Report of Investigation 2021-3 Tuntutuliak

EROSION EXPOSURE ASSESSMENT—TUNTUTULIAK

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Tuntutuliak, Alaska, in 2021. Photo: Alaska Division of Geological & Geophysical Surveys.

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EROSION EXPOSURE ASSESSMENT—TUNTUTULIAK

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TUNTUTULIAK EROSION EXPOSURE ASSESSMENT

This is a summary of erosion forecast results near infrastructure at Tuntutuliak, Alaska. We conduct a shoreline change analysis, forecast 60 years of erosion, and estimate the replacement cost of infrastructure in the forecast area. Buzard and others (2021) describe the method and guidance for interpreting tables and maps.

Source data for this summary include the following:

- Delineated vegetation lines and change assessment by Buzard and others (2021) following the methods of Overbeck and others (2020).
- Infrastructure AutoCAD outlines and metadata from the Division of Community & Regional Affairs (2004) Community Profile Map series.
- Added infrastructure such as roads, water and sanitation facilities, and outbuildings, delineated if visible in the most up-to-date high resolution (≤ 0.66 ft [20 cm] ground sample distance) aerial orthoimagery (Overbeck and others, 2016).
- Computed infrastructure cost of replacement based on square or linear footage from Buzard and others (2021).

Tuntutuliak is located in the southern Yukon-Kuskokwim Delta where the Kinak River joins the Kuskokwim River before emptying into Kuskokwim Bay. The Kinak River undergoes linear erosion along its cutbanks and accretion at point bars (Overbeck and other, 2020). From 1952 to 2015, the Kinak River nearly doubled in width from about 170 ft to 320 ft, with erosion rates

reaching 4.3 feet per year (Overbeck and others, 2020). A large portion of the community's infrastructure is built on cutbanks and is exposed to erosion. Erosion protection built near the tank farm is reportedly not effective (ADEC, 2012) so we include that section of the river in our analysis.

We forecast erosion 60 years from the most recent shoreline (2015) at 20-year intervals to identify the exposure of infrastructure to erosion. The forecast shows all categories of infrastructure are exposed to erosion over the next 60 years (table 1). The greatest replacement costs are in the 2015 to 2035 period (figs. 1 and 2). Buildings have the greatest replacement cost ($11.3 million) followed by the barge landing ($2.5 million; table 2). There are at least 19 residences within the erosion forecast area over 60 years, as well as the old power plant, and the gas station (table 3). The total replacement cost of infrastructure exposed to erosion is $14.8 million (± $4.4 million) by 2075 (table 2; fig. 1).

ACKNOWLEDGMENTS

This work was funded by the Denali Commission Village Infrastructure Protection Program through the project "Systematic Approach to Assessing the Vulnerability of Alaska's Coastal Infrastructure to Erosion." The community of Tuntutuliak was not consulted for this report.

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Table 1. Quantity of infrastructure with estimated erosion exposure by linear footage (LF), square footage (SF), or count (n).

Quantity of Exposed Infrastructure							
Erosion Forecast Date Range	**Buildings (n)**	**Power Lines (LF)**	**Fuel Lines (LF)**	**Water Lines (LF)**	**Boardwalks**	**Airport (LF)**	**Barge Landing (SF)**
2015 to 2035	25	367	74	110	622	0	22,410
2035 to 2055	28	400	245	331	1,466	0	23,256
2055 to 2075	17	505	199	362	946	13	145,237
Combined Total	70	1,272	518	803	3,034	13	190,903

Table 2. Replacement cost of infrastructure exposed to erosion per 20-year interval.

Cost to Replace Exposed Infrastructure							
Erosion Forecast Date Range	**Buildings**	**Power Lines**	**Fuel Lines**	**Water Lines**	**Boardwalks**	**Airport & Barge Landing**	**Sum**
2015 to 2035	$4,864,300	$73,400	$20,000	$50,000	$75,000	$2,500,000	$7,582,700
2035 to 2055	$3,100,000	$80,100	$0	$126,400	$81,600	$0	$3,388,100
2055 to 2075	$3,335,300	$101,000	$11,100	$144,800	$70,900	$130,000	$3,793,100
Combined Total	$11,299,600	$254,500	$31,100	$321,200	$227,500	$2,630,000	$14,763,900

Table 3. Cost estimate of exposed buildings and tank facilities by 20-year interval. The count of exposed residential or unspecified buildings is denoted in parentheses. NCA designates buildings with no cost assigned.

Cost to Replace Exposed Buildings and Tank Facilities		
Erosion Forecast Date Range	**Building Type**	**Cost of Replacement**
2015 to 2035	Residential (3)	$1,214,300
	Old Power Plant	$3,250,000
	Unspecified (21)	$400,000
2035 to 2055	Residential (5)	$2,000,000
	Storage Facility	NCA
	Gas Station	$100,000
	Airport Equipment Storage	$200,000
	Unspecified (20)	$800,000
2055 to 2075	Residential (6)	$2,449,300
	Unspecified (11)	$886,000

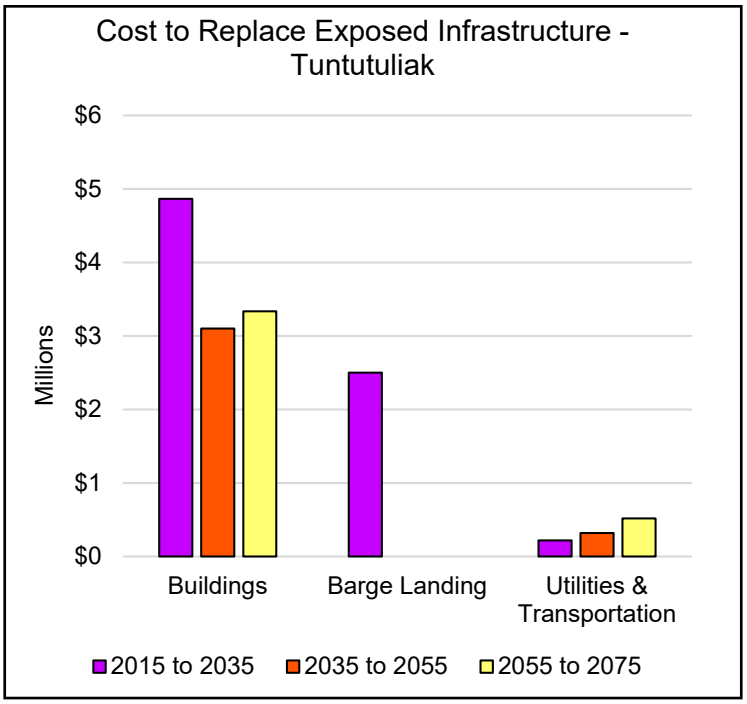

Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2015 to 2035, red represents 2035 to 2055, and yellow represents 2055 to 2075. The bulk of costs are buildings, especially from 2015 to 2035.

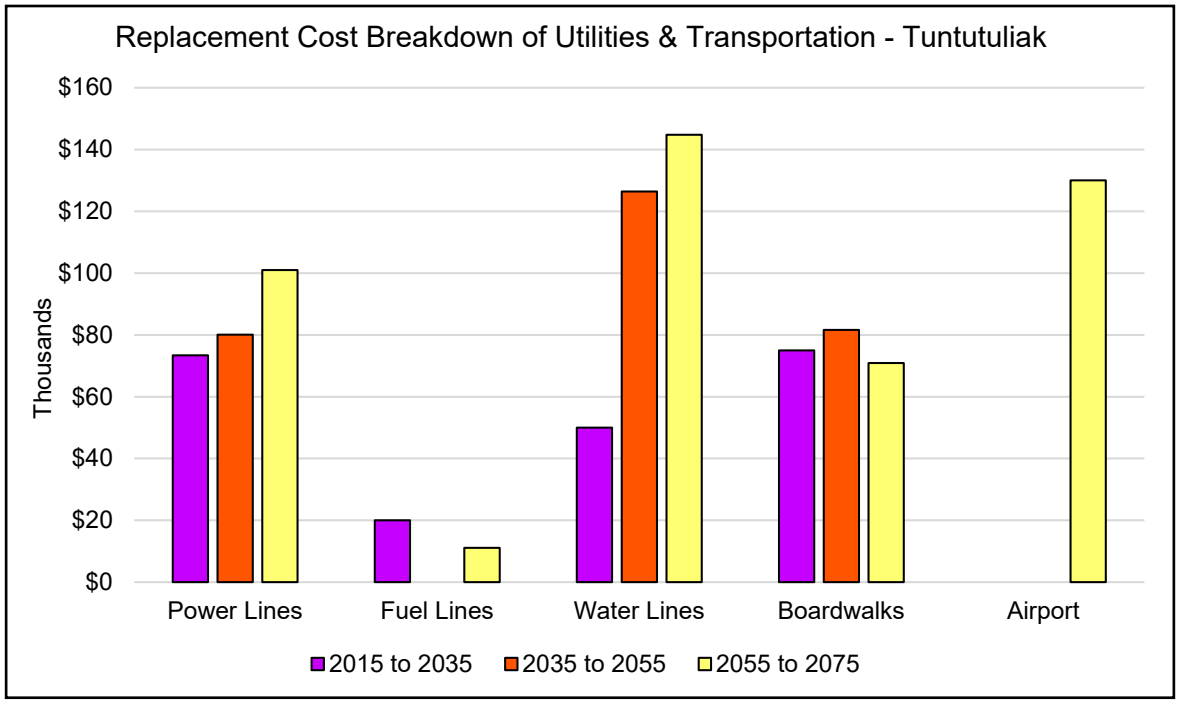

Figure 2. This figure breaks down the replacement cost of all utilities and transportation infrastructure in the erosion forecast area. The greatest cost is erosion of water lines from 2035 to 2075.

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Erosion Forecast
Tuntutuliak, Alaska

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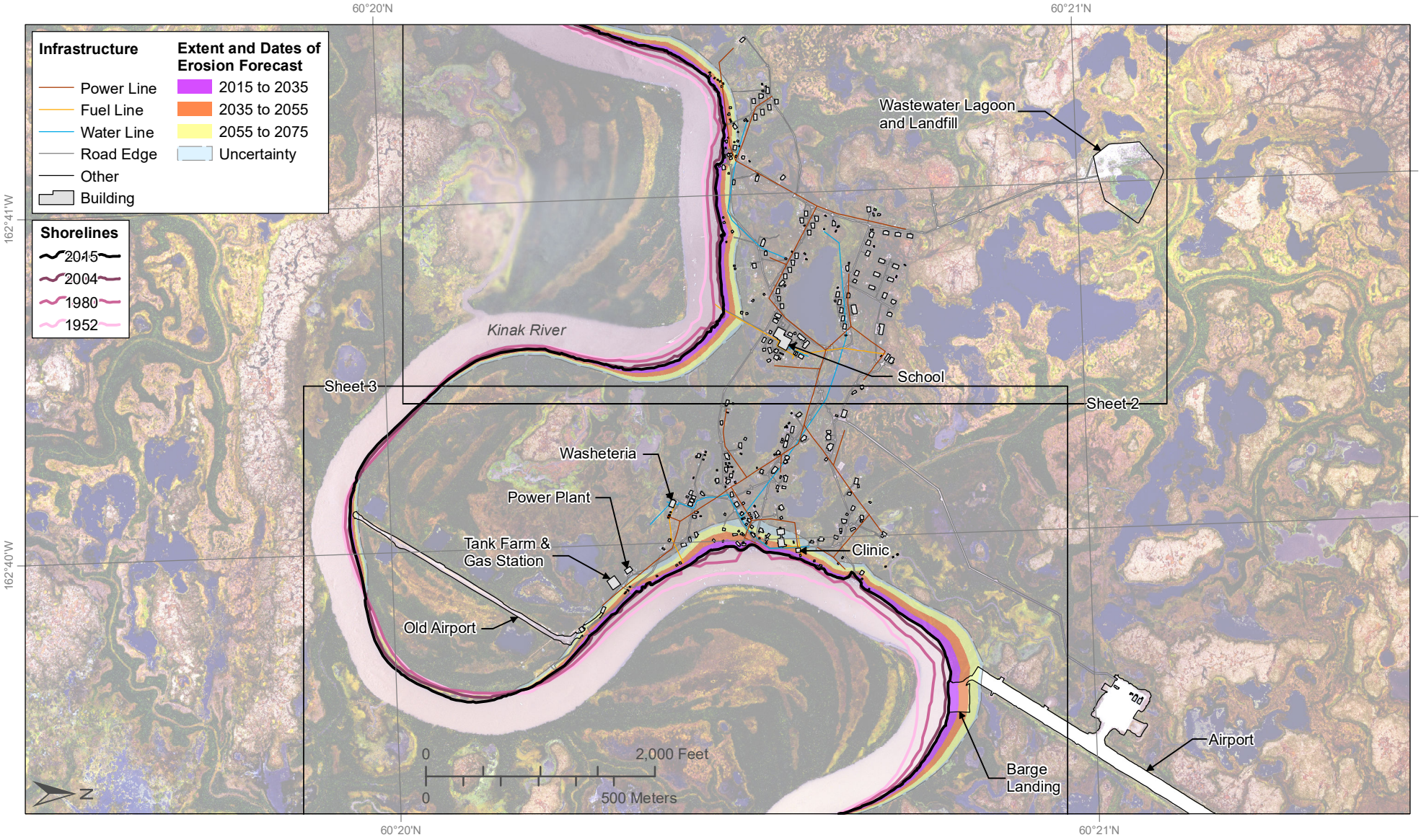

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Projection: NAD83 UTM Zone 3N. Orthoimagery year: 2015. Orthoimagery available from elevation.alaska.gov

Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pinkscale and labeled by year). The long-term (1952 to 2015) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to reach the colored areas by specified time intervals: 2015 to 2035 (purple), 2035 to 2055 (orange), and 2055 to 2075 (yellow). The area of uncertainty of the 2075 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2075 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Tuntutuliak, refer to the Tuntutuliak erosion exposure assessment report.

This work is part of the Coastal Infrastructure Erosion Vulnerability Assessment project funded by the Denali Commission Environmentally Threatened Communities Grant Program. Components of this map were prepared by the Alaska Department of Commerce, Community, and Economic Development (DCCED) using funding from multiple municipal, state, federal, and tribal partners. The original AutoCAD drawing of the infrastructure data layers was converted to ArcGIS.

Erosion Exposure
Tuntutuliak, Alaska

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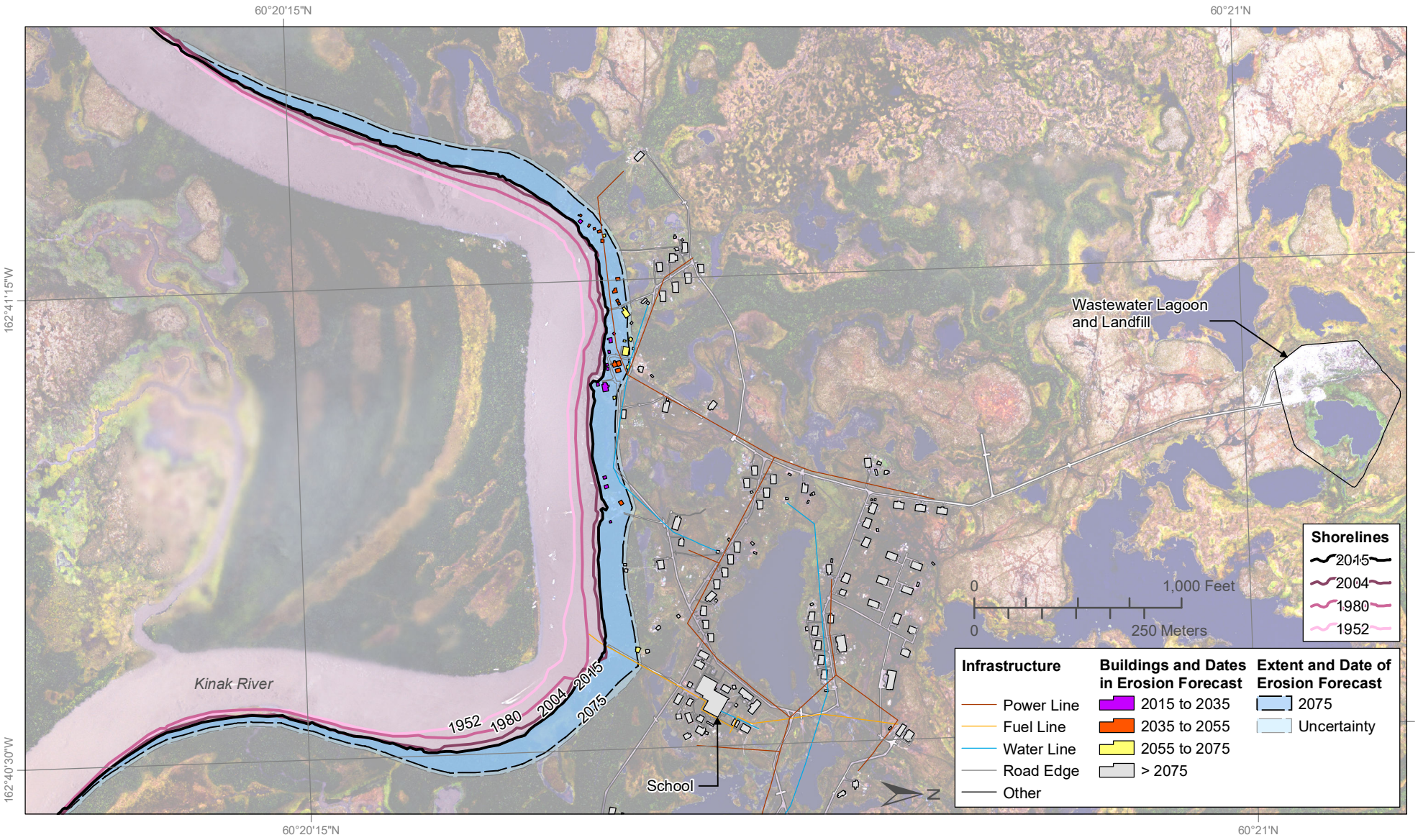

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Erosion Exposure
Tuntutuliak, Alaska

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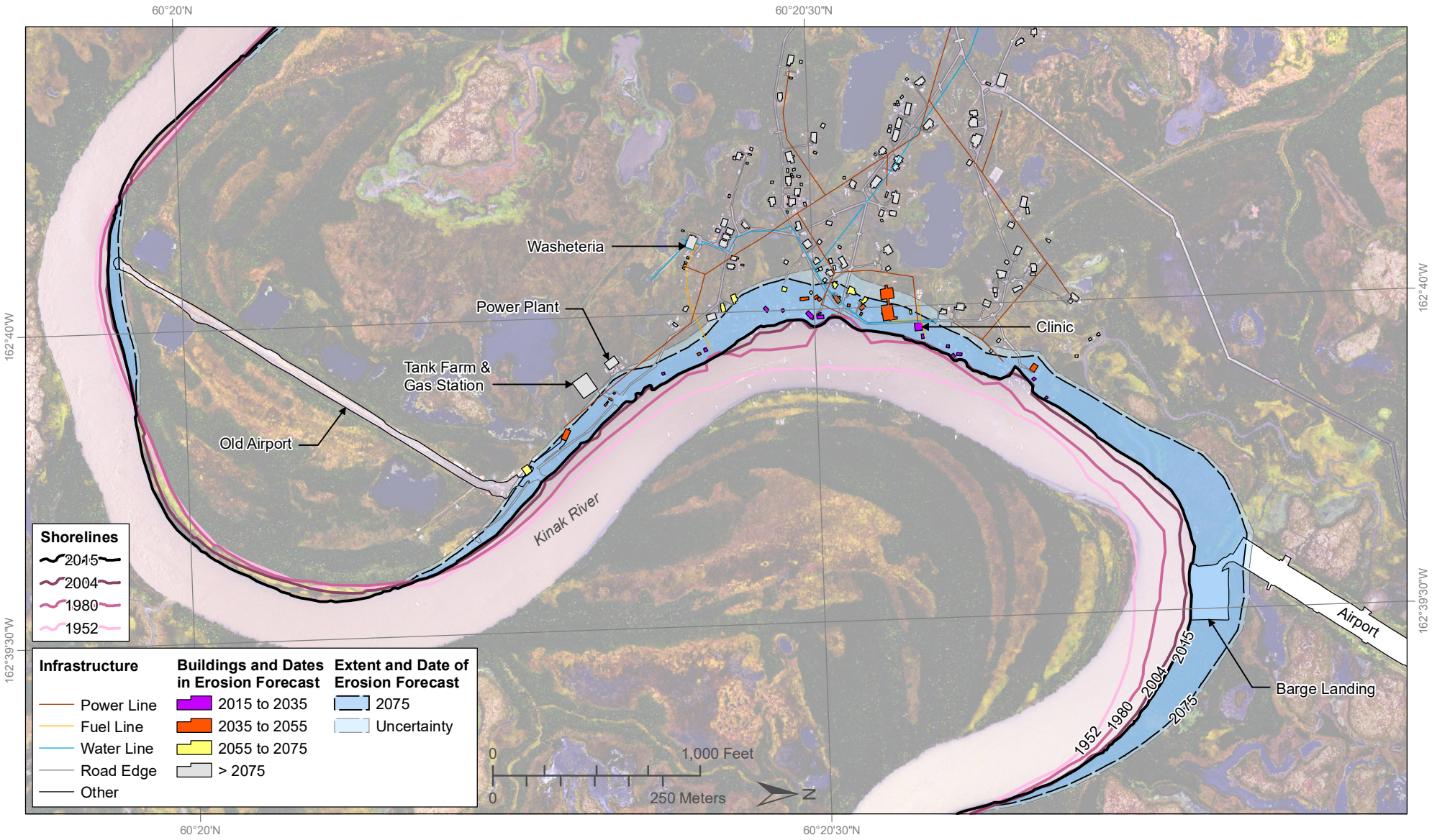
Buzard and others, 2021
Tuntutuliak, Sheet 3 of 3



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