sparsely populated (USAC, 2018i). Service providers operating in remote and underserved communities receive subsidies to charge below-market rates in rural areas and must be designated as ETCs to qualify for reimbursement under this \$4 billion program. The High Cost program is the largest and most complex of the four USAC programs.

The High Cost program is better known as the Connect America Fund (CAF), Phase I and Phase II (e.g. CAF-II). CAF was developed from the National Broadband Plan in 2011 and a Phase I rollout of funding began in 2012. In 2014, Phase II began and was much more substantial in funding than Phase I. CAF also includes the Mobility Fund to support providers who expand wireless services into underserved areas.

As noted in Section 4.1.1.3, the Alaska Plan is part of the High Cost program (CAF-II), where wireline and wireless providers will receive fixed funding from the USF for a 10-year period. Alaska Communications also receives fixed funding for a 10-year term under CAF-II, but its plan differs slightly from the model-based Alaska Plan.

#### **4.1.4 Other Federal Programs**

##### **4.1.4.1 White House Infrastructure Plan 2018**

On February 12, 2018, the White House officially released a 55-page proposal for U.S. infrastructure (The White House, 2018). The proposal would need to be drafted into spending legislation by Congress for approval. The

following text summarizes parts relevant to this study.

- The plan contains a framework for lawmakers to craft legislation for \$1.5 trillion in various infrastructure projects with a focus on P3s (Shelbourne, 2018).
- Only \$200 billion would be provided by the federal government over ten years (\$20 billion/year) and the large majority of funds would come from local and state governments and/or private investment.
- Part 1, Section II of the outline specifically calls out \$50 billion in spending for a “Rural Infrastructure Program,” but rural broadband is not funded specifically, but listed amongst other eligible projects such as transportation, water and waste, power and electric, and water resources. 80 percent of the funds would be provided to the governor of each state via a formula distribution. Governors would have discretion to choose individual investments to respond to the unique needs of their states. Funds would be distributed as block grants to be used for infrastructure projects in rural areas with populations of less than 50,000.
- The “rural formula” would be calculated on rural road miles and rural population. It is expected that the Alaska delegation will recommend changes to the formula, much like what was proposed and adopted under E-Rate Modernization, so as not to penalize Alaska’s rural communities due to the lack of connecting roadways.
- An additional \$20 billion is proposed in Part 1, Section III, for the “Transformative Projects Program.” This program calls for the establishment of a program to advance transformative projects, which again, broadband is included in a list of other types of infrastructure, with the purpose of:
  - Significantly improving performance, from the perspective

- of availability, safety, reliability, frequency, and service speed
  - Substantially reducing user costs for services
  - Introducing new types of services
  - Improving services based on other related metrics
- Section IV, “Infrastructure Financing Programs,” makes \$14 billion in funds available to expand existing credit programs to address a broader range of infrastructure needs giving states and local governments increased opportunity to finance large-scale projects. One named program relevant to this study is the USDA RUS lending program, which would remain available until the end of FY 2028.
- Another part of Section IV proposes to list rural broadband projects as eligible to participate in what are known as Private Activity Bonds. This would allow private companies access to tax-exempt interest rates like municipal bonds. The broadband project would still need to have either public ownership, or private ownership where rates were subject to state or local regulatory approval.
- Part 3 proposes to streamline permitting projects, which may affect remote broadband projects on federal lands or in federal waters (The White House, 2018).

#### **4.1.4.2 U.S. Department of Treasury— New Market Tax Credits**

One mechanism to encourage investment in Alaska’s rural communities is the issuing of federal tax credits to private entities who invest in economically distressed communities. The U.S. Department of the Treasury’s Community Development Financial Institutions Fund created the New Market Tax Credit (NMTC) program under the Community Renewal Tax Relief Act of 2000.

The program attracts private capital into low-income communities by permitting individual

and corporate investors to receive a tax credit against their federal income tax in exchange for making equity investments in specialized financial intermediaries called Community Development Entities (CDEs). The credit totals 39 percent of the original investment amount and is claimed over a period of seven years (Ecotrust, n.d.).

The NMTC program is set to expire on December 31, 2019, although a New Markets Tax Credit Extension Act of 2017 was introduced with the intent to extend the program indefinitely. This bill (SB384) has not yet received U.S. Senate approval (New Markets Tax Credit Coalition, 2017).

These tax credits have been utilized for the purposes of establishing new and upgraded broadband in Alaska. GCI’s subsidiary, Unicom, received \$78 million in NMTC allocation from three CDEs to aid in the construction of the TERRA Northwest Project, which extended the TERRA network to Nome and Kotzebue.

#### **4.1.4.3 NTIA – BroadbandUSA and Grant Programs**

The National Telecommunications & Information Administration (NTIA), located within the Department of Commerce, is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy matters. NTIA’s programs and policymaking focus largely on expanding broadband access and adoption in the United States, expanding the use of spectrum by all users and ensuring that the Internet remains an engine for continued innovation and economic growth. NTIA’s focus includes improving education, health care, and public safety (NTIA, 2018a).

NTIA’s BroadbandUSA programs provide information and technical support to state and local governments, federal agencies, policy organizations, trade associations, and the public. They host workshops, training, publish resources, host webinars, and provide direct technical assistance. Relevant technical support topics for this study include P3s and municipally-owned networks.

In addition to its technical support and outreach programs under BroadbandUSA, the NTIA is also responsible for administering grant programs that further the deployment and use of broadband and other technologies. Past grant programs have included the Broadband Technology Opportunities Program and State Broadband Initiative (SBI) program, as well as grants supporting FirstNet deployments. It is recommended that the NTIA grants website be checked for current grant programs: [www.ntia.doc.gov/category/grants](http://www.ntia.doc.gov/category/grants).

#### 4.1.4.4 Broadband Technology Opportunities Program

Although the Broadband Technology Opportunities Program (BTOP) is closed to new participants (there are only two remaining active projects), this was an example of a federal program that furthered NTIA's mission, although not targeted specifically at building new middle-mile networks. This was an approximately \$4 billion grant program administered by NTIA that proposed to help bridge the digital divide in the United States. Funded by the American Recovery and Reinvestment Act of 2009, BTOP projects deployed broadband Internet infrastructure, built and expanded public computer centers, and encouraged the sustainable adoption of broadband service (NTIA, 2018b).

There were several projects in Alaska that benefited from the BTOP:

- **Alaska Department of Education & Early Development** was awarded \$5.35 million for public computer centers. This was combined with funds from the Bill and Melinda Gates Foundation in creating the Alaska OWL (Online With Libraries) Project to enhance libraries in 104 rural locations around the state. This program was kicked off in late 2010 and concluded in 2014 (NTIA, 2010b; Neville, 2014).
- **Communication Service for the Deaf, Inc.** was awarded \$14.99 million for projects across all U.S. states and territories to improve educational and employment opportunities for the deaf

and/or hard of hearing. This program ran from 2010 through 2013. No report could be found that identified how much of the nearly \$15 million was spent in Alaska (NTIA, 2010c).

- **University Corporation for Advanced Internet Development (UCAID, also known as Internet2)** Although Internet2 was founded in 1996, BTOP funded the US-UCAN Project, which was a large P3 to help expand the footprint and bandwidth of the nationwide fiber network. The project proposed to benefit 121,000 community anchors across 50 states through a dedicated, high speed fiber network. Internet2 was awarded \$62.54 million under the BTOP program (NTIA, 2010d). No detailed information was found on the direct impacts or benefits to Alaska as a result of this program; however, the University of Alaska Fairbanks is currently listed as one of the 328 higher education members (Internet2, 2018). Alaska's statewide education network, AK20, connected to Internet2 in 2006 (Internet2, 2006), which predates the US-UCAN Project.
- **University of Alaska Fairbanks (UAF)** was awarded \$4.54 million for "Bridging the e-Skills Gap in Alaska." Project goals were to develop computer skills and broadband training for up to 7,400 residents of rural Alaska, provide 600 mobile computers for residential loan and identify recipients recommended for introductory discounted broadband rates. UAF partnered with 21 Alaska agencies and businesses. The project final report indicates that the target area contained an audience of nearly 82,000 and by the conclusion of the program in 2013 there had been 9,360 new households and 1,068 new businesses added. The project focused heavily on the geographic areas where GCI's TERRA network had been deployed, which brought terrestrial broadband to areas previously served only by satellite (NTIA, 2010a; NTIA, 2013).

#### **4.1.4.5 State Broadband Initiative**

Also funded by the 2009 American Recovery and Reinvestment Act, NTIA's State Broadband Initiative (SBI) allowed for state entities, or non-profits working under state entities, to “facilitate the integration of broadband and information technology into state and local economies” (NTIA, 2018c). All funding from this program has been awarded.

Through the SBI (formerly called the State Broadband Data and Development grant program), NTIA awarded a total of \$293 million to 56 grantees, one from each of the 50 states, five territories, and the District of Columbia, or their designees. In Alaska, \$6,378,198 was awarded to Connected Nation, a Kentucky-based, non-profit corporation (NTIA, n.d.). Connected Nation formed an Alaska subsidiary called Connect Alaska, who took the lead in developing the Alaska Broadband Task Force (Connect Alaska, 2018a; Connect Alaska, 2018b). The Task Force created the 2014 report titled “Blueprint for Alaska’s Broadband Future” (Connect Alaska, 2014) and the “Connect Alaska Final Grant Report” in May of 2015 (Connect Alaska, 2015a). As part of this grant, Connected Nation was also to provide training and sub-grants to fund innovative e-government and Web 2.0 applications, which emphasize user-generated content (NTIA, 2018d).

The SBI also created the National Broadband Map, which is still available, but data updates were discontinued on June 30, 2014. The successor broadband map is hosted by FCC at <https://broadbandmap.fcc.gov>.

## **4.2 State of Alaska Programs**

### **4.2.1 Regulatory Commission of Alaska**

#### **4.2.1.1 Broadband Internet Grant Program**

The Alaska Broadband Internet Grant Program was established in 2002 when the Regulatory Commission of Alaska (RCA) received \$15 million in funding from the USDA for rural broadband in Alaska. Funding was a result of

then Senator Ted Stevens’ efforts. The goal of the Rural Alaska Broadband Internet Access Grant Program was to facilitate long-term affordable broadband Internet services in rural Alaska communities where these services did not exist. To accomplish this goal, the program provided up to 75 percent of the funding that companies required to expand Internet service to underserved communities and stipulated that rates had to be comparable to those in Anchorage, Fairbanks, and Juneau for at least two years (RCA, 2011).

Applications and awards from this one-time grant continued through 2011. Four Alaska-based service providers applied for and received funding to provide some variation of broadband into 30+ locations. None of the communities were in the study area.

The program furnishing such federal grants has since been replaced by the USDA’s RUS programs (see Section 4.1.2).

#### **4.2.1.2 Alaska Universal Service Fund**

The RCA established the Alaska Universal Service Fund (AUSF) in March of 1999 to help subsidize rural telephone rates. It is funded by a surcharge on consumer billings across Alaska, and currently provides subsidies to carriers to support programs such as Lifeline (see Section 4.1.3.4), small carriers’ switching costs, public interest pay telephones, carrier common line support, and local carriers of last resort (AUSF, 2018b). AUSF surcharges of in-state telephone service have been as low as 0.4 percent in 2001 and will reach a new high of 19.0 percent for 2018 (AUSF, 2018a). Although the AUSF subsidizes rural rates, it is not intended to directly reimburse service providers for the construction of middle-mile broadband infrastructure.

#### **4.2.2 Connect Alaska**

As noted earlier in this study, Connected Nation’s 100-percent owned Alaska subsidiary, Connect Alaska LLC, was funded by a (federal) SBI grant (NTIA, 2018d). In 2009 Connected Nation received a \$6,378,198 SBI grant from the U.S. Department of Commerce that was administered by the NTIA. Connect Alaska ran

programs over a five-year period in broadband mapping, planning, data collection, technical assistance, and application usage and development (Connect Alaska, 2015a).

### **4.2.3 AIDEA**

The Alaska Industrial Development and Export Authority (AIDEA) was established in 1967 as a state corporation to provide financing options for projects that grow Alaska's economy. The projects that AIDEA finances do not fit into any one industry and they can provide financing for non-profit, for-profit, and municipal projects.

AIDEA gave a presentation about its financing programs to Connect Alaska's Broadband Task Force, which can be found on the meetings page (Connect Alaska, 2018c). AIDEA was identified in the Connect Alaska Final Report under potential loan programs (Connect Alaska, 2015a) and the report included a recommendation that AIDEA recognize broadband as infrastructure as part of its financing programs. The final report also included an example of AIDEA financing an Alaska-focused satellite to deliver broadband to rural Alaska.

Bond programs offered by AIDEA are included in Section 4.4.1.

### **4.3 Military**

While there are no military broadband funding programs available to non-military entities, the funding of infrastructure for military operations may aid in bringing broadband to unserved or underserved areas in Alaska. Government telecommunications contracts can offer providers a substantial and often long-term economic benefit. Similar to health care and education, government telecommunications contracts are often awarded on a multi-year basis. Some contract requirements have been known to drive infrastructure upgrades that ultimately benefit surrounding communities.

Shemya (west of the study area) and Adak remain two possible locations where military or future military installations could drive the need for subsea fiber communications. Former Quintillion CEO, Elizabeth Pierce, noted,

"Based upon potential demand from the military, the network could be extended to Shemya" (Arctic Fibre, 2013). Quintillion has not announced landing locations for its Phase II at the time of this study.

Although directed at civilian aircraft, the Alaska Satellite Telecommunications Infrastructure (ASTI) and the Alaska National Airspace System Interfacility Communication System (ANICS) are, by design, dedicated networks and therefore do not add secondary infrastructure value for the community. These systems are owned by the FAA and operated by private contractor, currently Harris.

## **4.4 Bonds**

Municipal bonds are typically issued by states, boroughs or cities and are exempt from most taxes. Bonds are regulated instruments and there are many steps required to identify which bond is most appropriate, and how the bond would be issued and serviced. This section is a general overview and not all inclusive.

Many jurisdictions require public approval for bonds, and thus politics and industry interests become factors. One example is the State of New Hampshire, where there has been an effort to remove a law that limits the issuance of municipal bonds to fund municipally-owned broadband networks (Community Networks, 2018c).

When discussing municipal bonds that are used to help finance broadband construction projects, these are typically of two different main types: revenue bonds and general obligation bonds.

### **4.4.1 Revenue Bonds**

Revenue bonds are intended to be paid back from the revenue associated with the project (e.g. a toll road or income from dark fiber leases). Revenue bonds can be either taxable or tax-free.

Taxable and non-taxable revenue bonds have been used to finance public broadband networks. One example is the KentuckyWired Project (see Section 5.2), where the State's Economic Development Finance Authority issued \$232

million in tax-exempt revenue bonds and \$58 million in taxable revenue bonds. In addition to the revenue bonds, the State of Kentucky allocated \$30 million in state capital funds, and there were also \$23.5 million in federal grants used to start the 3,400-mile fiber network build out (Community Networks, 2018b).

In Alaska, AIDEA acts as a conduit to issue both taxable and non-taxable revenue bonds. According to AIDEA's website on its Conduit Revenue Bond Program, "Neither the assets nor credit of AIDEA is at risk in this program; the creditworthiness of the project, borrower strength and credit enhancements offered by the applicant are essential to the underwriting and placement of bonds" (AIDEA, 2018).

## 5 Regional Ownership Models

### 5.1 Public-Private Partnerships

Public-Private Partnerships, known as P3s, are cooperative agreements between a public entity (city, borough, state, or federal) and a private sector entity (e.g. service provider) to develop and execute a broadband project that is a betterment to the public. P3s are a viable alternative to a fully owned and operated municipal (middle-mile) network for public entities that lack the necessary capital and/or expertise to design and operate a fiber network or operate as an Internet Service Provider (Hovis et al., 2017).

P3s can take different forms as will be discussed, and there is no one cookie cutter or "best" model, but the public entity takes on a role to support the development of a network that will benefit its stakeholders. The role of the public entity may vary from just supporting the private party with permitting and not own any of the infrastructure, all the way to the public entity financing and owning the infrastructure and the private party operating the network on behalf of the public entity. It is important to note that P3 projects are often unique and present their own challenges and constraints.

### 4.4.2 General Obligation Bonds

General obligation (municipal) bonds are also used to fund broadband infrastructure. Municipal bonds are often paid back in higher property taxes, which may or may not be passed by the voting public. Isleboro, Maine proposed approximately \$3.8 million in municipal bonds to build a public network (Community Networks, 2018a).

### 4.4.3 Private Activity Bonds

As noted in Section 4.1.4.1, Private Activity Bonds have recently been proposed by the White House to be authorized for funding for broadband projects. These bonds are tax exempt and are typically issued by a local or state government for projects by a private company. These are also called conduit bonds.

Funding of P3 broadband projects does not need to be different from other municipally-owned infrastructure projects and can include a variety of sources such as general obligation bonds, revenue bonds, grants, loans, government broadband loans/grants, and/or a mix of other public and private funding sources. One of the major benefits a public entity can bring to a P3 is access to public funding mechanisms such as municipal bonds, which have tax and interest rate advantages.

Per NTIA/BroadbandUSA, there are generally three P3 models (NTIA, 2015):

- **Private Sector-Led:** The network is built, owned and operated by a private, commercial entity. Community Anchor Institutions and economic development authorities provide support through planning, monetary, and regulatory support, and by aggregating demand and obtaining customer commitments in advance.
- **Government-Led and Private Supported:** The network is publicly-owned (by a government, municipal utility, or rural co-op) and built,

operated and/or maintained by a private partner in exchange for financial and in-kind support, as well as the same types of contributions as in the private sector-led model. The public entity can be either existing or newly created.

- **Joint-Ownership Model:** The investment and capacity of the network are shared jointly by a commercial operator (either private or non-profit) and the public enterprise. Both partners contribute a combination of financial,

in-kind and other support to the project (NTIA, 2015).

Joanne Hovis, Marc Schulof, Jim Baller and Ashley Stelfox authored a 2017 report titled “The Emerging World of Broadband Public-Private Partnerships: A Business Strategy and Legal Guide” (Hovis et al., 2017), which elaborated on the three NTIA models. They designated these as Models 1, 2 & 3 and assigned risk, benefit and control levels for each as shown in Figure 26. Their 47-page report is highly recommended reading for broadband P3s.

Figure 26. Matrix of Risk, Benefit and Control in Public-Private Partnership Models

	MODEL 1 PUBLIC FACILITATION, PRIVATE INVESTMENT	MODEL 2 PUBLIC FUNDING, PRIVATE EXECUTION	MODEL 3 SHARED INVESTMENT & RISK
RISK	LOW	HIGH	MODERATE
BENEFIT	POTENTIAL BUT NOT ASSURED	HIGH	HIGH
CONTROL	NONE	MODERATE	MODERATE

(Hovis et al., 2017)

The three P3 models from their report are as follows:

- **Model 1: Public Facilitation of Private Investment:** Hovis’ Model 1 focused on steps the public entity can take to encourage or promote investment by the private party. This can include permitting support, access

to public utility poles, lease of publicly-owned fiber, right-of-way access, and other support. Dedicated public staff may be assigned to facilitate deployment, or economic development credits might be offered to the private entity. This option has the lowest financial risk for the public entity, and the private entity has complete control

of the infrastructure. Decisions about when and where to build are made by the private entity.

Local and Tribal governments could consider contributing the following (NTIA, 2016a):

- Streamline permitting & construction
- Make conduit broadly available under fair/equitable terms
- Make fiber or other telecom assets broadly available with fair/equitable terms
- Sell or lease fiber strands in bundle
- Add fiber to owned network
- Sell or lease space (towers, water towers, buildings) to wireless providers
- Sell or lease secure space for Network Operating Centers (NOCs) or hubs
- Trade ROW to telecom operator in exchange for capacity or fiber
- Waive fees in exchange for capacity, equipment co-location, services or fiber
- Sell or lease excess capacity in conduit

The most well-known examples of this were the fiber network deployments by Google Fiber in Austin, Kansas City, Nashville, and Atlanta. In exchange for the investment by the private entity, the public sector supported the projects by streamlining government processes, such as permitting, which reduced costs and allowed installations to proceed efficiently. As a secondary benefit of this model, other existing Internet Service Providers may offer upgrades or reduce prices in order to remain competitive with such entities like Google.

Although this model greatly reduces cost and risk to the public entity, there is a public relations risk if the fiber deployment fails to meet expectations. If this happens, the local government may be held accountable. In addition, private investors are not motivated to expand services to more rural areas that have a lower rate of return on their investment. This type of partnership provides little leverage from local governments for the expansion of services to

sparsely populated areas (Hovis et al., 2017).

- **Model 2: Public Funding and Private Execution (Concessionaire Model):** This model usually includes public funding and private entity execution. The private partner may also participate in financing under certain arrangements. A long-term “concession” is granted to the private entity to operate and maintain the network after it is built. The public entity has much more involvement and control of the design and can ensure that the network includes underserved areas, and the private entity usually assumes a major role in the design and construction of the project. There are many details that are worked out under this model, such as revenue sharing, customer pricing controls, termination for convenience clauses, access to over-built dark fiber, and performance requirements.

Transferring development risk to a private company, with performance incentives, can result in lower costs and provide substantial benefits to cash-strapped governments (Brehmer, 2015). Cost estimates provided by the successful bidder can be used as caps, with the developer accepting liability for any cost overruns. A private company is motivated to minimize capital and operational costs, which is advantageous to the public entity as well as consumers (NTIA, 2015).

Unlike other concessionaire P3 projects for toll roads, bridges, etc., broadband projects usually compete with other networks, so there is additional financial risk. If the network does not generate the anticipated revenue, the public entity is still responsible for paying the debt or being the guarantor of the debt.

Examples include KentuckyWired; Lake Oswego, Oregon; and Utopia Fiber in Utah (Hovis et al., 2017).

- **Model 3: Shared Investment and Risk:** The public and private entities work together to find mutually beneficial and innovative ways to share both the risks and costs of

building and operating the broadband network. The outcome is determined by each partner's priorities and the willingness and ability to develop win-win outcomes. Risks, costs, and control are shared, allowing the community to achieve its policy goals and desired benefits, while avoiding full liability for the financial risks (Hovis et al., 2017).

Examples include Westminster, Maryland; Urbana/Champaign, Illinois; and Huntsville, Alabama. The Westminster project was the first community to use this model in a partnership with Ting Internet (Hayes, 2017). \$21 million in general obligation bonds were obtained by Westminster even before the private partner was selected to show the city's commitment to potential partners.

The Hovis report identifies numerous issues that should be closely reviewed when exploring a P3 broadband project as follows (Hovis et al., 2017):

### **1. Review authority issues**

- a. Are localities authorized by state law to enter into public-private partnerships?
- b. Are there any state restrictions on the ability of localities to provide or partner for the provision of communications services of any kind?
- c. Are there procedural requirements (e.g., hearings, referenda, etc.) with which the locality must comply?
- d. In the absence of clear state laws, how much discretion do localities have to determine their own authority?
- e. Do local charters, ordinances, franchises, or other agreements limit the activities a locality can undertake?

### **2. Understand the legal tools and instruments that could shape the partnership**

- a. Financing – What types of financing are available and what are the tax, political, and other consequences of using them?
- b. Access issues – Projects will usually benefit from streamlined access to the

public rights-of-way and facilities, but non-discrimination requirements may introduce complications. What will be the overall net impact of the locality's choices concerning access to infrastructure?

- c. Regulatory considerations – Different business models may be regulated in significantly different ways. To what extent will regulatory considerations affect the locality's choice of a business model?
- d. Organizational issues – In order to achieve its business, governance, tax, and other goals to the maximum extent possible, what kind of legal structure should the locality select for its entity that will participate in the public-private partnership?

### **3. Negotiating the agreement**

- a. What is your tolerance for risk and which responsibilities are you willing to undertake?
- b. Rank the risks, rewards and responsibilities. Which are negotiable vs. non-negotiable?
- c. How do you negotiate for the best possible outcome?

## **5.2 Municipally-Owned Networks**

Municipally-owned networks can involve an ownership interest by a city, borough/county or an entire state, and these typically involve fiber networks. There are different models, including:

- Offering full retail services directly
- Not offering services directly but acting as a wholesaler to for-profit telecom providers
- Building out conduit and dark fiber for lease
- Building public networks that serve only Community Anchor Institutions such as schools, libraries, public safety entities, and public utilities with some leasable dark fiber

Combinations of the aforementioned models are common. Another model is a municipally-backed broadband co-op where the members (customers) are the owners but it is financed by

the public. The website MuniNetworks.org maps municipally-owned networks in the U.S. They also provide case studies, resources, and videos, and host a podcast exploring community-led broadband initiatives. The MuniNetworks.org Community Map (MuniNetworks.org, 2018a) states there are:

- *55 municipal networks serving 108 communities with a publicly-owned FTTH (fiber to the home) citywide network*
- *76 communities with a publicly-owned cable network reaching most or all of the community*
- *197 communities with some publicly-owned fiber service available to parts of the community (often a business district)*
- *More than 120 communities with publicly-owned dark fiber available*
- *More than 130 communities in 27 states with a publicly-owned network offering at least 1 gigabit services*
- *258 communities served by rural electric cooperatives. 10 communities served by one broadband cooperative. (Communities served by telephone cooperatives will soon be on the map as well)*

According to MuniNetworks.org, the most common municipally-owned broadband model is where an existing municipally-owned electric utility builds out a fiber network (MuniNetworks.org, 2017). This model works well because there is already an administrative billing entity already in-place, they are familiar with the customer base, they are experienced with pole connection agreements (if the fiber is not already going to be deployed on the utility's own poles), and electric utilities often have digital networks in addition to the power lines to monitor and operate their power grid. In Alaska, Ketchikan Public Utilities (KPU) and Nushagak Cooperative (NushTel) in Dillingham provide power, phone, cable TV and Broadband. KPU has their own middle-mile fiber backhaul to Seattle and NushTel backhauls on GCI's TERRA network. KPU began offering

broadband in 2004 and cable TV in 2006 (Kiffer, 2007).

There are current political hurdles with municipally-owned networks. There are 19 states in the U.S. that have laws that limit municipal ownership of broadband networks in some fashion. Alaska is not shown as one of these 19 states on MuniNetworks.org broadband map (2018a), but this report did not explore Alaska's current regulatory environment as it pertains to municipally-owned networks (or P3s) and this is included in the recommended next steps (Section 7 of this report).

### **FCC's BDAC Guidance for "State Model Code"**

In late January 2018, the FCC's Broadband Deployment Advisory Committee (BDAC) issued a draft of its "State Model Code for Accelerating Broadband Infrastructure Deployment and Investment" (FCC 2018d). BDAC's purpose was to draft language that states could adopt into law that would address how broadband would be developed and deployed. This committee and document were not without controversy, including public claims by members of being biased against municipally-owned networks (CNN, 2018).

Article 12 of this model code addresses municipally-owned broadband networks, and the preamble of this section states:

*The preference of the State is that municipal Broadband networks be built, owned, and operated by private industry. But the State also recognizes that in Rural areas the economics of building such networks may be economically less viable, relative to other areas of the State, such that private industry interest in deploying Broadband Facilities may not exist in a timeframe or at a price to the consumer that the municipality finds reasonably acceptable.*

The BDAC's Model Code goes on to outline a process for how a municipality would approach building a network. It is important to note that this draft language for states to consider has not been approved by the FCC or the State of Alaska as of the time of this report. As noted above, there has been push-back on BDAC's approach and perceived private industry bias; however,

there is value in the proposed approach that SWAMC can use for future steps.

As a side note, on April 6, 2017, the FCC announced that Chairman Ajit Pai had appointed Quintillion's (then) CEO, Elizabeth Pierce as Chair of the 29-member BDAC. The FCC announced her resignation on September 1, 2017 for "personal reasons" (FCC, 2017).

The draft BDAC model spells out five options in Section 4 of Article 12 that municipal owners are supposed to evaluate as described in Section 5. BDAC lists them in order of preference:

*4.1. Private-led Investment with Public Assistance. In which a privately-owned entity constructs, maintains, and operates the Broadband network, and the municipality assists by facilitating permitting, granting, and customer sign-ups and ensures that the Broadband service is not discriminatory in its service standards or areas served.*

*4.2 Balanced Public-Private Partnerships. In which a Rural municipality provides all or some of the necessary capital funds to construct the network, and one selected service provider is granted an exclusive franchise agreement for a finite period of time sufficient for the Broadband provider to recover its capital investment. At the end of that timeline, the system is open access with the incumbent Broadband provider retaining responsibility for system maintenance and operations.*

*4.3. Public Assets – Open Access. In which one or more Broadband providers contract for access to a community-owned infrastructure that is developed through a local improvement district, fee for services, donations, grants, and/or other non-tax revenue sources.*

*4.4. Public-Led Contracting. In which the community serves as the lead entity and Broadband provider by constructing, financing, and owning the network infrastructure with a private sector partner providing crucial network operations or other duties specifically negotiated.*

*4.5. Fully Public Funded and Operated Networks. In which the Rural municipality designs, builds, operates, and manages a community-wide ISP, and the Rural municipality is responsible for all aspects of the network, including customer support and installations.*

#### *5. Required Evaluation.*

*5.1. Before initiating the planning or deployment of a Fully Public Funded and Operated Network or investing or engaging in Public-Led Contracting, a Rural municipality shall design and implement a process through which to solicit and accept proposals to deploy a Broadband network from private Communications Providers.*

*5.2. Prior to a Rural municipality investing in a fully Publicly-Funded and Operated Broadband Network and/or investing in Public-Led Contracting, Rural municipal leaders shall evaluate each of the other options for viability and also determine the following:*

*5.2.1. That the benefits associated with purchasing or constructing the facilities outweigh the costs;*

*5.2.2. That the project is both feasible and sustainable; and*

*5.2.3. That the purchase and construction of the facilities is in the interest of the general public.*

*5.3. If, and only if, the Rural municipality receives no reasonable and credible proposal from a private Communications Provider to build a Broadband network and otherwise determines that none of the first three options in Article 12(b) are viable and if, and only if, the Rural municipality makes a positive determination of costs, feasibility, sustainability, and that the action is in the interest of the general public may the Rural municipality invest in a Fully Public Funded and Operated Network and/or engage in Public-Led Contracting.*

The above draft language closely follows the five "Principles on Municipal/Government

Owned Networks” issued by the American Legislative Exchange Council (ALEC), a largely politically conservative organization (ALEC, 2018). These principles note the success of private investment and claim “Many municipal and government-owned networks have records of failure.” ALEC’s Telecommunications & Information Task Force has been reportedly heavily represented by private sector telecom interests (Rosen, 2012).

Public entities are countering movements against municipally-owned networks through an organization known as the Coalition for Local Internet Choice (CLIC). CLIC has organized political outreach efforts and the CEO of CLIC recently testified to a U.S. House Subcommittee to counter preemption of municipal involvement, listing numerous success stories to close the urban-rural digital divide. The CEO made the following recommendations (CLIC, 2018):

- *First, support public–private partnerships that ease the economic challenges of constructing rural and urban infrastructure.*
- *Second, incent local efforts to build infrastructure—ones that private service providers can use—by making bonding and other financing strategies more feasible, potentially through reduced interest payments or expanded use of tax-exempt bonds.*
- *Third, target meaningful infrastructure capital support to rural and urban broadband deserts, not only to attract private capital but also to stimulate private efforts to gain or retain competitive advantage.*

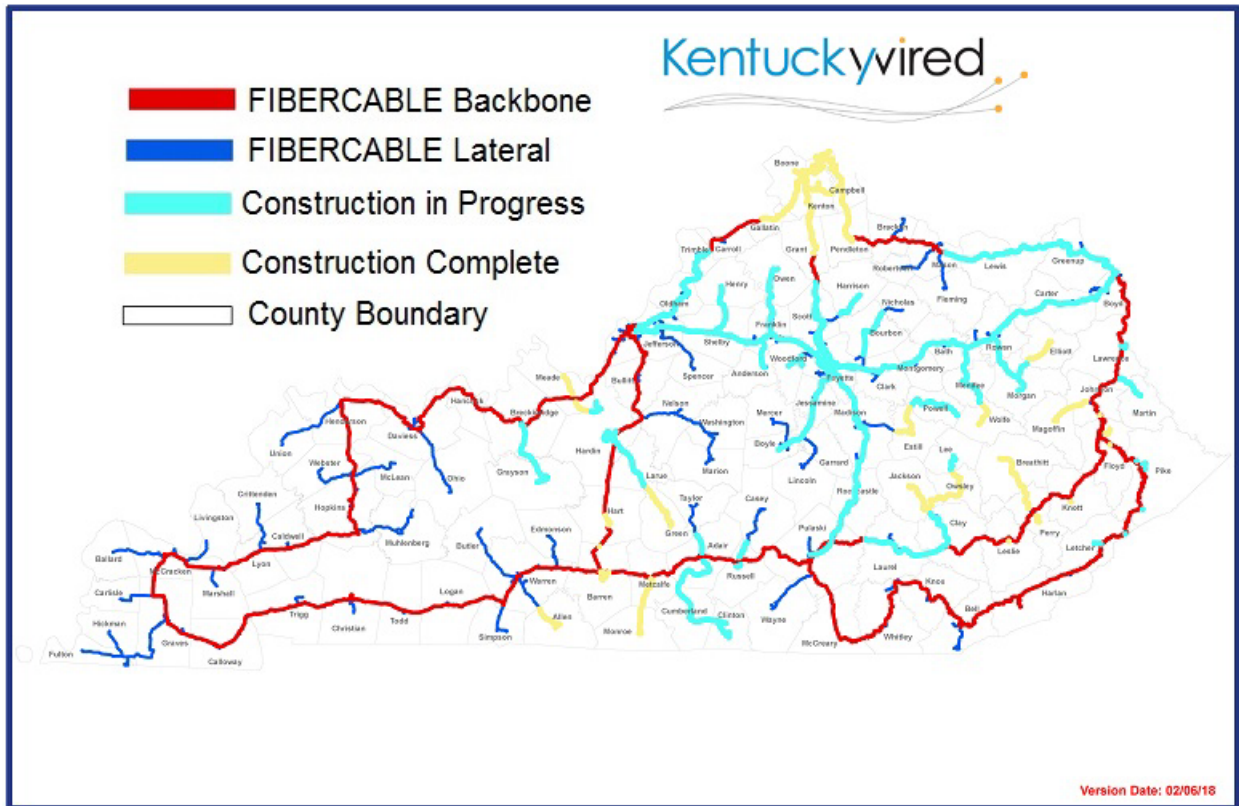
- *Fourth, empower local governments to pursue broadband solutions of all types, including use of public assets to attract and shape private investment patterns, so as to leverage taxpayer-funded property and create competitive dynamics that attract incumbent investment.*
- *Fifth, require all entities that benefit from public subsidy, including access to public assets, to make enforceable commitments to build in areas that are historically unserved or underserved.*
- *And, maximize the benefits of competition by requiring that all federal subsidy programs are offered on a competitive and neutral basis for bid by any qualified entity.*

### **Example Network: KentuckyWired**

The Commonwealth of Kentucky ranked forty-eighth in the nation for Internet speed and accessibility (KentuckyWired, 2018). Due to declines in the coal mining industry, once a mainstay, Kentucky’s economy was struggling, including losing 13,000 jobs in eastern Kentucky alone since 2009 (Hovis et al., 2017). To become more competitive and to provide better opportunities for residents, the state identified broadband network expansion as a priority.

KentuckyWired, the largest P3 middle-mile project in the U.S., was formed in 2015 to create a statewide, open-access fiber optic network that would connect to all of the state’s 120 counties. The 3,400-mile fiber optic backbone will serve as middle-mile construction, while last-mile construction will be completed by existing ISPs and possibly by new competitors. Half of the fiber backbone consists of dark fiber, available to commercial providers for lease through a third-party serving as the state’s wholesaler (Hovis et al., 2017). Ownership of the network

Figure 27. KentuckyWired Map



(Source: KentuckyWired.ky.gov)

will be retained by the Commonwealth, and a third-party contractor, Leducor, will operate and maintain the network for 30 years. The project was funded with \$307M in bonding, \$23.5M in federal grants and \$30M from Kentucky’s general fund. Half of the fiber was designed to be leased to private service providers.

The project used a design-build delivery with Leducor and Black & Veatch as the major design-build contractors. The project was originally scheduled to be completed in one year, which was changed to August of 2018. As of February 1, 2018, KentuckyWired predicted a delay of at least 18 months, and only 619 miles of fiber had been constructed (KentuckyWired, 2018). The project identified additional time to obtain pole attachment agreements (with at least 70 different entities and the associated pole attachment calculations) as the primary sources of delay. Approximately 85 percent of the fiber was to be aerial. One example cited by the project was a pole attachment approval delay of 212 days by AT&T (Kapps, 2018).

**Example Network: RS Fiber Cooperative**

RS Fiber, named after Renville and Sibley Counties in Minnesota, is a cooperative, owned by its members, that was formed in 2012 to deliver broadband, telephone, and television to 6,200 potential customers in southcentral, rural Minnesota. A third-party would operate the network on behalf of the co-op (Carlson, 2016). The two-phased project includes first building a fiber loop to 11 fixed wireless sites (and picking up homes nearest this fiber), and the second phase includes FTTH deployments. This approach allowed revenue to be generated quickly from the relatively easy to reach customers while the second phase was underway.

The \$55 million project was financed by forming a Joint Powers Agreement among 10 cities and 17 townships to collectively sell a \$13.7 million general obligation bond and loan the money to the RS Fiber Co-op. The bonds were taxable because the co-op was a private entity. Like GCI’s TERRA-NW project, RS Fiber included New Market Tax Credits, but

only in the amount of \$3.2 million. A \$1 million grant was also obtained from the State of Minnesota, Office of Broadband Development. The co-op will also borrow \$42 million from other lenders (RS Fiber, 2018; Carlson, 2016).

On December 2, 2017, one of RS Fiber's board members, Mark Erickson, was invited to Fairbanks by State Representative David Guttenberg to talk about RS Fiber's co-op efforts and if they could be applied to the Fairbanks/North Star Borough area (Klouta, 2017). Representative Guttenberg has started a website ([www.heyfairbanks.net](http://www.heyfairbanks.net)) that furthers the efforts of electric co-ops (specifically Golden Valley Electric Association) to begin deploying fiber in the Fairbanks area.

### 5.3 Pros of Regional Ownership

Goals for the study area include access to modern, reliable, and affordable broadband for all stakeholders in the region. Much like other rural regions of the U.S., low population densities and geographic remoteness have created challenging economics for service providers to develop profitable business plans for the region, even when considering state and federal government programs to help close the urban-rural digital divide. Stakeholders in many areas of the U.S. are taking the initiative to bring broadband to their areas, which includes having an ownership stake. An ownership stake allows the public entity to ensure that specific areas are served that would otherwise be passed by for more populated areas that have better economics.

Ownership may also include pricing requirements since the goal of a non-profit government, or rural broadband co-op, is service and not profit. But this is not to say a money-losing enterprise is in the best interest of the public owner, and actual cost of delivered service may still be too high for some without a profit factor included. Thus, the issue of being able to balance control and risk becomes an important discussion point, as well as developing a realistic (and not overly optimistic) business case that can meet the public stakeholders' approval. Affordability is often a

gating item for the public's approval of bond guarantees (i.e. what is in it for them).

### 5.4 Cons of Regional Ownership

Every option, including different P3 models, has downside risks. When it comes to municipally-owned networks, it depends on the model used. Examples include whether the broadband service is originating with an existing municipally-owned electric utility, or if the owner intends to operate and maintain the network with its own forces (make repairs, perform locations and forced relocations, etc.).

The primary downside of public ownership is financial risk: Will the project remain financially solvent 5, 10, 15, or more years in the future? Was the business plan's income forecast too optimistic in light of future unknown competition?

An often-cited report by critics of municipally-owned broadband networks was a 2017 report from Professor Christopher S. Yoo and Timothy Pfenninger from the University of Pennsylvania Law School (Yoo/Phenninger, 2017). This is an important report to read and there is also a two-hour YouTube panel presentation facilitated by Professor Yoo that touches on many issues of broadband ownership and risk (Yoo, 2017). Professor Yoo looked at 20 municipal broadband projects and used a five-year period to establish a net-present-value model. Of the 20 projects, 11 showed negative cash flow, 7 would need more than 60 years to break even, and only 2 projects were on track to pay back the debt over 30-40 years.

MuniNetworks.org's creator, the Institute for Self-Reliance, issued a strong rebuttal of Professor Yoo's study claiming numerous errors, lack of fact-checking, author bias, and that the five-year time period was a flawed methodology (Mitchell, 2017). There are additional responses by other authors to the Yoo/Phenninger paper, as well as links to other reports and counter opinions at MuniNetworks.org's website (MuniNetworks.org, 2018b).

It is apparent that more academic research is needed to independently review the performance

of municipally-owned networks, and it would be interesting to see how actual subscribership (income) compared over time with original business case forecasts since the authors of this study have seen significant increase in demand in those areas where broadband has been introduced to underserved areas (i.e. GCI's TERRA program).

As noted in the Institute for Self-Reliance's response to the Yoo/Phenninger study, laws can be passed that affect municipally-owned networks' ability to operate and expand, such as with the UTOPIA Network in Utah (Mitchell, 2017). It is important to note that incumbent telecom providers will protect their interests with lobbying efforts when they see a threat. But in some cases, incumbent providers received public dollars for network construction in the past that was based on future public benefit, which is now at risk of being devalued due to competition.

Regulatory approaches to municipal broadband networks are subject to changing politics. There is a philosophical gap between those who see

broadband as "telecommunications" such as past FCC Chairman, Tom Wheeler, where broadband should be regulated to protect the public's interests, and those who define broadband as an "information service," which is how the current FCC Chairman, Ajit Pai, defines broadband and wishes to implement a "light-touch" regulatory policy. Both chairmen Wheeler and Pai applied an earlier court ruling that the FCC "is free to change its approach to interpreting and implementing a statute so long as it acknowledges that it is doing so and justifies the new approach" (Ars Technica, 2017).

Another challenge for municipally-owned networks is that communities do not have a history of completing such rural infrastructure projects like they would have with building roads and other infrastructure. Construction of a new municipally-operated network (if that model is selected) that includes tech support, repair and maintenance, customer service, accounting, and billing could be challenging for some in the public to support without a prior track record (ILSR, 2015).

## **6 Large-Scale Broadband Projects: Lessons Learned**

### **6.1 Kodiak Kenai Fiber Link**

This project connected the island of Kodiak to the mainland of Alaska with a submarine fiber optic cable. There were two cable landings on Kodiak Island, at Mill Bay and Narrow Cape, and four cable landings on the mainland at Seward, Homer, Kenai and Anchorage. This project was owned and operated by Kodiak Kenai Cable Company, a subsidiary of the Old Harbor Native Corporation, until GCI purchased it in 2016. Meridian's project manager, Johnathon Storter, served as project manager of terrestrial design and construction on the project.

As small issues came up that impacted the design and installation, the project team actively worked to identify possible solutions or alternatives. The bulk of the project team was located in Alaska, which allowed for expeditious decision making. Although small changes were made locally, larger changes, such as shifting landing sites or significant deviations in cable

routing, were not possible without financial impacts that would stop the project. These decisions required more time and approvals. As a result, issues like erosion near a seasonal freshwater stream were dealt with by field solutions such as employing additional hard conduit covering like riprap and concrete rather than relocating the landing site completely.

### **6.2 Arctic Fibre**

As described in Section 3.2.1.2, Quintillion was originally the firm that was going to be responsible for the Alaska segment of the larger London-to-Tokyo fiber project envisioned by the Canadian firm, Arctic Fibre. Quintillion later acquired the assets of Arctic Fibre, and during two construction seasons, completed the construction of their 1,400 mile network in 2017. They installed marine fiber to connect Nome, Kotzebue, Pt. Hope, Wainwright, Utqiagvik, and Prudhoe Bay and then terrestrial

fiber from Prudhoe Bay (Deadhorse) to Fairbanks.

During the early planning phase of the Arctic Fiber project, prior to Quintillion’s acquisition, public announcements were very optimistic regarding the completion date of the (then) proposed project. New dates were announced when old dates came and went. As with any large project, there are lots of components and business cases can be somewhat fluid as conditions change as well as investors (e.g. the addition of two Alaska Native Corporations). A lesson learned from this project was that public announcements should be measured in their optimism with respect to completion dates.

### **6.3 SeaFAST**

This project connected various Southeast Alaska communities to the termination points of GCI’s two existing long-haul submarine fiber cables in Southeast Alaska. The project had landing sites in Juneau, Hawk Inlet, Angoon, Sitka, Petersburg, Wrangell, and Ketchikan. GCI was the project owner for SeaFAST and Meridian’s Johnathon Storter worked on the project as the construction manager and owner’s representative.

Final design decisions were planned for and made after several onsite permitting meetings with the various land and right-of-way owners due to conflicting design and construction specifications between different government entities that both had governance because one owned a right-of-way on the other’s land. The project budget had contingency reserved for these conflicts and, once resolved, the budget was re-forecasted. Up-front flexibility was key to the successful resolutions and design adjustments that kept the project on budget and schedule.

Local contractor availability in some of the smaller communities was also a challenge. In-depth, onsite pre-bid meetings were required to receive accurate bids from contractors located outside of the region, which extended the timeline due to the number of landings and distances between them. Early engagement of construction contractors identified this issue

early on and allowed for it to be reflected in the project schedule.

The availability (or lack thereof) of equipment in the vicinity of the landing sites figured into design considerations—such as avoiding directional drilling—which also helped to keep costs down.

### **6.4 Alaska United-NW**

This project, owned by GCI, connected Alaska’s two largest cities, Anchorage and Fairbanks, with a fiber optic cable routed along the Parks Highway. Meridian provided construction management support.

The project traversed over 250 miles of varied terrain. The project was designed with anticipated variable soil types. The objective was to maintain routing by being prepared for any subsurface conditions that might be encountered, which was addressed by including specific language in the construction contract that addressed variable soil types and different unit rates for the different soil types encountered. This approach allowed the project to progress when different soil conditions were encountered, thereby maintaining schedule and budget while minimizing standby costs.

The project utilized various local representatives at each end of the route with embedded inspectors to ensure the construction crews received timely and accurate answers to their questions during installation while also preventing the need for geotechnical investigations the year prior, accelerating the schedule and saving cost.

### **6.5 TERRA**

Begun in 2011, this multi-phased, multi-year project built a hybrid fiber-microwave network that connected over 84 Alaska communities to terrestrial broadband (refer to the map shown in Figure 7 in Section 2.2.2). The project included subsea, aerial and terrestrial fiber builds from Homer to Bristol Bay, and then microwave towers in villages and remote locations. Meridian provided various construction management and support staff for the different

phases (Southwest, Northwest, Yukon and Ring Closure).

A phased approach was used to build out and commission regional communities to better utilize funding efficiencies and contractor assets. The project had a fast-tracked schedule, which placed some of the permitting activities in a concurrent timeline with procurement of long lead materials. While this was planned for and included in the project schedule and budget, and flexible approaches were taken to each, there were occasional conflicts requiring changes to designs and materials procured. These conflicts caused some procurement costs to be 1.5–2.0 times greater than similar items when given a longer lead time. The project team’s upfront planning for these possible unknowns, and partnering approach with its construction contractors, allowed the project to stay on schedule and budget.

Each phase of the project had several key long-lead components that could drive the critical path if not properly planned well in advance, including design and construction of the communications and generator shelters, and commitments for heavy-lift helicopters that did not reside in the State of Alaska. When incorporating time to competitively bid the work and obtain all the necessary permits and approvals, developing detailed scope documents

in a short period of time was a challenge. In later phases of the project, GCI elected to negotiate contracts with previous contractors and used more of an informal CM/GC delivery method that was more collaborative during preconstruction as compared to a design-bid-build approach that resulted in numerous change orders as conditions changed.

Additional cost impacts were realized on logistics of materials that missed initial barge shipments to regional hubs due to vendors missing their shipping deadlines. Resulting shipping costs could be as much as four to five times higher for air freight as compared to scheduled, seasonal barging.

## 6.6 Lessons Learned Conclusion

Large-scale broadband projects in Alaska have the highest potential of budget and schedule success when adequate time is given to planning and design efforts during the preconstruction phase to prevent changes once the construction phase is underway. Careful consideration should be given to address potential unforeseen existing conditions that may be encountered in the field to better set the project up for timely adaptation at the lowest possible financial impact.

## 7 Recommendations for Future Steps

SWAMC is intending to issue a Phase II solicitation (this study is Phase I) to identify a consultant to move the effort forward to realize quality and affordable broadband in the study area. This study has identified several recommendations in this context.

### **Recommendation: Consider implications of BDAC’s State Model Code**

As noted in Section 5.2 of this report, the FCC’s BDAC in early 2018 issued a draft of its “State Model Code for Accelerating Broadband Infrastructure Deployment and Investment” (BDAC, 2018). If the language is adopted by the FCC and/or if the State of Alaska adopts this language into law, stakeholders will need to follow the steps outlined if they want to develop

a broadband co-op, municipally-owned network, or P3. It is important to note this is currently a draft (and controversial), but the text from section 5.3 of this draft can be used as a roadmap nonetheless when developing future steps for the study area, and if this code were to be adopted by the State of Alaska, SWAMC would be in full compliance with the required process:

*5.1. Before initiating the planning or deployment of a Fully Public Funded and Operated Network or investing or engaging in Public-Led Contracting, a Rural municipality shall design and implement a process through which to solicit and accept*

*proposals to deploy a Broadband network from private Communications Providers.*

*5.2. Prior to a Rural municipality investing in a fully Publicly-Funded and Operated Broadband Network and/or investing in Public-Led Contracting, Rural municipal leaders shall evaluate each of the other options for viability and also determine the following:*

*5.2.1. That the benefits associated with purchasing or constructing the facilities outweigh the costs;*

*5.2.2. That the project is both feasible and sustainable; and*

*5.2.3. That the purchase and construction of the facilities is in the interest of the general public.*

*5.3. If, and only if, the Rural municipality receives no reasonable and credible proposal from a private Communications Provider to build a Broadband network and otherwise determines that none of the first three options in Article 12(b) are viable and if, and only if, the Rural municipality makes a positive determination of costs, feasibility, sustainability, and that the action is in the interest of the general public [underline added] may the Rural municipality invest in a Fully Public Funded and Operated Network and/or engage in Public-Led Contracting.*

- b. Realistic market penetration in the context of future competition from different technologies such as satellite constellations, HTS satellites, fiber networks, etc.;
  - c. Debt servicing obligations if municipal or revenue bonds are used.
  - d. Identifying minimum terms that would need to be negotiated for wholesale broadband backhaul, such as on GCI's TERRA network, Quintillion's Phase 2, or on a HTS satellite if viable.
3. Can identify reasonable terms for operation and maintenance of the network by a third-party under a scenario where SWAMC (or other public stakeholder entity) would not perform these duties.
  4. Has experience representing the public side of a P3 broadband project.
  5. Has experience identifying what the public entity can offer to a project to be attractive for private partners under a P3 scenario.
  6. Can identify risks from the public entity's perspective from lessons learned from other co-ops, municipally-owned networks, and P3 projects.
  7. Can perform a deep-dive into Alaska's current regulations regarding co-ops, municipally-owned networks and P3s.

As part of SWAMC's solicitation for this consultant, deliverables should be identified.

It should be noted that such consultants may not exist in the State of Alaska and thus may not be aware of the solicitation. It is recommended that SWAMC reach out to muninetworks.org to see if they will post a news story about the solicitation. It is also recommended that the reports and stories regarding P3 projects discussed on muninetworks.org be reviewed to identify potential consultants who represent public entities.

## **Recommendations: Solicitation for Phase 2**

As part of a Phase 2 solicitation, we recommend SWAMC identify a consultant who:

1. After reviewing the Phase 1 report, can make a recommendation on what sort of model would be best, such as a broadband co-op, P3, or municipally-owned network.
2. Can develop a long-term business plan for a potential broadband co-op, municipally-owned network or P3; including, but not limited to:
  - a. Minimum income needed, including Community Anchor Institutions;

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