

**Hydro Vulnerability Assessment
Alakanuk, Alaska
September 2021**



Photo: Alakanuk High School and eroding river bank. Picture taken with a UAS (drone).

Prepared by the Yukon River Inter-Tribal Watershed Council (YRITWC) in partnership with the Alakanuk Traditional Council. Funding was provided by the BIA Tribal Climate Resilience Program, for the project: *Vulnerability Assessments for Changing Hydrology in Interior Yukon River Basin Communities*. Grant # A19AP00196.



Maryann Fidel , mfidel@yritwc.org

Executive Summary: The YRITWC worked with the Alakanuk Traditional Council's Environmental Department to assess threats related to water, or hydro-vulnerabilities in Alakanuk. This is not a comprehensive document, but includes what we can learn and document by using an Unmanned Aerial System (UAS) in addition to some easily available tools.

This report contains documentation and assessment of: 1.) erosion and at-risk infrastructure, 2.) potentially contaminated sites (or Brownfields) and proximity to drinking water protection areas, and 3.) documentation of the landfill. The Alakanuk Environmental Department has recently gained the capacity to do their own UAS documentation and monitoring. This work represents a snapshot in time that the Environmental Department can continue to build on.

Additional future work on erosion monitoring, and contaminated sites is planned through a continued partnership of YRITWC and Alakanuk Traditional Council with funding provided by the National Science Foundation and the Environmental Protection Agency.

Introduction: A hydro-vulnerability assessment is a look at how water moves around a community, and how that movement may impact human health and well-being in the context of a changing climate. Permafrost melt and increased rainfall is destabilizing once frozen landscapes leading to increases in erosion and changes in contaminant pathways. In this report erosion, contaminated sites and the landfill are documented using a UAS.

For this work an UAS (or drone) was used equipped with infrared and NDVI sensors. DroneDeploy software was used to mosaic images together and create elevation maps. Additional tools that were used included GoogleEarth historical imagery, and the Alaska Department of Environmental Conservation (AK DEC) datasets (community drinking water intakes, drinking water protection areas and contaminated sites).

EROSION

An area of concern for river bank erosion was flown and mapped with a UAS and compared to historical satellite imagery from GoogleEarth (figure 1). In this stretch of river water levels go up and down with the tide, and with seasonal river fluctuations, but in the aerial images changes to the river bank can be seen. Figures 2 - 5 document some of the community assets that are at risk from continued river bank erosion.

Figure 1. Documentation of river bank erosion.

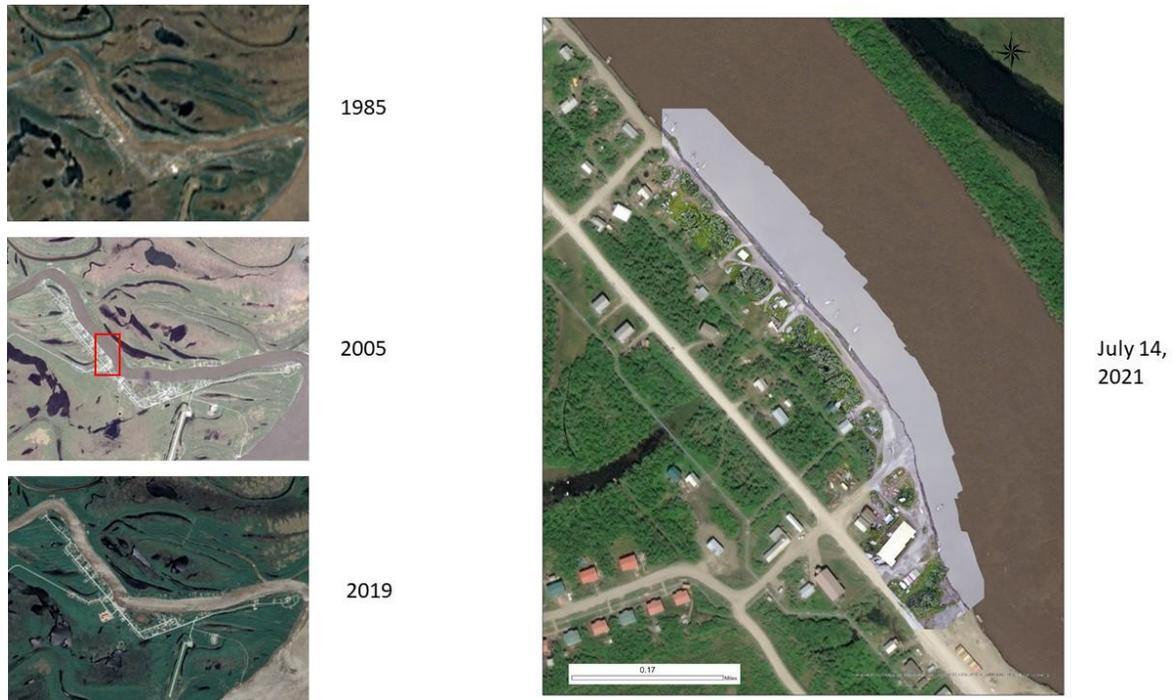


Figure 2. Erosion at boat landing and access road. Active erosion is apparent in the cracks in the road.



Figure 3. Electrical wire just a few feet from the eroding river bank.



Figure 4. A main electrical wire that connects the community is at risk from erosion.



Figure 5. View of main electrical wire that serves the community looking at the other side of the river.



Figure 6. Residences near a rapidly eroding river bank.



BROWNFIELDS (or potentially contaminated sites)

During this project two additional brownfield sites were added to YRITWC's inventory. Aerial photos were taken of one other previously documented site where clean-up work was occurring to document progress, and one site, the scrap yard, was documented to track future expansion.

Figure 7 shows the locations of contaminated sites in relation to the drinking water intake, and drinking water protection zones. Drinking water in Alakanuk comes from the surface waters of the river, as such there are two drinking water protections areas. The first is a 1000 foot buffer surrounding waters that feed into the intake (red line), and a 1 mile buffer zone (in orange). It is important to assess contaminated sites within these drinking water protection zones for potential impacts to drinking water.

Figure 7 includes contaminated sites from the AK DEC dataset (marked with triangles) and additional potentially contaminated sites that were documented by YRITWC and Alakanuk's Environmental Department during this project (yellow numbers). Sites from AK DEC include the fuel spill at the Alakanuk power plant that was cleaned-up in 1995¹ and the former South Bank Dumpsite, that YRITWC completed an Environmental Management Plan for in 2011². Structures and tanks were documented at the Old Native Store (#1 in yellow, figures 8-10). Great progress toward clean-up was documented at the Old BIA School North Bank, which is an inventoried site in YRITWC's Brownfield database (#2 in yellow, figure 11). The Scrapyard was documented (#3 yellow, figure 12) for monitoring. This isn't a brownfield site, but a staging area for backhaul, and reuse. Number four in yellow is the Boneyard (figures 13-14) which is in the process of being assessed through an EPA Brownfields Community-wide Assessment grant.

Except for the Boneyard, these potentially contaminated sites fall within a drinking water protection zone. Assessment and clean-up of these sites is important to protect clean water.

¹<https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/2114>

²<https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/25666>

Figure 7. Map of potentially contaminated sites in relation to drinking water intake, and drinking water protection zones.



Figure 8. The Old Native Store. The location is marked by a yellow #1 in figure 8.



Figure 9. A different view of the Old Native Store, showing its proximity to water.



Figure 10. A close-up with an infrared sensor of the propane tanks in front of the Old Native Store. If the tanks contained liquid there would be a clear line on the infrared imagery. The tanks do display different temperatures, which is due to the color of the tanks (dark colored tanks absorb more heat, while lighter tanks reflect it), but since there is no line they are likely empty. This was verified by tapping and lifting a few of the tanks.



Figure 11. The Old BIA School North Bank Brownfield site in the process of being cleaned-up. Marked by a yellow #2 on figure 7.



Figure 12. The Scrapyard, marked on figure 7 with a yellow #3. The photo was taken to monitor the site and examine near-by waters.



Figure 13. The Boneyard, marked by a yellow #4 on figure 7. Assessment and planning for clean-up will occur in 2022-23.



Figure 14. Another view of the Boneyard, showing the proximity to the river.



LANDFILL

Aerial photos were taken of the landfill in Alakanuk for monitoring purposes, and to look for any obvious impacts to nearby waters. The DroneDeploy software stitches aerial images together to make an orthomosaic aerial map, which has been mathematically corrected to represent an accurate view of the area. Unfortunately, not enough photos were taken of the west side of the landfill for a complete map of the landfill. Figure 15 shows the portion of the landfill that was successfully mapped. Figure 16 shows the elevation map and NDVI (or vegetation health) map that were examined for impacts to water. Since the elevation map is an incomplete view of the landfill it is difficult to know which direction surface waters flow. There are no patterns in the NDVI map that could indicate leachate flow. Continued monitoring of the landfill will help identify issues, and help to target areas that need attention. An additional flight with more pictures would contribute to understanding overland flow of waters.

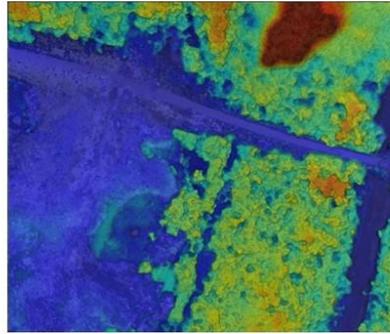
Figure 15. Orthomosaic map of a portion of the Alakanuk landfill.



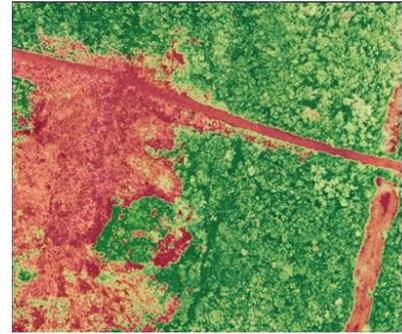
Figure 16. Aerial imagery including a Red, Green, Blue image, an elevation map and an NDVI map were examined for impacts to nearby waters.



Red, Green, Blue image



Elevation map, low areas are blue, higher elevation are red



NDVI Vegetation Health Index, where red is dead, and green is healthy plants

Figure 17. A complete view of the landfill showing surrounding waters taken from west of the landfill.



Figure 18. A complete view of the landfill taken from the east looking toward the village.



Conclusion: This report includes an aerial photo assessment of an area of concern for erosion and at risk community infrastructure, contaminated sites and the landfill. As climate change contributes to permafrost melt, contaminants may become more mobile, and erosion may accelerate. This report represents a snapshot in time and it is our hope that it may contribute to future monitoring and assessment toward achieving community goals and priorities.

Additionally, the Alakanuk Traditional Council is a partner on the NSF funded project *'Developing capacity for planning and adapting to riverbank erosion and its consequences in the Yukon watershed'*. Continued river bank monitoring with a UAS will occur as part of this project. The contaminated sites that were documented here have been added to YRITWCs Brownfields inventory. Assessment of 'the Boneyard' will occur during the next 2 years under an EPA funded Brownfields Community-wide Assessment grant.

