

# Seeking Local Knowledge to Improve Flood Hazard Assessments and Forecasting in Alaska

Community and Citizen Science in the Far North

2024 Conference



State of Alaska, Dept. of Natural Resources  
Division of Geological & Geophysical Surveys (DGGS)  
Coastal Hazards Program

Coastal Hazards Program Team  
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# STATE OF ALASKA COASTAL HAZARDS PROGRAM

*The goal of the Coastal Hazards Program is to connect with communities to support geological hazard response and resource management through scientific investigations informed by local knowledge.*

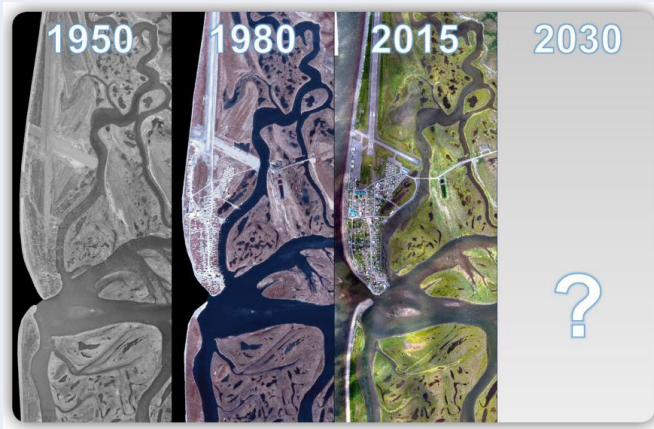
## Event Response



Credit: Paul Jimmy

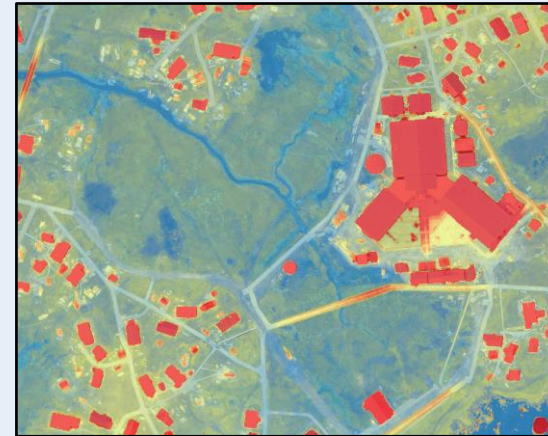
Flooding from Ex-Typhoon Merbok, 2022, in Tuntutuliak, AK

## Baseline Data Collection



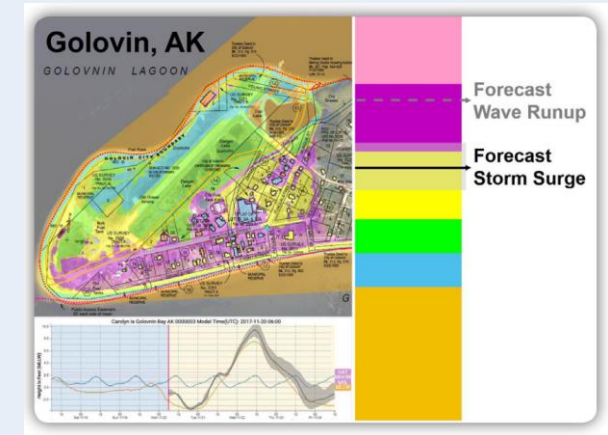
Historical aerial imagery of Unalakleet, AK

## Data Processing



Digital Elevation Model of Kipnuk, AK

## Analysis & Assessments



Flood forecast map of Golovin, AK

*We want to connect Alaskans to their data and provide them with the methods and tools they need to make well informed decisions.*  
**Seeking local knowledge through collaboration with Citizen Scientists is one of the best ways we can achieve this goal.**



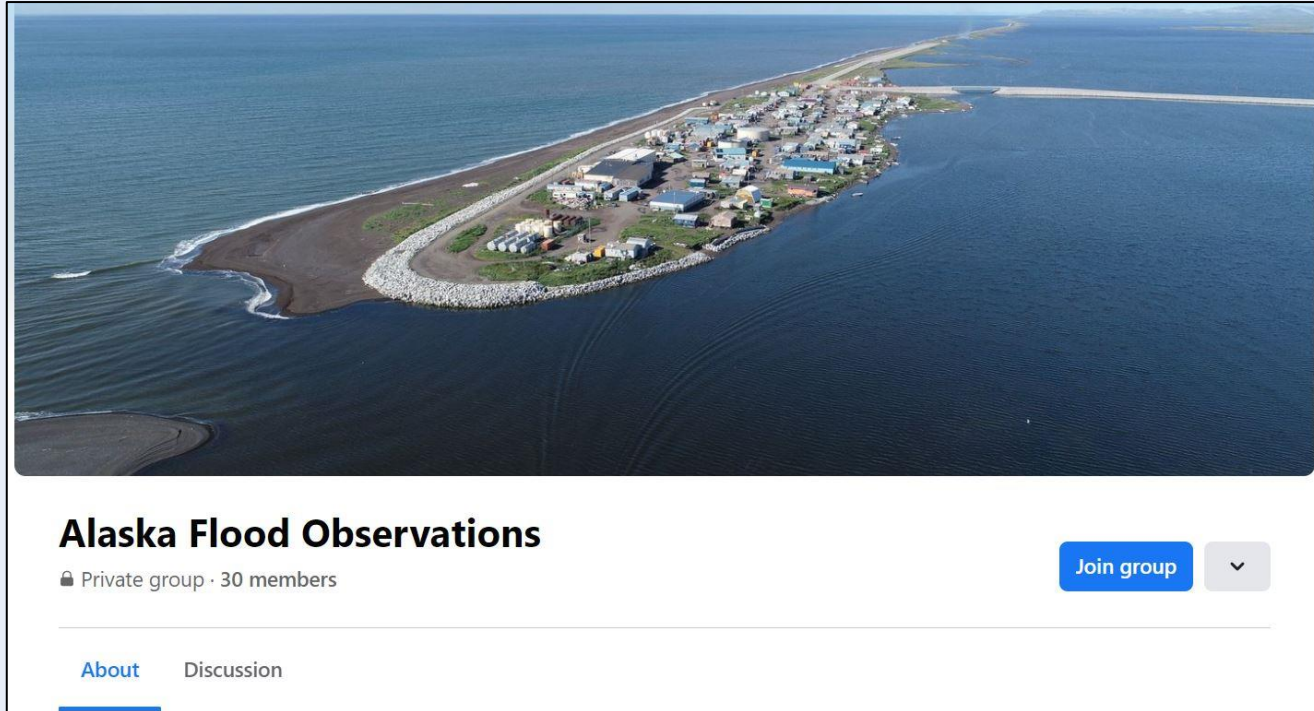


# COMMUNITY-BASED MONITORING & INVOLVEMENT





# Alaska Flood Observations Group



*A private Facebook group for Citizen Scientists to connect with each other and contribute local knowledge that will help connect modeled and forecasted inundation with on-the-ground observations.*



<https://akdggs.com/floodphotos>



## DGGS Coastal Hazards Photo Database

<https://maps.dggs.alaska.gov/photodb/#search=flood>  
<https://maps.dggs.alaska.gov/photodb/#search=storm>

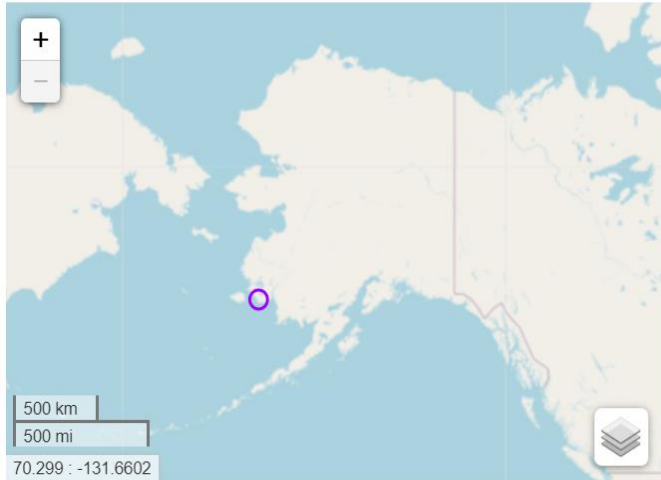
**Title**  
Kipnuk Storm 2016 October 28 p01

**Credit**  
Facebook

**Description**  
Flood waters at Kipnuk clinic looking northeast

**Taken**  
10/28/2016

**Tagged**  
[storm](#), [flood](#), [October](#), [Kipnuk](#), [2016](#)



Kipnuk Storm 2018 October 4 p01  
Facebook



Kipnuk Storm 2016 October 28 p01  
Facebook 10/28/16



Kipnuk Storm Oct 28 2016 p06  
Kipnuk EPA IGAP



Kipnuk Storm Oct 28 2016 p03  
Kipnuk EPA IGAP

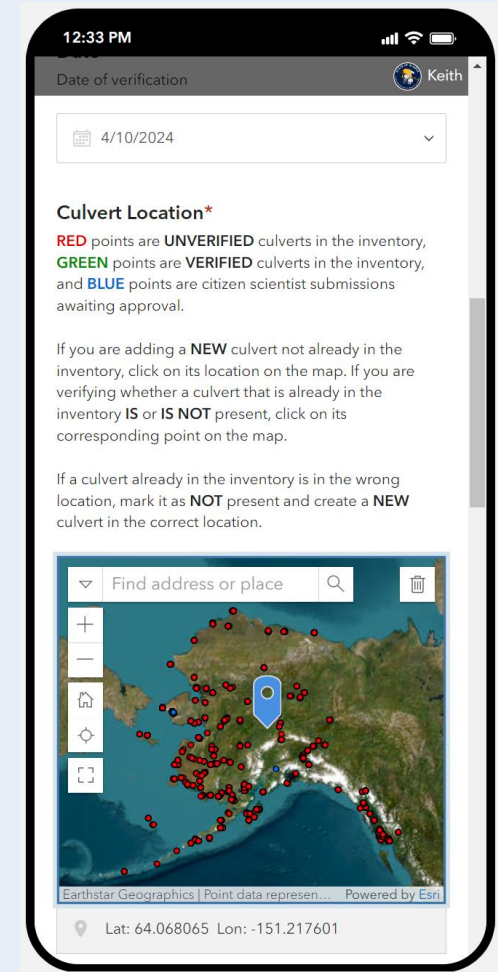
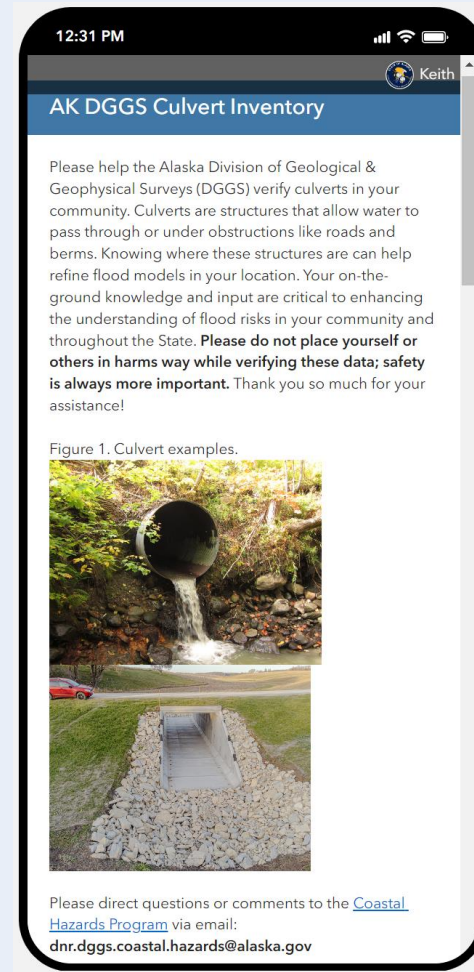
*Citizen Scientist contributions to the Alaska Flood Observations group will be added to the DGGS Photo Database, connecting Alaskans to a visual record of flood events throughout the State.*



# Culvert Inventory Survey



<https://akdggs.com/culverts>



*A publicly available web application for Citizen Scientists to verify hydrological connections in their communities.*



# SWIM Method Flood Modeling

## Traditional “Bathtub” Model



## Still Water Inundation Model



Modeled flood inundation from Ex-Typhoon Merbok, 2022, in Hooper Bay, AK

*The still water inundation model (SWIM) method leverages hydrological connectivity data to more accurately model inundation extents. The connections we make with Citizen Scientists through the Culvert Inventory Survey will **help generate hydrological connections in flood models**, while the local knowledge shared to the Alaska Flood Observations Group will **help validate and improve those models**.*



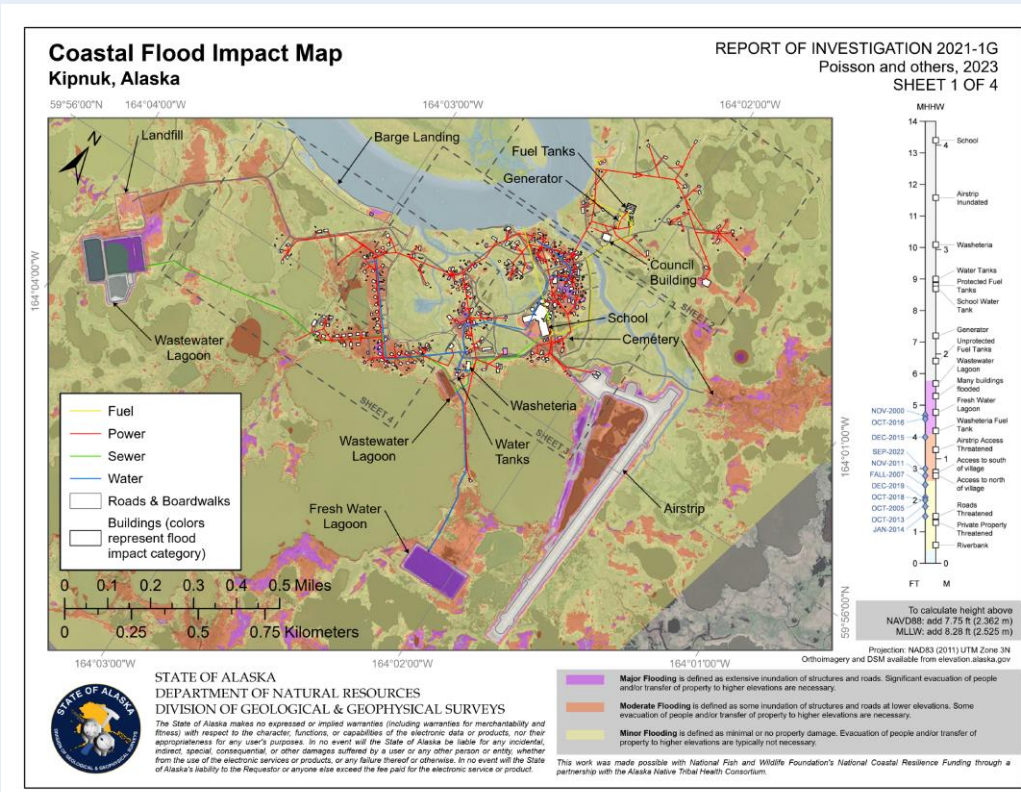
# Flood Impact Criteria & Assessments

*DGGS is currently working to establish a repeatable flood categorization schema based on quantifiable criteria for local governments and Citizen Scientists to use for community planning and risk assessment.*

**Table 1.** Summary of infrastructure elevations and flood categories. Gray = Extreme, purple = Major, red = Moderate, and yellow = Minor. The Extreme category represents infrastructure situated at elevations above the highest estimated flood height with uncertainty included. Categories are based on current infrastructure conditions.

Elevation Feature	Elevation (ft MHHW)	Vertical Uncertainty (ft)	Elevation (m MHHW)	Vertical Uncertainty (m)
School	13.4	0.1	4.07	0.04
Airstrip inundated	11.6	0.2	3.53	0.06
Washeteria	10.1	0.1	3.08	0.04
Water tanks	9.0	0.1	2.73	0.04
Fuel tank containment wall	8.8	0.1	2.68	0.04
School water tank	8.7	0.1	2.64	0.04
Generator	7.2	0.1	2.20	0.04
Fuel tanks	6.4	0.1	1.96	0.04
Many buildings flooded	6.2	0.1	1.90	0.04
<b>Extreme</b>	<b>5.8</b>		<b>1.78</b>	
Several buildings flooded	5.7	0.1	1.74	0.04
Wastewater lagoon	5.7	0.2	1.72	0.06
Freshwater lagoon	4.8	0.2	1.48	0.06
Lowest residences flooded	4.6	0.1	1.40	0.04
Washeteria fuel tank	4.2	0.1	1.27	0.04
<b>Major</b>	<b>4.1</b>		<b>1.25</b>	
Airstrip access	3.6	0.2	1.09	0.06
Access to large portions of village	2.8	0.2	0.84	0.06
<b>Moderate</b>	<b>2.6</b>		<b>0.79</b>	
Low-lying roads threatened	1.5	0.2	0.46	0.06
Private property threatened	1.3	0.2	0.38	0.06
Riverbank	0.6	0.2	0.17	0.06
<b>Minor</b>	<b>0.4</b>		<b>0.11</b>	

Example Flood Impact Categorization for Kipnuk, AK

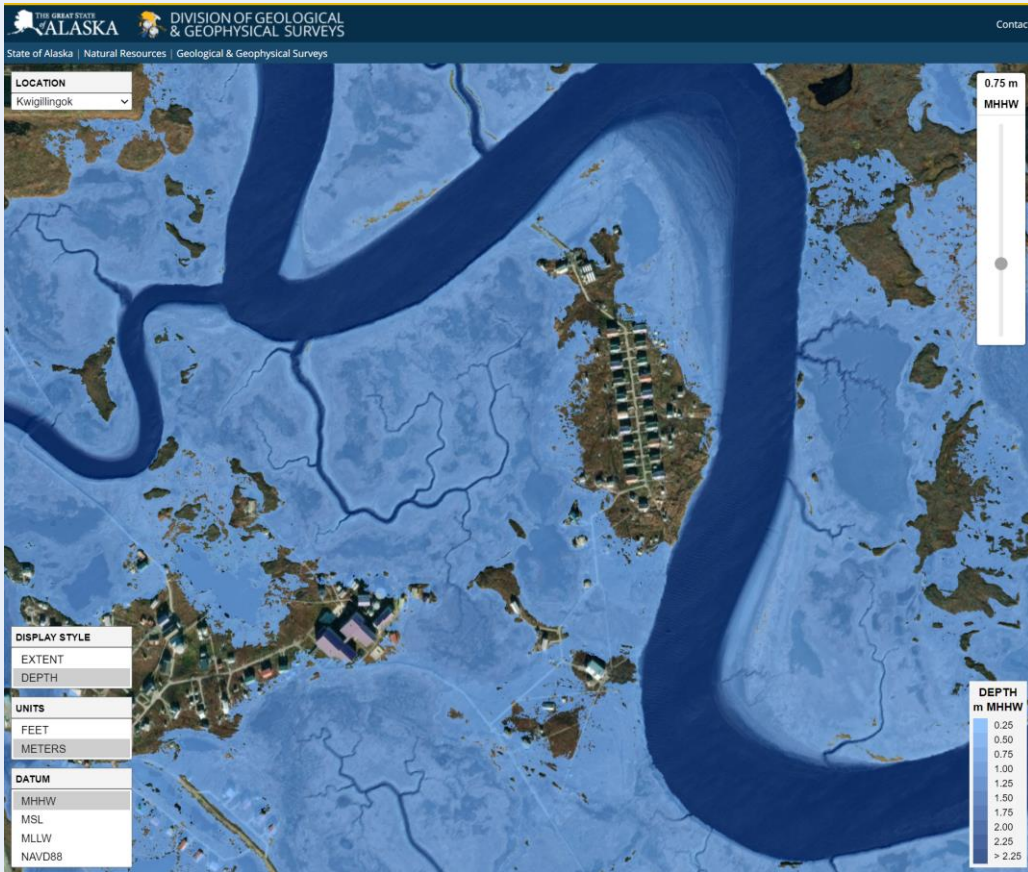


Flood Impact Map of Kipnuk, AK





# Alaska Flood Inundation Tool (AK-FIT)



**AK-FIT is a web-based flood modeling application that will bring together the connections we make through our Citizen Science outreach, connecting Alaskans with their data in a user-friendly and impactful way.**



<https://akdggs.com/akfit-demo>



# Upcoming Publications and Products



<https://dggs.alaska.gov/pubs/>

**Keep an eye on the DGGS Publications page for:**

Horen, K.C., 2024, **Still water inundation modeling with hydrological connectivity**: Alaska Division of Geological & Geophysical Surveys Miscellaneous Publication 176, 35 p. <https://doi.org/10.14509/31154>

Horen, K.C., Poisson, A.C., Christian, J.E., and Nieminski, N.M., *In Press*, **Updated methods for determining coastal flood impact assessments for Alaska communities**: Alaska Division of Geological & Geophysical Surveys Report of Investigation Addendum

Horen, K.C., *In Press*, **Alaska Flood Inundation Tool (AK-FIT)**: Alaska Division of Geological & Geophysical Surveys Digital Data Series

**And be on the look out for flood modeling and risk assessment training opportunities coming soon from the Coastal Hazards Program**







# Reach out

Coastal Hazards Program Website:  
<https://dggs.alaska.gov/hazards/coastal/>

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