

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

1. Community: Kwigillingok, Alaska



Figure 1: Kwigillingok Location & Vicinity Map

2. Community Profile Summary:

Kwigillingok is an unincorporated village of 361 people located in the Bethel Recording District of the Unorganized Borough on the western shore of Kuskokwim Bay near the mouth of the Kuskokwim River. It lies 77 miles southwest of Bethel and 388 miles west of Anchorage. Kwigillingok is located in a marine climate. Precipitation averages 22 inches, with 43 inches of snowfall annually. Summer temperatures range from 41 to 57 degrees Fahrenheit, winter temperatures are 6 to 24 degrees Fahrenheit.

The area has long been occupied by the Yup'ik Eskimos. The population of the community consists of 97.9 percent Alaska Native or part Native. Kwigillingok is a traditional Yup'ik Eskimo village, practicing a commercial fishing and subsistence lifestyle. The sale or importation of alcohol is banned in the community.

3. Concise Description of Erosion Problem:

For this study the area was divided into four reaches. Reach 1 is a 3,150-foot portion of riverbank that fronts the community and is eroding at a rate of 4.0 feet per year. Reach 2 is a 3,500-foot portion of riverbank directly upstream (and north) of Reach 1 and is eroding at a rate of 7.7 feet per year. Reach 3 is a 2,750-foot portion of riverbank upstream of Reach 2 and is eroding at a rate of 2.0 feet per year. Reach 4 is a 1,000-foot portion of riverbank upstream of Reach 3 and is eroding at a rate of 3.0 feet per year. There is an area near the store that is eroding at a rate of 13 feet per year.

Erosion at Kwigillingok is episodic, occurring primarily during spring breakup and fall storm season. Ice in the spring is also a particular problem as it physically degrades the bank while the soil is soft. Fall storm events act in a similar manner as south winds because storm surges come up the Quillingok River to saturate the soils in the same manner as in the spring.

Erosion may become an issue at the airport, as well as along the Quillingok River. Aerial photography shows that a small drainage that once ran along the airfield in 1983 had expanded to about three times its original width in 2004. This enlargement of the channel corresponds to the disappearance of a large lake at the south end of the airfield. According to residents, the draining of the lake was a dramatic event occurring over the course of just one season.

The terrain in the area is predominantly low laying lands that flood annually with isolated areas of higher ground. The elevation difference between low and high ground in Kwigillingok is only about three feet resulting in periodic flooding of the high ground areas as well. Most of the community is built upon these high ground areas with only some older storage structures and the barge landing occupying the lower areas.

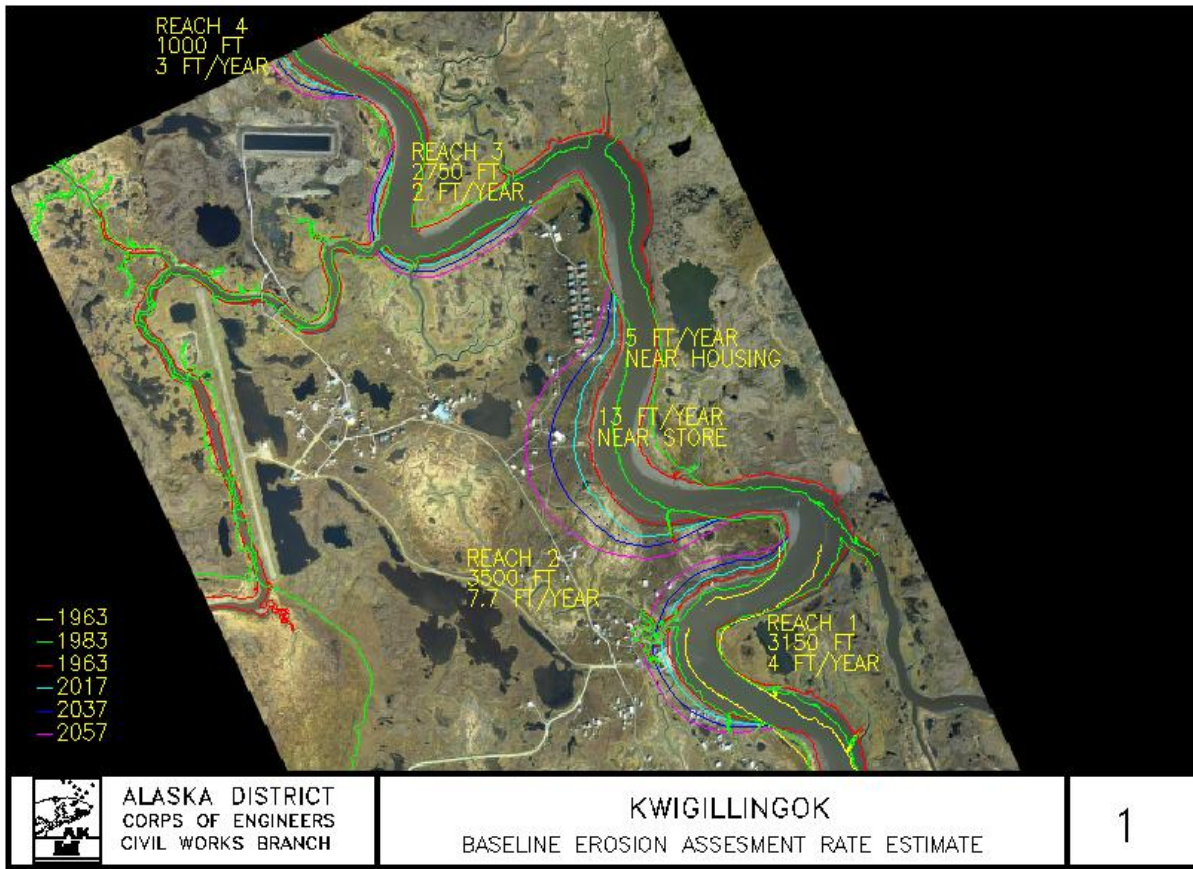


Figure 2. Kwigillingok Erosion Map

4. 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 will occur. 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.

Though many potential damage categories were evaluated during this assessment, Kwigillingok's expected erosion damages fit into six 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. Infrastructure considered for damages include roads, utilities, fuel stations and pipelines, the airstrip approach lights, and levees. Approximately 20 percent of the expected damages in Kwigillingok are expected to occur within the first 10 years of the 50-year examined 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.

Kwigillingok is losing approximately 48,050 square feet of land per year (1.10 acres). Estimated land losses for River Reach 1 are 14.75 acres with land losses for River Reach 2 of 31.55 acres, losses for Reach 3 of 6.44 acres, and losses for Reach 4 of 3.51 acres. It is expected that 56.26 acres will be lost over the 50-year period of analysis with a corresponding value of \$563,000 and a net present value of \$225,000.

The residential damages in Kwigillingok are all located in Reaches 1 and 2. There are 25 outbuildings and eight residences at risk within the 50-year period of analysis. Each of the outbuildings is valued at \$1,000. Residences, including their contents, are valued at \$205,000.

There are three commercial structures threatened by erosion in Kwigillingok: a local store, an outbuilding, and a storage facility all owned and operated by Kwik Incorporated. These are located in Reach 2, near the apex of the local river bend slightly downstream of the primary residential area. These figures likely understate the commercial damages caused by erosion in Kwigillingok. Were these structures to be lost, it could compromise the income earning opportunities for the affected businesses and relocation efforts could impact the earnings of the owners and employees.

There is one public building at risk in Kwigillingok, the IRA Council storage building located in the first erosion section, downstream of the barge landing.

Total expected structural damages for Kwigillingok are \$3.1 million with a net present value of \$832,000.

Infrastructure that lies within the 50-year erosion profile includes: approximately 32,935 feet of boardwalks, 27,920 feet of roads (including the barge landing), a bridge, two fuel headers, three fuel storage tanks with an estimated combined volume of 2,800 gallons, and 11 utility poles with associated power and phone lines.

Total infrastructure damages for Kwigillingok are \$26.5 million with a net present value of \$11.6 million.

The tank farms are subject to erosion and pose additional problems when threatened. Allowing contaminants to flow into the river could cause harm to the fish stock so vital for this community. Kwigillingok has three fuel tanks with approximately 2,800 gallons of storage that are at risk of erosion during the period of analysis. They are clustered near the IRA Council storage building, downstream from the barge landing. 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. The decommissioning and closure costs for these tanks are expected to be \$402,000, with a net present value of \$349,000 with an average annual loss of about \$18,000.

Summary

Total erosion damages in Kwigillingok over the 50-year period of analysis are approximately \$30.5 million with a net present value of almost \$13.0 million and an average annual value of \$671,100. Table 1 summarizes these findings by damage category.

Table 1. Summary of Expected Damages by Time Interval and Damage Category.

Damage Category	Quantity	Time Span (Years)			Total Value (50 years)	Net Present Value	Average Annual Value
		0-10	11-30	31-50			
Land (acres lost)	56.26	\$121,000	\$221,000	\$221,000	\$563,000	\$225,000	\$11,600
Residential	8	4,000	420,000	1,242,000	1,667,000	324,000	16,700
Commercial	3	--	989,000	299,000	1,288,000	410,000	21,200
Public buildings	1	131,000	--	--	131,000	98,000	5,100
Infrastructure	--	5,416,000	15,426,000	5,634,000	26,475,000	11,592,000	598,500
Environmental hazards	--	402,000	--	--	402,000	349,000	18,000
Total Damages	--	\$6,074,000	\$17,056,000	\$7,396,000	\$30,526,000	\$12,998,000	\$671,100

5. Potential Solutions:

A riprap revetment could be constructed to protect two bends in the river from the point at which historical erosion begins and extend approximately 6,000 feet downstream. The revetment would also include 50-foot tie back keys at the upstream ends to prevent erosion from flanking around the structures and a tie back or thickened section at the

downstream end. Approximate costs are \$26.7 million or roughly \$4,450 per linear foot of revetment.

6. Conclusion:

Kwigillingok has a definite erosion problem that is affecting the community over the next 50 years. The community has the potential to have more than \$30 million in damages.

Kwigillingok 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 to limited financial resources.

7. Community Photos:



N 59° 52.244' W 163° 08.713'

Kwigillingok
Photo 1: Reach 1.

RIMG0193



N 59° 52.173' W 163° 08.613'

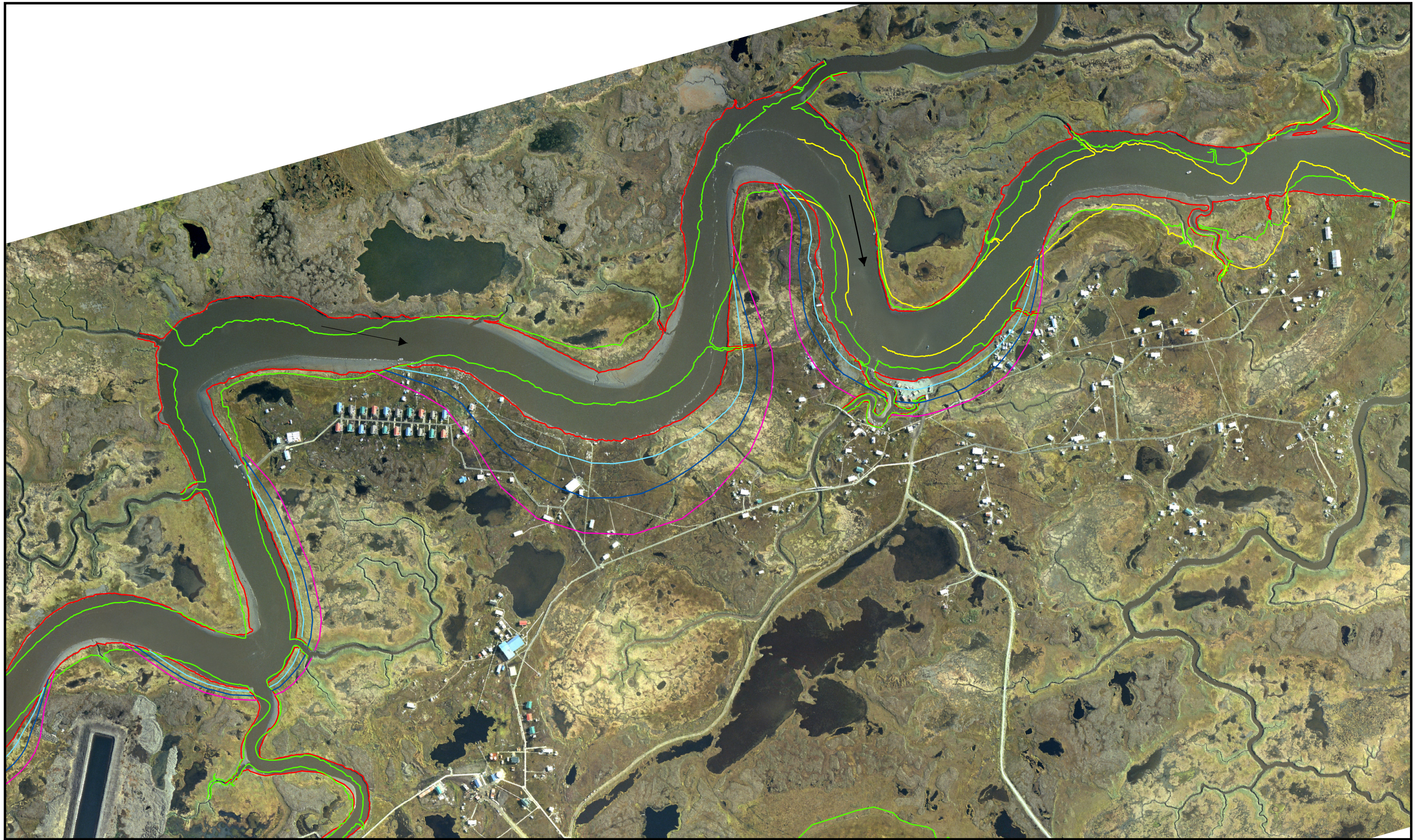
Kwigillingok

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Photo 2: Looking downstream at structures.

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.



	<p>Alaska District Corps of Engineers Civil Works Branch</p>	<p>Predicted and Historical Shorelines</p> <p>Legend</p> <table border="0"> <tr> <td></td> <td>1963</td> <td></td> <td>2004</td> <td></td> <td>2037</td> </tr> <tr> <td></td> <td>1983</td> <td></td> <td>2017</td> <td></td> <td>2057</td> </tr> </table>		1963		2004		2037		1983		2017		2057		<table border="0"> <tr> <td>0</td> <td>380</td> <td>760</td> <td>1,520</td> </tr> <tr> <td colspan="4">Feet</td> </tr> <tr> <td>0</td> <td>95</td> <td>190</td> <td>380</td> </tr> <tr> <td colspan="4">Meters</td> </tr> </table> <p>1 inch equals 600 feet Image dated 2004</p>	0	380	760	1,520	Feet				0	95	190	380	Meters				<p>Alaska Baseline Erosion Kwigillingok, Alaska</p>
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