

**Community Erosion Assessment
Alakanuk, Alaska
27 January 2009**

1. Community: Alakanuk, Alaska



Figure 1: Alakanuk Location & Vicinity Map

2. Community Profile Summary:

Alakanuk, (ah-LUCK-uh-nuck), is a second class city located at the entrance to Alakanuk Pass, a major southern channel for the Yukon River, 15 miles from the Bering Sea, 162 air miles northwest of Bethel, and 490 miles northwest of Anchorage. Snowfall in Alakanuk averages 60 inches, with total precipitation of 19 inches per year. Temperatures range from -25 to 79 degrees Fahrenheit. The Yukon is typically frozen from November through May.

3. Concise Description of Erosion Problem:

Erosion at Alakanuk is episodic, occurring during two times of the year; break-up and fall storm season. During breakup, the Yukon River experiences high flows due to thawing snow and ice as well as surges caused by the failure of ice jams upriver. These higher flows increase the hydraulic friction of water against the soil of the bank. This particularly affects the scour hole where erosion is caused by direct impingement of the current against the bank.

The side of Alakanuk Pass with the primary community has been divided into five reaches; referred to as Reaches 1 through 7. Reach 1 is a 1,350-foot stretch of riverbank at the far eastern end of the community and is eroding at a rate of 2 feet per year. Reach 2 is a 3,380-foot stretch of riverbank on the southern bank of the river just west of Reach 1 and is eroding at a rate of 2 feet per year. Reach 3 is a 2,610-foot stretch of riverbank on the southern bank of the river, fronts the majority of the community, and is eroding at a rate of 2 feet per year. Reach 4 is a 2,070-foot stretch of riverbank on the southern bank of the river and is eroding at a rate of 7.8 feet per year. Reach 5 is a 2,100-foot stretch of riverbank on the southern bank of the river and is eroding at a rate of 2 feet per year. Reach 6 is a 6,080-foot stretch of riverbank on the northern bank of the river and is eroding at a rate of 2 feet per year. Reach 7 is a 5,380-foot stretch of riverbank on the northern bank of the river and is eroding at a rate of 2 feet per year.

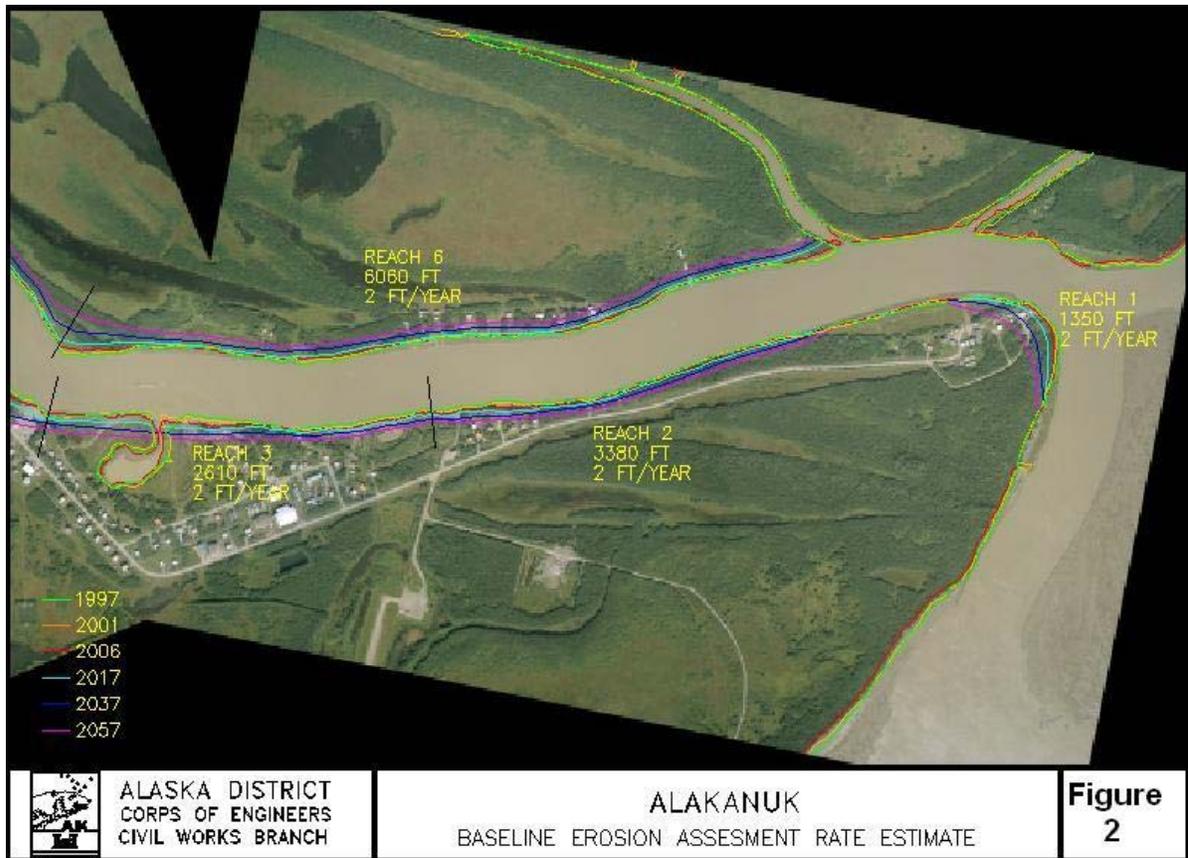


Figure 2. Alakanuk Erosion Reaches 1, 2, 3, and 6

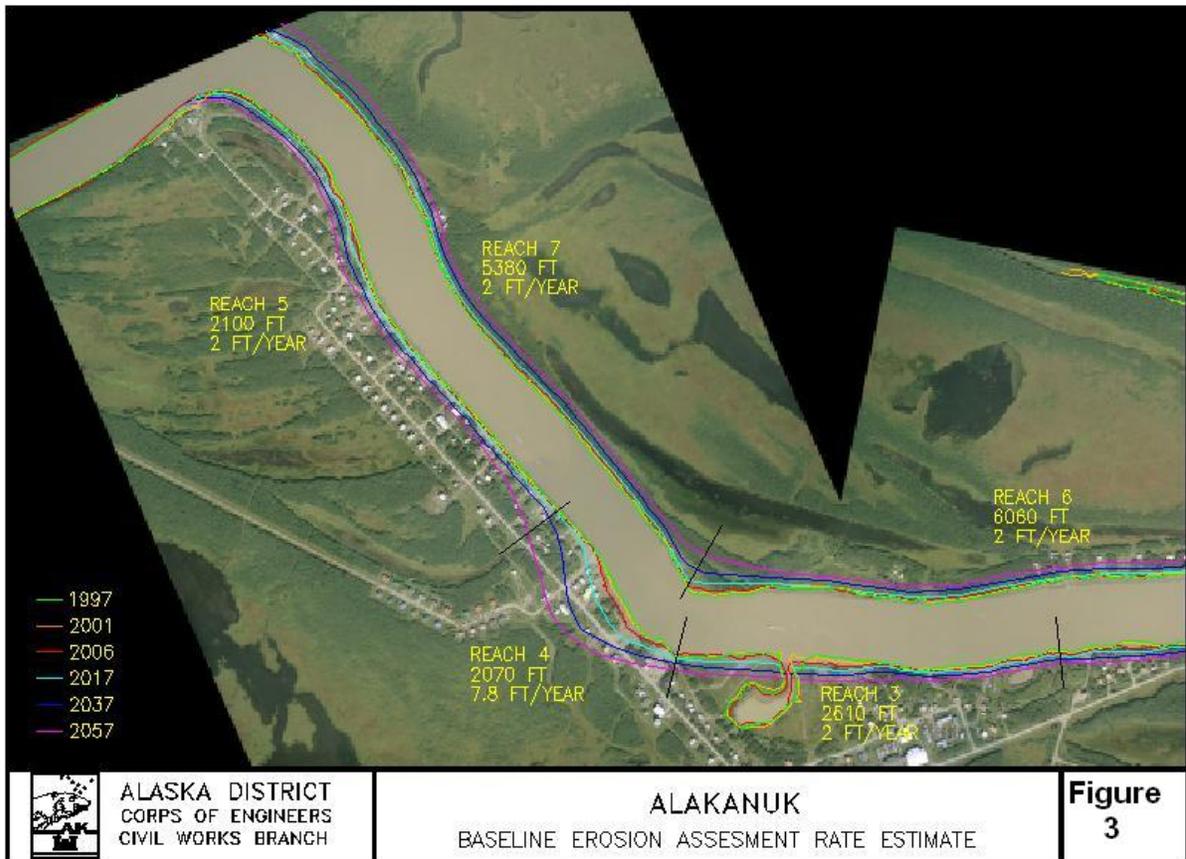


Figure 3. Alakanuk Erosion Reaches 3, 4, 5, 6, and 7

Potential Erosion Damages

Using the projected erosion interval lines on the aerial photograph, the economic damages were developed for the 50-year period of analysis and broken down into the sub-intervals of 0-10 years, 11-30 years and 31-50 years. Breaking down the economic damages into these sub-intervals allows us to determine when the greatest economic impact is expected to occur. Determining when the greatest economic impact could occur is important so that timely decisions can be made when an erosion retarding measure needs to be taken. For the purposes of this report, damages were assessed by time interval rather than attempting to estimate the exact year that the damage occurs. The analysis was completed in this manner to try and account for two types of uncertainty:

1. That which is associated with predicting erosion which is progressing at varying rates over time (including episodic events); and
2. That which exists when performing a surface analysis as opposed to doing an in depth investigation such as soils exploration and expensive modeling efforts.

Damage Categories

The approach used to determine potential erosion damages is based on several assumptions as they pertain to the damage categories of residential, commercial, public infrastructure, and land values. This evaluation relies on previous reports and information gathered during site visits to determine appropriate values where data was unavailable. Assumptions used for the various damage categories are described more fully in the following discussion of expected damages.

Damages caused by erosion in Alakanuk fall into six damage categories: land, residential structures, commercial structures, public structures, infrastructure, and environmental hazards. Structures were considered a loss when the bank line encroached within ten feet of the structure's foundation. Approximately 29 percent of erosion damages in Alakanuk are expected to occur within the first 10 years of the examined time period.

Expected Damages

The period of analysis for this evaluation is 50 years and all damage categories have net present values calculated based on the federal fiscal year 2009 discount rate of 4 5/8 percent. The sections below detail expected losses with a summary provided in Table 1.

Alakanuk is losing approximately 61,650 square feet of land per year (1.42 acres) throughout the aforementioned seven reaches. It is expected that 72.18 acres will be lost over the 50-year period of analysis. Estimated land losses include 3.16 acres in Reach 1, 7.91 acres in Reach 2, 6.11 acres in Reach 3, 18.90 acres in Reach 4, 9.30 acres in Reach 5, 14.19 acres in Reach 6, and 12.60 acres in Reach 7.

Total land damages in Alakanuk for the period of analysis are expected to be \$722,000 with a net present value of \$288,000. This represents an average annual loss of about \$14,900.

The residential damages in Alakanuk are spread out along the entire community and are located in all seven reaches. There are 59 outbuildings, including 30 residences, fish camps, and related structures at risk within the project area.

Projected commercial damages in Alakanuk are spread throughout the community and lie within Reaches 4, 5, and 6. There are five buildings at risk: one of the retail stores, two native store buildings, and two old fuel farm buildings. The old fuel farm is abandoned and located at the upstream end of the development across Alakanuk Pass.

Ten public buildings are at risk in Alakanuk over the 50-year period of analysis. Six of these structures are associated with the city including a storage building, workshop, city offices, garage, fire department, and a utility building associated with water and sewer. The Catholic Church has all three of its buildings at risk, including one outbuilding. The last at-risk structure is the tribal hall and its offices. All of these public structures are located in Reach 4.

Total structural damages in Alakanuk for the period of analysis are expected to be \$17.2 million with a net present value of \$5.8 million and an average annual loss of about \$298,500.

The portion of Alakanuk's infrastructure that sits within the 50-year erosion profile includes the following: 47,320 feet of roads (including the barge landing), 230 feet of boardwalks, 3,880 feet of water lines, 2,750 feet of sewer lines, 24 utility poles with associated power and phone lines, and 14 fuel storage tanks with an estimated combined volume of 63,730 gallons.

Damages to roads and the barge landing have a total value of \$19.4 million and a net present value of \$12.6 million. Damages to boardwalks have a combined value of about \$67,000 and a net present value of \$11,000.

Estimated water line damages have a total value of \$1.1 million and a net present value of \$215,000. There are several instances where erosion is likely to affect the midpoints of these pipes first, in which case large sections of the system would be compromised at the same time. This preliminary analysis does not attempt to differentiate these effects or to assign damages to the loss of services provided.

The sewer lines have a total value of \$828,000 and a net present value of \$186,000. Sewer lines are subject to the same considerations as water lines regarding the erosion of midpoints in the system.

The expected damages to fuel tanks have a total value of about \$341,000 and a net present value of \$156,000. Utility poles have a total value of about \$8.5 million and a net present value of \$2.1 million, each of these is valued at \$354,000; this includes the value of associated power and communication lines.

In total, Alakanuk has \$30.2 million of infrastructure at risk of erosion. The combined net present value of these items is \$15.2 million. The average annual loss of infrastructure is valued at \$786,600.

Alakanuk has numerous fuel tanks spread throughout the community. Each of these is considered an environmental hazard as their surrounding soils are likely contaminated and could harm the local ecosystem and fish stocks were they to erode away. Decommission and closure of these facilities will be needed to avoid these harmful effects.

Total fuel decommissioning and closure costs in Alakanuk are expected to be \$1,834,000 over the 50-year period of analysis. The net present value of these costs is about \$636,000 and the average annual loss for this damage category is about \$32,800.

Summary

Total erosion damages in Alakanuk over the 50-year period of analysis are \$49.9 million with a net present value of \$21.9 million and an average annual value of \$1.1 million. Table 1 summarizes the expected damages by category.

Table 1 Expected Damages over 50-Year Period of Analysis

Damage category	Quantity	Time Span (Years)			Total value (50 years)	Net Present Value	Average Annual Loss
		0-10	11-30	31-50			
Land (acres lost)	72.18	\$ 156,000	\$ 283,000	\$ 283,000	\$ 722,000	\$ 288,000	\$ 14,900
Residential	30	96,000	4,720,000	4,643,000	9,460,000	2,714,000	140,200
Commercial	5	--	1,261,000	820,000	2,081,000	601,000	31,000
Public buildings	10	2,525,000	535,000	2,566,000	5,626,000	2,466,000	127,300
Infrastructure	--	11,895,000	8,133,000	10,180,000	30,208,000	15,234,000	786,600
Environmental hazards	--	--	1,004,000	830,000	1,834,000	636,000	32,800
Total damages	--	\$14,672,000	\$15,936,000	\$19,322,000	\$49,931,000	\$21,939,000	\$1,132,800

5. Potential Solution:

Non-structural solutions include the establishment of a no-wake zone in front of the community and a vehicle-free zone on the top of the riverbanks. In addition, a channel survey should be conducted to determine the feasibility of river training structures.

A 6,000-foot long riprap revetment could be constructed to protect community infrastructure at the scour hole in Alakanuk Pass. Due to a channel depth of 90 feet, there are challenges associated with rock placement at the toe of the revetment. Therefore the preferred course of action is to armor the entire scour hole with rip rap to prevent future undercutting of the bank. Approximate costs are \$57.8 million with rough linear foot costs of \$9,600.

6. Conclusion:

Alakanuk has a definite erosion problem that is affecting the community over the next 50 years. The community has the potential to have nearly \$50 million in damages.

Alakanuk will require some sort of assistance to stop the erosion from causing significant damages as they are unable to solve their own erosion problems due limited financial resources.

7. Community Photos:



N 62° 41.261' W 164° 37.170'

Alakanuk

RIMG0021

Photo 1: Looking at Reach 1. The bank immediately downstream is accreting.



N 62° 41.275' W 164° 38.028'

Alakanuk

RIMG0124

Photo 2: Typical shoreline, Reach 6.

8. Additional Information:

This assessment, as well as those for other communities, can be accessed on the internet at www.AlaskaErosion.com. The web site also contains additional information on addressing erosion issues, educational materials, and contact information.



Alaska District
Corps of Engineers
Civil Works Branch

Predicted and Historical Shorelines

Erosion Year

	1997		2006		2037
	2001		2017		2057



Alaska Baseline Erosion
Alakanuk, Alaska