Report of Investigation 2021-3 Egegik

EROSION EXPOSURE ASSESSMENT—EGEGIK

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Egegik, Alaska, in 2006. Photo: ShoreZone, shorezone.org.

Published by
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
2021

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State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys

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Suggested citation:
Buzard, R.M., Turner, M.M., Miller, K.Y., Antrobus, D.C., and Overbeck, J.R., 2021, Erosion Exposure Assessment of Infrastructure in Alaska Coastal Communities: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2021-3.https://doi.org/10.14509/30672

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EROSION EXPOSURE ASSESSMENT—EGEGIK

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EGEGIK EROSION EXPOSURE ASSESSMENT

This is a summary of erosion forecast results near infrastructure at Egegik, 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 Division of Community & Regional Affairs (2002) 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 (Quantum Spatial, 2019).
- Computed infrastructure cost of replacement based on square or linear footage from Buzard and others (2021).

Egegik is located on the Alaska Peninusla in the eastern section of Bristol Bay, at the mouth of the Egegik River upstream of Egegik Bay. Fall storm surge is the primary driver of erosion in the community (Bristol Bay Native Association [BBNA], 2019). Additionally, BBNA (2019) reports that icebergs from Egegik Bay erode the beach. During spring break up, the Egegik River undercuts the bluffs along the riverbank (BBNA, 2019). Overbeck

and others (2020) show erosion rates of low-lying vegetation near the community that range between 1.0 and 13.5 feet per year, but the bluff is considered stable.

We forecast erosion 60 years from the most recent shoreline (2018) at 20-year intervals to identify the exposure of infrastructure to erosion. Erosion of the low-lying vegetated area is faster than the surrounding coastal bluffs. Future erosion may slow when the shoreline reaches the bluff. The forecast created for this report likely over-predicts erosion in the residential area between the bluff and the school because of this scenario. We delineate the inland bluff line on the maps to represent where erosion may slow when this transition occurs. We do not forecast erosion at the point where the two canneries are built because shorelines cannot be reliably identified. U.S. Army Corps of Engineers (2009) reports a seawall is built near Icicle Seafoods on the bluff toe near the city dock to prevent erosion.

In general, the erosion forecast primarily extends inland along the western shore. A total of five residential buildings are exposed to erosion between 2018 and 2038, with eight additional residential buildings in the following 40 years (tables 1–3). The erosion forecast area extends to water and sewer

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lines, with over 1,500 feet of line exposed in the first 20-year period and increasing in subsequent periods (table 1). Erosion and undermining of roads, power, and telephone lines are also forecast to increase each 20-year interval (table 1). The total replacement cost of infrastructure exposed to erosion is estimated at $16.2 million (± $4.8 million) by 2078 (table 2; figs. 1 and 2). We do not estimate erosion exposure for fuel lines because the data were not available. All exposed infrastructure are located on the bluff where forecasts may over-predict erosion.

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

Quantity of Exposed Infrastructure				
Erosion Forecast Date Range	**Buildings & Tank Facilities (n)**	**Power Lines (LF)**	**Water Lines (LF)**	**Roads (LF)**
2018 to 2038	10	73	1,545	359
2038 to 2058	16	505	2,715	763
2058 to 2078	8	1,574	4,257	1,326
Combined Total	34	2,152	8,517	2,448

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

Cost to Replace Exposed Infrastructure					
Erosion Forecast Date Range	**Buildings & Tank Facilities**	**Power Lines**	**Water Lines**	**Roads**	**Sum**
2018 to 2038	$400,000	$50,000	$618,100	$200,000	$1,268,100
2038 to 2058	$1,000,000	$65,600	$1,086,100	$248,500	$2,400,200
2058 to 2078	$10,000,000	$314,800	$1,702,800	$530,400	$12,548,000
Combined Total	$11,400,000	$430,400	$3,407,000	$978,900	$16,216,300

Table 3. Cost estimate of erosion exposure to buildings and tank facilities by 20-year interval. The count of exposed residential or unspecified buildings is denoted in parentheses.

Cost to Replace Buildings and Tank Facilities		
Erosion Forecast Date Range	**Buildings & Tank Facilities**	**Power Lines**
2018 to 2038	Residential (5)	$1,652,400
	Unspecified (5)	$964,900
2038 to 2058	Residential (5)	$2,299,000
	Unspecified (11)	$3,476,400
2058 to 2078	Residential (3)	$1,442,200
	Village Council	$500,000
	City Office	$500,000
	Community Baptist Church	$500,000
	Unspecified (2)	$552,600

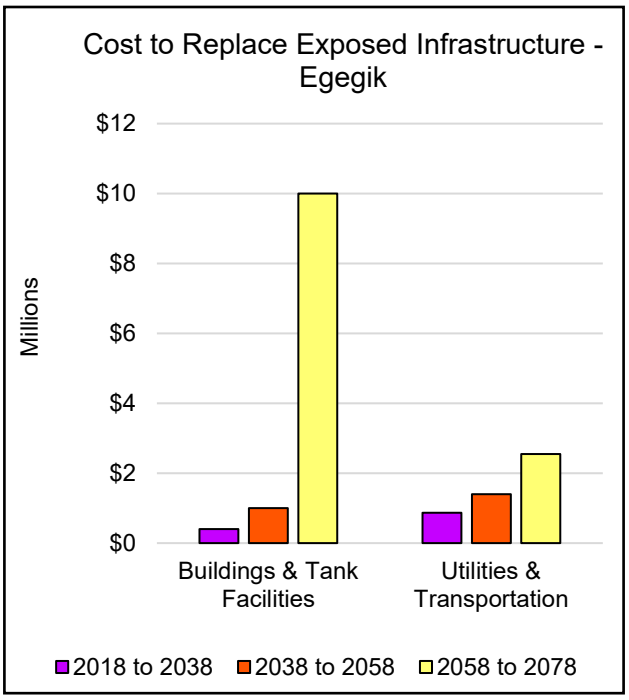

Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2018 to 2038, red represents 2038 to 2058, and yellow represents 2058 to 2078. The bulk of costs are buildings, especially from 2058 to 2078.

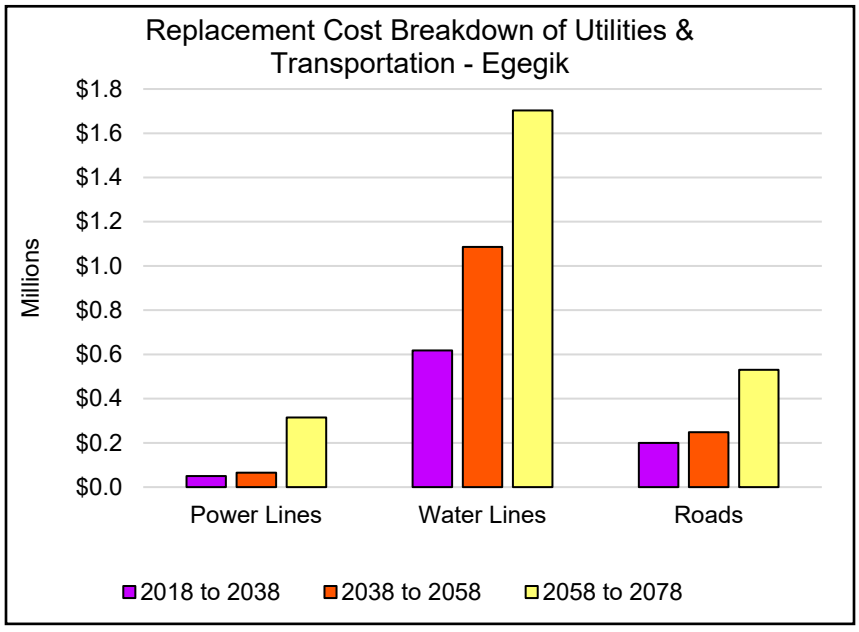

Figure 2. This figure breaks down the replacement cost of all utilities and transportation. The greatest cost is erosion of the water lines from 2058 to 2078.

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 Egegik was not consulted for this report.

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Erosion Forecast
Egegik, Alaska

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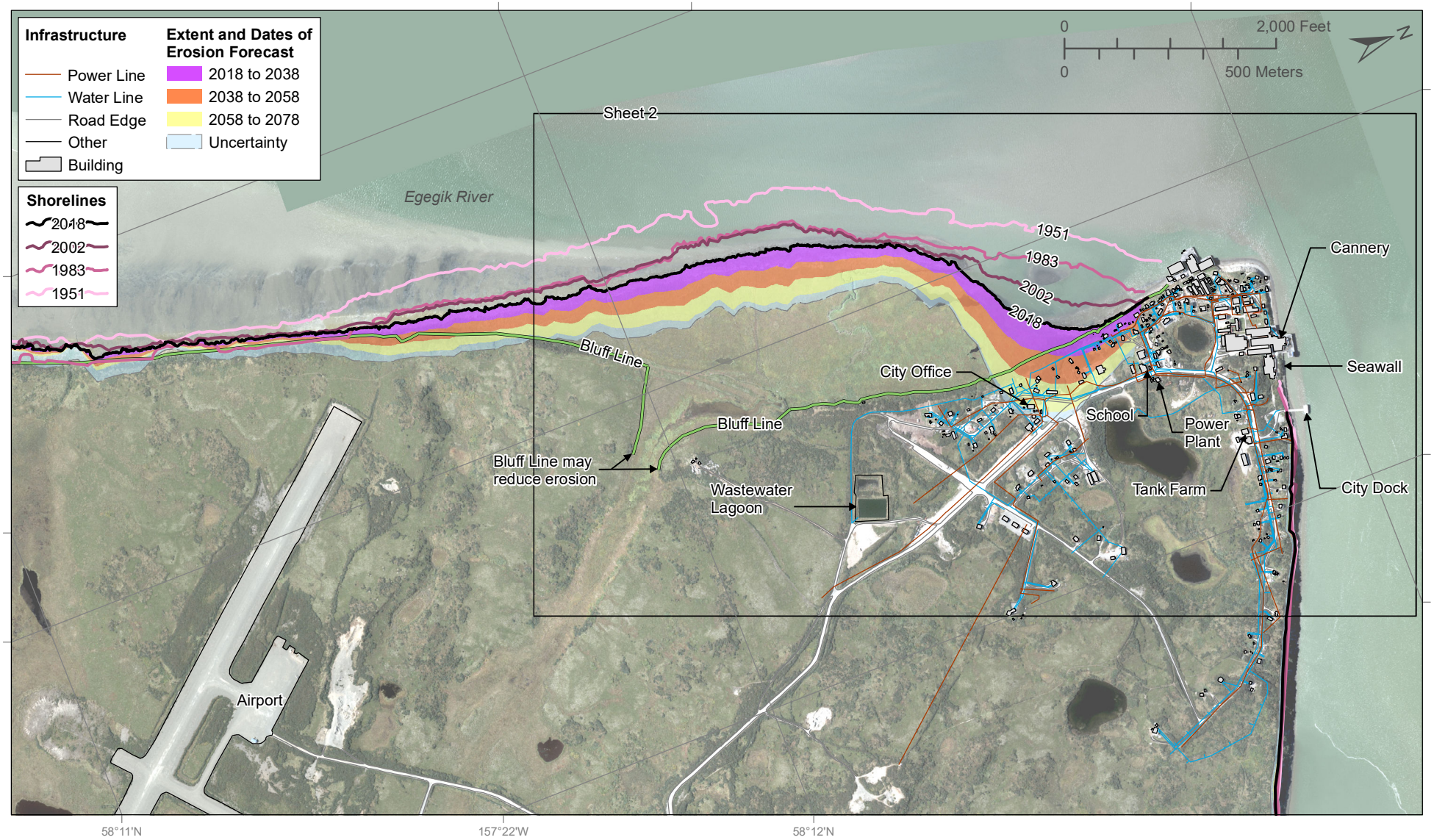
Egegik, Sheet 1 of 2



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Projection: NAD83 UTM Zone 4N. Orthoimagery year: 2018. 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 (1951 to 2018) 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: 2018 to 2038 (purple), 2038 to 2058 (orange), and 2058 to 2078 (yellow). The area of uncertainty of the 2078 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2078 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Egegik, refer to the Egegik 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
Egegik, Alaska

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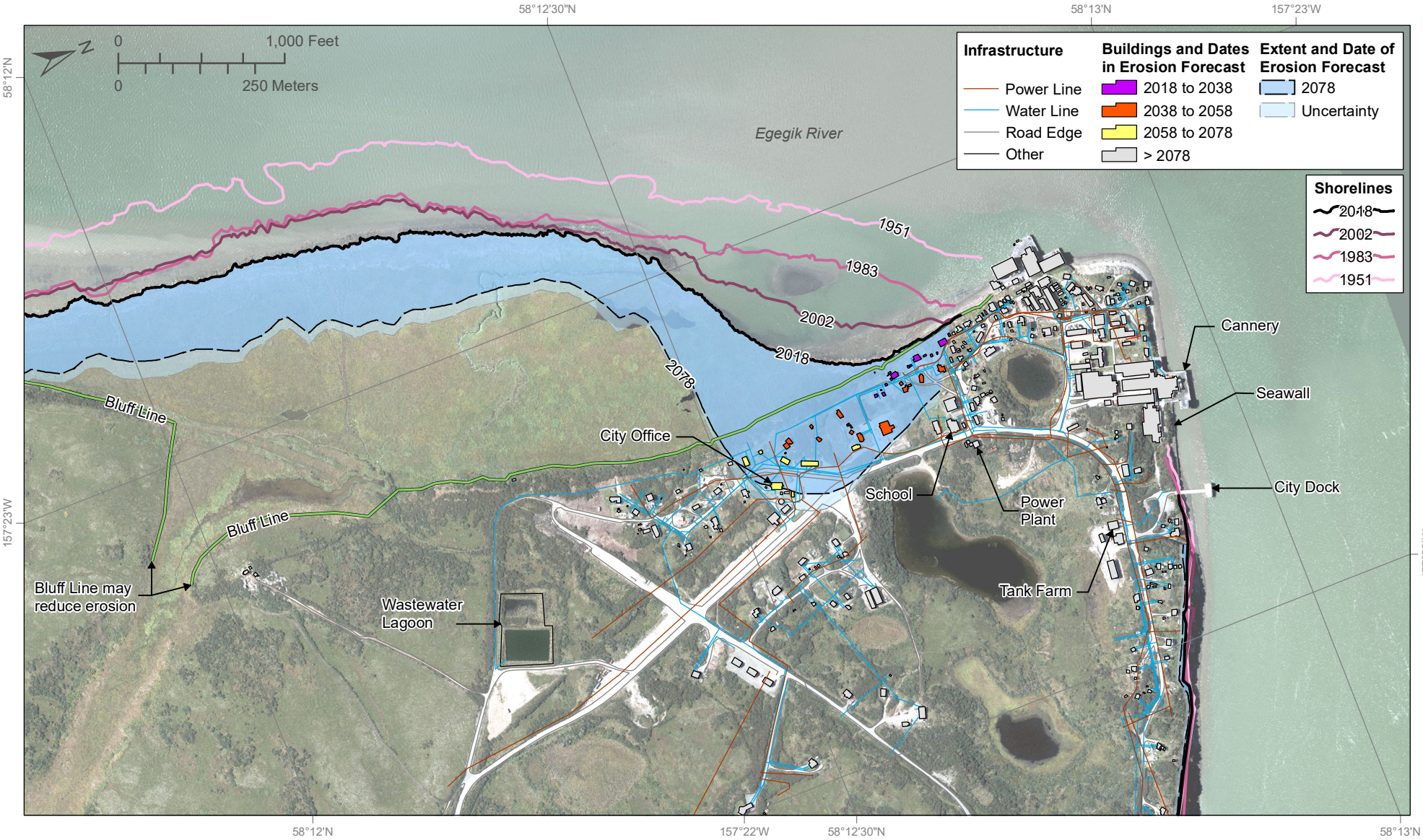
Egegik, Sheet 2 of 2



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