Appendix F – Alternative Analysis

National Telecommunications
and Information Administration

Alternative Analysis

NANA Regional Corporation, Inc. (NT23TBC0290014)

NANA Region Middle Mile Fiber Optic Project

Northwest Arctic Borough, Alaska

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List of Acronyms

ANILCA	Alaska Native Interest Lands Conservation Act
BLM	Bureau of Land Management
EA	Environmental Assessment
Gbps	Gigabits per second
GEO	Geostationary
HDD	Horizontal Directional Drilling
IIJA	Infrastructure Investment and Jobs Act
LEO	Low Earth Orbit
LIDAR	Light Detection and Ranging
m	meters
ms	milliseconds
NANA	NANA Regional Corporation
NEPA	National Environmental Policy Act
NP	National Park
NPS	National Park Service
NWR	National Wildlife Refuge
ROW	Right of Way
RTT	Round Trip Time
USFWS	US Fish and Wildlife Service

1 INTRODUCTION

This report presents the proposed action and alternatives for achieving the project's purpose and need, as well as a no action alternative (Figure 1). This provides the analysis to determine which alternatives to carry forward for analysis in the Environmental Assessment (EA) under the National Environmental Policy Act (NEPA).

NEPA requires consideration of a reasonable range of alternatives that are technically and economically feasible and meet the purpose and need. In some instances, when more than one alternative is found to meet these criteria, more than one alternative should be included in the EA. Reasonable alternatives may include different sitting options (e.g., different fiber routes) or differences in construction or deployment (e.g., wireless deployment or aerial fiber).

An alternative may be considered but eliminated from further analysis under NEPA if it would not be technically or economically feasible or if it would not meet the purpose and need.

The purpose of this project is to consider authorizations for infrastructure development that would provide broadband high-speed internet to the communities of Ambler, Buckland, Deering, Kiana, Kivalina, Kobuk, Noatak, and Shungnak.

A range of the alternatives are presented in Table 1-1 and Table 2-1. Appendix A has figures depicting the relevant alternatives.

Section 2 provides a discussion and analysis of each alternative.

Section 3 provides a conclusion of which alternatives are analyzed in the EA.

Table 1-1: Alternatives.

#	Alternative	Description
1	Alternative 1	Alignment that was made to be constructable, practicable, and minimize environmental impacts.
2	Alternative 2	Alternative 2 is a variation of Alternative 1, with changes in the eastern part of the alignment. This alternative eliminates the single cable “loop” connecting the easternmost communities, and replaces it with a double run cable, going north to Ambler, then Shungnak, and then Kobuk.
3	SF-299 Route	Alternative 3 is the original SF-299 Route (the SF-299 is the right-of-way (ROW) application for utilities on federal lands) proposed by the applicant. On further design, changes were made to this alignment due to constructability, practicality, or to minimize environmental impacts.
4	Kobuk Valley National Park Route	Crosses through Kobuk Valley National Park (NP). Substantially reduces the use of US Fish and Wildlife Service (USFWS) Selawik National Wildlife Refuge (NWR). Follows Alternative 1 for the other locations.
5	“Low Gradient” Kobuk National Park Route	Prioritizes a low gradient route through Kobuk Valley NP. Follows Alternative 1 for the other locations.
6	Microwave Tower Network	Delivers service through a series of microwave relay towers
7	Satellite Services	Delivers service through a series of Low Earth Orbit or Geostationary orbiting satellites
8	Alternative modified “Cut Across”	Cuts straight across a western portion of Selawik NWR, parallel to a section line.
9	Portage/Sinuaruk Creek Pass	Substantially reduces use of Selawik NWR by using Portage/Sinuaruk Creek Pass.
10	Selawik Lake	Avoids USFWS lands by introducing a dogleg with crossing of Selawik Lake.
11	Initial Route	Route based on the project feasibility study. This includes two separate alignments through the USFWS refuge, and utilization of Portage/Sinugruk Creek Pass.
12	Grant Route	The original route envisioned in the grant application. Primarily a marine and river footprint.

Table 1-2: Route Summary

Item	No Action	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Stream/River Crossings	0	761	768	759	589	591
River Crossings (Aerial)	0	20	19	3	26	28
River Crossings (Bore/HDD*)	0	14	11	0	17	17
River Crossings (Ground Lay)	0	727	738	756	546	546
Land Ownership (Total 30’ to either side of line, acres)	0	4,276.96	4,032.04	4,307.61	4,050.48	4,084.54
Alaska Native Allotment	0	0	0	0	0.01	4.08
Alaska Native Lands Patented or Interim Conveyed	0	2,048.93	1,944.31	2,084.17	2,095.80	2,095.44
Army	0	0	0	0.03	0	0
Bureau of Land Management	0	1,046.10	984.40	1,056.74	978.45	978.45
Fish and Wildlife Service	0	637.73	567.93	569.03	105.56	105.56
Local Government	0	0.66	0	0.66	0	0
National Park Service	0	0	0	0	338.87	368.44
Private	0	24.96	19.12	27.81	19.03	19.03
State	0	401.19	401.19	453.19	401.19	401.19
Undetermined (i.e. water)	0	117.40	115.10	115.97	111.56	112.35
Veg Clearing (Veg >0.2 m)	0	791.26	728.37	893.80	843.25	835.93
Slope (# of 100’ segments of differing alignment)						
> 15 degrees	0	0	0	-	1	0
> 10 degrees	0	10	0	-	4	0
> 9 degrees	0	1	1	-	9	4
> 8 degrees	0	5	2	-	14	6
> 7 degrees	0	8	5	-	26	16
> 6 degrees	0	16	15	-	53	34
> 5 degrees	0	32	29	-	140	67
> 4 degrees	0	91	68	-	303	150
Cost Difference from Alt 1	-	Base Case ($45 million)	+$39,020	-	+$5,125,128	+$5,283,565

* 2 aerial crossings in each route are attached to existing bridges (Kivalina and Selawik)

2 Alternatives

2.1 Alternative 1

This route connects the communities of the Northwest Arctic Borough (Figure 1). Two loops provide resiliency and redundancy, and connect:

- Kotzebue-Noorvik-Selawik
- Ambler-Kobuk-Shungnak

Lines extend from the loops, and connect to:

- Noatak and Kivalina
- Buckland and Deering
- Kiana

This alignment features a crossing of Hotham Inlet (near Kotzebue), and a single corridor through most of the Selawik National Wildlife Refuge (NWR) to the loop that connects the Upper Kobuk communities.

The total cost of this project is $65 million. The cost for construction of the routes is $45 million. The remainder of the project costs are common elements (such as network stations in each community). $45 million is the base case to compare different routing alignment for economic feasibility, because the remaining cost is common to all alternatives.

This alternative meets the Purpose and Need of the proposed project and is technically and economically feasible.

2.2 Alternative 2

Alternative 2 is a variation of Alternative 1, with changes in the eastern part of the alignment (Figure 1). This alternative eliminates the single cable loop connecting Ambler-Kobuk-Shungnak; and replaces it with a double run cable located within a common corridor, running north to Ambler, and then east to Shungnak and Kobuk.

This alternative has cost tradeoffs when compared to Alternative 1 (Table 2.2-1). For Alternative 2, the cable is changed from a single cable alignment to a co-located double cable (overall requiring 20.5 miles of additional cable). This alignment also increases the total number of waterbody crossings (where the former single cable crossing now is a double crossing) but eliminates an aerial and three HDD (horizontal directional drilling) crossing (along the southern portion of the loop that is no longer proposed for construction). The elimination of the southern portion of the loop also saves 33.4 miles of trail construction, and 6 days of clearing effort. A cost estimate was prepared for this additional cost (Table 2.2-1) and was found to be $39,020.11 more expensive than Alternative 1.

Table 2.2-1 Cost for Alternative 2 in comparison to Alternative 1

Line Item	Alternative 2	Southern Variant
Additional cable deployment	$1,474,825.70	$3,093,536.83
Reduction to trail construction	$(1,201,443.37)	$(816,549.84)
6 days reduction to clearing effort	$(390,078.00)	

HDD crossing reduced	$(190,699.22)	$(190,699.22)
1 aerial crossing reduction	$(34,000.00)	
Material	$380,415	$817,167
Total	**$39,020.11**	**$2,903454.77**

This route is "economically feasible," and it would fulfill the Purpose and Need. As a result, this alternative is analyzed in the EA.

A variation of this alternative was considered, with construction occurring on the southern part of the original Alternative 1 loop, instead of the northern route. This would go east to Kobuk, then northwest to Ambler. The cost for this alignment is provided in Table 2.2-1. It is more expensive because it would require 43 miles of additional cable. The cost savings are for 22.7 less miles of trail construction, and one less HDD crossing. As a result, this 'northern variant' was discarded from analysis.

2.3 Alternative 3

Alternative 3 is the original SF-299 Route (the SF-299 is the right-of-way [ROW] application for utilities on federal lands) proposed by the applicant (Figure 1).

This alignment was investigated in a Spring 2025 field visit, and some portions were found not to be practical to construct (one example is discussed in detail in Alternative 8). Other alignment shifts were made to provide a more refined, lower environmental impact alignment – resulting in Alternative 1.

2.4 Alternative 4

In this alternative, the alignment crosses through Kobuk Valley National Park (NP) (Figure 1-1). It substantially reduces the use of USFWS Selawik NWR lands by routing through National Park Service (NPS) lands north of the Kobuk River. It follows Alternative 1 or 2 for the remainder of the alignment.

2.4.1 Steep terrain

Winter roadless construction equipment can tolerate a limited cross slope, prior to having safety and stability difficulties (i.e. sliding, rolling over).

To examine routes for steepness, the alignment where each route differed from each other was broken down into 100-foot intervals, and LIDAR (Light Detection and Ranging) was used to calculate a cross slope 50 feet to the right and 50 feet to the left of the route. This comparison provides the slope in degrees. Table 2.4.1-1 provides the number of these 100' trail segments at different slopes for Alternatives 1, 2, 4, and 5.

Table 2.4.1-1 Slope for Alternative 1, 2, 4, and 5

100' Intervals of Trail with Slope Gradients of:	Alternative 1	Alternative 2	Alternative 4	Alternative 5
> 15 degrees	0	0	1	0
> 10 degrees	10	0	4	0
> 9 degrees	1	1	9	4
> 8 degrees	5	2	14	6

> 7 degrees	8	5	26	16
> 6 degrees	16	15	53	34
> 5 degrees	32	29	140	67
> 4 degrees	91	68	303	150

The relatively flat landscape Alternative 2 takes through the Selawik NWR presents less topographic variation.

2.4.2 Clearing

Clearing is proposed for vegetation >0.2 m tall. Landfire vegetation mapping provides vegetation height for the alignments. Table 2.4.2-1 provides the acres of vegetation for each alternative, summarized by different agency landownership and vegetation height.

More clearing is required (>0.2 m) in Alternative 4 than Alternative 1. More large vegetation (>2 m) clearing is required for Alternative 4 than Alternative 1. Table 2.4.2-1: Analysis of Vegetation Clearing for Alternative 1, 2, 4, and 5 (30 foot buffer, 15 feet to either side of the line)

	Agency					
	USFWS	NPS	Non USFWS/ NPS	Total		ANILCA Conservation Units
	Acres	Acres	Acres	Acres	%	Acres
Alternative 1	318.90	-	1,819.72	2,138.63	100%	318.90
Veg Height (No Clearing - <0.2 m)	216.50	-	1,130.86	1,347.35	63%	216.50
Veg Height 0.2 m to 1 m	89.20	-	576.25	665.45	31%	89.20
Veg Height 1m - 2 m	2.55	-	47.86	50.41	2%	2.55
Veg Height >2 m	10.66	-	64.75	75.41	4%	10.66
Alternative 2	283.99	-	1,732.15	2,016.14	100%	283.99
Veg Height (No Clearing - <0.2 m)	204.70	-	1,083.06	1,287.76	64%	204.7
Veg Height 0.2 m to 1 m	70.53	-	545.28	615.81	31%	70.53
Veg Height 1m - 2 m	2.33	-	42.57	44.9	2%	2.33
Veg Height >2 m	6.43	-	61.23	67.66	3%	6.43
Not Classified	-	-	0.01	0.01	0%	-
Alternative 4	52.78	169.44	1,803.17	2,025.40	100%	222.22
Veg Height (No Clearing - <0.2 m)	46.98	33.91	1,101.24	1,182.14	58%	80.89
Veg Height 0.2 m to 1 m	4.57	54.73	573.68	632.98	31%	59.30
Veg Height 1m - 2 m	0.63	4.64	43.12	48.38	2%	5.26
Veg Height >2 m	0.61	76.16	85.13	161.90	8%	76.77
Not Classified	-	-	0.01	0.01	0%	-
Alternative 5	52.78	184.22	1,805.38	2,042.39	100%	237.01
Veg Height (No Clearing - <0.2 m)	46.98	58.25	1,101.22	1,206.45	59%	105.23
Veg Height 0.2 m to 1 m	4.57	67.56	576.00	648.13	32%	72.13

Veg Height 1m - 2 m	0.63	3.24	42.97	46.83	2%	3.86
Veg Height >2 m	0.61	55.17	85.18	140.97	7%	55.78

More clearing is required (>0.2 m) in Alternative 4 than Alternative 1. More large vegetation (>2 m) clearing is required for Alternative 4 than Alternative 1.

2.4.3 Major River Crossings

This alternative route would require 3 additional major river crossings (Kobuk, Akillik, Hunt). One of those crossings would require an HDD bore of extended length, requiring specialized machinery. 10 additional aerial crossings would be required.

2.4.4 Cost

This alternative has cost tradeoffs when compared to Alternative 1 (Table 2.4.4-1). The cable is changed from a single cable alignment to a co-located double cable (overall requiring 27 miles of additional cable). There is a reduction in trail construction that is required (30.1 miles). There is an additional 26 days of clearing required. Crossings would add 5 additional aerial crossings, and one HDD crossing would be extended (requiring specialized machinery).

Table 2.4.4-1 Cost for Alternatives 4 and 5

Line Item	Alternative 4	Alternative 5
Additional cable deployment	$1,942,453	$186,000
Reduction (or increase) for trail construction	$(1,082,737)	$401,900
Increase for clearing effort	$615,000	$615,000
HDD crossings (including extended HDD)	$1,733,688	$1,733,688
10 additional aerial crossing	$1,265,250	$1,265,250
Additional Material	$651,475	$741,727
Total	**$5,125,128**	**$5,283,565**

2.4.5 Alternative 4 Summary

Alternative 4:

- Has steep slopes.
- Requires greater clearing of vegetation, and greater clearing of vegetation >2 m tall.
- Additional river crossings
- Additional cost

2.5 Alternative 5

In this alternative, USFWS proposes a “low gradient” alignment variation of Alternative 4, with a different, low grade, route through the Kobuk Valley National Park (Figure 1-1). The remainder of this alignment follows Alternative 1 and 2.

The steep terrain (Table 2.4.1-1), vegetation clearing (Table 2.4.2-1), and cost (Table 2.4.4-1) are higher than for Alternative 1 or 2.

Routes inside the Kobuk Valley NPS lands face a fundamental tradeoff between steep gradient (with smaller vegetation) and less gradient habitats (with taller vegetation). The greater amount of vegetation clearing would require different machinery and approximately 26 more days of work. In addition, additional extended bore for the Kobuk River would increase cost, and there would be additional cost for 10 additional aerial crossings.

2.6 Alternative 6: Microwave Tower Network

This alternative would deliver service through a series of microwave relay towers installed at locations throughout the NANA region. This technology requires maintaining line-of-sight between towers and would involve constructing approximately 20-30 towers (60-120 feet tall) throughout the region.

A microwave tower network provides (Analog Devices 2025, Christophe 2011, Credence Research 2024, Ericsson 2022, Infinity Technology Solutions 2023, Infinity Technology Services 2023, Internet Society 2019, Microwave Journal 2012, Military Aerospace 2010, NTIA 2013):

- *Limited bandwidth:* The Infrastructure Investment and Jobs Act (IIJA) defines "underserved" as areas where true broadband with reliable download/upload speeds of at least 100/20 Mbps are not available, and "unserved" as areas where download/upload speeds fall below 25/3 Mbps or there is no access to broadband at all.
    - The series of microwave broadband communication towers being installed by the OTZ Telephone Cooperative, Inc is offering cited as providing up to 25 Mbps/3Mbps (BLM 2024). (As of September 2025, OTZ currently advertises service as 1Mbps/256kbps[1])
- *Higher latency:* Depending on the equipment vendor and configuration, delay may be introduced on a per-hop basis. This is true in both fiber and microwave network infrastructure. The project's proposed fiber is a single hop between all communities. Microwave would require multiple hops between communities, due to the line-of-sight restriction.
    - Super High Frequency bands (3-30GHz) are limited by the visual horizon to 30–40 miles (48–64 km).
    - On top of the propagation latency, there is also have processing latency. The more "hops" in a networks, the more processing latency is added. This applies to both microwave and fiber networks.
    - Christophe (2022) describes a pilot test that included three microwave hops delivered results of 30.9 ms (millisecond) and 25.45 ms when interface speeds of 19,200 baud and 38,400 baud were used between the relay equipment and routers.
- *Congestion:* Subscribers would likely experience variable service quality during high-demand periods where demand would exceed transport capability.

While Alternative 6 is feasible from a cost standpoint, the technology does not meet the purpose and need for the project. It is not feasible to co-locate the utility ROWs between microwave towers,

[1] https://otz.net/service-plans/internet-service-2/

because microwave towers require high areas (for line of site) and fiber optic lines avoid impacts to high locations.

2.7 Alternative 7: Satellite Services

This alternative would leverage either Low Earth Orbit or Geostationary orbiting satellites to provide connectivity. Geostationary (GEO) satellites orbit at fixed positions approximately 22,000 miles above Earth, and Low Earth Orbit (LEO) satellites circle much closer to the planet at altitudes of approximately 300-1,200 miles.

This approach would require minimal ground infrastructure within the region but would rely entirely on third-party satellite systems for service delivery. Currently available satellite options include services offering speeds up to 30/3 Megabits per second (Mbps) with various data limitations; thus being defined as "underserved."

Alternative 7 technology would have significantly lower quality service (APNIC Labs 2022, Federal Communication Commission 2023, IEEE 2024, Meinrath et al. 2025, Resilio 2023, Space: Science & Technology 2023, Telarus 2024):

- *Insufficient bandwidth:*
    - Ogutu and Oughton (2021) demonstrate how limited the capacity will be once resources are spread across users in each satellite coverage area. For example, if there is 1 user per 10 km^2 the estimate is a mean per user capacity of 24.94 Mbps, 1.01 Mbps and 10.30 Mbps for Starlink, OneWeb and Kuiper respectively in the busiest hour of the day. These rates classify as "unserved" according to the IIJA.
- *Prohibitive latency:* 25-700 milliseconds for Low Earth Orbit systems and 550-650 milliseconds for Geostationary systems, rendering many real-time applications like telemedicine virtually unusable
    - LEO Satellites: Round-trip time (RTT): typically, 25–80 ms; ~20 ms is possible in theory, and recent observed medians are ~45 ms.
    - GEO Satellites: RTT: typically, 500–700 ms; often 600–750 ms end-to-end once protocol overheads are included.
- *Service degradation:* performance reduction during precipitation events, which are common in the region
    - LEO Satellites: Doppler effects, complex handover management, and reliance on dense constellations. Both are subject to spectrum interference, space weather, and rain fade (especially in the Ka-band).
    - GEO Satellites: Poor elevation angles above ~70° latitude, and rain fade issues at Ka-band. Larger dishes or Ku-band alternatives can, however, mitigate this. GEO may even be below the horizon above ~81° latitude. Both are subject to spectrum interference, space weather, and rain fade (especially in the Ka-band).
- *Capacity constraints:* limited total bandwidth shared among all users in a coverage area would cause congestion during peak usage periods. This technology will not meet federal requirements for speed when there are more than 6 households per square mile (Meinrath et al. 2005).

- *Limited scalability:* future capacity additions require launching new satellites, a process outside local influence
    - LEO Satellites: LEO satellites have a generally shorter lifetime compared to GEO satellites, which means they need to be replaced more frequently.
    - GEO Satellites: When covering large areas, may face interference and saturation problems in the frequency band, especially in densely populated areas.
    - In addition, due to their shorter service life, replacement costs are higher, which may limit long-term economic viability.
- *Medium and long-term viability:* Low Earth Orbit satellites experience orbital decay due to Earth's gravitational pull, requiring regular replacement to maintain network availability. The replacement process involves rocket launches which are inherently subject to failure risks, potentially compromising overall system reliability and continuity of service.

While satellite technology continues to evolve, even next-generation systems will not provide the reliability or capacity to meet the definitions of services in the IIJA. Thus, this alternative fails to meet the purpose and need of the project.

2.8 Alternative 8

In this alternative, the USFWS proposes making an alignment change that cuts straight across a western portion of the refuge, parallel to a section line (Figure 1-2). This proposal still requires the use of some USFWS lands but reduces the use of the USFWS refuge.

This alignment was originally evaluated under the SF-299 route. During route constructability site inspections, this alignment was found to require construction on steep terrain.

To provide quantitative metrics, the same slope analysis was completed for this portion of the alignment, as was conducted for the Kobuk National Park routes. To examine routes for steepness, the alignment was broken down into 100-foot intervals, and LIDAR was used to calculate a cross slope 50 feet to the right and 50 feet to the left of the route. This comparison provides the slope in degrees.

Table 2.7.2-1 Slope for Different Alternatives Limited to the Area of 8

100’ Intervals of Trail with Slope Gradients of:	Kiana to Selawik (USFWS Cut Across Vicinity)	
	Alternative 2	Alternative 8
> 15 degrees	0	2
> 10 degrees	0	4
> 9 degrees	0	6
> 8 degrees	0	8
> 7 degrees	0	12
> 6 degrees	0	14
> 5 degrees	2	27
> 4 degrees	10	48

When Alternative 8 is compared to the routings in Alternative 2 (Table 2.7.2-1), it is apparent that Alternative 8 has steeper alignments than Alternative 2.

2.9 Alternative 9

This alignment makes use of non-USFWS lands along the Portage Creek and Sinauruk Creek drainages (Figure 1-3).

This alignment would significantly reduce Alaska Native Interest Lands Conservation Act (ANILCA) Conservation Units, by aligning the project along non-USFWS and/or NPS lands.

This alignment was a part of a previous construction concept, proposed in Alternative 11: Initial Route. As a result, it was included in a site visit by the project team during the Spring of 2025.

This alignment requires use of a mountain pass between Portage Creek and Sinauruk Creek drainages. This pass is owned by a private landowner. The route was examined in person by the development team during the reconnaissance in the Spring of 2025. The private land extends across the pass and up the steep slopes. As a result, construction would be required up the steep slopes of the surrounding mountains.

2.10 Alternative 10

In this alternative, the USFWS proposes making an alignment change that moves the alignment out of USFWS lands and instead introduces a dogleg with a crossing of Selawik Lake specifically to avoid USFWS lands (Figure 1-4).

This new crossing of a major waterbody puts the reliability of the fiber at risk with

- two additional shoreline crossings (entrance and exit) and
- risk of cutting the cable by lake ice.

The most vulnerable portion of the project is the marine crossing of Hotham Inlet, near Kotzebue. A cut in the marine portion of the project means that the only fiber connecting most of the communities to Kotzebue is this overland route. As a result, it is important to keep this portion of the line functional. Large bodies of water, like Selawik Lake, have a greater danger of ice cutting the cable than overland installation. This alternative's routing into Selawik Lake puts the cable at a higher risk for outages to the entire system. This threat to system reliability causes the project to need to avoid crossing Selawik Lake entirely.

If Selawik Lake's ice damages the cable, it can't be accessed for repairs until ice-free summer conditions. (In contrast, an overland outage can be repaired during the winter). This means that the vulnerability of the system is greater, as communities may be isolated from telecommunications access until repairs can be completed the following summer.

During local meetings, an elder also stated that Selawik Lake has difficult and sensitive permafrost and icing conditions, which they recommended to be avoided.

2.11 Alternative 11

Alternative 11 was developed based on the project feasibility study (Figure 1-5). This route includes:

- Dual corridor through the USFWS Refuge (to increase reliability)
- Different route into Deering

Upon further analysis, this route was found to have

- Additional impacts to ANILCA Conservation Units (2 routes through the USFWS Refuge)
- More difficult terrain between Kiana and Ambler
- Landownership and terrain blocking Portage/Sinuaruk Creek Pass

2.12 Alternative 12: Grant Route

The original grant proposed a primarily subsea and in-river route for the proposed cable (Figure 1-5).

While in-river submarine cable technology exists and has been successfully implemented in temperate river environments, the Arctic environment presents challenges.

The best examples of the risks associated with submarine cable alternatives are the difficulties other projects in the region have had in providing services. The Quintillion network began operations in December 2017. It has suffered line breaks[2] in 2023, 2024, and 2025 - these were from ice scouring and breaking the line. It has taken months to repair the outages, because repairs must wait for summer.

As a result, some fiber projects in Alaska have moved away from in-water construction and towards overland construction with specific crossings of waterbodies. This minimizes the potential impacts to the waterbody, minimizes risk of breaks (of the cable) in the waterbody, and if breaks occur, allow repairs to be made without having to wait till spring.

[2] Citations for Quintillion breakages: https://alaskapublic.org/news/2023-06-12/cut-cable-causes-weeks-long-north-slope-northwest-alaska-internet-and-cellphone-outages, https://broadbandbreakfast.com/quintillion-to-repair-broken-arctic-fiber-line-after-six-month-delay/, https://www.nomenugget.net/news/fiber-optic-cable-cut-interrupts-internet-and-cell-services, https://www.alaskasnewssource.com/2025/01/27/quintillion-says-ice-scour-is-cause-long-term-internet-outage/

3 Alternatives Summary

This alternative analysis presents a reasonable range of alternatives and screens them for technical and economic feasibility, as well as achieving the project's purpose and need. The alternatives advanced forward for analysis are:

- Alternative 1
- Alternative 2

Table 3-1: Alternatives.

#	Alternative	Included in EA?
1	Alternative 1	Yes
2	Alternative 2	Yes
3	SF-299 Route	No
4	Kobuk Valley National Park Route	No
5	"Low Gradient" Kobuk National Park Route	No
6	Microwave Tower Network	No
7	Satellite Services	No
8	Alternative modified "Cut Across"	No
9	Portage/Sinuaruk Creek Pass	No
10	Selawik Lake	No
11	Initial Route	No
12	Grant Route	No

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Appendix A: Figures

Legend

- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5
- Fiber Mile Markers (10 Mile Intervals)
- Community
- Streams & Rivers
- Area Map Boundary Sheets

0 15 30 60 Miles

Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.
3. Stream data is from USGS National Hydrography Dataset (NHD).

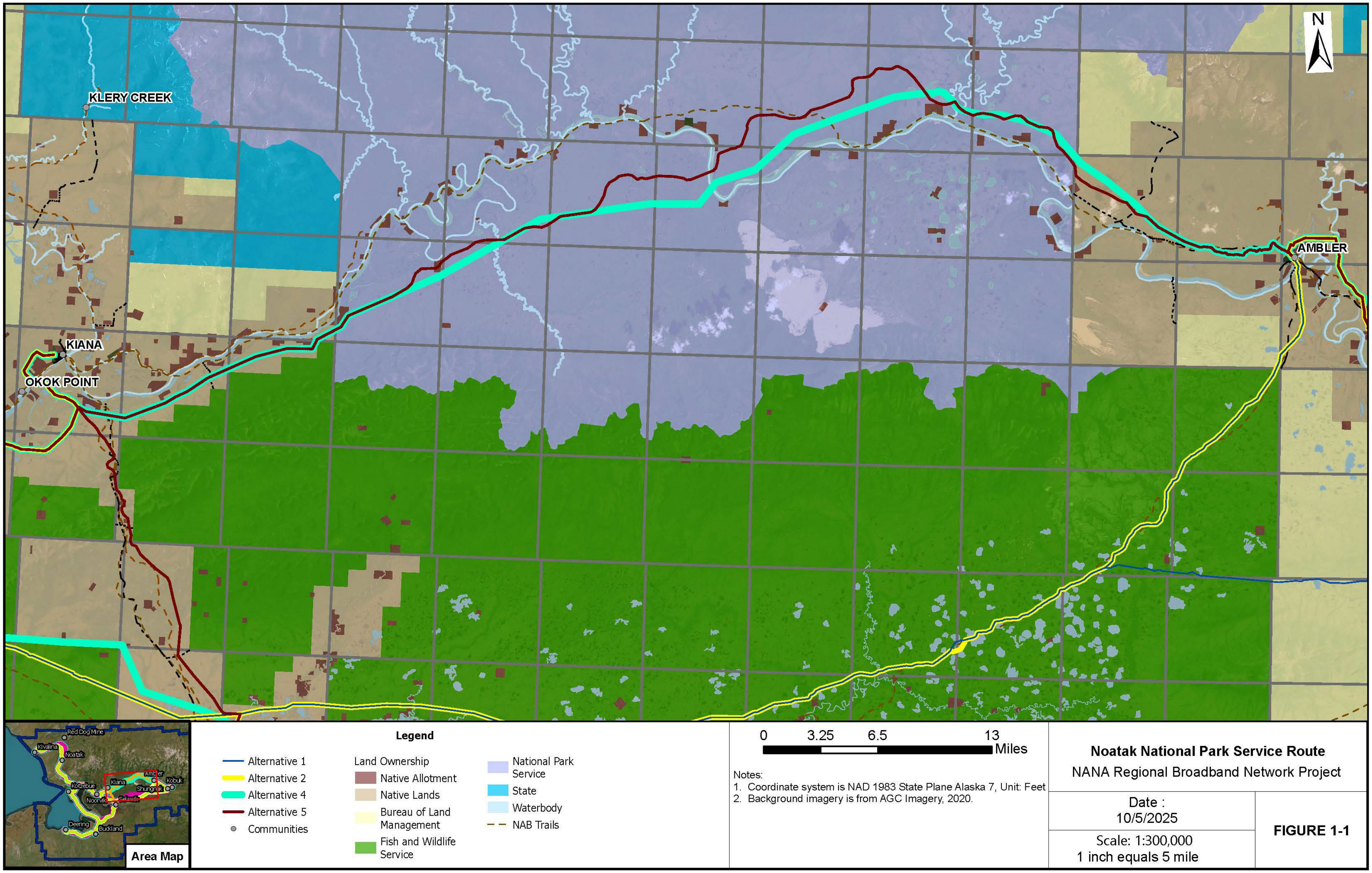
USFWS Alternative Routes Overview Map

NANA Regional Broadband Network Project

Date:
10/5/2025

Scale: 1:1,250,000
1 inch equals 20 miles

FIGURE 1



Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.

Noatak National Park Service Route

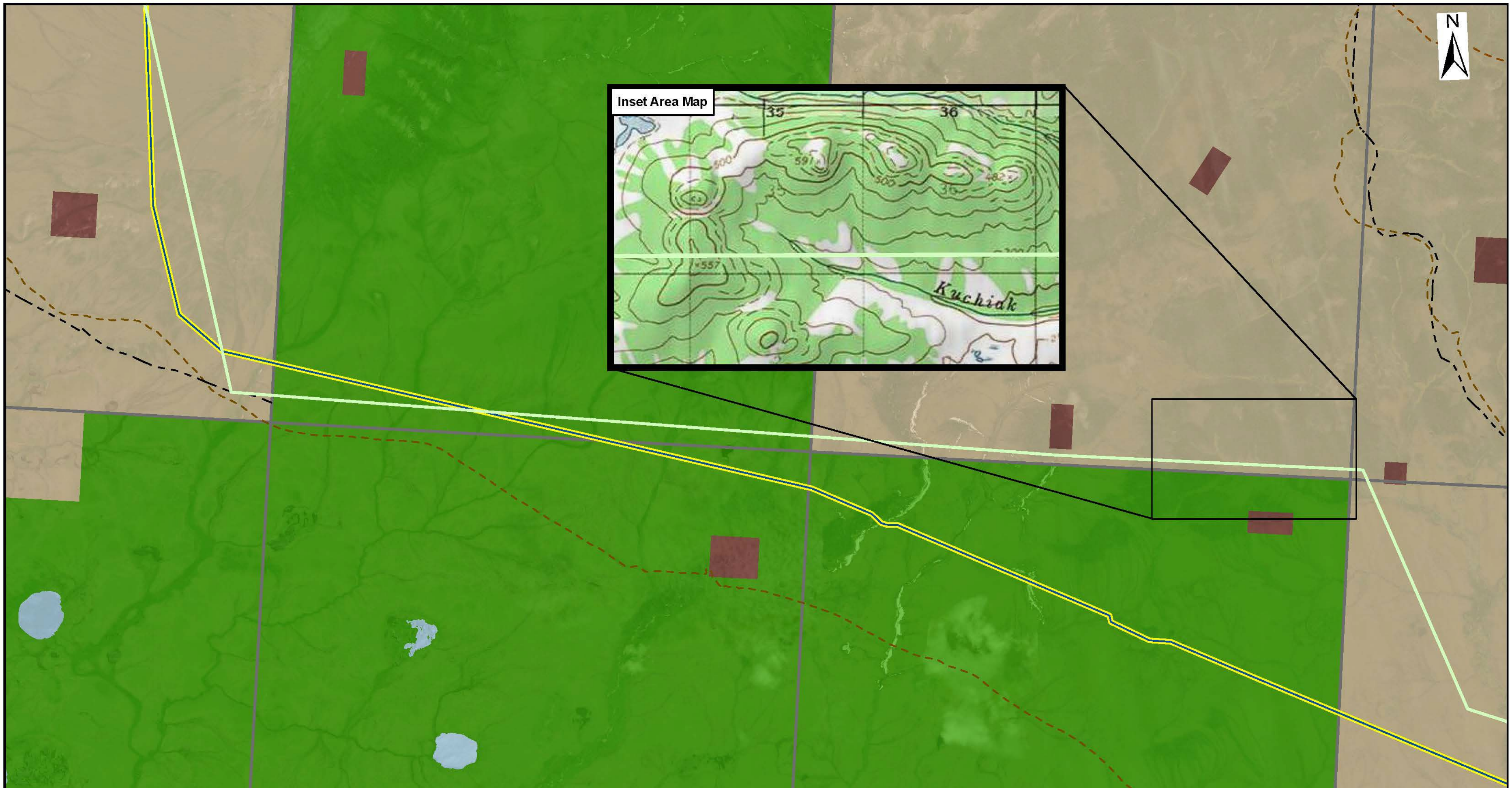
NANA Regional Broadband Network Project

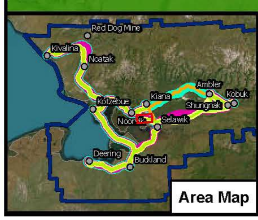
Date : 10/5/2025

Scale: 1:300,000

1 inch equals 5 mile

FIGURE 1-1





Legend

- Alternative 1
- Alternative 2
- Alternative 8
- Communities

Land Ownership

- Native Allotment
- Native Lands
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- State
- Waterbody

0 0.5 1 2 Miles

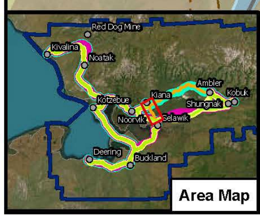
Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.

Western Refuge & "Cut Across"
NANA Regional Broadband Network Project

Date :
10/5/2025

Scale: 1:64,000
1 inch equals 1 mile

FIGURE 1-2



Legend

Alternative 1	Land Ownership	Fish and Wildlife Service
Alternative 2	Native Allotment	National Park Service
Alternative 9	Native Lands	State
Communities	Bureau of Land Management	Waterbody
NAB Trails		

0 1 2 4 Miles

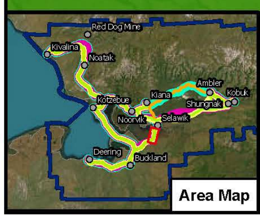
Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.

Portage/Sinuaruk Creek Pass
NANA Regional Broadband Network Project

Date :
10/5/2025

Scale: 1:100,000
1 inch equals 2 mile

FIGURE 1-3



Legend

- Alternative 1
- Alternative 2
- Alternative 10
- Communities
- NAB Trails

Land Ownership

- Native Allotment
- Native Lands
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- State
- Waterbody

0 0.5 1 2 Miles

Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.

Selawik Lake

NANA Regional Broadband Network Project

Date : 10/5/2025

Scale: 1:64,000
1 inch equals 1 mile

FIGURE 1-4

Legend

- Alternative 1
- Alternative 2
- Alternative 11
- Alternative 12
- Fiber Mile Markers (10 Mile Intervals)
- Community
- Streams & Rivers

0 15 30 60 Miles

Notes:
1. Coordinate system is NAD 1983 State Plane Alaska 7, Unit: Feet
2. Background imagery is from AGC Imagery, 2020.
3. Stream data is from USGS National Hydrography Dataset (NHD).

USFWS Alternative Routes Map

NANA Regional Broadband Network Project

Date:
10/5/2025

Scale: 1:1,250,000
1 inch equals 20 miles

FIGURE 1-5