Native Village and City of Wales
2024 Multi-Jurisdictional Hazard Mitigation Plan

Adopted: XX

Dates Active: XX, 2024 - XX, 2029

Prepared by:

Native Village and City of Wales Planning Team
Kawerak, Inc.
Fairweather Science, LLC

KAWERAK, INC.

FAIRWEATHER SCIENCE

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Buzard et al. (2021)- Erosion Exposure Assessment- Wales

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Acronyms/Abbreviations

°F	Degrees Fahrenheit
AICC	Alaska Interagency Coordination Center
AK	Alaska
BRIC	Building Resilient Infrastructure and Communities
BSRHA	Bering Straits Regional Housing Authority
CFR	Code Of Federal Regulations
City	City of Wales
COW	City of Wales
CS	Cryosphere
DCCED	Department of Commerce, Community, and Economic Development
DCI	Disaster Cost Index
DCRA	Division of Community and Regional Affairs
DGGS	Division of Geological and Geophysical Survey
DHS	Department of Homeland Security
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act Of 2000
DMVA	Department of Military and Veterans Affairs
ENSO	El Niño/La Niña Southern Oscillation
EPA	Environmental Protection Agency
EQ	Earthquake
ER	Erosion
FEMA	Federal Emergency Management Agency
FL	Flood
ft	Feet
GIS	Geographic Information System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
Kts	Knots
LS	Landslide
M	Magnitude
MAP	Mitigation Action Plan
MH	Multi-Hazard
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MLLW	Mean Lower Low Water
MMI	Modified Mercalli Intensity
mph	Miles Per Hour
NCAR CCSM4	National Center for Atmospheric Research Community Climate System Model 4.0
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NVOW	Native Village of Wales
NWS	National Weather Service
PGA	Peak Ground Acceleration
RCP(s)	Representative Concentration Pathway(s)
SHMP	2023 Alaska State Hazard Mitigation Plan
SNAP	Scenarios Network for Alaska + Arctic Planning
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act

Acronyms/Abbreviations

SW	Severe Weather
Tribe	Native Village of Wales
TS	Tsunami
UAF	University of Alaska Fairbanks
UR	Uranium
US, U.S., or USA	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDM	U.S. Drought Monitor
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
WF/TF	Wildland/Tundra Fire
WNC	Wales Native Corporation

EXECUTIVE SUMMARY

This Executive Summary meets the State of Alaska, Division of Homeland Security and Emergency Management's Element H: Additional State Requirements in the Local Mitigation Plan Review Tool.

The purpose of hazard mitigation planning is to reduce or eliminate long-term risk to people and property from natural hazards. The Native Village and City of Wales developed a Hazard Mitigation Plan (HMP) to make the residents of the Wales area less vulnerable to future hazard events. This plan was prepared following the requirements of the Disaster Mitigation Act of 2000 so that the Tribe and City would be eligible for the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grant programs and other federal programs.

The Tribe and City followed a planning process prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Team comprised of key Tribal and City representatives across various departments. The Planning Team conducted a risk assessment that identified and profiled hazards that pose a risk to Wales; assessed their vulnerability to those hazards; and examined the capabilities currently in place to mitigate them.

The people, property, and lands that the community members depend on are vulnerable to several hazards that are identified, profiled, and analyzed within this Plan. Earthquake, severe weather, wildland/tundra fire, changes in the cryosphere, naturally occurring uranium, flood, tsunami, erosion, and landslide are among the hazards that could have a significant impact on the people, property, and lands in Wales.

The hazards of greatest concern to the Planning Team are XX, XX, XX.

Based upon the risk assessment review and goal setting process, the Planning Team developed the following overarching goals for this Plan:

1. Minimize loss of life and property from natural hazard events
2. Increase public awareness of risk from natural disasters
3. Protect public health and safety
4. Promote rapid hazard disaster recovery

The 2024 MJHMP establishes a series of specific mitigation strategies that were developed collaboratively with the intent to meet the identified mitigation goals, by the Planning Team. These strategies provide a basis for continued planning to develop specific action plans. These will be implemented over time and can provide a means to measure progress towards hazard reduction. The Plan also describes future update and maintenance procedures.

Community Profile

This section describes Wales' location, climate, history, transportation, demographic, and economic information.

Location

Wales is located on Cape Prince of Wales, at the western tip of the Seward Peninsula, 111 miles northwest of Nome (Figure ExSummary-1). Wales is the westernmost community on the mainland of North America and lies at approximately 65.6052º North Latitude and -168.0862º West Longitude.

Wales encompasses approximately 2.8 square (sq.) miles of land and 0 sq. miles of water. Wales is located in the Cape Nome Recording District and Bering Strait School District REAA (REAA 02).

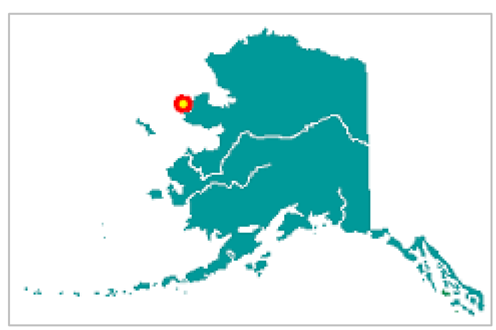


Figure ExSummary-1 Wales Location Map

A sculpture of an outstretched human hand releasing a dove sits above Wales, Alaska, facing Siberia. The Arctic Arc also known as "the hand" is one of the landmarks that look into tomorrow and symbolizes peace and relationship between the Alaskan and Chukotkan Inuit amidst a history of international tension that spanned since the Cold War. For many years, Inuit have traveled back and forth across the Bering Strait by umiaq to visit and trade with friends and family. These landmarks stand as symbols for the relationship between Alaskan and Chukotkan Inuit.

A corresponding sculpture sits on the Russian side of the Bering Strait. Villagers who helped install the piece of art had to hand-carry each piece up the hill outside town.

Source: USA Today 2016

Figure ExSummary-2 Arctic Arc Sculpture in Wales

Climate

Wales falls within the transitional climate zone, characterized by tundra interspersed with boreal forests, and weather patterns of long, cold winters and shorter, warm summers. Frequent fog, wind, and blizzards limit access to Wales. Temperatures in Wales range from a winter low of -5 degrees Fahrenheit (°F) to a high of 52° F in the summer. This area receives approximately 12 inches of rain and 76 inches of snow.

Table ExSummary-1 shows average weather data recorded at the Tin City Long Range Radar Station (LRRS) Airport, roughly 5 airmiles southeast of Wales.

Table ExSummary-1 Average Weather Data for Tin City (2015-2023)

Month	Avg Temp (ºF)	Avg Rainfall (in)	Avg Snowfall (in)	Avg Wind Speed (mph)
January	0º	0.0	7.6	17.5
February	1º	0.1	6.8	17.4
March	2º	0.0	4.9	16.2
April	13º	0.1	4.8	14.6
May	29º	0.4	3.0	12.6
June	40º	0.9	0.5	11.2

Month	Avg Temp (ºF)	Avg Rainfall (in)	Avg Snowfall (in)	Avg Wind Speed (mph)
July	47º	1.8	0.0	11.3
August	46º	2.4	0.0	12.8
September	40º	1.7	0.3	14.6
October	30º	0.8	2.5	16.0
November	18º	0.3	6.8	17.8
December	7º	0.1	7.1	18.2

Data collected at the Tin City Airport.
Source: Weather Spark (2024)

History

In the early 1900s, Wales became a major whaling center due to its location along migratory routes. It was the region's largest and most prosperous village, with more than 500 residents. Wales has a strong traditional Kingikmiut whaling culture. Ancient songs, dances, and customs are still practiced. In the summer, Little Diomede residents travel between the two villages in large traditional skin boats.

The following is an overview of the history of the community.

500-900 A.D:	A burial mound of the Birnirk culture was discovered near Wales and is now a national landmark
1827:	The Russian Navy reported the Inupiat villages of Eidamoo near the coast and King-a-ghe further inland
1890:	The American Missionary Association established a mission in Wales
1894:	A reindeer station was organized
1902:	A post office was established
1900s:	Wales became a major whaling center due to its location along migratory routes. It was the region's largest and most prosperous village, with more than 500 residents.
1918-1919:	The influenza epidemic in 1918-1919 claimed the lives of many Wales residents.
1964:	The City of Wales was incorporated as a 2nd Class City.

A 2006 article in the Alaska Magazine, republished in the Anchorage Daily News in 2012, further describes the history of the influenza epidemic and reviving the tradition of whaling in Wales.

On April 14, 1970, the whaling crew set out from Wales, a Bering Strait village straddling the westernmost tip of the North American continent. The tiny Inupiat Eskimo village—a smattering of tin roofs in an unforgiving landscape of jagged rock and moving ice—huddled beneath 2,290-foot Cape Mountain. Siberia lay 56 miles to the west, its shores shrouded by fog. The skies overhead were clear, the temperature around minus 30 and the wind, as usual on the Bering Strait, blew relentlessly. The hunters shivered on the shore ice for most of the day as they scanned for signs of a bowhead whale.

In late afternoon, a spout blew through a nearby open lead, and the hunters silently launched their skin boat. Their hearts beat fast, and their hands shook slightly, but the only sound was the faint swishing of paddles as the hunters closed on the whale. An 8-year-old boy hunkering down in the back of the boat wondered what would unfold when they finally encountered the 26-ton beast. Paddling behind the boy was *an Inupiat man who had recently returned from the Vietnam War. The boat captain, originally from Little Diomede Island, was the only one who had ever been on a successful bowhead hunt. Five other men were on the boat, including a white teacher towering over the bow with a harpoon.*

More was at stake than landing a whale that afternoon in 1970. The hunters were about to restore an ancient tradition, one that had been lost decades earlier during the 1918 flu pandemic when many of the best hunters had died.

As Native villages across Alaska struggle to rediscover traditions lost to time, death and colonialism, this little-known 1970 whale hunt proves it is possible to bring back the past and hold on to it for the future.

Whaling Tradition Fades

Wales was once one of the world's greatest whaling villages. At its peak, as many as 750 people lived in two settlements, hunting thousands of seals and hundreds of walruses every year. In a good year, they landed more than a dozen bowhead whales, and on such occasions, people from across northwestern Alaska and Siberia came to swap caribou skins and sealskins, iron and copper, jade and flint, ivory, and beads. There were big dancing and drumming festivals.

That all began to change in the mid-1800s, when New Englanders and Europeans invaded the Bering Strait, seeking the world's last untouched whaling grounds. More than 50 whaling ships per year passed through the channel, each taking 10 to 15 whales. Eskimos across arctic Alaska began to starve. Still, the people in Wales kept whaling well into the new century and, in spring 1901, crews took eight bowhead whales in a single week.

Their success might have continued had not a strange disease shown up in the village in 1918. That year the Spanish influenza circled the globe, traveling to Alaska aboard steamships. Mail carriers on dog sleds unwittingly spread the virus across the Seward Peninsula, striking Wales and killing at least 170 people—more than half the village's population at the time. Many of Wales' finest hunters died, taking with them centuries-old knowledge and traditions. Elders, the walking encyclopedias of the past, vanished. The village population dropped to 130 people.

By most accounts, the village's crews were unsuccessful at landing a bowhead whale in the years after the pandemic, although they continued to hunt smaller species like beluga and gray whales. Then, in 1944, another flu outbreak overcame Wales, killing a dozen people. Some surviving families moved to Nome and other towns to be closer to hospitals. "The hunting crews got very small, and the people didn't have the equipment for whaling," said Winton Weyapuk Jr. of Wales. "People thought it was easier to harvest walrus, so they concentrated on that."

Teacher With a Dream

In 1968, during his first spring in Wales, Charles Christensen stood at the edge of the Bering Strait watching bowhead whales pass through the ice-choked channel. He wondered why nobody was hunting. Christensen is most remembered in Wales as the outside teacher who harpooned the village's first bowhead in decades; "The Christensen Whale," the people call it today.

He was a charismatic leader, a family man who loved to hunt. In the 1960s, he and his wife, Sarah, were teachers living a life of adventure, from the far reaches of the South Pacific to the frosted fringes of Alaska. They taught in Samoa before moving to the Alaska village of Shaktoolik. In 1967 they arrived in Wales, where they were the only teachers in the village. Before he died in April 2005 at the age of 73, Christensen said that his time in Wales was one of the most exhilarating periods of his life. It was a place where he forged friendships and studied the ways of the Inupiat people. "Mr. Christensen learned how to live like the Eskimos," said Raymond Seetook, a whaling captain and lifelong resident of Wales.

Leland Christensen, son of the late teacher, said that by late 1968 his father was determined to hunt the bowhead whale. His motive was twofold. He wanted to help Wales revive whaling, but he was also driven by the challenge. "My dad was a very busy hunter," Christensen said. "He was the kind of guy who would *ask you if you wanted to go hunting, and if you didn't, he'd go out anyway and have a good time." But when it came to an animal weighing more than 25 tons, he would need a crew of hunters. His aspirations to kill a bowhead became the goal of the entire village. Any success would ultimately depend on scores of people, from Wales to Gambell to Barrow. For the people of Wales, it became a quest to reaffirm their roots as great whalers.*

Christensen interviewed Wales elders who taught him how to build walrus-skin boats and offered hunting tips, and he got used to being out on the icy Bering Strait with the younger men, shooting walruses and seals. He was good with a rifle, but he had never fired a whaling harpoon. Leland Christensen remembers one winter day when he and his father tested the harpoon. "He strapped the harpoon to a snowmachine sled and hooked it up with a long cord," Christensen said. "When he jerked the cord, it pulled the trigger and shot the round out across the tundra."

Charles Christensen kept meticulous files of his research, which he gave to Silas Komonaseak, a Wales villager who was on the 1970 crew. Komonaseak's son Luther, a whaling captain in the village today, inherited the files. Paging through the reams of notes, letters and diagrams, it's clear that Christensen was obsessed with reviving whaling. On the back of a student's homework assignment, the teacher drew pictures of a bowhead and where the best spots were to strike the whale. He wrote letters to famous whalers from Gambell to Barrow. Eben Hopson Sr., an influential Alaska Native leader from Barrow, wrote to Christensen in 1969, explaining how to divide the bowhead for the community, telling him to pay close attention to which portions go to the elders and the boat captain.

There was another 1969 letter, this one from the Alaska Department of Fish and Game, in which state biologist John J. Burns warned Christensen, "It is most desirable if you proceed with your plans without letting too many people learn of them." An international fight was brewing to protect the bowhead, with some activists calling for a ban on whale hunts in Alaska. Meanwhile, the U.S. government was on the verge of listing the bowhead as endangered. "If it was known that a non-Native man was trying to revive whaling in a historic whaling site, when the outside world was trying to eliminate whaling in these places, there would have been an uproar," recalled Burns. "There was a sense of secrecy to get it done and worry about the consequences later."

And so, a whaling crew soon formed. They were unsuccessful their first year, but the following spring, on April 14, 1970, they landed a bowhead. Thirty-six years later, some of the crewmembers remember it as one of the easiest whale hunts ever.

Landing a Whale

Roy Okpealuk grew up on Little Diomede Island, 26 miles west of Wales in the Bering Strait, where whaling had never ceased. He was the only member of the eight-man crew who had been on a successful bowhead hunt. Okpealuk had moved to Wales and taken a keen interest in helping the village revive the hunt. He captained the 23-foot-long skin boat built by Christensen. The teacher, who had bought and tested the harpoon gun, was assigned the job of striking the whale.

Six other men were on the boat, including Weyapuk, who had just graduated from high school, and his brother Amos. Herb Anungazuk had returned to Wales six months earlier after serving in Vietnam. All three men were paddlers. Silas Komonaseak, another paddler, sat in the middle of the boat. Jerry Fuller, who was in Wales as part of a volunteer program, also helped paddle. Christensen brought along 8-year-old Leland.

By 5:30 p.m., the crew had been on the ice about eight hours. They'd seen many whales pass by, but none close enough to chase. The younger men were eager for the hunt to begin; Okpealuk reminded everybody to stay quiet. Then a bowhead, roughly 26 feet long, emerged less than 200 yards away. The crew silently launched the boat and Okpealuk quickly guided them next to the whale. Christensen struck it with his harpoon and the whale disappeared momentarily. The teacher reloaded the darting gun and, when the whale came back up, he tried to strike it again but the bomb didn't explode. A few minutes later, Christensen *delivered the fatal strike, harpooning the whale near its flipper. It took about 10 minutes to tow the whale to the edge of the shore ice.*

Anungazuk went back to the village to let people know the crew had gotten a whale. "I told this older lady we landed the whale and she said, 'You lie,'" recalled Anungazuk.

Traditionally, the bearer of good news would have brought a slab of muktuk as proof. But this was the first bowhead the village had taken in decades. It was a learning experience for everybody, especially the younger generation. "One thing that just amazed me was that the elders completely took over after we landed the whale," Anungazuk said. "The older people divided the whale, keeping with tradition."

People from Shishmaref and other villages traveled to Wales to help. The carving went on through the night and into morning until the ice started to crack. By then the village had harvested most of the whale and everyone was smiling. People ate muktuk. Children interviewed the crew for the school newspaper. Young men talked about forming their own crews.

The hunt got little attention beyond the Bering Strait region, and that might have been a good thing for Native whaling villages at the time. On the same day Wales got its whale, the federal government proposed adding the bowhead on the nation's endangered species list. The order was approved six weeks later. Today, bowhead whales remain endangered, but their numbers are on the rise. A federal exemption allows 10 Alaska villages to hunt the bowhead, including Wales, where crews venture onto the Bering Strait each spring. They haven't always been successful, but they have landed at least 10 whales since 1970, including two bowheads in the past five years, as well as gray and beluga whales.

"People in Wales have come to expect the whaling crews to go out every year," said Weyapuk, now a whaling captain himself. "It helps remind us why we live here, that we're still alive and must go on."

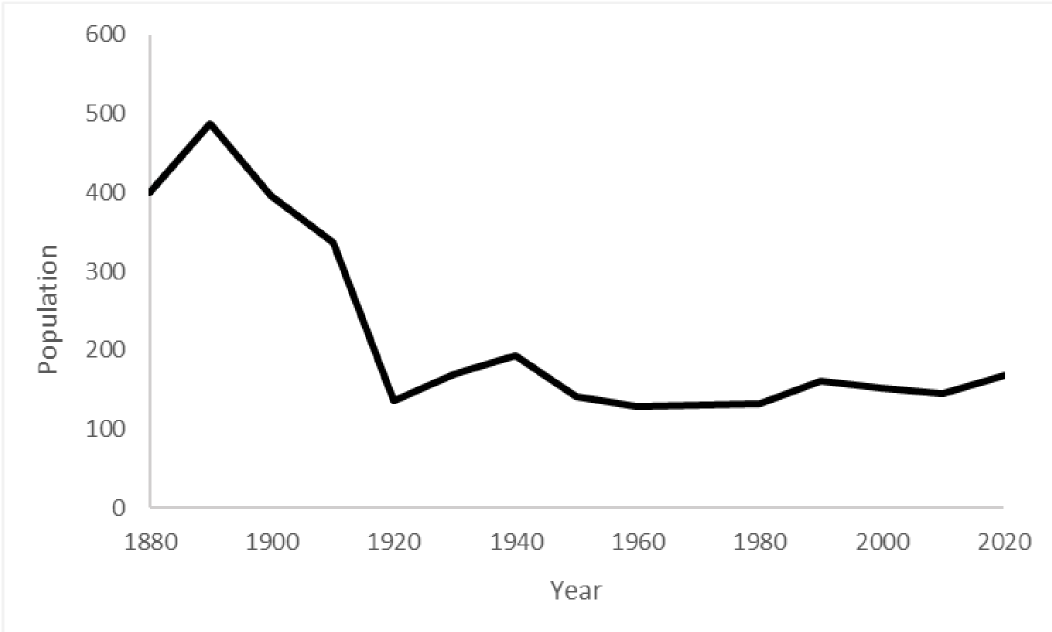
(ADN 2012)

Transportation

Wales has a state-owned gravel airstrip with scheduled air service and charter flights. Household goods are flown into the village. There is a 6.5-mile road to Tin City. Heavy freight and cargo are delivered to Tin City by barge and hauled by truck to Wales. Snow machines are used for travel in winter. A winter trail connects Wales to the communities of Brevig Mission, located 50 miles away, and Shishmaref, located 70 miles away. Aluminum boats are used for sea travel. On land, snowmobiles and ATVs provide year-round access to subsistence areas. In previous years, fall storms have caused some flooding and damage due to high winds. The beach is used as a road by the 4-wheelers to go from one end of town to another and also to go up the coast (DCRA 2024).

Demographics

In 2020, the DCRA certified population in Wales was 168 residents, up from 145 residents in 2010. The population is relatively young, and the median age is 23.9 years. 100% of residents identifiy themselves as Alaska Native. The composition of the population is 61.42% female and 38.58% male. There are an estimated 75 households in this community with the average household size of 3.56. It is reported that 68.4% of residents only speak english, while 31.6% speak another language other than english.



Data from DCRA (2024)

Figure ExSummary-3 Historical Population of Wales

Economy

Wales is a traditional Kingikmiut Eskimo village with a subsistence-based lifestyle.

The potential work force (those aged 16 to 64) in Wales was estimated to be 105, of which 25 (16.1%) were actively employed year-round (US Census 2022). The unemployment rate in Wales is estimated at 20% by American Community Surveys, while the state unemployment rate is currently 4.5% (as of December 2023) and nationally 3.7% (as of January 2024). A 5-year average from 2017-2021 places the median household income at $33,125 (US Census 2022).

86 people are below the poverty level, and 136 people are below 125% of the poverty level (DCRA 2024).

VULNERABILITY SNAPSHOT

Participating Jurisdiction(s): Native Village of Wales, City of Wales

Year MJHMP Completed: 2024

Executive Summary Snapshot

	Estimated Losses				Extent/Magnitude/Severity	Annual Probability
	# of CF:	$ of CF:	# of residences	$ of residences		
Earthquake	37	$69,188,077	99	$71,763,912	Negligible	Likely
Severe Weather	37	$69,188,077	99	$71,763,912	Critical	Highly Likely
Wildland/Tundra Fire	37	$69,188,077	99	$71,763,912	Negligible	Unlikely
Changes in the Cryosphere	37	$69,188,077	99	$71,763,912	Critical	Highly Likely
Naturally Occurring Uranium	Uranium in drinking water is a public health concern, but impacts are not anticipated to cause infrastructure damage.				Limited	Highly Likely
Flood	12	$24,075,000	-	-	Critical	Likely
Tsunami	12	$24,075,000	-	-	Critical	Possible
Erosion	7	$22,000,000	4	$2,899,552	Critical	Likely
Landslide	1	$120,000	-	-	Negligible	Possible
Volcano	Volcanoes do not pose a direct threat to Wales.					

CRITICAL FACILITIES AND INFRASTRUCTURE IN WALES

	# of Occupants	Facility Name	Address/ Lat/Long	Facility Type	Facility Owner	Facility Value	Hazards Vulnerable to: Earthquake, Severe Weather, Wildfire, Cryosphere[1]	Flood, Tsunami	Erosion	Landslide
Government	7	Tribal Office	65°36'38"N 168°05'23"W	W2	NVOW	$500,000	x			
Government	2	City Office	65°36'32"N 168°05'28"W	W2	COW	$500,000	x			
Government	1	Post Office	65°36'38"N 168°05'22"W	W2	Gov't	$250,000	x			
Government	6	Wales Native Corporation Office	65°36'24"N 168°05'18"W	W2	WNC	$750,000	x	x		
Emergency Response	0	Fire Dept- Code Red	65°36'41"N 168°05'18"W	N/A	COW	$75,000	x			
Education	42	Kingikmiut School	65°36'18"N 168°05'09"W	W2	BSSD	$17,000,000	x	x	x	
Medical	1	Toby A. Health Clinic	65°36'21"N 168°05'10"W	W2	NSHC	$1,500,000	x	x	x	
Medical	5	New Clinic	65°36'42"N 168°05'20"W	W2	NSHC	$3,000,000	x			
Roads/ Bridges	0	15.5 miles of road				$9,100,000	x			
Roads/ Bridges	0	Village Creek Bridge	65°36'34"N 168°05'29"W		COW	$50,000	x			
Transportation	0	Wales Airport	65°37'22"N 168°05'42"W	Airport	DOT	$17,000,000	x			
Transportation	1	Airport Maintenance Shop	65°36'59"N 168°05'37"W	W2	DOT	$1,758,077	x			
Transportation	0	Lopp Lagoon Boat Launch	65°37'35"N 168°02'25"W	N/A	COW	$750,000	x			
Utilities	0	Groundwater Wells 1 & 2	65°36'56"N 168°04'26"W	N/A	COW	$120,000	x			x
Utilities	0	500-gallon water storage	65°36'31"N 168°05'27"W	PWTS	COW	$85,000	x			
Utilities	0	BSSD water storage tanks	65°36'16"N 168°05'10"W	PWTS	BSSD	$500,000	x	x		
Utilities	0	Septic Systems x2	65°36'14"N 168°05'05"W	WWTS	COW	$225,000	x			
Utilities	0	Landfill (Class 3 9932-BA001)	65°37'12"N 168°06'18"W	N/A	COW	$25,000	x	x		
Utilities	0	Wales Tank Farm	65°36'22"N 168°05'06"W	PWTS	COW	$1,000,000	x			
Utilities	0	Power Plant	65°36'30"N 168°05'26"W	EPPS	AVEC	$800,000	x			
Utilities	0	Windmills (non-operable)	65°36'57"N 168°05'13"W	EPPS	KEA	$800,000	x			
Utilities	0	AT&T Alascom	65°36'57"N 168°05'18"W	CBO	AT&T	$500,000	x			
Utilities	0	GCI	65°36'58"N 168°05'22"W	CBO	GCI	$250,000	x			
Utilities	0	Sewage Lagoon	65°37'23"N 168°06'01"W	PWSO	COW	$1,000,000	x			

							Hazards Vulnerable to			
	# of Occupants	Facility Name	Address/ Lat/Long	Facility Type	Facility Owner	Facility Value	Earthquake, Severe Weather, Wildfire, Cryosphere[1]	Flood, Tsunami	Erosion	Landslide
Community	1	Multi-Purpose Building	65°36'41"N 168°05'20"W	W2	NVOW	$2,500,000	x			
	0	Storage Vans by Multi x2	65°36'41"N 168°05'20"W	N/A	NVOW	$100,000	x			
	1	Washeteria (existing)	65°36'32"N 168°05'28"W	W2	COW	$2,500,000	x	x	x	
	1	Washeteria (new)	65°36'31"N 168°05'28"W	W2	COW	$4,000,000	x			
	5	Teacher Housing 4-plex	65°36'19"N 168°05'08"W	W2	WNC	$350,000	x	x	x	
	3	Teacher Housing 2-plex	65°36'19"N 168°05'08"W	W2	BSSD	$350,000	x	x	x	
	0	Community Plot	65°36'59"N 168°05'21"W	Gravel	TRI-Entities	$100,000	x			
	1	Morgue	65°36'43"N 168°05'20"W	W2	NSHC	$150,000	x			
	1	ARCS	65°36'44"N 168°05'20"W	W2	WNC/COW	$250,000	x			
	2	Church	65°36'20"N 168°05'12"W	W2	Wales Lutheran	$300,000	x	x	x	
	2	Parsonage	65°36'20"N 168°05'13"W	W2	Wales Lutheran	$300,000	x	x		
	1	Wales Native Store	65°36'21"N 168°05'14"W	W2	NVOW	$500,000	x	x		
	0	Cemetery	65°36'48"N 168°05'46"W	N/A	COW	undefined	x	x	x	
	0	Culturally Sacred or Significant Sites	The locations of these sites are sensitive. Contact the Tribal office if you need further information or assistance.							
	0	Subsistence Camps								
Total:	83				Total:	**$68,938,077**				

[1] – Earthquake, Severe Weather, Wildfire, and Cryosphere hazards impact the entire community of Wales.
Uranium in drinking water is a public health concern, but impacts are not anticipated to cause infrastructure damage.

MITIGATION ACTION PLAN (MAP)

The Native Village and City of Wales' MAP below depicts how each mitigation action will be implemented and administered by the Planning Team. The MAP details each selected mitigation action, its priorities, the responsible entity, the anticipated implementation timeline, and provides a brief explanation as to how the overall benefit/costs and technical feasibility were taken into consideration.

Native Village and City of Wales' 2024 MAP

Action ID	Action Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility	Other Plans to Include Development Action In
MH 1							
MH 2							
MH 3							
MH 4							
MH 5							
MH 6							
MH 7							
MH 9							
MH 10							

Action ID	Action Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility	Other Plans to Include Development Action In

FEMA APPROVAL LETTER

PLAN DISTRIBUTION LIST

The Native Village and City of Wales 2024 Multi-Jurisdictional Hazard Mitigation Plan is distributed to:

- Native Village of Wales
- City of Wales
- Wales Native Corporation
- Kawerak, Inc.
- Federal Emergency Management Agency (FEMA)
- State of Alaska Division of Military and Veterans Affairs (DMVA), Department of Homeland Security and Emergency Management (DHS&EM)

RECORD OF CHANGES

Hazard Mitigation Plans should be continually updated as circumstances change, new data becomes available, hazards are mitigated, etc. This Record of Changes Table is included to summarize and document changes to this document as they are made throughout time.

Change ID	Description of Changes	Date
01	Created a Multi-Jurisdictional HMP for the Native Village of Wales and the City of Wales	XX

1. PLAN INTRODUCTION AND BACKGROUND

Hazard mitigation planning is required under the Disaster Mitigation Act of 2000 (DMA 2000) which identified the need for Tribal, Local, and State jurisdictions to coordinate mitigation planning and implement mitigation efforts. It also provided the legal basis for the Federal Emergency Management Agency's (FEMA) mitigation plan requirements for mitigation grant assistance.

1.1 PURPOSE

Disasters may cause loss of life, damage buildings and infrastructure, and have devastating effects on a community's economic, social, and environmental well-being. The Native Village and City of Wales intend to reduce or eliminate the long-term risk to life and property from hazards by implementing a Hazard Mitigation Plan. The Plan is intended to reduce community risk and promote long-term sustainability by:

- Protecting the public and preventing loss of life and injury.
- Reducing harm to existing and future community assets.
- Preventing damage to a community's cultural, economic, and environmental assets.
- Minimize downtime and speed up recovery following disasters.
- Reducing the costs of disaster response and recovery and the exposure of first responders to risk.
- Help accomplish other community objectives, such as leveraging capital improvements, infrastructure protection, and economic resiliency.

1.2 MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN LAYOUT DESCRIPTION

The Native Village and City of Wales 2024 Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) consists of the following sections and appendices:

- **Executive Summary**

  Provides information to meet Element H- Additional State Requirements. Provides general history and background for Wales, including historical trends for population, the demographic and economic conditions that have shaped the area, as well as the government and leadership within the community. Lists hazards that impact the planning area, critical facilities, and prioritized Mitigation Action Plan (MAP).

- **Section 1- Introduction and Background**

  Defines what a hazard mitigation plan is and its purpose.

- **Section 2- Planning Process**

  Describes the planning process for the MJHMP, identifies Planning Team members, lists the meetings held as part of the planning process, and lists the key collaborators within the surrounding area. This section documents public outreach activities performed by the Tribe and City (support documents are in Appendix D); including document reviews and relevant plans, reports, and other appropriate information data utilized for MJHMP development.

- **Section 3- Risk Assessment/Hazard Analysis/Summary of Vulnerability**

  Describes the process through which the Planning Team identified, screened, and selected the hazards for profiling in this MJHMP. The hazard analysis includes the nature of the hazard, previous occurrences (history), location, extent, and impact of past events, and future event recurrence probability for each hazard. The influence of climate change is also discussed within each hazard profile.

Identifies the Tribe's and City's potentially vulnerable assets—people, critical facilities, critical infrastructure, and residential and non-residential buildings (where available). The resulting information identifies the full range of hazards that the community could face and the potential damages, economic losses, and social impacts. Land use and development trends are also discussed.

- **Section 4- Mitigation Strategy**

  Defines the Tribe's and City's mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. This section lists the community's policies, programs, available resources, and governmental authorities.

  The Planning Team developed a list of specific mitigation goals and potential actions to address the risks facing Wales. Mitigation actions include structural projects, emergency services, natural resource protection strategies, property protection techniques, preventive initiatives, and public information and awareness activities.

- **Section 5- Plan Maintenance**

  Describes the formal Plan maintenance process to ensure that the MJHMP remains an active and applicable document. This section includes an explanation of how the Tribe and City's Planning Team intends to organize their efforts to ensure that improvements and revisions to the MJHMP occur in an efficient, well-managed, and coordinated manner, actions that the Tribe and City plans to implement to assure continued public participation, and their methods and schedule for keeping the plan current.

- **Section 6- Plan Update**

  This section describes hazard events that have occurred and changes in development, changes in mitigation priorities, and describes how the mitigation plan was integrated into other planning mechanisms.

- **Section 7- Plan Adoption**

  Describes the Tribe's and City's adoption process of the MJHMP. Supporting documentation can be found in Appendix C.

- **Section 8- References**

  Lists reference materials and resources used to prepare this MJHMP.

- **Section 9- Appendices**

  Appendix A: Delineates federal, state, and other potential mitigation funding sources. This section will aid the Tribe and City with researching and applying for funds to implement their mitigation strategy.

  Appendix B: Provides the FEMA Tribal and Local Mitigation Plan Review Tool, which documents compliance with FEMA criteria.

  Appendix C: Provides the Tribe's and City's adoption resolutions.

  Appendix D: Provides public outreach information, including newsletters and survey.

2. PLANNING PROCESS

This section provides an overview of the planning process; identifies the key collaborators and Planning Team members, documents public outreach efforts, and summarizes the review and incorporation of existing plans, studies, and reports used to develop this MJHMP. Meeting information regarding the Planning Team and public outreach efforts are included below and outreach support documents are provided in Appendix D.

This section addresses a portion of Element A of the Tribal Mitigation Plan regulation checklist and Element A of the Local Mitigation Plan regulation checklist.

Regulation Checklist- 44 Code of Federal Regulations (CFR) § 201.7 Tribal Mitigation Plans
ELEMENT A. Planning Process
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process? [44 CFR § 201.7(c)(1)]
A2. Does the plan document an opportunity for public comment during the drafting stage and prior to plan approval, including a description of how the tribal government defined “public”? [44 CFR § 201.7(c)(1)(i)]
A3. Does the plan document, as appropriate, an opportunity for neighboring communities, tribal and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? [44 CFR § 201.7(c)(1)(ii)]
A4. Does the plan describe the review and incorporation of existing plans, studies, and reports? [44 CFR § 201.7(c)(1)(iii)]
A5. Does the plan include a discussion on how the planning process was integrated, to the extent possible, with other ongoing tribal planning efforts as well as other FEMA programs and initiatives? [44 CFR § 201.7(c)(1)(iv)]
Source: FEMA 2017 (Tribal)

Regulation Checklist- 44 § 201.6 Local Mitigation Plans
ELEMENT A. Planning Process
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement 44 CFR § 201.6(c)(1))
A1-a. Does the plan document how the plan was prepared, including the schedule or time frame and activities that made up the plan’s development, as well as who was involved?
A1-b. Does the plan list the jurisdiction(s) participating in the plan that seek approval, and describe how they participated in the planning process?
A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development as well as businesses, academia, and other private and non-profit interests to be involved in the planning process? (Requirement 44 CFR § 201.6(b)(2))
A2-a. Does the plan identify all stakeholders involved or given an opportunity to be involved in the planning process, and how each stakeholder was presented with this opportunity?
A3. Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval? (Requirement 44 CFR § 201.6(b)(1))
A3-a. Does the plan document how the public was given the opportunity to be involved in the planning process and how their feedback was included in the plan?
A4. Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement 44 CFR § 201.6(b)(3))
A4-a. Does the plan document what existing plans, studies, reports, and technical information were reviewed for the development of the plan, as well as how they were incorporated into the document?
Source: FEMA 2022 (Local)

2.1 OVERVIEW

In 2021, Kawerak Inc. (Kawerak) received a project grant from Bureau of Indian Affairs to fund 10 Tribal Hazard Mitigation Plans in the region. Kawerak contracted Fairweather Science, LLC (Fairweather Science) to facilitate the Plan developments. Kawerak had remaining funding from the BIA grant they received to fund 10 Tribal HMPs, and with the additional funding, Kawerak was able to fund this HMP.

This MJHMP follows the following guidance for mitigation planning:

- FEMA 2019 Tribal Mitigation Planning Handbook, which is a companion to the Tribal Mitigation Plan Review Guide, released by FEMA in 2017
- FEMA 2022/2023 Local Mitigation Planning Policy Guide (Released April 2022, Effective April 2023)
- State of Alaska DHS&EM Element H- Additional State Requirements, Effective April 1, 2024

In 2015, the City of Wales drafted a HMP which was funded by the State of Alaska. This HMP was given APA status by FEMA; however, the City never formally adopted the plan. That plan was used as to inform the development of this HMP.

The planning process began in January 2024 with the Native Village of Wales inviting the City of Wales to participate in the project.

The Kickoff Meeting occurred on February 22, 2024. Representatives from the Tribe, the City of Wales, Kawerak, and Fairweather Science were in attendance. The purpose of this meeting was the discuss the purpose of a HMP, the planning process, expectations, and the project schedule. There was discussion of critical facilities, hazard identification and screening, initial ideas for mitigation projects, and opportunities for public involvement. The Planning Team discussed recent hazard events, including Typhoon Merbok. The Planning Team was tasked with reviewing a preliminary list of critical facilities to make any edits and provide additional information, and to share the survey on social media and post flyers in common places in the community.

On May 21, 2024, the Planning Team met Fairweather Science to discuss the draft risk assessment that they reviewed. The team shared feedback on the draft risk assessment; reviewed and updated the collaborator notification list; discussed the public notification and involvement process; and set the date for the next meeting to review, select, and prioritize mitigation projects based on the results of the draft risk assessment. The team also discussed Kawerak’s deployment of water filters obtained through a Red Cross grant to address drinking water concerns associated with naturally occurring uranium. The filters will provide reverse osmosis, carbon and UV filtering for every household in Wales.

In summary, the following five-step process took place from January 2024 through October 2024.

1. Organize resources: members of the Planning Team identified resources needed in the development of the hazard mitigation plan update- including staff, agencies, and local community members who could provide technical expertise and historical information.
2. Assess risks: with the assistance of a hazard mitigation planning consultant (Fairweather Science), the Planning Team identified the hazards specific to Wales and the consultant developed the risk assessment for the identified hazards. The Planning Team reviewed the risk assessment prior to and during the development of the mitigation strategy.
3. Assess capabilities: the Planning Team reviewed current capabilities to determine whether existing provisions and requirements adequately addressed relevant hazards. Examples of these capabilities are administrative and technical, legal, and regulatory, and fiscal.
4. Develop a mitigation strategy: after reviewing the risks posed by each defined hazard, the Planning Team developed a comprehensive range of potential mitigation goals and actions. The Planning Team then identified and prioritized the actions for implementation.

5. Monitor, evaluate, and update the Plan: the Planning Team developed a process to monitor the plan to ensure it was used as intended while fulfilling the needs of the community. The team then developed a process to evaluate the plan to compare how their decisions affected recognized hazard impacts. The Team then outlined a method to share their successes with members of the community. By sharing their successes, the team aimed to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide data for the plans five-year update.

Table 2-1 describes Planning Team meetings convened to develop this MJHMP.

Table 2-1 Hazard Mitigation Planning Team Meetings

Date	Agenda	Attendees	
02/22/2024	Project Kickoff Meeting. MJHMP overview; project schedule; roles and responsibilities, review a list of hazards; initial suggestions for mitigation projects; current critical facilities; discussion about community input via an online survey.	Wales Planning Team	Anna Oxereok (Tribe) Stanley Milligrock (City) Brian Weyaput (City)
		Kawerak, Inc.	Kevin Knowlton
		Fairweather Science	Laura Young Olivia Kavanaugh
05/21/2024	Review of draft risk assessment and comments from Planning Team, confirm list of collaborators, methods for public notification of availability of draft risk assessment.	Wales Planning Team	Anna Oxereok (Tribe) Stanley Milligrock (City) Brian Weyaput (City)
		Kawerak, Inc.	Kevin Knowlton
		Fairweather Science	Laura Young Olivia Kavanaugh

2.2 HAZARD MITIGATION PLANNING TEAM

Table 2-2 identifies the complete hazard mitigation Planning Team.

Table 2-2 Hazard Mitigation Planning Team

Name	Title	Organization	Key Input
Anna Oxereok	Tribal Council President	Native Village of Wales	Planning team lead, data input, and MJHMP review.
Marissa Oxereok	Tribal Council Vice President	Native Village of Wales	Planning team member, data input, and MJHMP review.
Stanley Milligrock	Vice Mayor	City of Wales	Planning team member, data input, and MJHMP review.
Brian Weyapuk	Council Member	City of Wales	Planning team member, data input, and MJHMP review.
Kevin Knowlton	Emergency Preparedness Specialist	Kawerak, Inc.	Project Manager, responsible for project coordination.
Laura Young	Project Manager, Hazard Mitigation Planner	Fairweather Science, LLC	Responsible for project management/ coordination, subject matter expertise in plan development, and MJHMP review.
Olivia Kavanaugh	Staff Scientist, Hazard Mitigation Planner	Fairweather Science, LLC	Responsible for MJHMP development, writer, research, and data analysis.

2.3 OPPORTUNITIES FOR COLLABORATORS AND OTHER INTERESTED PARTIES TO PARTICIPATE

Fairweather Science extended an invitation to all individuals and entities identified on the project mailing list in which they described the planning process and announced the upcoming communities' planning activities. The announcement was emailed to relevant academia, nonprofits, and local, state, and federal agencies on date.

Wales is a rural Alaska village and does not have any typical neighboring communities. However, the Planning Team invited the following communities to participate in the planning process as Wales relies on them for resources after a hazard event: Nome, Diomede, Shishmaref, and Brevig Mission.

- Alaska Department of Community, Commerce, and Economic Development (DCCED)
  - DCCED, Division of Community and Regional Affairs (DCRA)
  - DCCED, National Flood Insurance Program (NFIP)
  - DCCED, Risk Mapping, Assessment and Planning (Risk MAP)
- Alaska Department of Environmental Conservation (DEC)
  - DEC, Division of Spill Prevention and Response (DSPR)
- Alaska Department of Fish and Game (ADF&G)
- Alaska Department of Health and Social Services (DHSS)
- Alaska Department of Military and Veterans Affairs (DMVA)
  - DMVA, Division of Homeland Security and Emergency Management (DHS&EM)
    - DHS&EM All-Hazards Resilience Programs
    - DHS&EM Hazard Mitigation Programs
- Alaska Department of Natural Resources (DNR)
  - DNR, Division of Forestry (DOF)
  - DNR, Division of Geological and Geophysical Surveys (DGGS)
    - DGGS, Coastal Hazards
    - DGGS, Geology
  - DNR, Mining, Land, and Water (MLW)
- Alaska Department of Public Safety (DPS)
- Alaska Department of Transportation and Public Facilities (DOT/PF)
  - DOT/PF Northern Region
- Alaska Native Tribal Health Consortium-Community Development (ANTHC)
- Alaska State Troopers
  - C Detachment, Nome Post
- Alaska Village Electric Cooperative (AVEC)
- American Red Cross of Alaska- Disaster Program Manager
- Anchorage Emergency Management
- Association of Village Council Presidents (AVCP)
- Bering Strait School District (BSSD)
- Bering Straits Native Corporation (BSNC)
  - BSNC, Bering Straits Development Company

- Bering Straits Regional Housing Authority (BSRHA)
- Denali Commission
- Donny Olson- State Senator (Western Alaska)
- Fairbanks Emergency Management
- FEMA Region 10
- National Oceanic and Atmospheric Administration (NOAA)
  - NOAA, National Weather Service (NWS)
    - NWS Northern Region
  - NOAA, Regional Preparedness
- Neighboring Communities
  - Nome
  - Diomede
  - Shishmaref
  - Brevig Mission
  - Teller
  - Mary's Igloo
  - Fairbanks
  - Anchorage
- Neal Foster- Alaska State Representative (Nome)
- Norton Sound Economic Development Corporation (NSEDS)
- Norton Sound Health Corporation (NSHC)
- Rural Alaska Community Action Program, Inc. (RurAL CAP)
- University of Alaska Fairbanks (UAF)
  - UAF, Alaska Earthquake Information Center (AEC)
  - UAF, Alaska Volcano Observatory (AVO)
  - UAF, Geophysical Institute (GI)
  - UAF, Scenarios Network for Alaska + Arctic Planning (SNAP)
- US Army Corps of Engineers, Alaska Region (USACE)
- US Bureau of Land Management (BLM)
- US Department of Agriculture (USDA)
  - USDA, Division of Rural Development (RD)
  - USDA, Forest Service (USFS)
  - USDA, Natural Resources Conservation Service (NRCS)
- US Department of Housing and Urban Development (HUD)
- US Department of the Interior
  - Bureau of Indian Affairs (BIA)
    - Tribal Climate Resilience
    - Tribal Operations
  - National Park Service (NPS)
- US Environmental Protection Agency (EPA)

- US Fish & Wildlife Service (USFWS)
- US Geological Survey (USGS)
    - USGS, Alaska Science Center
- Wales Native Corporation

2.4 PUBLIC INVOLVEMENT AND TRIBAL DEFINITION OF MEMBERSHIP

The Tribe defines their tribal population as all tribally enrolled members through direct lineage. However, for the purposes of public engagement for this HMP, the Tribe defines "public" as anyone who is a Tribal member (living in or outside of Wales) as well as anyone who lives in Wales. This assures that anyone within the community is eligible to attend and participate in public tribal meetings regarding hazard mitigation plan development and implementation activities.

The public was encouraged to provide input regarding local hazards and ideas for mitigation projects via an online survey, the project Storymap, Kawerak's website, and the Wales and Kawerak Facebook pages.

Outreach support documents and survey results are provided in Appendix D.

2.5 REVIEW AND INCORPORATION OF EXISTING PLANS, STUDIES, AND REPORTS

During the development of this MJHMP, Fairweather Science and the Planning Team reviewed and incorporated pertinent information from available resources into the document. Data included available plans, studies, reports, and technical research, which is listed in Table 2-3. The data was reviewed and referenced throughout the document.

Table 2-3 Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)	Data Used (How was this information incorporated into this MJHMP?)
2023 State of Alaska Hazard Mitigation Plan (SHMP)	Defines statewide hazards and their potential locational impacts.	Compared hazard profiles, history, and impacts of events for risk assessment.
2015 City of Wales HMP (not adopted)	Defines hazards, resources, and mitigation projects for Wales in 2015.	Compared hazard profiles, history, and impacts of events for risk assessment, list of critical facilities, and list of mitigation projects.
Other regional HMPs: Diomede MJHMP (2023), Brevig Mission MJHMP (2023), Teller THMP (2023)	Defines hazards, resources, and mitigation projects for communities in the area.	Compared hazard profiles, history, and impacts of events for risk assessment.
2007 USACE Erosion Information Paper- Wales, Alaska	Baseline erosion assessment of the community.	Used to describe historical erosion locations and impacts in Wales.
Shoreline Change in Wales (1950-2012)	Map of erosion locations and rate of erosion in Wales from 1950-2012.	Used map in erosion hazard profile to discuss extent and rate of erosion.
2017 Floodplain Manager's Report- Wales	Provides details on historic flood events in the community and approximates the 100-year floodplain	Used to determine the 100-year floodplain for facilitates at risk of flooding.
Erosion Exposure Assessment- Wales	This is a summary of results from an erosion forecast near infrastructure at Wales, Alaska. DGGS scientists conducted a shoreline change analysis, forecasted 60	Report was used in the erosion hazard profile to determine severity of erosion, future impacts, and infrastructure threatened by erosion.

Table 2-3 Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)	Data Used (How was this information incorporated into this MJHMP?)
	years of erosion, and estimates the replacement cost of infrastructure in Wales.	
2019 Denali Commission Statewide Threat Assessment	Determines and ranks individual communities and infrastructure on their risk level by erosion, flooding, and thawing permafrost.	Used group classification rankings in flooding, erosion, and permafrost degradation hazard profiles.
2018 National Climate Assessment	Assesses the science of climate change and variability and its impacts across the U.S., now and throughout the century.	Assessment cited several times in hazard sections describing how climate change will influence future conditions.
UAF/SNAP Database	Provides historical data and future projections on climate change impacts, wildfire danger, and other applicable hazards.	Cited several figures and other data in hazard profiles.
October 2022 DHS&EM Disaster Cost Index	Provides details for historic statewide disasters.	Incorporated relevant disaster descriptions in each applicable hazard profile to strengthen the hazard history, extent, and impact sections.
Wales Local Economic Development Plan (2004-2009 and 2011-2016)	Describes the economic development program of Wales and charts the course of action over a five-year time period.	Reviewed during plan development and incorporated information into relevant sections as applicable.

A complete list of references in provided in Section 8.

2.6 OTHER ONGOING TRIBAL EFFORTS

Once the 2024 MJHMP is completed, the Native Village of Wales intends to apply for available Hazard Mitigation Assistance Grant funding and will work closely with the FEMA Region X Tribal Liaison in doing so. In addition, on completion of the 2024 MJHMP, information will be incorporated into future planning efforts and the creation of Tribal plans as well as other FEMA programs and initiatives.

3. RISK ASSESSMENT/HAZARD ANALYSIS

This section identifies and profiles the hazards that could affect Wales.

This section addresses a portion of Element B of the Tribal and Local Mitigation Plans regulation checklists.

Regulation Checklist- 44 CFR § 201.7 Tribal Mitigation Plans
ELEMENT B. Hazard Identification and Risk Assessment
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect the tribal planning area? [44 CFR § 201.7(c)(2)(i)]
B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for the tribal planning area? [44 CFR § 201.7(c)(2)(i)]
B3. Does the plan include a description of each identified hazard's impact, as well as an overall summary of the vulnerability of the tribal planning area? [44 CFR § 201.7(c)(2)(ii)]
Source: FEMA 2017 (Tribal)

Regulation Checklist- 44 CFR § 201.6 Local Mitigation Plans
ELEMENT B. Risk Assessment
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events? (Requirement 44 CFR § 201.6(c)(2)(i))
B1-a. Does the plan describe all natural hazards that can affect the jurisdiction(s) in the planning area, and does it provide the rationale if omitting any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area?
B1-b. Does the plan include information on the location of each identified hazard?
B1-c. Does the plan describe the extent for each identified hazard?
B1-d. Does the plan include the history of previous hazard events for each identified hazard?
B1-e. Does the plan include the probability of future events for each identified hazard? Does the plan describe the effects of future conditions, including climate change (e.g., long-term weather patterns, average temperature, and sea levels), on the type, location, and range of anticipated intensities of identified hazards?
B1-f. For participating jurisdictions in a multi-jurisdictional plan, does the plan describe any hazards that are unique to and/or vary from those affecting the overall planning area?
Source: FEMA 2022 (Local)

3.1 OVERVIEW

Hazard identification is the process of recognizing any natural events that may threaten an area. Natural hazards result from uncontrollable or unexpected natural events of sufficient magnitude. This plan does not take in account any man-made, technological, or terrorism related hazards. Historical hazards are noted, but all natural hazards that have the potential to affect the study area must be considered. Any hazards that are determined to be unlikely to occur or cause little to no damage, are eliminated from consideration.

A hazard analysis includes the identification, screening, and profiling of each hazard.

Hazard profiling entails describing hazards in terms of their nature, history, location, magnitude, frequency, extent, and probability. Hazards are identified through historical and anecdotal information collected by members of the community, previous mitigation plans, studies, and study area hazard map preparations/reviews, when appropriate. Hazard maps are then used to define the geographic extent of a hazard, as well as define the approximate boundaries of the risk area.

3.2 HAZARD IDENTIFICATION AND SCREENING

On February 22, 2024, the Planning Team evaluated and screened the comprehensive list of potential hazards that could impact the community. The Planning Team determined that nine hazards pose a threat to Wales: earthquake, flood, erosion, severe weather, wildland/tundra fire, landslide, changes in the cryosphere, tsunami, and naturally occurring uranium. The Planning Team decided to discuss the influence of climate change within each individual hazard.

The Native Village and City of Wales are located in the same geographic area and thus experience the same vulnerability to hazards.

The assets at risk of the identified hazards, both within and outside of the planning area, are identified in Section 3.4.6.

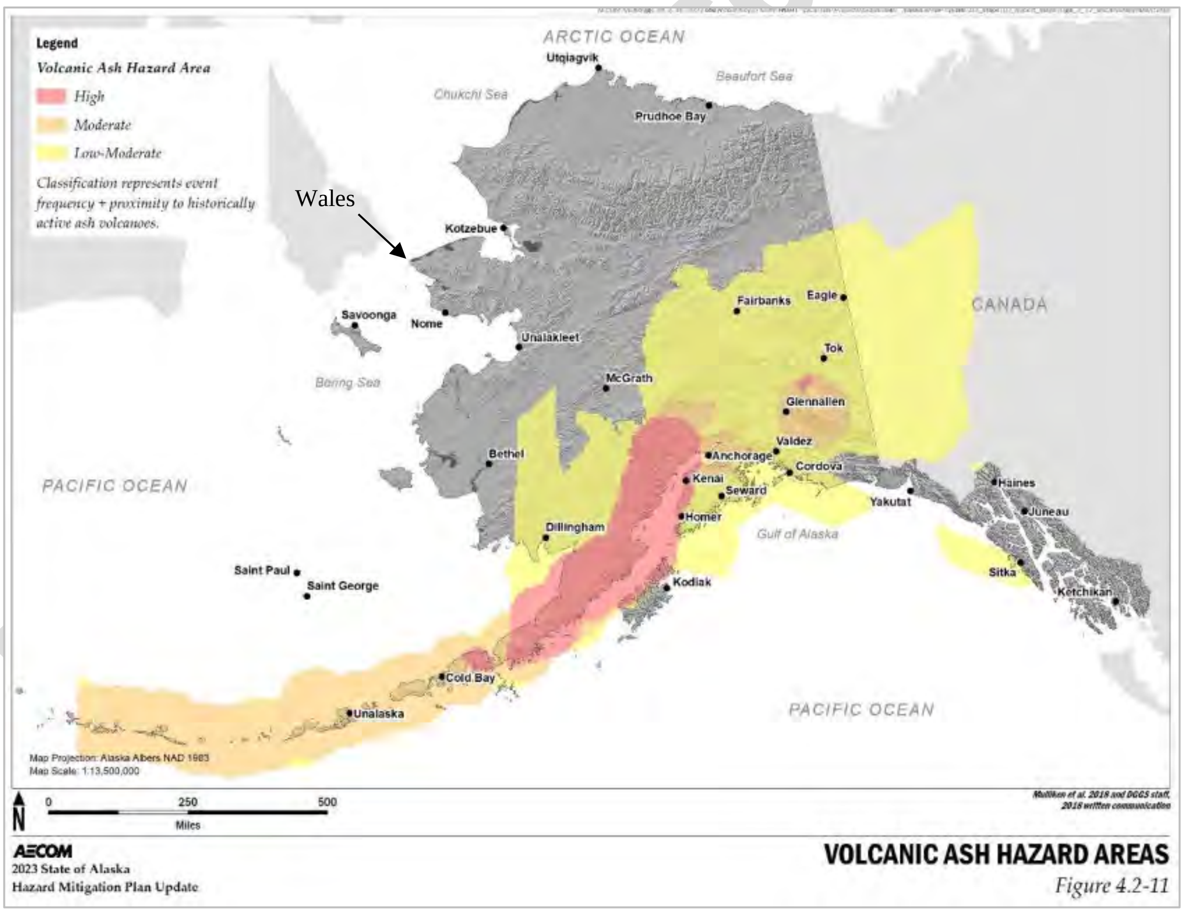
Table 3-1 Identification and Screening of Hazards

Hazard Type	Explanation
Earthquake	Wales is not located near the Aleutian Subduction zone and historical earthquakes have been minor and fewer in number compared to areas along the subduction zone and the rest of the state. There are Pre-Quaternary faults (not active in over 1.6 million years) near Wales, but they are not named. Wales has not been severely impacted by historical earthquakes.
Severe Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Wales experiences severe weather events such as the following: extreme cold, freezing rain/ice storms, heavy and drifting snow, winter storms, blizzards, heavy rain, high winds, and droughts.
Wildland/Tundra Fire	Wales is located in the EC5 Level II Ecoregion which is classified as Bering Tundra. The Seward Peninsula is a predominantly treeless region and the vegetation/landcover class of this region is primarily made up of sparse vegetation containing trees, shrubs, and herbaceous cover. Ecoregion EC5 has a low fire load, but fires do happen under favorable conditions. Mainly short lived as moisture frequently impacts the west coast. However, with certain combinations of fuel availability, weather, topography, and sources of ignition, wildland fires may occur near Wales. Wales is occasionally impacted by smoke from distant wildfires that impacts their air quality.
Changes in the Cryosphere	Hazards associated with permafrost degradation, sea ice extent, and snow avalanches occur in Wales. Wales has historically had continuous permafrost. Thawing permafrost has led to subsidence and heaving on subsistence trails, roads and underneath some homes. Sea ice in the Bering Sea has been declining and has impacted the community's subsistence lifestyle. An avalanche in the early 1900s resulted in a fatality in the community.
Naturally Occurring Uranium	A uranium deposit discovered in 1977 in western Alaska, by means of airborne radiometric data, is the largest known in Alaska on the basis of industry reserve estimates. The major radioactive minerals in placer concentrations from the Cape Mountain area in the western Seward Peninsula are monazite, xenotime, and zircon. The source of the radioactive minerals is likely the granite at Cape Mountain, although they may be genetically related to the tin deposits in the area. Wales regularly tests their drinking water for levels of uranium.
Flood	Wales is located on the coastline and experiences coastal flooding associated with Bering Sea storms. Wales is not threatened by riverine flooding, but a creek near the Village does occasionally overtop due to heavy rain or storms. The Denali Commission 2019 Statewide Threat Assessment provides statewide risk ratings for flooding. Wales is located in Group 3, which are the communities that are least threatened by flooding.
Tsunami	There has never been a tsunami observed in Wales, but members of the Planning Team recall that when they were young, they prepared for a tsunami following an earthquake and went to higher ground, but no tsunami came. Wales does not have inundation mapping to determine if/how a tsunami would impact the community. Until mapping can be done, the Planning Team wanted to profile the hazard.

Hazard Type	Explanation
Erosion	Wales is located on the coastline and experiences coastal erosion associated with Bering Sea storms. From 1950-2012, Wales was losing approximately 5.6 feet of shoreline per year. Facilities in Wales have been impacted by erosion including the school, old church, clinic, washeteria, teacher housing, 4 homes, the cemetery, and subsistence trails.
Landslide	Landslides may occur on Cape Mountain, 3 miles SE of the community. The mountain has granite formations that are massive and jointed.
Climate Change	The Planning Team chose to incorporate the influence of climate change into each hazard rather than profiling it as a standalone hazard. In Wales, average annual temperatures may increase by about 14ºF by the end of the century while winter temperatures are increasing the most (+25ºF) (UAF/SNAP 2024a- Northern Climate Reports). Winter is likely to have +53% more precipitation and by the late century, permafrost within about 10ft of the ground surface may completely disappear (UAF/SNAP 2024a- Northern Climate Reports).

3.2.1 HAZARDS NOT PROFILED IN THIS MJHMP

- **Volcano:** The 2023 State of Alaska SHMP identifies volcanic ash hazard areas across the State (Figure 3-1). Wales is not located near any active volcanoes and volcanic ash does not pose a direct threat to the community. Wales may be indirectly impacted by a future volcanic eruption as travel/supplies may be delayed from Nome, Anchorage or Seattle if planes are not permitted to travel due to ash or other volcanic hazards.



Source: DHS&EM 2023

Figure 3-1 Statewide Volcanic Ash Hazard Areas

3.3 HAZARD PROFILES

The specific hazards selected by the Planning Team for profiling have been examined based on the following factors:

- Nature (type)
- History (previous occurrences)
- Location (where the hazard occurs in the Planning Area)
- Extent (includes magnitude and severity)
- Impact (provides general impacts associated with each hazard)
- Probability of Future Events (annual likelihood of hazard occurring in the Planning Area)
- Future Conditions Including Climate Change (how climate change is influencing the hazard)

Each hazard is assigned a rating based on the following criteria for magnitude/severity (Table 3-2) and probability of future event (Table 3-3). Estimating magnitude and severity are determined based on historic events using the criteria identified in the following tables.

Table 3-2 Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
Catastrophic	• Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent (%) of property is severely damaged.
Critical	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least two weeks. • More than 25% of property is severely damaged.
Limited	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than one week. • More than 10% of property is severely damaged.
Negligible	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10% of property is severely damaged.

Table 3-3 Hazard Probability of Future Events Criteria

Probability	Criteria
Highly Likely	• Event is highly likely to occur within the next year. • Greater than 90% annual probability of occurring.
Likely	• Event is likely to occur within the next year. • Between 50-89.9% annual probability of occurring.
Possible	• Event is possible to occur within the next year. • Between 10-49.9% annual probability of occurring.
Unlikely	• Event is unlikely to occur within the next year. • Less than 10% annual probability of occurring.

The hazards profiled for the Native Village and City Wales are presented throughout the remainder of this section. The presentation order does not signify their importance or risk level.

3.3.0 CLIMATE CHANGE

To meet updated FEMA guidelines, the Planning Team decided to incorporate the influence of climate change into each individual hazard rather than profile it as standalone hazard. General background information regarding climate change in Alaska, with emphasis on Western Alaska/Arctic region, is described below and the specific influences are described in each hazard section.

Nature

Climate change is the long-term variation in Earth's average weather patterns and atmospheric composition. These variations may be natural, but since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels (like coal, oil, and gas) which produce heat-trapping gases. These gases act as a blanket over the Earth, and with more gasses, the thicker the blanket, the warmer the earth. Trees and other plants are not able to absorb the excess carbon dioxide in the atmosphere, and this excess carbon dioxide changes precipitation and temperature patterns. These changes in precipitation patterns lead to increasing frequency and intensity of storms and floods, wildfires, and substantial changes in flora, fauna, fish, and wildlife habitats.

For the past million years the natural climate has oscillated between warm periods and ice ages. This shifting in and out of warm periods and ice ages is correlated strongly with Milankovitch cycles. These cycles affect the amount of sunlight and therefore, energy, that Earth absorbs from the Sun. They provide a strong framework for understanding long-term changes in Earth's climate, but Milankovitch cycles can't explain all climate change that's occurred over the past 2.5 million years. Milankovitch cycles cannot account for the current period of rapid warming Earth has experienced since the pre-Industrial period (years 1850-1900), and particularly since the mid-20th Century. Earth's recent and continual warming is primarily due to human activities- specifically, the direct input of carbon dioxide into Earth's atmosphere from burning fossil fuels. This is significant because hazard mitigation planning relies greatly upon the historical record.

As noted in the 2018 4th National Climate Assessment (USGCRP 2018), the effects of climate change in Alaska will include:

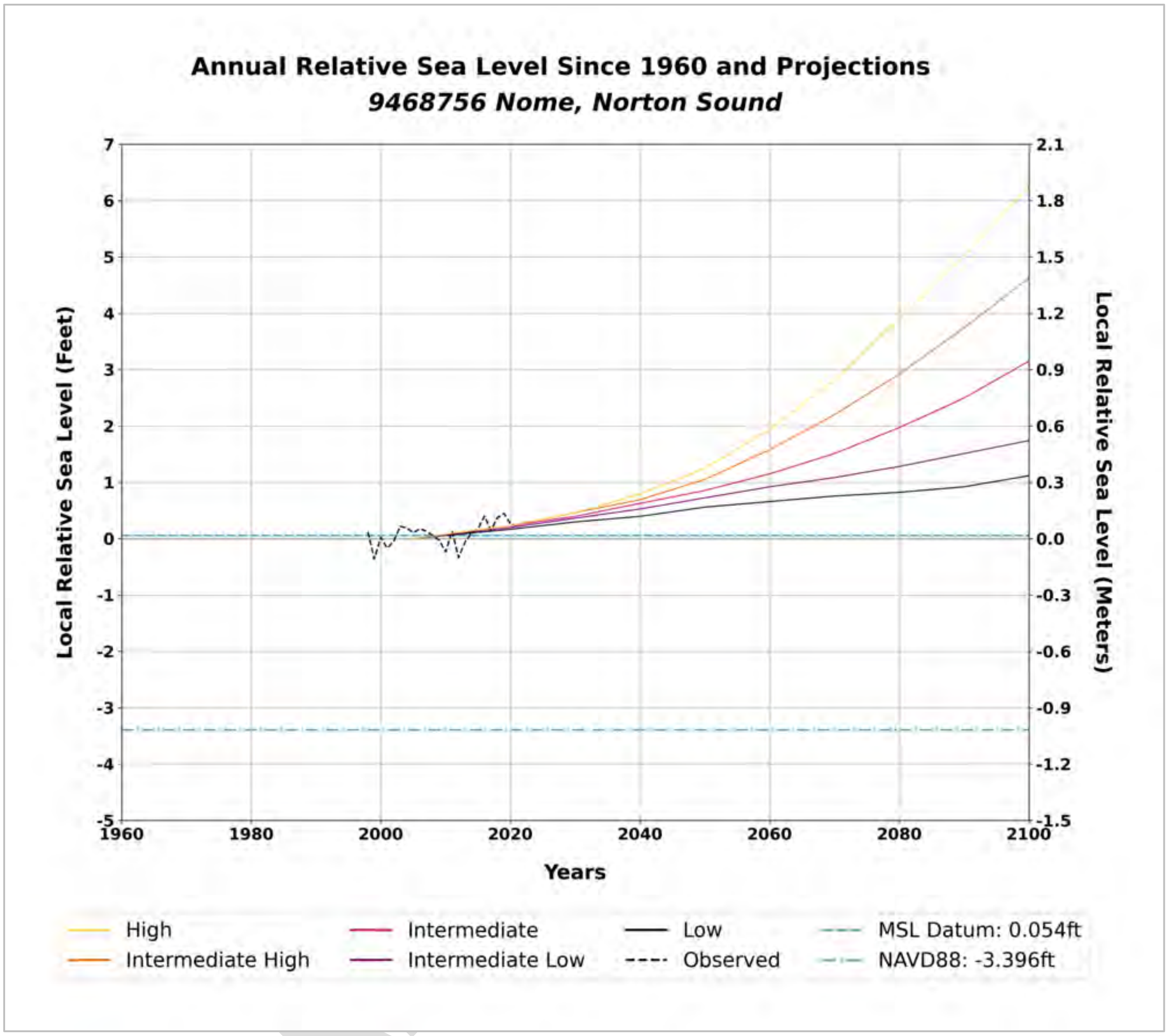
- Increase in ocean acidification which will affect marine habitats.
- Lack of sea ice, which will contribute to increased storm surge and coastal flooding and erosion.
- Increase in the size, intensity, and frequency of wildfires.
- Thawing permafrost, melting glaciers, and the associated effects on the state's infrastructure and hydrology.
- Increase of health threats, such as injuries, smoke inhalation, damage to vital infrastructure, decrease of food and water security, and new infectious diseases.

Location

Alaska has been called a ''climate canary'' because it is already seeing the early effects of global climate change. Climate researchers expect future climate change in Alaska and other Arctic places to be more pronounced than it is elsewhere in the world (Larsen et al. 2008).

Global sea level has risen between 6 and 8 inches (15-20 cm) over the last 100 years (NOAA 2021). About one third of the increase is due to the thermal expansion of ocean water as it has gotten warmer, and about two-thirds is due to meltwater flowing back to the ocean as glaciers and ice sheets on land melt.

Figure 3-2 depicts the rising sea level in Nome from 1992 to 2022, which is the closest monitoring station to Wales. In those 30 years, the highest sea level was recorded in February 2019 and the lowest was recorded in March 1994.



Source: NOAA 2022

Figure 3-2 Annual Relative Sea Level in Nome and Future Projections (1960-2100)

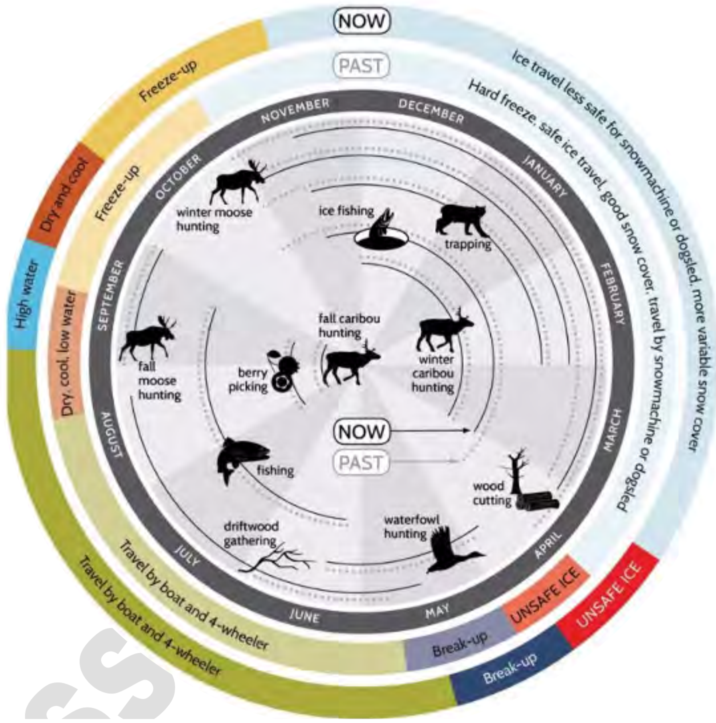
Despite the global nature of climate change, amplified local/regional effects occur and can be significant. The entire community of Wales is vulnerable to climate change.

Impact

Climate change in Alaska is causing widespread environmental change that is damaging critical infrastructure, especially in coastal communities. As climate change continues, infrastructure may become more vulnerable to damage, increasing risks to residents and resulting in large economic impacts (Melvin et al. 2016).

It is estimated that climate change in Alaska could add $3.6–$6.1 billion (+10% to +20% above normal wear and tear) to future costs for public infrastructure between 2008 and 2030 and $5.6–$7.6 billion (+10% to +12%) between 2008 and 2080 (Larsen et al. 2008).

Climate change is impacting food security in Alaska, especially that of Indigenous Alaskans who rely on subsistence hunting, fishing, and gathering. Observed greening of tundra biomes and browning of boreal forest biomes is affecting the abundance and distribution of animals such as reindeer and salmon, reducing available harvests of these important subsistence species, and is impacting access to and availability of foraging plants (IPCC 2019).



Source: Steffen et al. 2021

Figure 3-3 How Climate Change is Affecting the Timing of Traditional Subsistence Activities

Ocean acidification is a less commonly discussed impact of climate change in which the pH level of ocean waters decreases due to the absorption of atmospheric carbon dioxide. According to NOAA, the world's oceans have become 30% more acidic since the Industrial Revolution, and as atmospheric CO_2 rises, more of this gas is absorbed by the oceans (NOAA 2020). Ocean acidification has also been shown to disrupt some fish species and their ability to identify suitable habitats and detect predators and can impact the shells and sensory organs of crab. Additionally, ocean warming is impacting available fish stocks, and marine animal biomass is projected to decrease in the 21st century by as much as 6.4% in a low emissions scenario, and 24.1% in a high emissions scenario. Ocean acidification and warming are anticipated to be irreversible on human time scales, indicating that societies will be required to adapt to these changing conditions and reductions of fish availability (IPCC 2019).

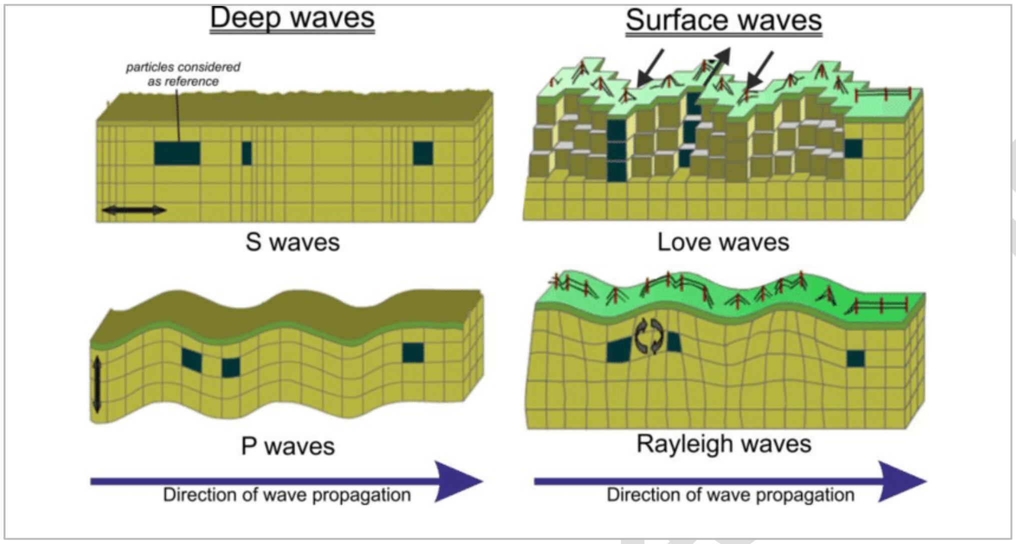
The combined impacts of changes to boreal forest and tundra biomes, ocean acidification, and ocean warming could prove highly disruptive to food security and the economy of Alaska, which relies heavily on subsistence and commercial hunting and fishing. The IPCC's 2019 report concludes that these ecosystem changes will further erode the cultural identities and livelihoods of Indigenous as well as non-Indigenous peoples (IPCC 2019).

3.3.1 EARTHQUAKE

3.3.1.1 Nature

An earthquake can be defined as any shift along the Earth's tectonic plates and faults due to accumulated strain built up by friction which precipitates a sudden movement or trembling of the Earth's crust. This sudden movement can be felt at sometimes very distant sites from the epicentre, and it usually occurs without warning. The movement can build rapidly after just a few seconds and cause significant, sometimes catastrophic, damage and severe numbers of casualties, and this often-violent motion or shaking is the most common effect of earthquakes.

Like sound, the motion of the ground is the strongest near the source and increases in concert with the amount of energy released. It also attenuates with distance, i.e., decreases in force as you travel farther away from the epicentre of the earthquake. An earthquake causes several types of waves both with the Earth's interior (seismic waves) and along the surface of the Earth (surface waves). Two distinct types of seismic waves are produced during an earthquake. Primary waves (P waves) are compressional and longitudinal in nature, and this causes back and forth oscillation in parallel to the direction of travel (the vertical motion). Secondary waves (S or shear waves) are slower in nature than the P waves and cause vibrations that are in the side-to-side plane (horizontal motion). Additionally, there are two types of surface waves: both Rayleigh and Love waves travel more slowly and usually cause considerably less damage than the seismic waves. A visual depiction of each of these waves is shown below (Figure 3-4).



Source: Martinez-Moreno 2015

Figure 3-4 Types of Seismic Waves

Besides the motion and resultant damage, there are also several other hazards which occur due to earthquakes. These are:

Fault Displacement: this is distinct movement on the surface along the two sides of a seismic fault. These displacements can be very considerable in both length and width, i.e., as much as 7 meters vertically and more than 60 kilometers along the rupture line. This type of faulting can cause severe damage to surface structures such as pipelines, roads, railways, and tunnels.

Liquefaction: when granular soil or sediments that is saturated becomes distorted due to the vibrations and surface movements. The empty spaces between the granules can collapse, and water pressure within the pores may increase enough to make the soil/sediments behave more like a fluid during the earthquake causing sometimes serious deformations. Horizontal movements (i.e., lateral spreading) of 5 meters are common but can be as much as 30 meters. Massive flows (i.e., flow failures) that are typically tens to a hundred meters can sometimes extend even to 6-7 kilometers. Liquefaction can also cause a considerable loss of bearing strength, and this can result in structures settling significantly or tipping severely. All of this can result in severe property damage.

Both the intensity and magnitude are considered during the measurement of the severity of earthquakes. The observed level of damage and effects on people, nature, and human structures are variables when describing the intensity. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale.

As shown in Table 3-4, the MMI Scale consists of 10 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location, or measured as acceleration due to gravity (g). The USGS describes the MMI Scale as:

> *"The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture,*

> *damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale.*
>
> *The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the non-scientist than the magnitude because intensity refers to the effects actually experienced at that place."*

The following table is an abbreviated description of the comparisons of earthquake magnitude, intensity, ground-shaking comparisons, perceived shaking, and damage.

Table 3-4 Magnitude/Intensity/Ground-Shaking Comparisons

Magnitude	Intensity	PGA: Acceleration (g)	Perceived Shaking	Damage
1.0-3.0	I	<0.000464	Not felt	None
3.0-3.9	II-III	0.000464 - 0.00297	Weak	None
4.0-4.9	IV	0.00297 - 0.0276	Light	None
	V	0.0276 - 0.115	Moderate	Very light
5.0-5.9	VI	0.115 - 0.215	Strong	Light
	VII	0.215 - 0.401	Very Strong	Moderate
6.0-6.9	VIII	0.401 - 0.747	Severe	Moderate/Heavy
	IX	0.747 - 1.39	Violent	Heavy
7.0+	X+	>1.39	Extreme	Very Heavy

Adapted from: USGS (2008) and Er et al. (2010)

3.3.1.2 History

Reliable data in the seismology of Alaska has been recorded only since 1973 for most locations, and this makes the data relatively young compared to other areas. Obtained for the U.S. Geological Survey (USGS) and the archives of the UAF Geophysical Institute, State of Alaska, the information provided is based on the best-known data. Thorough research was conducted for all events since 1950 (1950-1972 data is less reliable than current data) and up to the present within the earthquake database of the USGS.

Alaska's strongest earthquake, and the second largest earthquake in the world, occurred on March 27, 1964, in Prince William Sound and was magnitude M9.2. Similar to most earthquakes in Alaska, this one occurred near the Alaska-Aleutian subduction zone and was felt by many residents throughout the State. Wales did not experience any damages from this event.

Another notable earthquake occurred on November 3, 2002. The Denali Fault Earthquake, which measured M7.9 in magnitude, lasted for roughly 90 seconds. The earthquake struck a sparsely populated region, and caused thousands of landslides, but little structural damage and no deaths were reported. Wales did not experience any damages from this event.

Table 3-5 lists the historical earthquakes M4.0 and greater within 100 miles of Wales. Historical earthquake data was pulled from the USGS Earthquake Catalog from January 1, 1900, through April 25, 2024. Since

1900, there have been 43 recorded earthquakes M4.0 and greater within 100 miles of Wales- the largest occurred on December 28, 1952, and registered as a M5.8.

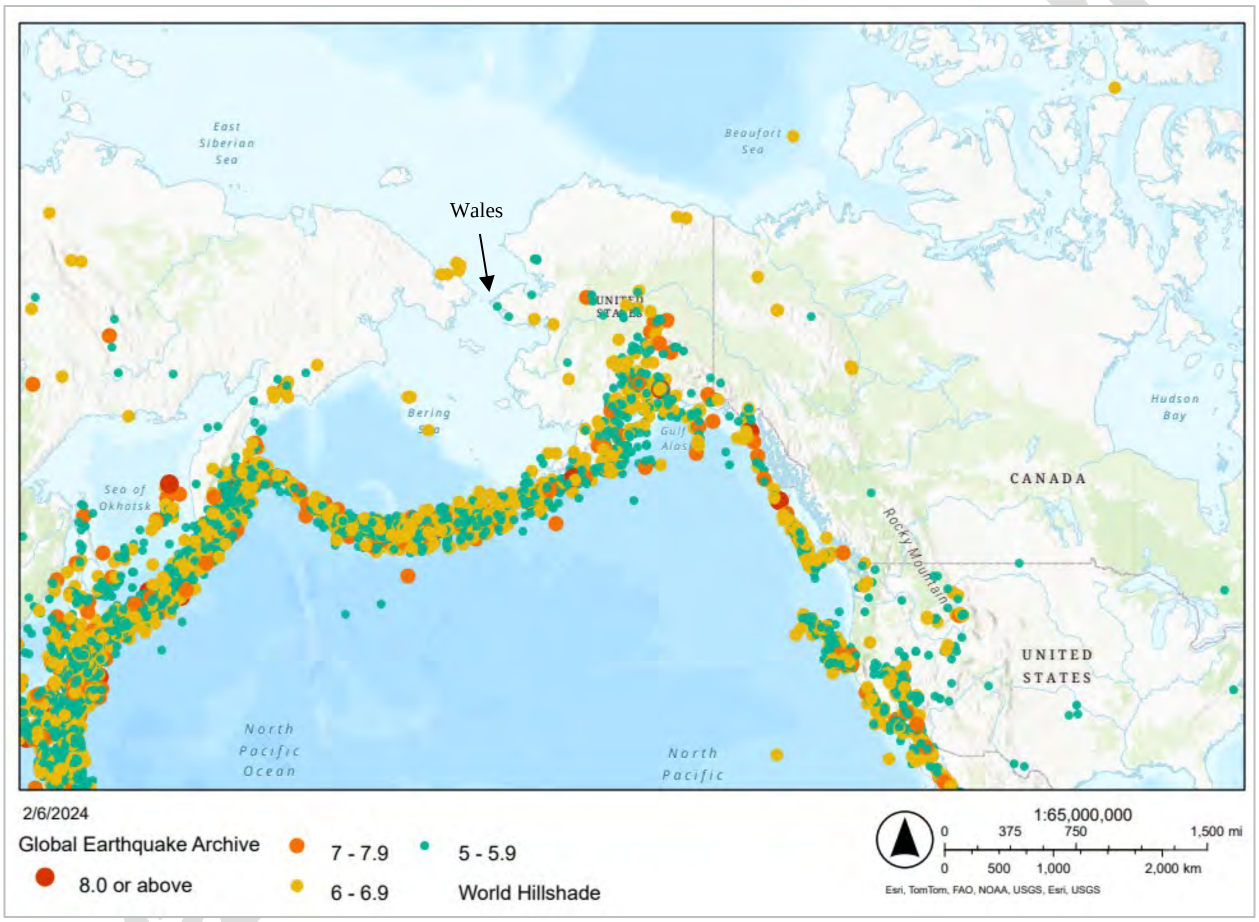
Table 3-5 Historical Earthquakes (M4.0 and greater within 100 miles of Wales)

Date	Latitude	Longitude	Magnitude
12/28/1952	65.49	-167.209	5.8
12/13/1964	64.948	-165.81	5.6
08/11/1974	66.02	-165.505	4.1
10/24/1979	65.238	-164.736	4.4
01/26/1980	66.079	-168.027	4.5
08/07/1982	65.999	-166.766	4.8
11/04/1983	65.725	-167.941	4.2
04/07/1985	65.016	-166.447	4.2
02/04/1987	65.04	-166.801	4.7
09/11/1988	65.468	-167.837	4.2
08/30/1992	64.7333	-165.627	4.7
08/09/1996	64.926	-169.786	4.9
08/09/1996	65.086	-169.983	5.2
08/09/1996	64.974	-169.855	4.4
08/10/1996	65.066	-169.915	4.1
08/27/1996	65.204	-165.444	4.4
11/03/1996	64.812	-170.481	5.2
11/21/1996	65.01	-170.862	4.2
05/21/1997	65.389	-166.979	4.3
04/04/1999	65.1633	-170.875	4.3
11/25/2000	66.557	-170.283	4.6
10/22/2003	65.4542	-167.446	4.4
09/11/2004	65.8864	-166.21	4.0
07/08/2006	65.9611	-170.149	4.5
07/10/2006	65.773	-169.623	4.9
11/26/2006	65.7929	-170.114	4.2
04/07/2010	65.164	-170.652	4.2
05/13/2010	65.663	-166.691	4.4
05/25/2010	66.4044	-169.837	4.2
08/08/2010	65.3053	-168.107	4.0
11/02/2010	65.395	-169.06	4.4
05/21/2011	65.3739	-166.866	5.0
04/25/2014	65.334	-166.354	4.4
03/17/2015	64.8603	-167.991	4.0
07/09/2016	65.7005	-166.13	4.8
07/17/2016	65.6862	-166.102	4.2
03/22/2017	65.1993	-169.033	4.2

Date	Latitude	Longitude	Magnitude
06/29/2017	65.2778	-168.029	4.1
11/16/2018	65.5781	-166.807	4.6
11/16/2018	65.5676	-166.779	4.2
11/21/2018	65.5734	-166.783	4.0
07/03/2019	65.8176	-166.191	4.1
11/01/2020	65.3927	-168.772	4.6

Source: USGS 2024a

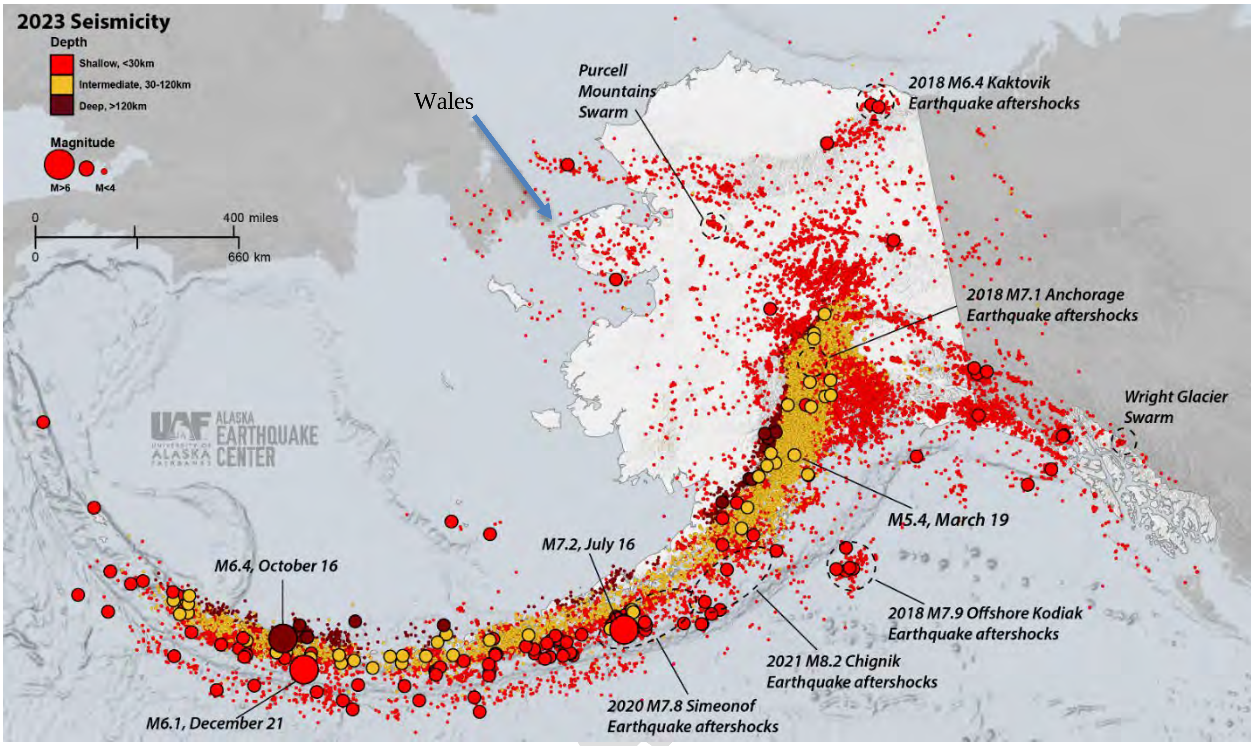
Figure 3-5 shows historical Alaska earthquakes from 1900 – February 6, 2024, M5.5 and greater.



Source: Global Earthquake Archive- Updated December 11, 2023, Accessed February 6, 2024

Figure 3-5 Historical Alaska Earthquakes Greater than M5.5, 1900 - February 6, 2024

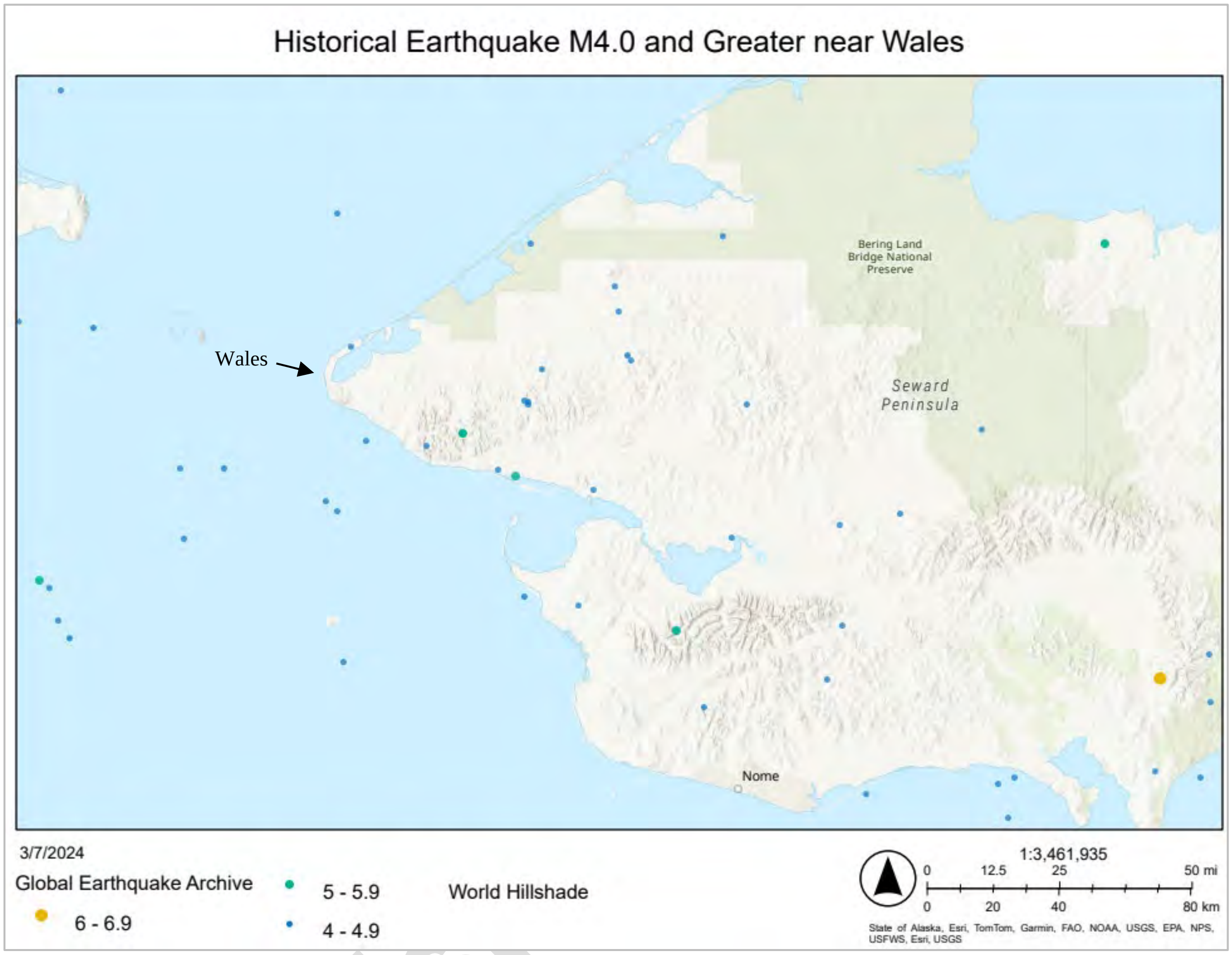
Figure 3-6 depicts one year of earthquake activity in Alaska during 2023. The Alaska Earthquake Center (AEC) states that "when Alaska has less than 50,000 earthquakes in a given year, we consider it quiet. 2023 was a quiet year for Alaska, with the AEC reporting 45,546 seismic events in Alaska and neighboring regions. This is ~1,500 less than in 2022, and about 8,900 less than the record-breaking 2018" (AEC 2024).



Source: AEC 2024- (Note, there is a lack of seismometers deployed in the northern portion of the state.)

Figure 3-6 Map of Alaska's Recorded Earthquakes in 2023

Figure 3-7 depicts historical earthquakes M4.0 and greater near Wales.



Source: Global Earthquake Archive- Updated December 11, 2023, Accessed March 7, 2024

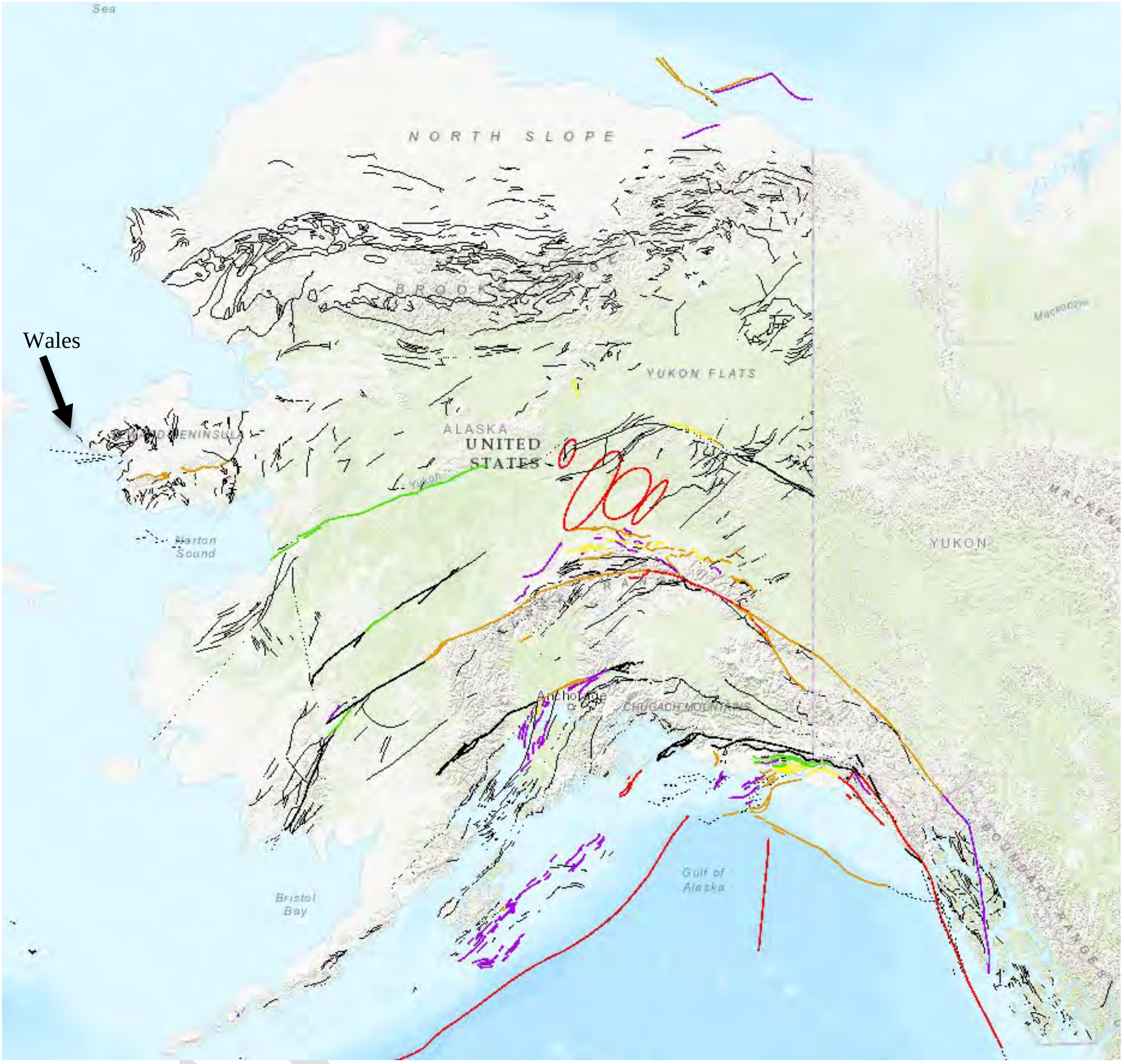
Figure 3-7 Historical Earthquakes M4.0 and Greater near Wales

Within ~100 miles of Wales, the largest earthquake occurred on August 25, 1950, and registered as a M6.0, but there were no recorded damages in Wales.

3.3.1.3 Location

Due to Alaska's location along the border between two tectonic plates, near the Aleutian Islands, the entire state is subject to the effects of earthquakes. Wales is not located near this subduction zone and historical earthquakes have been minor and fewer in number compared to areas along the subduction zone and the rest of the state.

Figure 3-8 shows Alaska's earthquake faults and folds. The accompanying legend is below.



Source: DGGS Quaternary Fault and Folds Database (2013)

Figure 3-8 Alaska's Faults and Folds

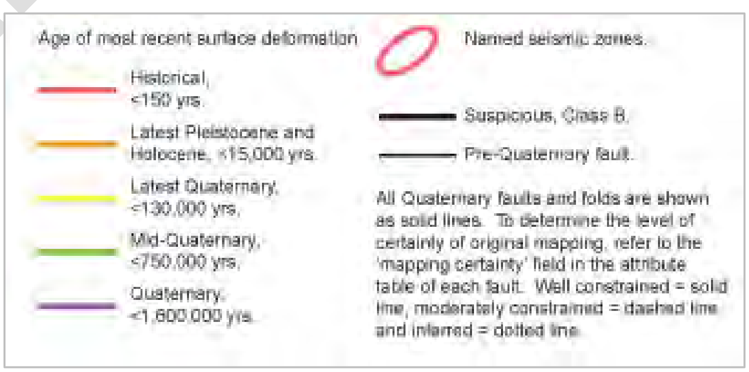
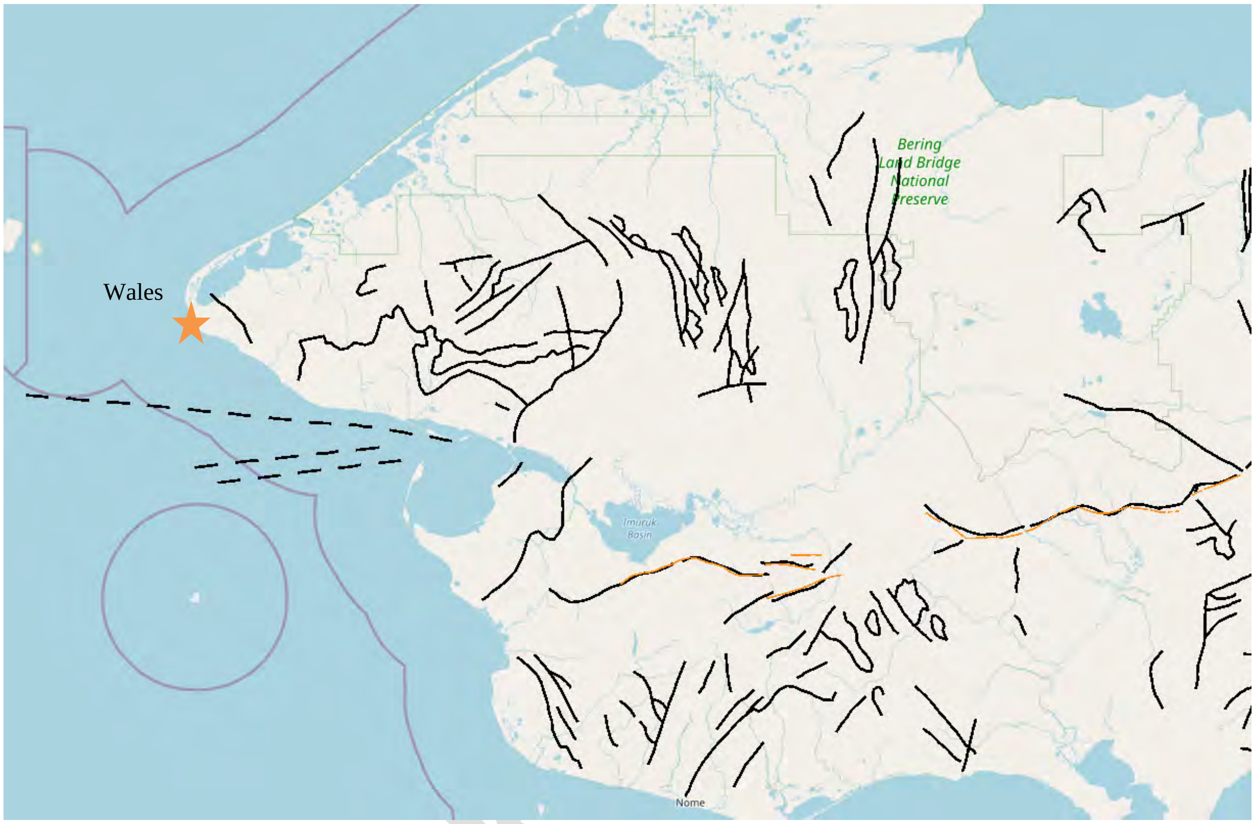


Figure 3-9 is a zoomed in image of the Quaternary Fault and Folds near Wales. The legend above is applicable to this figure as well.

The faults near Wales are Pre-Quaternary faults (not active in over 1.6 million years) and are not named.



Source: DGGS Quaternary Fault and Folds Database (2013)

Figure 3-9 Faults and Folds Near Wales

3.3.1.4 Extent (Magnitude and Severity)

Intensity is a subjective measure of the strength of the shaking experienced in an earthquake. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region depending on the location of the observer with respect to the earthquake epicenter.

The "intensity" reported at different points generally decreases away from the earthquake epicenter. Local geologic conditions strongly influence the intensity of an earthquake; commonly, sites on soft ground or alluvium have intensities two to three units higher than sites on bedrock. The Richter scale expresses magnitude as a decimal number.

A M2.0 or less is called a microearthquake; they cannot even be felt by people and are recorded only on local seismographs. Events of about M4.5 or greater are strong enough to be recorded by seismographs all over the world. A M5.0 earthquake is a “moderate” event, a M6.0 characterizes a “strong” event, a M7.0 is a “major” earthquake, and a “great” earthquake exceeds M8.0. Great earthquakes occur once a year on average worldwide; some examples of Great earthquakes are British Columbia 1700, Chile 1960, and Alaska 1964. The Richter Scale has no upper limit, but for the study of massive earthquakes, the moment magnitude scale is used. The modified Mercalli Intensity Scale is used to describe earthquake effects on structures (Table 3-4).

Most earthquake injuries and fatalities occur within buildings from collapsing walls and roofs, flying glass, and falling objects. As a result, the extent of Wales' risk depends not just upon its location relative to known faults, and its underlying geology and soils, but also on the design of its structures. Buildings that have not been constructed to meet seismic standards can pose major threats to life and the continued functioning of key public services during an earthquake.

Based on past event history and the criteria identified in Table 3-2, the extent of earthquakes in Wales is considered Negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged.

3.3.1.5 Impact

The Seward Peninsula is not a typically seismically-active area of Alaska, but damages to buildings from past earthquakes have been documented in the region. Impacts from earthquakes pose a larger threat to Wales if a large and damaging earthquake impacts a larger community hub such as Anchorage, and disrupts the supply chain. Rural Alaskan communities rely on food, supply, and freight deliveries from Anchorage and if air travel is disrupted due to an earthquake (or any other hazard event), rural villages would be without food and supplies for extended periods of time.

3.3.1.6 Probability of Future Events

While it is not possible to predict an earthquake, the USGS has developed earthquake probability maps that use the most recent earthquake rate and probability models.

Figure 3-10 shows the earthquake probability/risk for Wales. This map layer shows the potential ground shaking intensity from earthquakes and the value that is shown is an estimate of the worst amount of shaking due to earthquakes experienced at a specific location in a 50-year time frame (Esri, USGS 2022).

In Wales, the associated earthquake risk category is 9% (0.09g). Based on the MMI scale (Table 3-4), Wales could experience moderate shaking and very light potential damage.

This layer shows the probability of a 10% chance of exceeding the displayed horizontal ground acceleration within 50 years. A 10% chance in 50 years means that statistically this earthquake happens on average every 500 years.
Source: Esri, USGS- USA Earthquake Risk. Accessed February 6, 2024.

Figure 3-10 Wales Earthquake Probability/Risk

Based on previous occurrences and the criteria identified in Table 3-3, it is Likely that there will be an earthquake M4.0 or greater within 100 miles of Wales in the calendar year. There is between 50-89.9% annual probability of occurring.

3.3.1.7 Future Conditions Including Climate Change

Changing Factor	Description of Future Changes due to Climate Change
Nature	Climate change is not anticipated to influence the nature of future earthquakes in Alaska.
Location	Climate change is not anticipated to influence the location of future earthquakes in Alaska.
Extent	Climate change is not anticipated to influence the extent of future earthquakes in Alaska.
Impact	Climate change is not anticipated to influence the impact of future earthquakes in Alaska.
Probability of Future Events	Climate change is not anticipated to influence the recurrence probability of future earthquakes in Alaska.

3.3.2 SEVERE WEATHER

3.3.2.1 Nature

Severe weather is any dangerous meteorological development that has the power to cause damage or disruption, including the loss of human life. Severe weather instances that occur throughout Alaska with extremes experienced by Wales' residents include extreme cold, freezing rain/ice storm, heavy and drifting snow, blizzard, winter storm, heavy rain, high winds, and drought. The nature of each event is described below.

Severe Weather Event	Nature of the Event
Extreme Cold	Extreme cold is generally defined as a prolonged period of excessively cold weather. Extreme cold conditions are often, but not always, part of winter storms. In Alaska, extreme cold usually involves temperatures between -20 to -50°F or more.
Freezing Rain and Ice Storms	Freezing rain and ice storms occur when the layer of freezing air is so thin that the raindrops do not have enough time to freeze before reaching the ground. Instead, the water freezes on contact with the surface, creating a coating of ice on whatever the raindrops contact. These events are noted by accumulation of at least 12 inches in less than 24 hours.
Heavy Snow	Heavy snow generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six inches or more in depth in 24 hours or less.
Drifting Snow	Drifting snow is the uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.
Blizzard	A blizzard as a specific type of snowstorm that consist of large amounts of snow or blowing snow, winds greater than 35 mph, and visibility of less than ¼ mile for at least three hours.
Winter Storm	A winter storm is a combination of heavy snow, blowing snow, and/or dangerous wind chills. A winter storm is life-threatening. A snowstorm is an example of a winter storm. A snowstorm occurs when a mass of very cold air moves away from the polar region and collides with a warm air mass. The warm air rises quickly and the cold air cuts underneath it, causing huge cloud bank to form. As the ice crystals within the cloud collide, snow is formed. However, snow will only fall from the cloud if the temperature of the air between the bottom of the cloud and the ground is below 40 degrees Fahrenheit. A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Similar to ice storms, the effects from a snowstorm can disturb a community for a prolonged period of time. Buildings and trees can collapse under the weight of heavy snow.
Heavy Rain	Heavy rain occurs when the precipitation rate is between 0.39 - 2.0 inches per hour.
High Winds	High winds pose a moderate threat to a community when they reach sustained speeds of 26 to 39 mph, or frequent wind gusts of 35 to 57 mph. High winds pose a high threat to a community when they reach sustained speeds of 40 to 57 mph. High winds pose an extreme threat to a community when they reach sustained speeds greater than 58 mph, or frequent wind gusts greater than 58 mph. While Alaska does not experience hurricanes, it experiences hurricane-force winds. Various wind scales equate wind speed to expected damages. Two widely used wind scales are the

Severe Weather Event	Nature of the Event
	Beaufort Scale of Wind Strength and the Saffir-Simpson Hurricane Wind Scale, further explained below in Table 3-6 and Table 3-7.

Table 3-6 Beaufort Scale of Wind Strength

Force	Wind Speed (mph)	Damages
0	0-1	Calm: smoke rises vertically.
1	1-3	Direction of wind shown by smoke drift, but not by wind vanes.
2	4-7	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8-12	Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	Raises dust and loose paper; small branches are moved.
5	19-24	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25-31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32-38	Whole trees in motion; inconvenience felt when walking against the wind.
8	39-46	Breaks twigs off trees; generally impedes progress.
9	47-54	Chimneys blown down; slate & tiles torn from roofs.
10	55-63	Trees broken or uprooted.
11	64-75	Trees uprooted; cars overturned.
12	75+	Wide-spread devastation, buildings damaged or destroyed.

Table 3-7 Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds (mph)	Damages
1	74-95	<u>Very dangerous winds will produce some damage:</u> Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	<u>Extremely dangerous winds will cause extensive damage:</u> Well-constructed frame homes could sustain major roof and siding

Severe Weather Event	Nature of the Event

		damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157+	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Drought

A drought is a period of time when an area or region experiences below-normal precipitation. Droughts may range in severity but have many effects on the surrounding land and weather conditions. Droughts threaten people's livelihoods and can result in a water shortage, poor quality drinking water, poor air quality, loss or destruction of aquatic habitat, loss of vegetation or crops, and an increase in infectious diseases. Droughts are a slow-onset hazard and can last weeks, months, or even years. Because of the possible long duration of droughts, the impacts last for years and can ripple through a community over time.

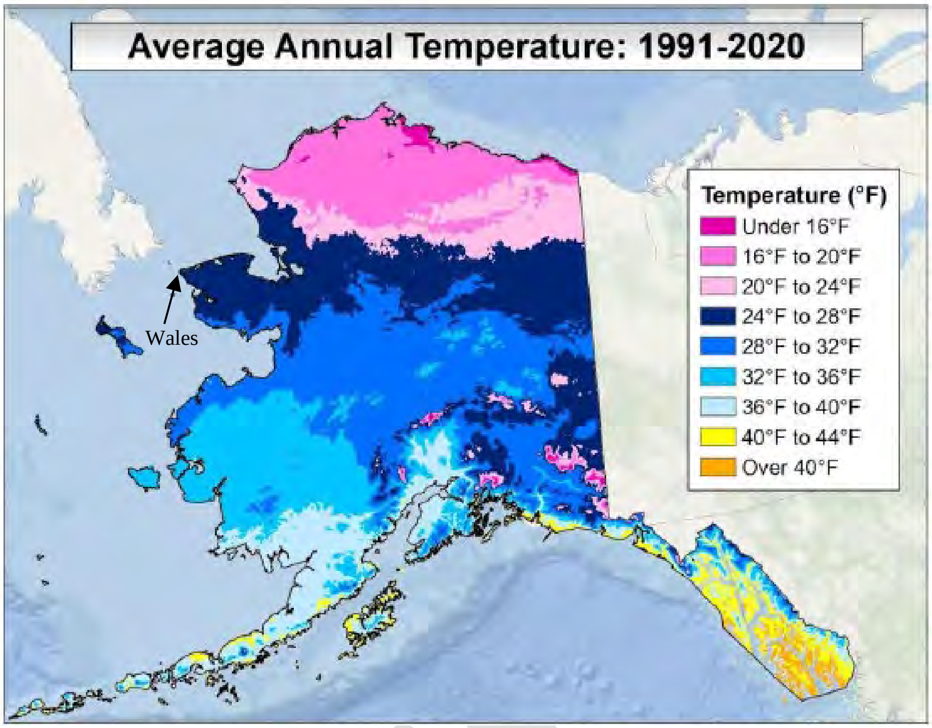
Drought conditions are classified in categories, which are described below:

Table 3-8 Classifications of Drought Conditions

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

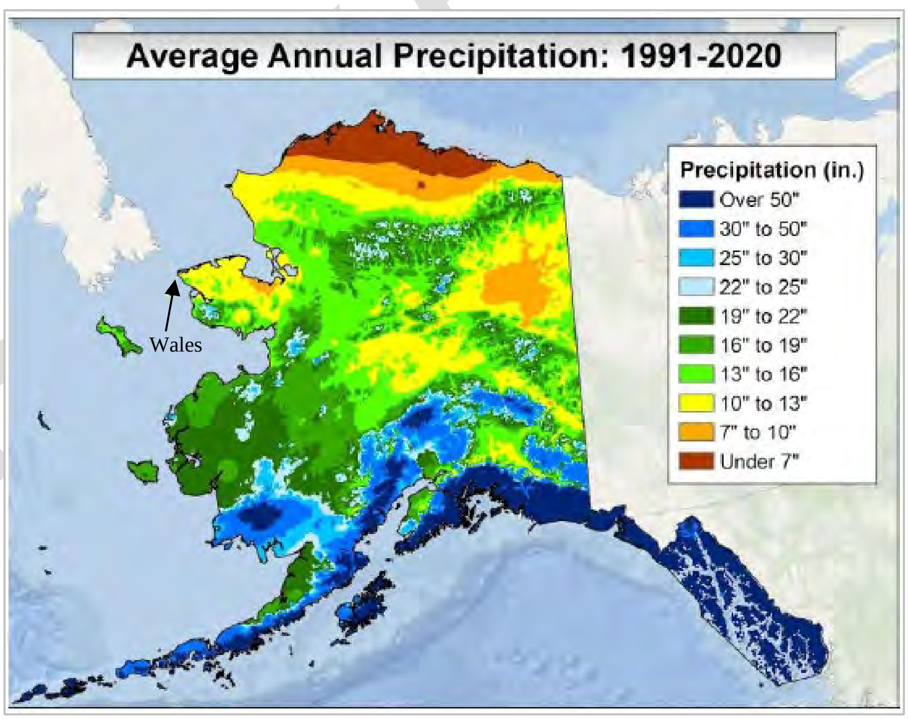
Source: U.S. Drought Monitor (USDM) 2024

Figure 3-11 shows Alaska's average annual temperature from 1991-2020 and Figure 3-12 shows Alaska's average annual precipitation from 1991-2020.



Source: NOAA NCEI Gridded Normals

Figure 3-11 Alaska Average Annual Temperature 1991-2020



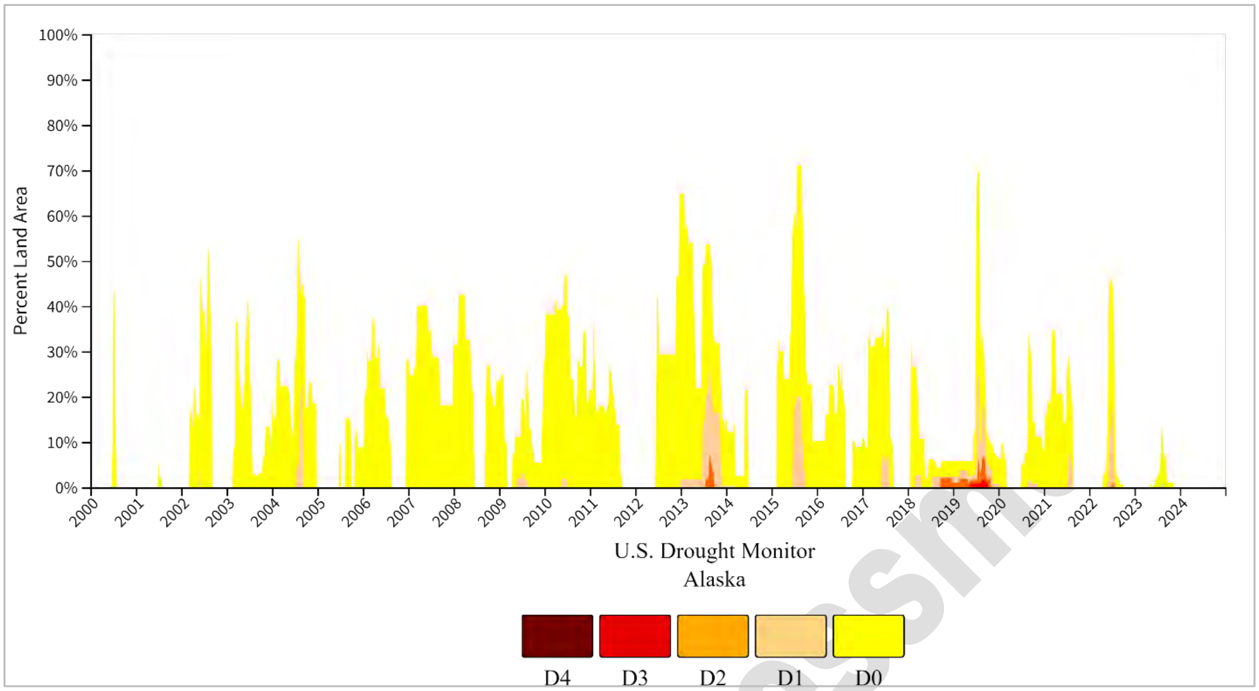
Source: NOAA NCEI Gridded Normals

Figure 3-12 Alaska Average Annual Precipitation 1991-2020

3.3.2.2 History

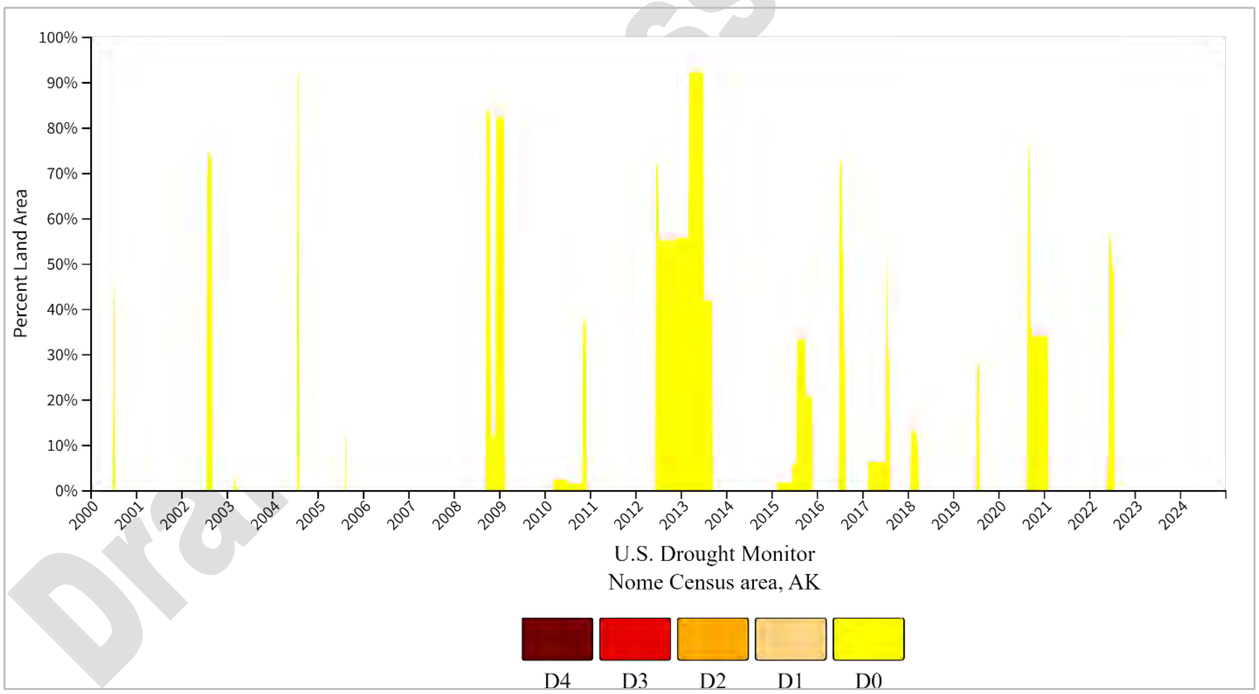
The history of severe weather events documented in Wales are described below.

Severe Weather Event	History of the Event
Extreme Cold	Wind chills of -65ºF have been documented in Wales.
Freezing Rain and Ice Storms	Freezing rain and ice storms are not commonly reported in Wales, but they have historically occurred.
Heavy Snow	Wales averages 76 inches of snowfall per year. 10+ inches of snow have fallen with several hours in Wales.
Drifting Snow	Drifting snow has occurred in Wales during severe storm events with snowfall and accompanying high winds.
Blizzard	Blizzards are documented nearly annually in Wales.
Winter Storm	Numerous winter storms occur throughout Alaska every year. The most notable winter storms in Alaska's history are: • February 1966 in Fairbanks. Over 35 feet of snow. • March 2002 in Anchorage. Over 29 inches of snow with a rate of over 2 inches of snow per hour. • January 2012 in Valdez. Over 320 inches (27 feet) of snow in the span of a couple months. • January 2012 in Cordova. Over 18 feet of snow. • December 2017 in Thompson Pass. Over 40 inches of snow in 12 hours. Winter storms, particularly blizzards, are common in Wales.
Heavy Rain	In Alaska, the year of 2022 was the 17th wettest year to date over the last 98 years, and specifically, July 2022 was the 6th wettest July over the past 98 years (USDM 2023). Wales averages 12 inches of rainfall per year. In Wales, winter precipitation is projected to increase by 53% by the end of the century (UAF/SNAP 2024a- Northern Climate Reports).
High Winds	The windiest places in Alaska are generally along the coastlines. Wind gusts of 75+ mph have been recorded in Wales. The Planning Team shared that they have experienced gusts of 100+ mph.
Drought	The U.S. Drought Monitor (USDM) started in 2000 and is a is an interactive tool/map that is updated each Thursday to show the location and intensity of drought conditions across the country. Since the creation of the USDM, the longest duration of drought conditions (D1–D4) recorded in Alaska lasted for 79 weeks. This drought began on July 17, 2018 and ended on January 14, 2020. This drought intensified to a D3 during the week of August 27, 2019 and affected 1.5% of Alaskan land (USDM 2023). Figure 3-13 shows the historical drought conditions for the State of Alaska (2000-January 2024) and Figure 3-14 shows historical drought conditions for the Nome Census Area (2000-January 2024).



Source: NIDIS 2024

Figure 3-13 Historical Drought Monitor Conditions for Alaska (2000-January 2024)



Source: NIDIS 2024

Figure 3-14 Historical Drought Monitor Conditions for Nome Census Area (2000-January 2024)

Table 3-9 lists Wales' historical severe storm events the National Weather Service (NWS) identified for their Weather Zone (Zone 213- St. Lawrence Island and Bering Strait) from January 1996 - November 2023. The NWS Storm Events Database has data dating back to January 1950 for many states, but it began collecting data for Alaska in January 1996. Additionally, any events resulting in a flood are addressed in the flood hazard section. See Table 3-12 for a list of these flooding events.

Table 3-9 Historical Severe Weather Events in Wales

Date	Event Type	Magnitude
01/27/1996	High Wind	A strong high over Alaska and several low-pressure centers moving north in the far western Bering Sea. Maximum sustained wind speeds were 44 kts at Cape Prince of Wales.
03/19/1996	High Wind	The combination between a deepening low-pressure center in the southwest Bering Sea and strong high pressure over eastern Alaska, and the low's weather front moving north over the Bering Sea produced strong winds intermittently. Cape Prince of Wales: SE 42g60 kts.
07/22/1996	High Wind	A slow-moving storm was just south of the Gulf of Anadyr and the associated weather front was moving north toward the Bering Strait. The combination created a strong southerly push of warm air, even though the weather front did not reach the Bering Strait until the next day, after it had greatly weakened. Cape Prince of Wales PMEL Platform reported winds south 36 to 40 kts sustained.
10/26/1996	High Wind	Cold air over Far East Russia met the remains of typhoon Carlo, deepening the storm as it moved north over the extreme western Bering Sea, then over Far East Russia to the Russian Arctic Coast. The warm front moved over the west coast of Alaska Sunday 27th, followed by a cold front Tuesday 29th. Maximum winds reported at Cape Prince of Wales: 39g58 kts.
11/13/1996	High Wind	The remains of super-typhoon Dale moved from the western Aleutians, north over Far East Russia, and continued northwest over the Russian Arctic. Central pressure of the storm remained between 940 and 950 mbs during this time, filling little, while 1040 mb High over eastern Alaska drifted into Canada at 1048 mbs. Peak winds speeds include Cape Prince of Wales: S 54g80 kts.
02/27/1997	High Wind	Strong High Pressure over Far East Russia and cold air moving south over the West Coast of Alaska produced strong winds at Tin City, possibly at Wales.
11/01/1997	High Wind	A series of storms moved from the southwest Bering Sea to the northeast Bering sea and southern Chukchi Sea. Resulting in high winds and possible blizzard conditions. Cape Prince Of Wales: 40 kts gusts 62 kts.
12/19/1998	High Wind	A storm south of the central Aleutian Islands moved north into the Bering Sea then northwest to far east Russia and weakened. On the 19th, the PMEL (Pacific Marine Environmental Laboratory) platform at Cape Prince of Wales on the Bering Strait Coast reported wind gusts to 60 mph.
01/14/2000	High Wind	A strong and complex frontal system over Russia Far East moved across the Bering Sea...Chukotsk Peninsula ...and into the Chukchi Sea on the 13th. On the morning of the 14th, a low-pressure center of 984 mb was located 480 miles northwest of Barrow with the cold front extending due south over the far western Brooks Range and central Seward Peninsula. Cape Prince of Wales PMEL platform gust 60 mph.
12/24/2004	Blizzard	With strong high pressure of 1049 mb covering the interior of Alaska, an occluded weather front moved north over the Bering Sea and Chukchi Sea on the night of the 24th through the 25th. At nearby Wales, a 29 YOM is presumed to have perished overnight on the 24th while he was returning to his home at the edge of the village. It is presumed he became disoriented, and ended up walking away from his home and village, to eventually die of hypothermia.
02/19/2008	Blizzard	Blizzard conditions likely occurred for a few hours overnight on the 19th, at Wales on the Bering Strait Coast, based on winds and visibility reported at the Tin City AWOS.
12/12/2008	High Wind	Ahead of a strong occluded front a period of very strong wind was observed at Wales along the Bering Strait coast. Sustained winds of 50 to 60 mph were observed with frequent gusts to 70 mph and a peak wind gust of 68 kts (78 mph).
12/14/2008	Blizzard	A low-pressure system over the western Bering Sea created blizzard conditions over the Bering Strait during the afternoon of the 14th. Blizzard conditions likely occurred at the village of Wales for 8 hours, as reported by the AWIS. Occasional wind gusts to near 52 kts (60 mph) were reported by the Wales AWIS during the afternoon.
12/17/2008	High Wind	A strong pressure gradient between a 1045 mb high in the Yukon and a 996 mb low in the Gulf of Anadyr produced a period of high winds along the Bering Strait Coast. The strongest winds were observed at Wales. A peak wind gust of 60 kts (69 mph) was observed at the Wales AWIS.

Date	Event Type	Magnitude
02/04/2009	Extreme Cold/Wind Chill	Temperatures of 20 to 35 below zero combined with a north to northeast wind of 25 to 40 mph to produce wind chills as low as 74 below zero along the Bering Strait coast during the 4th through the morning hours of the 5th. Here are the lowest wind chills that were observed: Wales AWIS: 65 below.
02/21/2009	High Wind Blizzard Blowing Snow	A 1047 mb high across northern Alaska on the morning of the 21st gradually shifted east into northern Canada by the morning of the 22nd. A 968 mb low tracked north along the Kamchatka Peninsula. A strong pressure gradient between the high and low produced a period of high wind and blizzard conditions along parts of the Bering Sea coast and Chukchi Sea coast. Along the Bering Strait Coast, the visibility was reduced to one quarter mile or less in snow and blowing snow at Wales from the afternoon hours of the 21st through the morning hours of the 22nd. In addition, the wind gusted as high as 65kt/75 mph at the Wales AWSS.
02/27/2009	Blizzard Drifting Snow	A 976 mb low near the northern Kamchatka Peninsula on the afternoon of the 26th tracked across the Chukotsk Peninsula during the afternoon of the 27th, and into the southern Chukchi Sea on the evening the 27th as a 983 mb low. The low then tracked northeast across the Arctic Ocean on the 28th. The storm brought blizzard conditions to much of the west coast as well as the arctic coasts of Alaska. On the Bering Strait coast, the wind gusted as high as 86 mph/75kt at the Wales AWSS with blizzard conditions in heavy snow and blowing and drifting snow.
03/08/2009	Blizzard	A 988 mb low south of the Aleutians at 3 pm on the 6th lifted north and deepened to 980 mb in the northern Bering Sea by 10 am on the 8th. A 1052 mb high across northern Alaska drifted slowly into western Canada during this time. The strong differences in pressure between the high and low produced strong winds and blizzard conditions along much of the west coast of Alaska. The blizzard conditions spread to the Bering Strait coast during the morning hours on the 8th, and continued into the afternoon. The following peak wind gusts were observed during this event: Wales AWSS: 63 mph/55kt.
03/29/2009	Blizzard	A 964 mb low in Bristol Bay at 4 am on the 29th lifted to the north and weakened to 977 mb across the Yukon Delta by the evening hours of the 30th. Ahead of the low, snow and blowing snow reduced the visibility to one quarter mile or less at Wales during the afternoon and evening hours of the 29th. A northeast wind of 35 to 45 mph was observed at the Wales AWSS with a peak wind gust of 48 mph/42kt.
05/16/2009	High Wind	A strong difference in pressure between a 993 mb low in the Northern Bering Sea, and a 1034 mb high in Northern Canada, produced a period of high winds on Saint Lawrence Island and along the Bering Strait Coast during the late evening hours on the 16th through the morning hours on the 17th. Here are the highest wind gusts that were observed: Wales (AWSS): 74 mph/64kt.
04/10/2010	Blizzard	A 956 mb low in the western Bering Sea at 1000AKST on the 9th tracked to the northeast and gradually weakened to 976 mb near the Gulf of Anadyr by 0400AKST on the morning of the 11th. A strong occluded front associated with the low produced blizzard conditions on Saint Lawrence Island and along parts of the west coast of Alaska. The blizzard conditions were observed at Wales from 1030AKST on the 10th, and likely continued into the late afternoon hours. After a peak wind gust of 60kt/69 mph was observed at the Wales AWSS, the power was lost.
12/18/2010	Blizzard High Wind	A frontal boundary associated with a 984 mb low near Wrangel Island produced heavy snowfall and blizzard conditions along portions of the west coast of Alaska on December 18-19, 2010. Peak wind gusts of 53 kt (61 mph) was observed at Both the Teller and Wales AWSS's during the late morning and early afternoon hours on the 18th. The high winds were accompanied by falling snow and the visibility was briefly reduced to one quarter mile in snow and blowing snow at Wales, but the blizzard conditions were short lived, and the visibility was one half mile or better during much of this event.
12/25/2010	Blizzard	A strong ridge of high pressure across eastern Russia combined with low pressure in the Gulf of Alaska to produce a strong pressure difference along the Chukchi Sea coast, the Bering Strait coast and on Saint Lawrence Island. The strong difference in pressure produced strong winds and created significant blowing and drifting snow and blizzard conditions. Blizzard conditions were observed at Wales along the Bering Strait Coast. At Wales, the blizzard conditions were observed from approximately 0300AKST on the 25th through 0400AKST on the 26th. The visibility was frequently reduced to one quarter mile or less in snow and blowing snow. A peak wind gust of 48 kt (55 mph) was observed at the Wales AWIS.
01/07/2011	Blizzard	A 978 mb low approximately 300 miles southwest of Saint Lawrence Island combined with a 1030 mb high across interior Alaska to produce blizzard conditions at Savoonga on Saint Lawrence. A brief period of blizzard conditions were also observed at Wales during the afternoon, but several observations were unavailable and it did not appear that the blizzard conditions lasted for 3 hours. There was, however, a peak wind gust of 53 kt (61 mph) at the Wales AWSS and several consecutive hours when the wind gusted to 52 kt (60 mph).

Date	Event Type	Magnitude
01/08/2011	High Wind	A second low quickly followed on the heels of the low that produced blizzard conditions on Saint Lawrence Island on the 7th and high winds at Wales. A 966 mb low near the southern Aleutians on the evening of the 7th moved rapidly north across the central Bering Sea on the 8th and produced another period of high winds at Wales. There was a peak wind gust of 60 kt (69 mph) at the Wales AWSS.
01/09/2011	High Wind	The area of low pressure that moved north across the central Bering Sea on the 8th continued to move north and across eastern Russia on the 9th. The strong pressure difference between the low and high pressure in the interior produced another period of high winds at Wales from approximately 1000AKST through 1530AKST on the 9th. A peak wind gust of 56 kt (64 mph) was observed at the Wales AWSS.
01/27/2011	Blizzard	A 960 mb low moving north crossed the Aleutians during the afternoon hours on the 27th and weakened to 974 mb 200 miles west of Saint Matthew Island by 3 pm AKST on the 28th. The low combined with a 1037 mb in Northwest Canada to produce strong winds on Saint Lawrence Island and along parts of the Bering Strait Coast. A peak wind gust of 46 kt (53 mph) was observed at the Wales AWSS.
02/14/2011	Blizzard High Wind	A 978 mb low along the coast of Kamchatka combined with a 1030 mb high across the southern interior of Alaska to produce snow and high winds on Saint Lawrence Island and along parts of the Bering Strait Coast. Blizzard conditions were observed at Gambell, Savoonga and Wales. The visibility was reduced to one quarter mile or less with white-out conditions at times. A second 998 mb low several hundred miles off the arctic coast combined with the high across the interior to produce blizzard conditions along parts of the arctic coast. The most severe blizzard conditions were observed at Barter Island along the eastern Beaufort Sea coast. Blizzard conditions were observed at Wales at times from 1908AKST on the 14th through 1851AKST on the 15th. The visibility was reduced to one quarter mile or less. There was a peak wind gust of 63kt (72 mph) at the Wales AWSS.
02/17/2011	Blizzard	A 970 mb low in the Gulf of Anadyr combined with a 1040 mb high in the Yukon to produce heavy snow and blizzard conditions along a portion of the west coast of Alaska. Along the Bering Strait Coast, blizzard conditions were observed at Wales at times during the last evening hours on the 16th into the early morning hours on the 17th. Although there was not a three consecutive hour stretch with the visibility below one quarter mile, there was a peak wind gust of 60 kt/69 mph at the Wales AWSS.
02/19/2011	Blizzard	A 966 mb low along the northern coast of Kamchatka at 0900AKST on the 19th moved into the Gulf of Anadyr as a 980 mb low at 0300AKST on the 20th. The low continued to gradually weaken to 988 mb in the southern Chukchi Sea by 1500AKST on the 20th. The low produced blizzard conditions along parts of the west coast of Alaska on the 19th into the 20th. Blizzard conditions were also observed at Wales from approximately 1800AKST on the 19th through 0400AKST on the 20th. There was a peak wind gust of 73 kt (84 mph) at the Wales AWSS.
02/22/2011	High Wind	A 968 mb low in the central Bering Sea at 2100AKST on the 23rd moved to the Gulf of Anadyr as a 976 mb low at 0900AKST on the 24th. The low tracked to the northeast as a 978 mb low in the southern Chukchi Sea at 2100AKST on the 24th. The low then tracked to the east and passed just south of Banks Island as a 980 mb low by 0900AKST on the 25th. The storm produced widespread blizzard conditions along the west coast as well as the arctic coast and heavy snowfall and high winds in parts of the interior. There were also areas of flooding and high water observed along parts of the west coast. Wales, which is located along the Bering Strait Coast had a wind gust to 53 kt (61 mph) during the early morning hours on the 24th, and Tin City had a wind gust to 52 kt (60 mph) during the morning hours on the 24th. Temperatures were a little above freezing at the time, which limited the amount of blowing snow and blizzard conditions, if they occurred were only very short in duration.
04/07/2011	Blizzard	A north Pacific low rapidly deepened south of the Aleutians during the evening of the 5th and was a 940 mb low as it passed over the Bering Sea buoy 46035 (350 miles north of Adak) around 1900AKST on the 6th. The low then weakened to 954 mb 150 miles west of Nunivak Island by 1500 AKST on the 7th, and to 981 mb along the Kuskokwim Delta at 1500AKST on the 8th. The low produced strong winds and heavy snowfall along much of the west coast. At Wales, blizzard conditions were observed from 2346AKST on the 6th until 0858AKST on the 7th. There was a peak wind gust of 43 kt/49 mph at the Wales AWSS.
10/12/2011	High Wind	A low-pressure center of 978 mb moved along the western Bering Sea on the 12th reaching the Bering strait on the morning of the 13th and weakening to 989 mb. The storm produced strong south to southeast winds on the 12th. Wind gusts reached up to 60 mph (52 knots) at the Wales AWSS.
11/08/2011	Blizzard	A 960 mb low over the southern Aleutians at 0300AKST on the 8th intensified to 945 mb near the Gulf of Anadyr by 2100AKST on the 8th. The low crossed the Chukotsk Peninsula as a 956 mb low at 0900AKST on the 9th, and moved into the southern Chukchi Sea as a 958 mb low by 2100AKST on the 9th. The low then tracked to the northwest and weakened to 975 mb about

Date	Event Type	Magnitude
		150 miles north of Wrangel Island by 1500AKST on the 10th. The storm was one of the strongest storms to impact the west coast of Alaska since November 1974. At Wales, blizzard conditions were observed much of the time from 1450AKST through 1806AKST on the 8th. There was a peak wind gust to 77 kt (89 mph) at the Wales AWSS during the early morning hours on the 9th. There was some minor wind damage to buildings in the village.
12/03/2011	Blizzard	A 960 mb low approximately 200 miles west of Nunivak Island at 1500AKST on the 3rd moved north to Saint Lawrence Island by 0300AKST on the 4th as a 968 mb low. The low drifted slowly north to the Bering Strait as a 970 mb low by 1500AKST on the 4th. The low then weakened to 997 mb near Barrow by 0900AKST on the 5th and dissipated as a new 968 mb low developed bear Banks Island by 1500AKST on the 5th. The low produced heavy snow and blizzard conditions along much of the west coast and Arctic coast. At Wales, there was a brief period of blizzard conditions during the early afternoon hours on the 3rd, but the visibility only briefly dropped to one quarter of a mile.
02/01/2012	Extreme Cold/ Wind Chill	A cold air mass across northern Alaska combined with a strong pressure difference between a 950 mb low in the northern Gulf of Alaska and a ridge of high pressure across eastern Russia to produce strong wind and low wind chills along parts of the west coast of Alaska. A period of blizzard conditions were observed at Point Hope along the Chukchi Sea Coast. Temperatures of 29 to 33 below zero combined with a north wind of 15 to 25 mph to produce wind chills as low as 66 below zero at Wales. The wind chills were 60 below or lower from approximately 2100AKST on the 2nd through 1700AKST on the 3rd.
02/08/2012	Blizzard	There was a short period of blizzard conditions at Gambell and Wales during the afternoon hours on the 8th. The strong wind that produced the blizzard conditions was caused by a strong pressure difference between a 965 mb low south of the Alaska Peninsula and a 1025 mb high across eastern Russia. At Wales, the public reported that blizzard conditions were occurring at Wales during the early afternoon. The blizzard conditions likely occurred at times from approximately 1300AKST through 1600AKST.
02/25/2012	Extreme Cold/ Wind Chill	A 986 mb low in the southeast Bering Sea combined with a 1045 mb high in eastern Russia to produce snow and strong wind on Saint Lawrence Island and through the Bering Strait. Both Wales and Teller did have wind chills as low as 60 below.
08/23/2012	High Wind	A strong occluded front associated with a 976 mb low in the Gulf of Anadyr approached the Bering Strait coast late on the evening of the 23rd into the early morning of the 24th. There was a peak wind gust to 62 kt/71 mph at the Wales AWOS during the early morning hours of the 24th. The wind gusted over 60 mph at times from 2250AKST on the 23rd through 0116AKST on the 24th.
12/21/2012	High Wind	Strong southeast winds occurred over Saint Lawrence Island and the Bering Strait Coast during the early morning of the 21st as a weather front associated with a low over Far East Russia moved east across the Bering Sea. High Winds were reported at Wales, where the AWSS reported wind gusts as high as 63 kts (74 mph).
12/29/2012	Blizzard	A storm moving from the western Gulf of Alaska to Bristol Bay while high pressure remained stationary over Russia caused increased winds and blizzard conditions over far western Alaska at the end of December. Blizzard and near-blizzard conditions occurred at times during two days at Wales.
10/21/2012	High Wind	A strong 979 mb low over the Kamchatka Peninsula at 1000AKST coupled with strong high pressure over the interior of Alaska produced strong southerly winds over the west coast of Alaska during the day on the 21st. Zone 213- There was a peak wind gust to 56 kt (64 mph) at the Wales AWSS around midday on the 21st.
01/09/2013	Blizzard	A strong 980 mb low in the southern Bering Sea brought blizzard conditions to Wales on the 9th, as indicated by the AWOS.
01/11/2013	Blizzard	A 984 mb low moved north over the eastern Bering Sea on the 11th and gradually weakened by early on the 12th north of the Bering Strait. This system brought blizzard conditions to Wales. The Wales AWOS reported a peak gust to 45 kts (52 mph) during the event.
02/04/2013	Blizzard	Strong high pressure over Russia and low pressure in the Gulf of Alaska produced blizzard conditions on Saint Lawrence Island and the Bering Strait from 1456AKST on the 4th through 1850AKST on the 5th. Blizzard conditions were also observed at Wales on the afternoon of the 5th. The visibility was reduced to one quarter mile or less. There was a peak wind gust of 39kt (45 mph) at the Wales AWOS.
02/10/2013	Blizzard	Strong high pressure over Russia and low pressure over the Seward Peninsula produced blizzard conditions along the Bering Strait during the evening hours of the 10th through the early morning hours of the 11th. The visibility was frequently reduced

Date	Event Type	Magnitude
		to one quarter mile or less. Blizzard conditions were also observed at Wales. The visibility was reduced to one quarter mile or less. There was a peak wind gust of 43kt (50 mph) at the Wales AWOS.
03/04/2013	High Wind	Strong winds developed along the west coast of Alaska between a 1045 high over the Arctic and 977 mb low pressure in the Gulf of Alaska. A gust of 58 kt (67 mph) was recorded at the Wales AWOS during the morning of the 5th.
03/05/2013	Blizzard	A 977 mb low moved north over the Bering Sea on the 5th of March and gradually weakened by early on the 6th north of the Bering Strait. This system brought blizzard conditions to Wales. The Wales AWOS reported a peak gust to 54 kts (63 mph) during the event.
11/06/2013	High Wind	A large and persistent area of high pressure which developed over the North Pacific forced the jet stream northward, which directed a series of very strong low-pressure systems into the Bering Sea from the 6th through the 14th of November. This weather pattern transported moisture and energy from the subtropics to the Bering Sea, which strengthened several storms. The AWOS at Wales reported a peak gust of 55 kt (63 mph) during the early afternoon on the 7th.
11/11/2013	Ice Storm High Wind	A complex low-pressure center of 993 mb over Kamchatka on the morning of the 12th moved to the southeast Beaufort Sea near Barter Island on the morning of the 14th deepening to 979 mb. This storm brought a variety of hazardous weather to northern Alaska: another surge of sea water across Norton Sound, rising 4 to 8 feet to prolong the inundation which had occurred just a few days earlier though the peak surge did occur during the falling tide so the overall rise in sea level was not as high as the previous event. A strong warm front with this system spread precipitation across the west coast and interior starting out as freezing rain, then rain, though remaining as snow near the Brooks Range. An estimated 0.20 inches of rain was reported at Wales along with high winds of 56 kt (64 mph) reported at the Wales AWOS. This event resulted in over $2M in damages in the region.
01/16/2014	Blizzard	A strong 952 mb low entered the eastern Bering Sea during the morning hours of the 17th. The associated occluded front pushed north during the day. A strong pressure gradient along with snow and strong winds produced blizzard conditions at a variety of locations along the West Coast of Alaska on January 17th. Wales likely experienced blizzard conditions on the 17th. The AWOS at Wales stopped reporting visibility after a few hours during what was likely the worst conditions.
02/15/2014	Blizzard	A strong 1043 mb high pressure centered over the Arctic coupled with a low-pressure center in the central Bering Sea produced strong winds and blowing snow and local blizzard conditions for several locations over western Alaska during the 16th and 17th. Blizzard conditions were observed at Wales. The visibility was reduced to one quarter mile or less in blowing snow. There was a peak wind gust of 46 kt (53 mph) at the Wales AWOS.
02/23/2014	Blizzard	A weather front moving north over the Bering Sea brough strong winds and blizzard conditions to Wales during the afternoon and early evening of the 23rd, as the AWOS frequently reported a visibility of around one-quarter mile in snow and blowing snow. Winds gusted to 53 kt (61 mph) just before the onset of blizzard conditions.
04/30/2014	High Wind	A strong warm front moved north over the Bering Sea early on the 30th, bringing high winds to Saint Lawrence Island and the Bering Strait Coast. The Wales AWOS reported gusts as high as 52 kt (60 mph).
10/26/2014	High Wind	A weather front moving north over the west coast of Alaska produced strong winds over the Bering Strait Coast and Saint Lawrence Island, as well as heavy snow over a portion of the Lower Kobuk Valley. High winds reported at Wales. The Wales AWOS: highest gust 56 kt (64 mph).
12/26/2014	High Wind	A tight pressure gradient developed between a strong 968 mb low pressure center in the far western Bering Sea and a 1045 mb high pressure center over the eastern Arctic slope on the 27th and 28th of December 2014. Wales AWOS highest reported gust was 70 mph (61 kt).
02/25/2015	Blizzard	A series of low-pressure systems developed in the western Bering Sea on the 25th of February. These lows produced strong south winds with snow and blowing snow and local blizzard conditions for the Bering Strait and along the coast of northwest Alaska during most of the day on the 25th. Blizzard conditions were observed at the Wales AWOS. The visibility was reduced to one quarter mile or less in snow and blowing snow. There was a peak wind gust of 51 kt (59 mph) at the Wales AWOS.
10/01/2015	High Wind	A tight pressure gradient developed between a strong 980 mb low pressure center in the far western Bering Sea and a 1040 mb high pressure center over the Canadian Yukon on the evening of the 1st and into the early morning hours of October 2nd 2015. High winds were reported at Wales. Wales AWOS highest reported gust was 71 mph (62 kt).

Date	Event Type	Magnitude
03/04/2016	Blizzard	A strong pressure gradient developed along the Bering Strait between 1031 mb high pressure over the arctic and a 968 low pressure system in the Gulf of Alaska. Blizzard conditions and strong winds developed on the west coast of the Seward Peninsula from the afternoon of the 4th of March into the morning hours of the 5th. Blizzard conditions were observed at Wales. Additionally, the wind gusted to 45 mph (39 kt) at the Wales AWOS.
10/24/2016	High Wind	A 950 mb low in the western Bering along with its associated occluded front produced strong winds along the Bering strait on the 25th of October. A peak wind gust of 84 mph (73 kt) was reported at the Wales AWOS.
01/30/2017	Blizzard	Low pressure system brought strong southerly winds and snow creating blizzard conditions for the upslope areas of Kobuk and Noatak valleys and the Bering Strait. Blizzard conditions at Wales. Gust of 62 kt (71 mph) reported at the Wales AWOS.
02/14/2017	Blizzard	A strong pressure gradient developed along the Bering strait between a 1034 mb high pressure center over Russia and a 965 mb low in Bristol Bay. Blizzard conditions developed along the Bering strait coast on February 14th. Blizzard conditions and one quarter mile visibility was reported on the Wales AWOS. A peak wind of 53 kt (61 mph) was reported.
10/11/2017	High Wind	Strong winds developed out ahead of an approaching 958 mb low pressure center along the west coast of Alaska on October 11. The strong winds continued into the 13th. Minor beach erosion also occurred along the coast. Low level areas of Wales saw elevated seas of 3 to 5 feet above normal tides. Wales AWOS reported 60 mph (52 kt).
11/06/2017	High Wind	A strong pressure gradient set up along the west coast on November 6th. Strong winds continued into the 7th. A peak wind of 70 mph (61 kt) was reported at the Wales AWOS.
11/14/2017	Blizzard	A weather front produced strong winds and low visibility to parts of the west coast and northwest Alaska on the 14th of November. Blizzard conditions reported at the Wales AWOS. A peak wind of 52 kt (60 mph) also reported.
11/19/2017	Blizzard	Strong winds developed out ahead of an approaching frontal boundary along the west coast of Alaska on November 19th. The strong winds continued into the 23rd. Blizzard conditions and high winds along the Bering Strait and along the west coast and north slope were observed. Wales AWOS reported one quarter mile or less at times with a peak wind gust of 60 mph (52 kt).
11/25/2017	High Wind	Strong winds developed out ahead of an approaching low pressure system along the west coast of Alaska on November 25th. High winds and high surf along the Bering Strait were observed. Water levels rose 2 to 3 feet above normal tides and waves of 12 to 14 feet offshore. Minor beach erosion reported. Wales AWOS reported a peak wind gust of 67 mph (59 kt).
12/17/2017	Blizzard	Low pressure brought snow and blowing snow and strong winds to the west coast on December 17th 2017. Heavy snow fell in the mountains of the Seward Peninsula and the Nulato Hills. Blizzard conditions were observed at the Wales AWOS. The visibility was reduced to one quarter mile or less in snow and blowing snow. There was a peak wind gust of 65 kt (75 mph) at the Wales AWOS.
11/04/2020	Blizzard	A strong low-pressure system produced strong winds and blizzard conditions to much of the west coast from November 4th into the 5th. Blizzard conditions were reported at the Wales AWOS. A peak wind of 80 mph (70 kt) was reported.
01/29/2021	Blizzard	A strong low-pressure system entered the Bering Strait on the 29th of January. Blizzard conditions were reported along the Bering strait on January 29th. Blizzard conditions reported at the Wales AWOS with a peak gust of 33 kt (38 mph).
05/13/2023	High Wind	On May 13, 2023, front associated with a 988 mb low in the Bering Sea brought high winds to the Bering Strait Coast, St. Lawrence Island, as well as the Yukon Delta. High winds developed along the Bering Strait Coast as well as St. Lawrence Island on the evening of May 13th and continued into the early morning hours of May 14th. Wales reported gusts as high as 62 mph before the wind sensor failed during the middle of the event.
05/16/2023	Blizzard	On May 16, 2023, a 1002 mb low moving through the Bering Sea brought blizzard conditions to the Bering Strait. Blizzard conditions developed on the Bering Strait coast early in the morning, of the 16th and continued into the early evening.

Date	Event Type	Magnitude
		Blizzard conditions were reported at both Brevig Mission and Wales. Wales reported blizzard conditions for much of the morning of the 16th. The peak wind gust at Wales was 41 mph.
10/23/2023	High Wind	High winds developed over the Bering Strait Coast as a front moved to the north over the area. Wales reported a gust to 63 mph, while Tin City reported a gust to 59 mph and Teller reported a gust to 54 mph.
11/12/2023	Blizzard	Blizzard conditions were observed at the Wales (PAIW) AWOS. Wind gusts of 60 mph began at 06:13 and continued through 12:52, with a peak wind gusts of 73 mph. These winds were accompanied by visibility of 1/4 mile or less in blowing snow.

Source: NWS 2024- Storm Events Database and Storm Prediction Center Product

Additionally, the DHS&EM October 2022 DCI lists the following severe weather disaster events which may have affected the area:

83. Omega Block Disaster, January 28, 1989 & FEMA declared (DR-00826) on May 10, 1989. The Governor declared a statewide disaster to provide emergency relief to communities suffering adverse effects of a record-breaking cold spell, with temperatures as low as -85°F. The State conducted a wide variety of emergency actions, which included: emergency repairs to maintain & prevent damage to water, sewer & electrical systems, emergency resupply of essential fuels & food, and DOT/PF support in maintaining access to isolated communities.

3.3.2.3 Location

The entire community of Wales experiences periodic severe weather impacts.

3.3.2.4 Extent (Magnitude and Severity)

Wales is vulnerable to the impacts from severe weather. The extent (magnitude and severity) of each severe weather event is listed below.

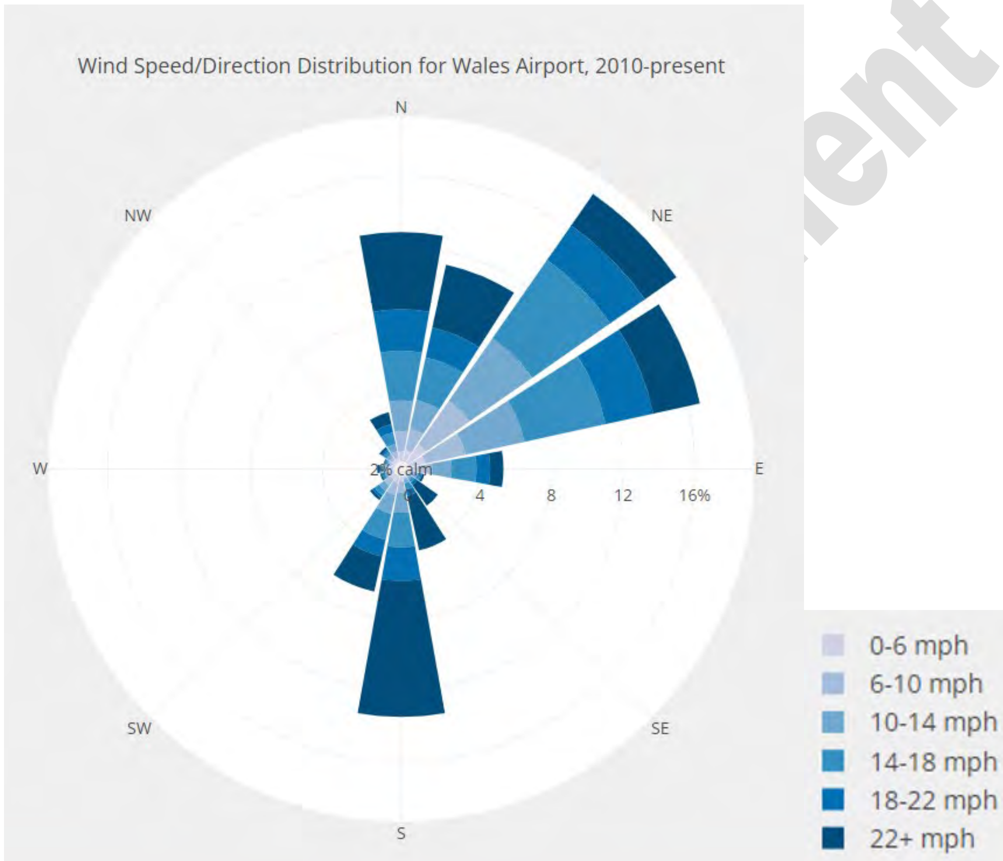
Severe Weather Event	Extent (Magnitude and Severity) of the Event
Extreme Cold	Wind chills of -65ºF have been recorded in Wales. The Planning Team shared that in 1999, the wind chill reached -94ºF.
Freezing Rain and Ice Storms	Wales experiences periodic freezing rain and ice storms that have damaged utility lines and cause dangerous road conditions.
Heavy Snow	Wales experiences severe storm conditions accumulating over 10-20 inches of snowfall within several hours.  Source: USA Today 2016 **Figure 3-15 Deep Snow Buries Boat in Wales**

Severe Weather Event	Extent (Magnitude and Severity) of the Event
Drifting Snow	Wales experiences periodic drifting snow events that have caused blockages on roads and snow buildup on the sides of buildings.  Source: Wales LEDP 2011-2016 **Figure 3-16 Snow Drift at the Native Store**  Source: USA Today 2016 **Figure 3-17 Snow Drift in Wales**
Blizzard	Blizzards reduce visibility and can lead to disorientation and eventual hypothermia. There has been one fatality in Wales due to a blizzard.
Winter Storm	Wales experiences periodic winter storms that have caused blizzard conditions, heavy snowfall, high winds, and deaths due to hypothermia.
Heavy Rain	Heavy rain in Wales leads to runoff and causes local creeks to overtop and threaten facilities.
High Winds	Wales experiences severe storm conditions with wind speeds and gusts exceeding 75 mph. Figure 3-18 shows annual wind speed and direction distribution for Wales from 2010-present.

<table>
<tr><th>Severe Weather Event</th><th>Extent (Magnitude and Severity) of the Event</th></tr>
<tr><td></td><td>

- Spokes in the rose point in the compass direction from which the wind was blowing (i.e., a spoke pointing to the right denotes a wind from the east).
- Colors within each spoke denote frequencies of wind speed occurrence.
- Size of the center hole indicates the % of calm winds.

The accompanying legend is below.



Source: UAF/SNAP 2024b- Community Wind

Figure 3-18 Annual Wind Speed/Direction Distribution in Wales, 2010-Present
</td></tr>
<tr><td>Drought</td><td>Wales has not been too severely impacted by historical droughts in the area.</td></tr>
</table>

Based on past severe weather events and the criteria identified in Table 3-2, the extent of overall severe weather in Wales is considered Limited to Critical, where injuries and/or illnesses could result in temporary to permanent disability; with potential for critical facilities to be shut down for more than a week, and 10-25% of property would be severely damaged.

3.3.2.5 Impact

The location, land topography, and intensity influence the severity of a severe weather event impact within a community. Below are the impacts of various historical severe weather events in Wales.

Severe Weather Event	Impact of the Event
Extreme Cold	Extreme cold may also impact a community by disrupting the flow of transportation within the community. With extreme cold temperatures, comes ice fog, which may ground an aircraft carrying supplies until conditions improve. Prolonged periods of cold can cause large bodies of water to freeze, disrupting shipping and increasing the likelihood of ice jams and associated flooding. While Alaskans have engineered ways to stay warm during extreme cold, infrastructure can only withstand and function within a certain temperature range. Extreme cold can cause electric generation to malfunction or cause fuel to congeal in supply lines and storage tanks. Without electricity, heaters and furnaces do not work, and water/sewage pipes can freeze or rupture. A combination of extreme cold and little to no snow cover, increases the ground's frost depth, which can disturb pipes beneath the ground. Extreme cold can impact a community's infrastructure, the greatest danger from extreme cold is its impact on humans. Prolonged exposure to extreme cold can cause frostbite or hypothermia and become life-threatening very quickly. Infants and elderly people are most susceptible to these conditions. Carbon monoxide poisoning is another threat as people use supplemental heating devices without proper ventilation. Extreme cold accompanied by wind intensifies life-threatening exposure injuries such as hypothermia and frostbite. Impacts from extreme cold in Wales have included loss of utilities and school closures.
Freezing Rain and Ice Storms	Ice accumulations can damage trees, utility poles, and communication towers. Ice on communication towers can disrupt transportation, power, and communications within the community. Ice storms are often the cause of automobile accidents, power outages, and personal injury. Impacts from freezing rain and ice storms in Wales have included loss of utilities.
Heavy Snow	Heavy snow can impact a community by halting transportation in and out of a community. Until the snow can be removed, roadways and airports are impacted, even closed completely. With these services out of commission, supplies are not able to be brought into the community, and emergency and medical services are halted. Excess weight from accumulated snow on roofs, trees, and powerlines can cause them to collapse. Heavy snow can also damage light aircraft and cause small boats to sink. Once temperatures reach above freezing, the heavy snow will begin to thaw, and can cause substantial flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on the community. Heavy snow can lead to injury or death as a result of vehicle and or snow machine accidents. Other causalities can occur due to hypothermia caused by prolonged exposure to cold weather or overexertion while shoveling snow. Impacts from heavy snow in Wales have included structural damages to buildings and home. Heavy snow has buried homes in the community and residents have to dig through the snow to enter their homes. There are snow fences in Wales that help minimize the number of snowdrifts.
Drifting Snow	The most common hazard caused by blowing and drifting snow is quickly reduced visibility while driving. The combination of near-zero visibility and drifting snow can cause unexpected travel difficulties and accidents in remote areas during dangerously cold winter weather situations. Impacts from drifting snow in Wales have included loss of visibility and dangerous road conditions. There are snow fences near the airport and homes that help minimize the number of snowdrifts in the community.
Blizzard	Conditions during a blizzard can be extreme, resulting in severe impacts to community. During a blizzard, heavy or blowing snow can cause whiteout conditions, making travel difficult and unsafe. Roads can become partially or fully blocked by snowdrift. Cold temperatures associated with blizzards can last for days after the storm has ended, increasing the potential for hypothermia or frostbit. High

Severe Weather Event	Impact of the Event
	winds during a blizzard may disrupt utilities, potentially leaving homes without heat and power until after the storm has ended and utilities are restored. Impacts from blizzards in Wales have included reduction or loss of visibility, loss of utilities, damage to buildings, and a fatality.
Winter Storm	A winter storm can last a few hours or several days, cut off utilities, and put older adults, children, sick individuals, and pets are at greater risk. Winter storms create a higher risk of car accidents, hypothermia, frostbite, carbon monoxide poisoning, and heart attacks from overexertion. Winter storms can also cause property damage. Some impacts to homes and other infrastructure may include roof damage or collapse, water damage from frozen or busted pipes, cracks in caulking due to extreme cold, damage to building foundations. Winter storms and cold temperatures can also impact vehicles (cars, snowmachines) that the community relies upon for transportation. These impacts may include slowing the battery, hurting the cooling system, thickening fluids, damaging the engine, and increasing the potential for vehicular accidents. Impacts from winter storms in Wales have included loss of visibility, loss of utilities, snow load considerations, school closures, damage to critical facilities and infrastructure, and hindered snow removal efforts.
Heavy Rain	The potential impacts of heavy rain include crop damage, erosion, and an increased flood risk. Floods onset from heavy rain can result in road washouts, injuries/loss of life, or drowning. Impacts from heavy rain in Wales have included localized flooding of local creeks and streams. If a creek becomes blocked and overflows, the community will open the creek and allow it to flow into the ocean until the water level recedes.
High Winds	High winds can result in downed power lines, flying debris, building collapses, transportation disruptions, damage to buildings, damage to vehicles, and injury or death. High winds can cause power outages, resulting in lack of heating, running water, refrigeration loss, and damage to electronics and/or medical equipment. Impacts from high winds in Wales have included loss of utilities, blown in doors on homes, and damage to buildings and residences.
Drought	Droughts can severely impact a community by causing shortages in safe drinking water, reducing air quality by increasing the risk of wildfires and dust storms, increasing the potential of illness and disease, and increasing economic burdens. Droughts can also impact the environment by reducing soil quality for vegetation, reduction or degradation of fish and wildlife habitat, and lowering the water level of lakes, ponds, or reservoirs which can hinder salmon spawning abilities. For 64 weeks, starting on October 2, 2019, Alaskan salmon were unable to enter many streams due to low flow conditions and drought conditions throughout Alaska caused many pre-spawn mortality events of salmon. All species of salmon were affected by the drought conditions statewide, leading to widespread mortality (USDM 2023). On June 27, 2019, there was a statewide ban of purchasing fireworks due to the high to very high fire danger as a result of hot, dry weather. At the time, there were 130 active wildfires burning 273,521 acres across the state (USDM 2023). Wales has not been severely impacted by droughts.

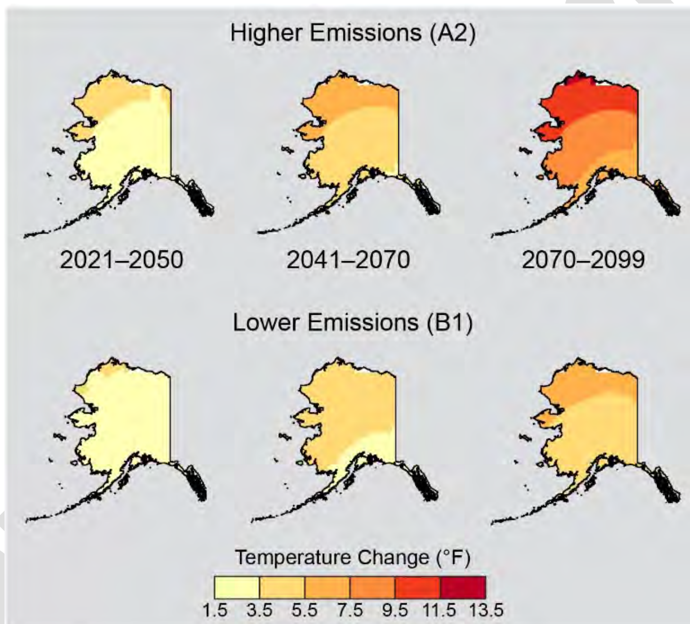
3.3.2.6 Probability of Future Events

The probability of future events for each severe weather event is outlined below.

Severe Weather Event	Probability of the Event
Extreme Cold	Based on previous occurrences and the criteria identified in Table 3-3, it is Likely that Wales will experience an extreme cold event in the next year. There is between 50-89.9% annual probability of occurring.
Freezing Rain and Ice Storms	Based on previous occurrences and the criteria identified in Table 3-3, it is Possible that Wales will experience a freezing rain/ice storm event in the next year. There is between 10-49.9% annual probability of occurring.
Heavy Snow	Based on previous occurrences and the criteria identified in Table 3-3, it is Likely that Wales will experience a heavy snow event in the next year. There is between 50-89.9% annual probability of occurring.
Drifting Snow	Based on previous occurrences and the criteria identified in Table 3-3, it is Likely that Wales will experience a drifting snow event in the next year. There is between 50-89.9% annual probability of occurring.
Blizzard	Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a blizzard event within the next year. There is a greater than 90% annual probability of occurring
Winter Storm	Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a winter storm event within the next year. There is a greater than 90% annual probability of occurring
Heavy Rain	Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a heavy rain event within the next year. There is a greater than 90% annual probability of occurring
High Winds	Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a heavy wind event within the next year. There is a greater than 90% annual probability of occurring
Drought	Based on previous occurrences and the criteria identified in Table 3-3, it is Possible that Wales will experience drought conditions in the next year. There is between 10-49.9% annual probability of occurring.

3.3.2.7 Future Conditions Including Climate Change

The nature or location of severe weather events in Wales are not anticipated to change due to climate change. However, the extent of severe weather events is expected to change due to climate change. The anticipated changes for each event are described below.

<table>
<tr><th>Severe Weather Event</th><th>Projected Changes in Extent (Magnitude and Severity) due to Climate Change</th></tr>
<tr><td>Extreme Cold</td><td>
Average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050 (USGCRP 2018). If global emissions continue to increase during this century, temperatures can be expected to rise 10°F to 12°F in the north, 8°F to 10°F in the interior, and 6°F to 8°F in the rest of the state (USGCRP 2018).
In Wales, average annual temperatures may increase by about 14°F by the end of the century (UAF/SNAP 2024a- Northern Climate Reports). Winter temperatures are increasing the most (+25°F) and fall may transition from below freezing to above freezing temperatures in the future (UAF/SNAP 2024a- Northern Climate Reports).
Figure 3-19 shows Alaska’s predicted temperature changes under a higher emissions scenario and a lower emissions scenario through 2099. See Figure 3-21 for historical and projected temperatures for Wales.


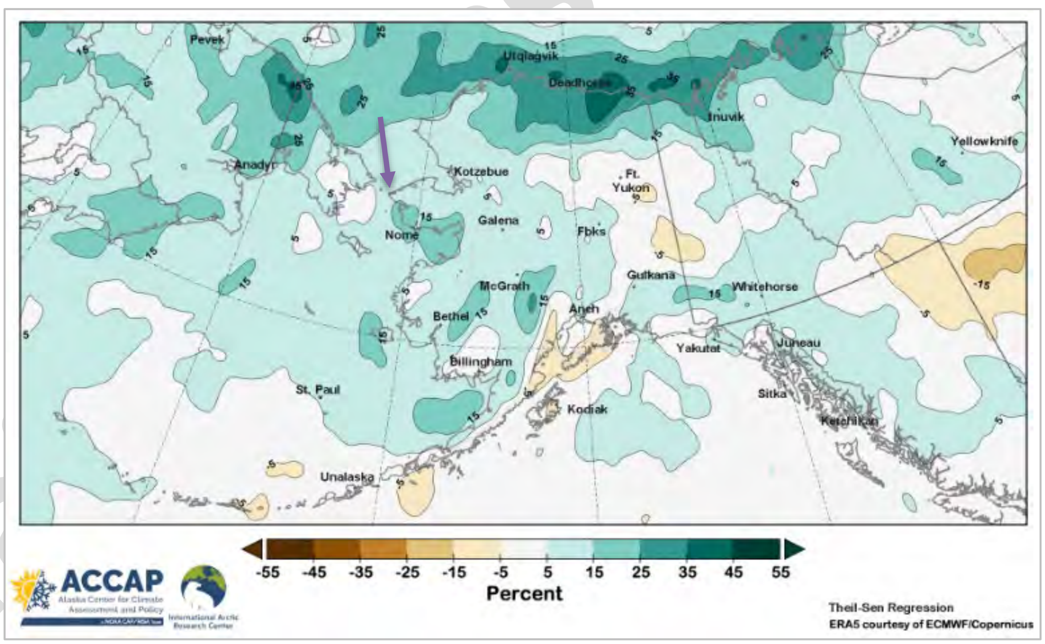
Source: USGCRP 2018
Figure 3-19 Alaska’s Predicted Temperature Changes Through 2099
</td></tr>
<tr><td>Freezing Rain and Ice Storms</td><td>Alaska has experienced an 11% increase in the amount of precipitation falling in very heavy events from 1958 to 2012 (EPA 2016). As global temperatures continue to rise, freezing rain and ice storm events may be less severe as historical storms.</td></tr>
<tr><td>Heavy Snow</td><td>
In southern and coastal parts of Alaska, large decreases in spring snowpack are expected by the mid-21st century, even with more winter precipitation because temperatures warm to above freezing, causing a shift from snow to rain or more melt during the winter (NPS 2020).
Wales experiences severe storm conditions accumulating over 10-20 inches of snowfall within several hours.
</td></tr>
<tr><td>Drifting Snow</td><td>As wind speeds are projected to increase in the northern and western coastal regions of Alaska (Redilla et al. 2019), drifting snow events will increase as long as snow is present. However, in southern and coastal parts of Alaska, large decreases in spring snowpack are expected by the mid-21st century, even with more winter precipitation because temperatures warm to above freezing, causing a shift from snow to rain or more melt during the winter (NPS 2020).</td></tr>
</table>

<table>
<tr><th>Severe Weather Event</th><th>Projected Changes in Extent (Magnitude and Severity) due to Climate Change</th></tr>
<tr><td></td><td>Wales experiences periodic drifting snow events that have caused snow buildup and blockages on roads. Blowing and drifting snow in Wales have caused school delays and closures.</td></tr>
<tr><td>Blizzard</td><td>There are many studies on the effect of climate change on the extent of blizzards in the contiguous United States, particularly the Northeast region of US. However, there is little published information on the effect of climate change and blizzards in Alaska.

Studies show that climate change could exacerbate the severity of blizzards (Dixon et al. 2018). A warmer atmosphere holds more moisture. This moisture eventually falls as precipitation—either as rain or snow, which results in more frequent and intense storms.</td></tr>
<tr><td>Winter Storm</td><td>Climate scientists have suggested that warming temperatures, caused by the increase of greenhouse gases in the atmosphere, may be enabling longer and more intense cycles of droughts, floods, and winter storms (Dixon et al. 2018).</td></tr>
<tr><td>Heavy Rain</td><td>Alaska has experienced an 11% increase in the amount of precipitation falling in very heavy events from 1958 to 2012 (EPA 2016). Extreme precipitation events have occurred throughout Alaska with increasing frequency.

In Wales, winter precipitation is estimated to increase by +53% by the end of the century (UAF/SNAP 2024a- Northern Climate Reports).

Figure 3-20 shows the percent change in annual average precipitation from 1973–2022 in Alaska. Based off this figure, average precipitation in Wales has increased by 5-15%.



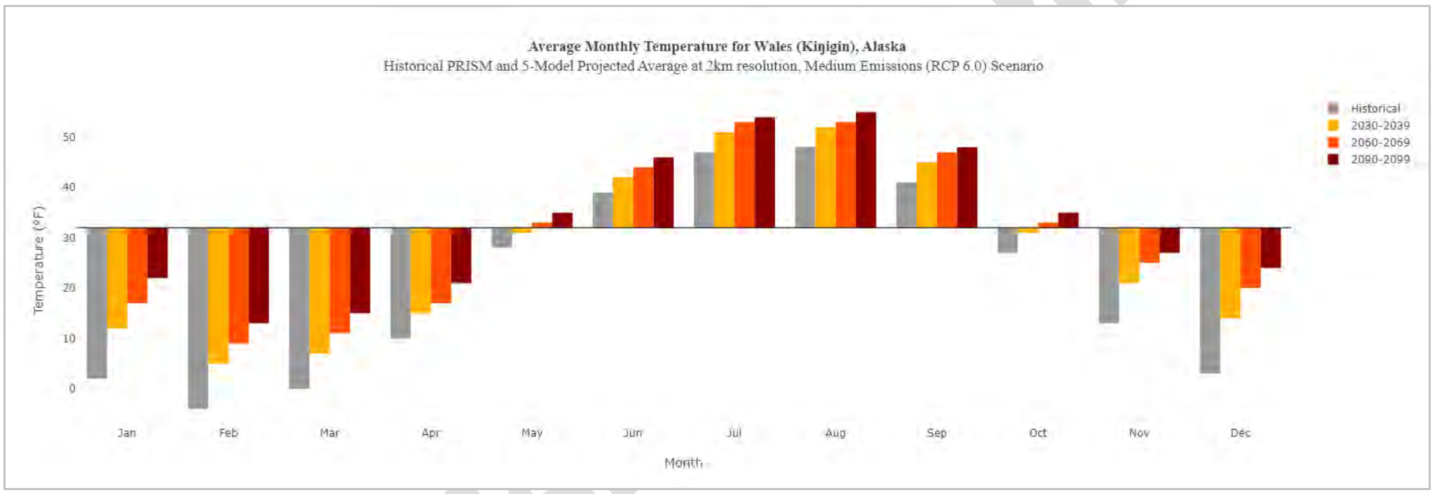
Source: USDA 2024

Figure 3-20 Percent Change in Annual Average Precipitation Statewide (1973-2022)

See Figure 3-22 for historical and projected precipitation amounts for Wales.</td></tr>
<tr><td>High Winds</td><td>High-wind events are projected by models to become more frequent in Alaska, with changes most noticeable in the northern and western coastal regions of Alaska (Redilla et al. 2019).</td></tr>
<tr><td>Drought</td><td>Climate change is increasing the intensity and length of severe weather events including droughts. Increased exposure to extremes will surpass the resilience of ecological and human systems.</td></tr>
</table>

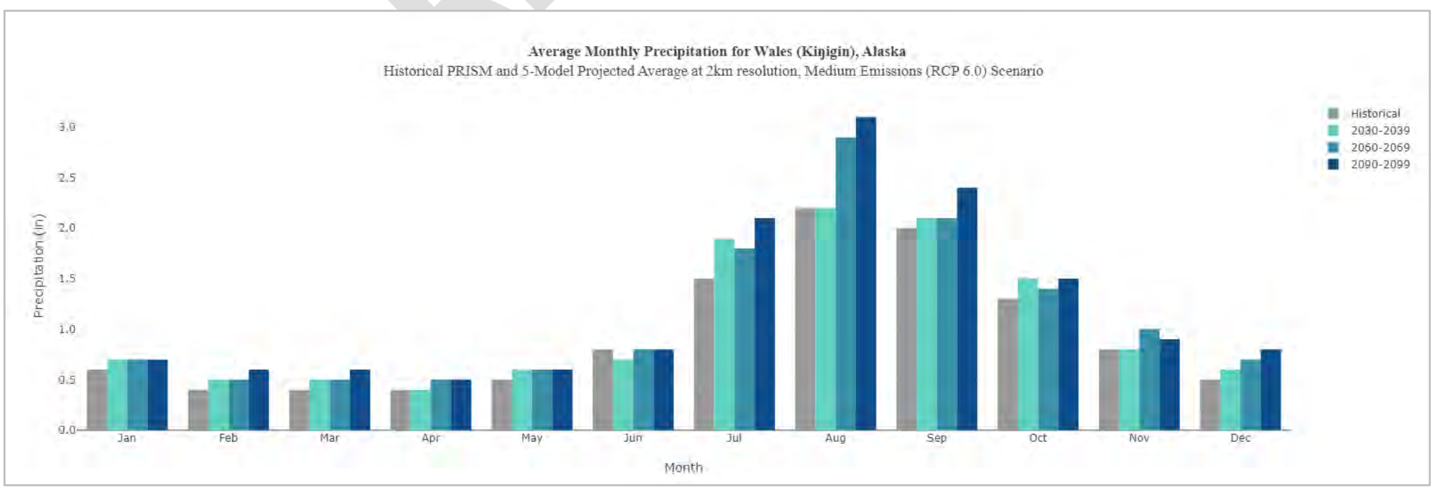
Severe Weather Event	Projected Changes in Extent (Magnitude and Severity) due to Climate Change
	Already vulnerable communities may be unable to adapt, laying bare systemic inequalities and requiring emergency assistance (IPCC 2019). The U.S. Drought Monitor started in 2000. Since 2000, the longest duration of drought (D1–D4) in Alaska lasted 79 weeks beginning on July 17, 2018 and ending on January 14, 2020. The most intense period of drought occurred the week of August 27, 2019, where D3 affected 1.5% of Alaska land (USDM 2023). Climate change has altered the natural pattern of droughts, making them more frequent, longer, and more severe (USGS 2024b).

The University of Alaska Fairbanks's (UAF) Scenarios Network for Alaska and Arctic Planning (SNAP) depict Wales' historical and future projected temperatures and precipitation amounts under a medium emissions scenario (Figure 3-21 and Figure 3-22).



Source: UAF/SNAP 2024c- Community Climate Charts

Figure 3-21 Historical and Projected Temperatures for Wales



Source: UAF/SNAP 2024c- Community Climate Charts

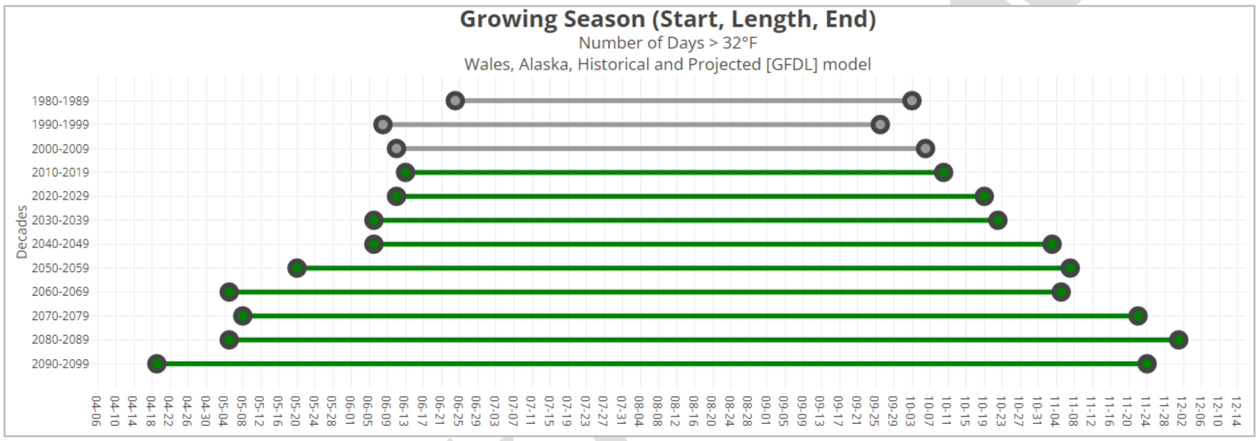
Figure 3-22 Historical and Projected Precipitation Amounts for Wales

Due to climate change, the impacts of severe weather events to the community of Wales are expected to change. Projected impacts of each event are outlined below.

Severe Weather Event	Projected Changes in Impact due to Climate Change
Extreme Cold	Due to climate change, average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050 (USGCRP 2018). In nearby Tin City, average annual temperatures may increase by about 14°F by the end of the century (UAF/SNAP 2024a- Northern Climate Reports). Winter temperatures are increasing the most (+25°F) and fall may transition from below freezing to above freezing temperatures in the future (UAF/SNAP 2024a- Northern Climate Reports). Extreme cold may also impact a community by disrupting the flow of transportation within the community. With extreme cold temperatures, comes ice fog, which may ground an aircraft carrying supplies until conditions improve. Prolonged periods of cold can cause large bodies of water to freeze, disrupting shipping and increasing the likelihood of ice jams and associated flooding. While Alaskans have engineered ways to stay warm during extreme cold, infrastructure can only withstand and function within a certain temperature range. Extreme cold can cause electric generation to malfunction or cause fuel to congeal in supply lines and storage tanks. Without electricity, heaters and furnaces do not work, and water/sewage pipes can freeze or rupture. A combination of extreme cold and little to no snow cover, increases the ground's frost depth, which can disturb pipes beneath the ground. While extreme cold can impact a community's infrastructure, the greatest danger from extreme cold is its impact on humans. Prolonged exposure to extreme cold can cause frostbite or hypothermia and become life-threatening very quickly. Infants and elderly people are most susceptible to these conditions. Carbon monoxide poisoning is another threat as people use supplemental heating devices without proper ventilation. Extreme cold accompanied by wind intensifies life-threatening exposure injuries such as hypothermia and frostbite. Reduced snow cover and winter precipitation in the form of snow, along with increased air temperature, are expected to increase stream water temperature (NPS 2020). During winter and spring, warmer waters could hasten development and growth of salmon eggs and fry, possibly leading to earlier life stage transitions (NPS 2020). Additionally, ecological impacts to spawning salmon from rising temperatures may be seen. During summer, warmer waters could increase physiological stress on adult salmon migrating to spawning grounds, potentially reducing spawning rates (NPS 2020). Higher temperatures in spring and fall could also result in longer a growing season (UAF/SNAP 2024d- Alaska Garden Helper). See Figure 3-23 below for the historical and projected length of the growing season in Wales. Impacts from extreme cold in Wales have included loss of utilities.
Freezing Rain and Ice Storms	Due to climate change, average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050 (USGCRP 2018), while the intensity and frequency of winter storms and other storm events is projected to increase (Dixon et al. 2018). How these factors will affect the impact of freezing rain and ice storm events in Wales is unknown. Impacts from freezing rain and ice storms in Wales have included loss of utilities.
Heavy Snow	Within the next century, climatically-driven changes in snow characteristics (decreasing snowfall, snowpack, and snowmelt) will affect hydrologic and ecological systems in Alaska (Littell et al. 2018). Impacts from reduced snowpack and less frequent snowfall will directly affect the spawning habitats for salmon. Reduced snow cover and winter precipitation in the form of snow, along with increased air temperature, are expected to increase stream water temperature (NPS 2020). During winter and spring, warmer waters could hasten development and growth of salmon eggs and fry,

Severe Weather Event	Projected Changes in Impact due to Climate Change
	possibly leading to earlier life stage transitions (NPS 2020). Additionally, ecological impacts to spawning salmon from rising temperatures may be seen. During summer, warmer waters could increase physiological stress on adult salmon migrating to spawning grounds, potentially reducing spawning rates (NPS 2020). A shift from snow to rain impacts water storage capacity and surface water availability (UAF/SNAP). Impacts from heavy snow in Wales have included structural damages to buildings.
Drifting Snow	Projected climate change impacts are expected to reduce snowpack (NPS 2020), while high-wind events are projected to become more frequent, with the highest increases in the northern and western Alaska coastal regions (Redilla et al. 2019). How these competing factors will affect the impact of drifting snow events in Wales is unknown. Impacts from drifting snow in Wales have included loss of visibility, dangerous road conditions, and buried homes.
Blizzard	Studies show that climate change could exacerbate the severity of blizzards (Dixon et al. 2018), potentially resulting in worsening impacts to the community. Conditions during a blizzard can be extreme, resulting in severe impacts to community. During a blizzard, heavy or blowing snow can cause whiteout conditions, making travel difficult and unsafe. Roads can become partially or fully blocked by snowdrift. Cold temperatures associated with blizzards can last for days after the storm has ended, increasing the potential for hypothermia or frostbite. High winds during a blizzard may disrupt utilities, potentially leaving homes without heat and power until after the storm has ended and utilities are restored. Impacts from blizzards in Wales have included reduction or loss of visibility, loss of utilities, damage to homes, and a fatality.
Winter Storm	Climate scientists have suggested that warming global temperatures may be enabling longer and more intense cycles of winter storms (Dixon et al. 2018) resulting in worsening impacts to the community. A winter storm can last a few hours or several days, cut off utilities, and put older adults, children, sick individuals, and pets are at greater risk. Winter storms create a higher risk of ATV/snowmobile accidents, hypothermia, frostbite, carbon monoxide poisoning, and heart attacks from overexertion. Winter storms can also cause property damage. Some impacts to homes and other infrastructure may include roof damage or collapse, water damage from frozen or broken pipes, cracks in caulking due to extreme cold, damage to building foundations. Winter storms and cold temperatures can also impact vehicles by draining the battery, damaging the cooling system, thickening fluids, damaging the engine, and increasing the potential for vehicular accidents. Impacts from winter storms in Wales have included loss of visibility, loss of utilities, snow load considerations, school closures, and damage to critical facilities and infrastructure.
Heavy Rain	In Wales, winter precipitation is projected to increase by 53% by the end of the century (UAF/SNAP 2024a- Northern Climate Reports). With increased precipitation, the impact of heavy rain in Wales may increase. These impacts may include increased flooding and road washouts throughout the community. Impacts from heavy rain in Wales have included localized flooding of creeks.
High Winds	As high wind events are projected to increase (Redilla et al. 2019), impacts from high wind events may also increase.

Severe Weather Event	Projected Changes in Impact due to Climate Change
	Impacts from high winds in Wales have included loss of utilities, and damage to buildings and residences.
Drought	Climate change-driven effects upon hydrology, seasonal snowpack, and days above freezing temperatures will alter the water supply in snowmelt/glacier runoff fed streams and rivers in turn affecting the water supply for Alaskan communities, wildlife, and landscapes. In conjunction with lower ground-water levels, droughts can drive salinization in soil, estuaries, and wetlands along coastlines as sea-water fills voids formerly occupied by fresh water. Indirect effects of climate change-induced droughts include threats to the tourism industry, food insecurity, and threats to the Alaskan subsistence lifestyle (IPCC 2019). Wales has not been severely impacted by droughts.



Source: UAF/SNAP 2024d- Alaska Garden Helper

Figure 3-23 Historical and Projected Length of Growing Season in Wales

The frequency of severe weather events is dependent on the event and climate change will impact each differently. The projected changes in event frequency are outlined below.

Severe Weather Event	Projected Changes in Probability of Future Events due to Climate Change
Extreme Cold	Due to climate change, average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050 (USGCRP 2018; UAF/SNAP). In nearby Tin City, average annual temperatures may increase by about 14°F by the end of the century (UAF/SNAP 2024a- Northern Climate Reports). Winter temperatures are increasing the most (+25°F) and fall may transition from below freezing to above freezing temperatures in the future (UAF/SNAP 2024a- Northern Climate Reports). Statewide, by 2046, the number of nights with below freezing temperatures is expected to decrease by at least 20 nights per year (USGRCP 2018).
Freezing Rain and Ice Storms	Freezing rain and ice storm events are dependent on the ambient air mass temperature. Average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050 (USGCRP 2018; UAF/SNAP). As global temperatures continue to rise, freezing rain and ice storm events may become less frequent as in previous decades.
Heavy Snow	The snowfall season is expected to decrease across Alaska, with snowpack decreasing by 20–90% in Southern and Western Alaska due to increasing temperatures (USDA 2024).

Severe Weather Event	Projected Changes in Probability of Future Events due to Climate Change
	Models indicate a broad switch from snow-dominated to transitional annual hydrology across most of Southern and Coastal Alaska (Littell et al. 2018). Therefore, as winter temperatures continue to increase, the amount of snowfall will decrease and precipitation in the form of rain will be more common in winter months.
Drifting Snow	Projected climate change impacts are expected to reduce snowpack (NPS 2020), while high-wind events are projected to become more frequent, especially in northern and western Alaska coastal regions (Redilla et al. 2019). How these competing factors will affect the probability of drifting snow events in Wales is unknown. While unknown, the probability of drifting snow events will depend on the geography of the area and predisposition for snowfall.
Blizzard	Climate scientists have suggested that warming global temperatures may be enabling longer, more frequent, and more intense cycles of winter storms and blizzards (Dixon et al. 2018).
Winter Storm	Climate scientists have suggested that warming global temperatures may be enabling longer, more frequent, and more intense cycles of winter storms (Dixon et al. 2018).
Heavy Rain	In Wales, winter precipitation may increase by 53% by the end of the century (UAF/SNAP 2024a- Northern Climate Reports).
High Winds	High-wind events are projected to become more frequent (Redilla et al. 2019).
Drought	Climate change within Alaska is likely to result in increased frequency of drought conditions (IPCC 2019). Drought risks will increase globally throughout the end of the 21st century, scaling upwards with emissions projections/additional degrees of heating. In the high latitudes of North America, droughts will be 150-200% more likely at 2°C warming and over 200% more likely at 4°C warming (IPCC 2019).

3.3.3 WILDLAND/TUNDRA FIRE

Fires can be divided into the following categories:

- **Prescribed fires**: ignited under predetermined conditions to meet specific objectives, to mitigate risks to people and their communities, and/or to restore and maintain healthy, diverse ecological systems.
- **Wildland fire**: any non-structure fire, other than prescribed fire, that occurs in the wildland.
- **Wildland Fire Use**: a wildland fire functioning in its natural ecological role and fulfilling land management objectives.
- **Wildland-Urban Interface Fires (Community Fire)**: fires that burn within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The potential exists in areas of wildland-urban interface for extremely dangerous and complex fire burning conditions which pose a tremendous threat to public and firefighter safety.

Both wildland/tundra and community fires pose a risk to the residents and infrastructure in Wales. For this HMP, these fires will be described as wildfires.

3.3.3.1 Nature

Wildland fires are types of fires which spread via the consumption of vegetation, and they often spread very quickly due to amount of vegetation available. Tundra fires are more specific, as they occur on the Bering tundra, where Wales is located.

They begin sometimes unnoticed and cause dense smoke that is usually visible from several miles or tens of miles around. Two principal causes for them are natural (e.g., lightning) and by human activity (campfires, cigarettes, unattended burns). They more usually happen in forests or other areas with sufficient vegetation (e.g., prairies). Wildland fires are usually classified as to a specific type or locale such as: urban, tundra, interface or intermix fires, as well as prescribed fires.

There are four significant variables which contribute to the behavior and extent of wildland fires, and these can be used to identify potential areas that are more susceptible to wildland fires. These are:

- **Topography**: the amount and aspect of slopes influence how wildland fires spread and how quickly. Slopes that face south are subject to more solar radiation which makes them generally drier and more prone for wildfires. Sometimes ridge lines or ridge tops become a natural barrier to wildfires as fires spread more slowly downhill.
- **Fuel**: Wildland fires are heavily dependent on the type and extent of fuel, i.e., vegetation, present for their spread and occurrence. Certain species of plants are much more ignitable and will burn with greater intensity. The amount of combustible material available is referred to as the fuel load, and the denser the vegetation the more intense the wildland fire can become. The amount of dead matter, e.g., leaf litter, compared to living matter also considerably effects the nature of these fires. Periods of prolonged droughts cause a decrease in the moisture of both living and dead matter and significantly increase the odds of wildland fire occurrence and extent. Climate change is now a factor as well. Lastly, the continuity of the fuel load is a main factor in both horizontal and vertical planes. The more continuous the fuel, the easier a fire will spread.
- **Weather**: Of all the factors which affect wildfires, weather is the most variable. The ignition and spread of a wildfire are dependent on humidity, temperature, winds, and lightning. Extreme bouts of weather, such as heat waves or droughts, can lead to extensive wildfire activity. Dry seasons are generally becoming longer due to climate change, and this has led to an increase in wildfires. Conversely, periods of increased rain and cooling decrease the odds of wildland fires and ease their containment as well.
- **Season**: The seasons with more vulnerability for wildfires are late summer and early autumn. This is generally the time when the fuel (vegetation) dries out. The moisture content drops sharply and the ratio to dead to living material increases. Though there are many factors which contribute to the extent and intensity if wildfires such as: wind speed and direction, fuel load and type, humidity, and topography. The most common causes of wildfires in Alaska, historically, have been lightning or human negligence.

Other hazards do have an effect on the extent and frequency of wildland fires. These are, for example: infestations, lightning, and drought. If a wildland fire is not quickly and properly controlled, it can grow rapidly into a disaster or emergency. The smallest of wildfires can even threaten lives, resources, and destroy properties. Livestock and pets are also susceptible to wildfires. Some wildfires can precipitate the need for emergency food and water, evacuation, and temporary shelters.

Sometimes the effects of wildland fires can be catastrophic. They can destroy large swathes of forest and other vegetation, damage the soil, waterways, and the land itself. Some soils may lose their capacity to keep moisture and support life for years after an intense wildfire.

3.3.3.2 History

Wildland fires occur in every state in the country, including all regions of Alaska. Each year, between 600 and 800 wildland fires, mostly between March and October, burned across Alaska, causing extensive damage.

Table 3-10 lists historical wildfires with 100 miles of Wales. None of these fires occurred in the community or impacted the residents. The Planning Team states that smoke from distant fires has impacted the air quality in the Village.

Table 3-10 Historical Wildfires within 100 miles of Wales (1939-2023)

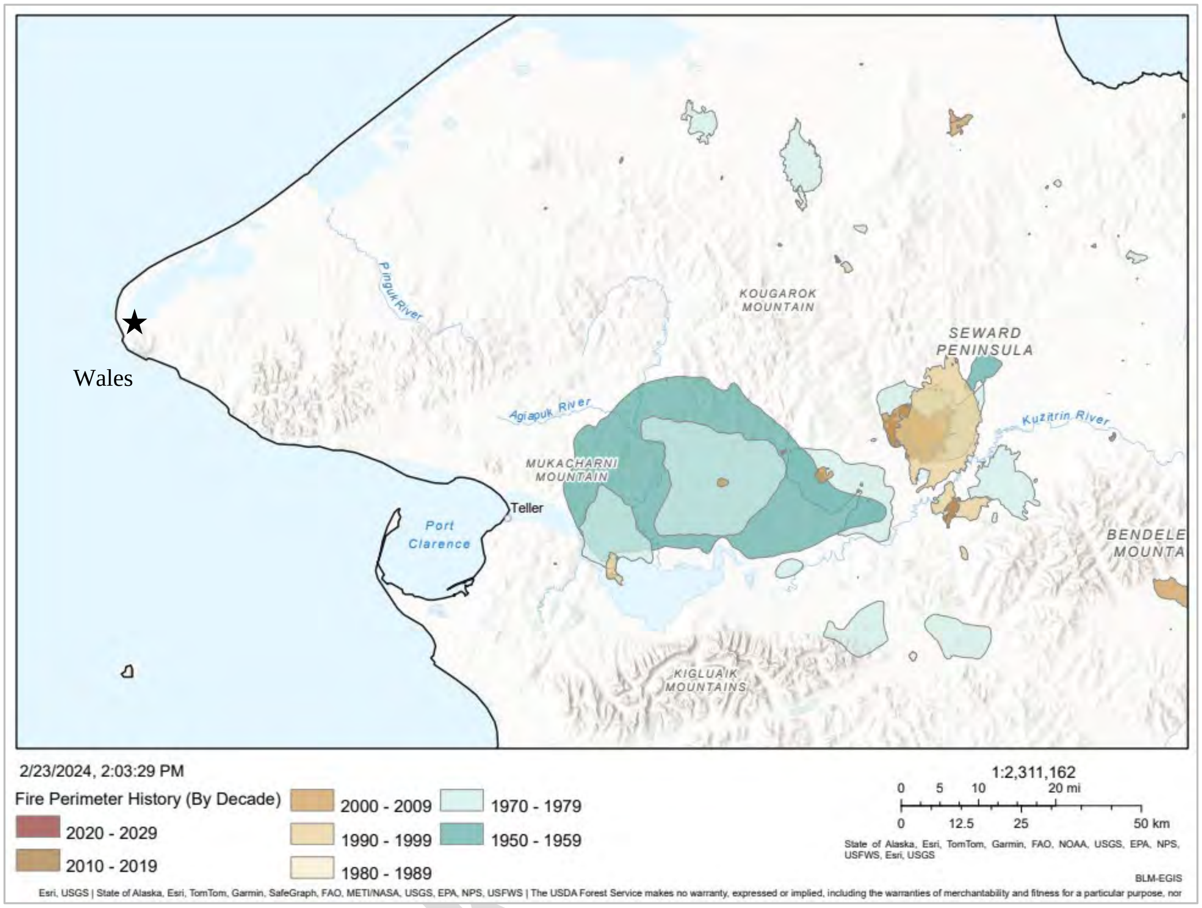
Discovery Date	Fire Name	Latitude	Longitude	Total Acres Burned	Cause
6/4/1954	Imuruk Basin	65.0000	-165.0000	224,000	Lightning
8/13/1959	Teller Mission W-2	65.3333	-166.5000	12	Children
6/3/1961	Koyuk	65.2000	-166.9333	400	Natural
7/23/1964	Teller Rd	64.7833	-165.4667	1	Human
8/8/1964	Kougarok	65.4167	-164.6667	25	Natural
9/5/1970	Surprize	65.0500	-164.9833	10	Camping
6/24/1971	Seabert	65.4000	-165.5333	1,000	Lightning
6/24/1971	Little Ptarmigan I	65.2667	-165.8333	800	Lightning
6/24/1971	Little Ptarmigan Ii	65.2500	-165.8333	100	Lightning
6/26/1971	New Igloo	65.1667	-165.1167	3,600	Lightning
6/26/1971	165-30	65.3000	-165.5000	58,520	Lightning
6/26/1971	Tuksuk Channel	65.2559	-165.6751	20,480	Lightning
6/26/1971	Officid Creek	65.2500	-166.0000	399	Lightning
6/29/1971	Anc Nw 500	65.3333	-164.8333	100,000	Lightning
6/29/1971	Coffee Dome	65.2500	-164.7500	500	Lightning
7/13/1972	Henry Creek	65.4700	-164.9742	800	Unknown
6/30/1973	Taylor	65.6697	-164.8700	320	Lightning
8/3/1973	Kingegan	65.6144	-167.9836	10	Unknown
8/6/1974	Burke	64.6833	-165.4833	1	Lightning
9/8/1974	Taylor	65.8000	-164.7667	766	Unknown
7/23/1977	Shishmaref	66.0287	-165.5402	50	Lightning
7/24/1977	Shh Se 38	65.9000	-165.0000	20,000	Lightning
7/24/1977	Shh Se 26	65.9821	-165.4357	2,500	Lightning
7/24/1977	Shh Corral	66.1104	-165.6328	0	Lightning
8/31/1978	Shelton	65.2406	-164.8753	75	Lightning
6/24/1982	Shh Se 12	66.0885	-165.6759	6	Natural
6/26/1982	Ome N 50	65.2833	-165.9167	0	Natural
6/26/1982	Ssh S 20	65.9397	-166.3124	55	Natural
7/22/1983	Ome N 90	65.8833	-166.2667	5	Natural
6/25/1984	Ome Ne 40	65.1000	-165.9699	20	Lightning
7/14/1985	Otz Sw 95	65.6333	-164.8500	40	Lightning
7/17/1985	Ome 35 N (531050)	65.0500	-164.9167	10	Lightning
8/5/1985	531055	65.8509	-165.0232	500	Unknown
7/8/1986	Ome N 45	65.2443	-165.7014	2	Lightning
8/4/1990	Ome W 25	64.4833	-166.2000	4	Trash Burning

Table 3-10 Historical Wildfires within 100 miles of Wales (1939-2023)

Discovery Date	Fire Name	Latitude	Longitude	Total Acres Burned	Cause
9/2/1991	Ome N 85	65.7167	-164.8333	55	Other
9/2/1991	Lil Diomede	65.7500	-168.9333	3	Children
6/21/1992	231280	64.7500	-165.9333	80	Other
7/5/1992	Qrz Ssw 21	65.0500	-164.9500	3	Lightning
7/5/1992	Qrz Ssw 20	65.0500	-165.0000	1	Lightning
7/6/1992	Qrz N 45	66.0333	-164.8500	36	Lightning
9/23/1992	No Name	64.7500	-165.9333	5	Field Burning
8/12/1993	Shhsw22	65.9833	-166.8667	0	Smoking
6/11/1994	Ome Nw 60	65.1667	-165.8500	3,200	Lightning
8/2/1997	731682	65.8333	-164.9833	5	Lightning
7/13/2000	Ring Creek	65.1167	-166.2667	1	Lightning
7/13/2000	Lucky Strike	65.1833	-166.1500	35	Lightning
8/12/2002	Imuruk Basin	65.1486	-165.8967	381	Human
6/25/2003	Hunter Creek	65.3244	-165.3905	519	Lightning
6/13/2004	Quartz Creek	65.4000	-164.7000	37	Lightning
6/13/2004	Quartz Creek #3	65.3000	-164.8000	80	Lightning
6/13/2004	Quartz Creek #2	65.3333	-164.8333	1,648	Lightning
7/26/2005	Black Creek	65.4167	-165.6422	0	False Alarm
7/26/2005	South Agiapuk	65.4189	-165.6447	67	Lightning
7/13/2007	Snow Shoe Creek	65.8761	-165.3906	39	Lightning
7/14/2007	Serpentine River	66.0364	-165.0633	1	Lightning
7/14/2007	Hill Creek	65.9269	-166.0294	2	Lightning
8/8/2014	Artic River	65.8333	-166.1667	70	Lightning
8/8/2014	Teller Creek	65.7667	-165.1167	200	Lightning
7/23/2015	Coco Creek	65.3881	-165.1305	180	Lightning
8/13/2016	Pilgrim FA 15	65.0833	-164.9833	0	False Alarm
6/6/2018	False Alarm 6	65.1667	-166.4167	4,451	Unknown
6/13/2018	Wander Gulch	65.3268	-164.7625	59	Lightning
6/13/2018	Camp Creek	65.3143	-164.7777	68	Lightning
7/5/2018	Winter Creek	65.3453	-164.9369	15	Lightning
6/20/2019	Imuruk Basin	65.1803	-165.1604	0	Lightning
6/20/2019	Sango Creek	65.9305	-165.8432	128	Lightning
7/8/2019	Ptarmigan Creek	65.2904	-164.9577	1	Lightning
7/8/2019	Hooligan Creek	65.2895	-164.9011	30	Lightning
6/3/2020	Coffee Dome	65.2969	-164.7310	21	Lightning
6/3/2020	Macklin	65.7419	-164.8744	268	Lightning
6/22/2021	American River	65.5191	-165.6426	13	Lightning

Source: AICC 2024

Figure 3-24 depicts the perimeters of historic wildfire fires near Wales (1940-2023).



Source: AICC 2024

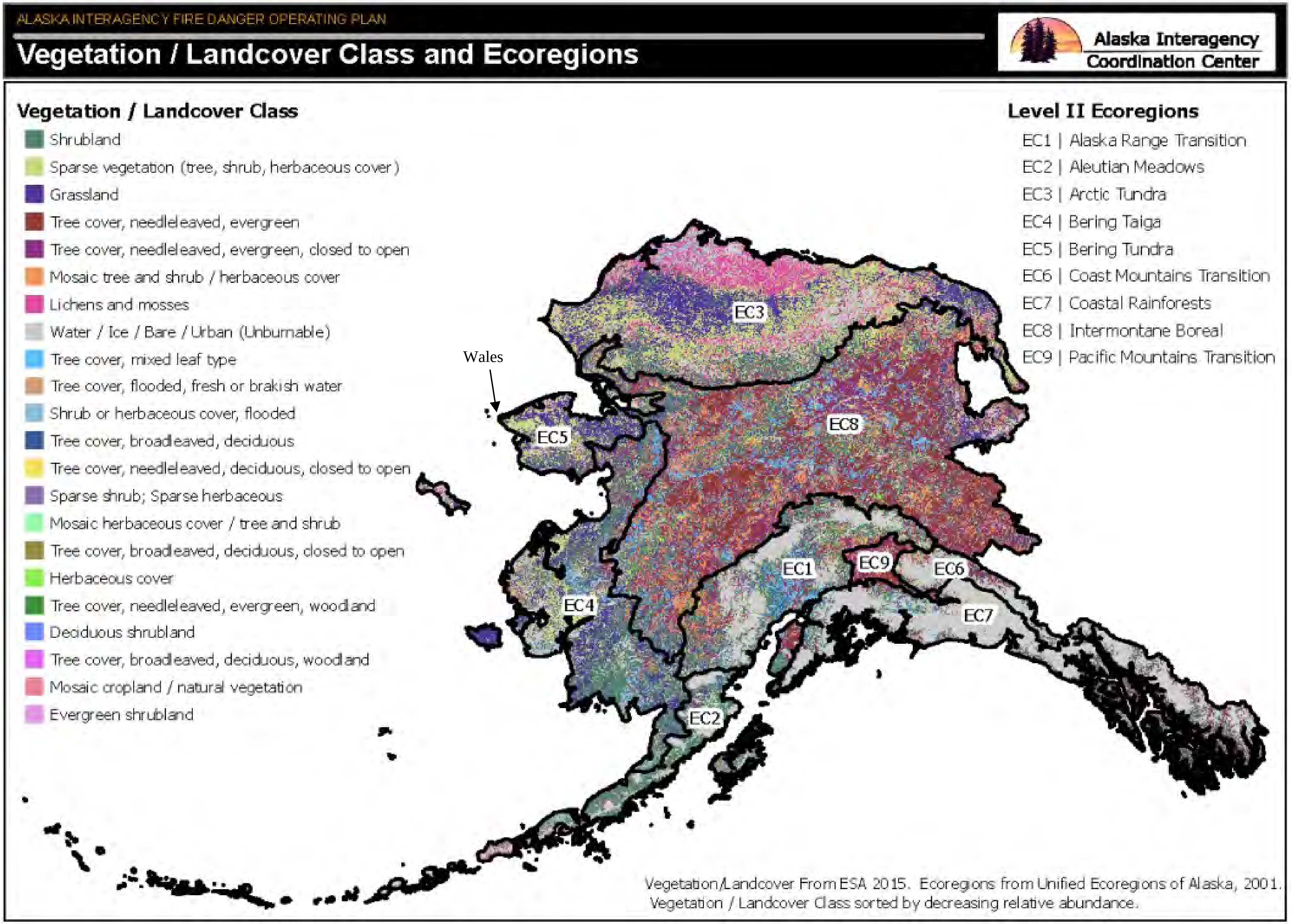
Figure 3-24 Historical Wildfire Perimeters near Wales (1940-2023)

3.3.3.3 Location

Figure 3-25 depicts the Level II Ecoregion classifications and the vegetation/landcover classes found throughout the State.

Wales is located in the EC5 Level II Ecoregion which is classified as Bering Tundra. The Seward Peninsula is a predominantly treeless region and the vegetation/landcover class of this region is primarily made up of sparse vegetation containing trees, shrubs, and herbaceous cover.

Ecoregion EC5 has a low fire load, but fires do happen under favorable conditions. Mainly short lived as moisture frequently impacts the west coast. However, with certain combinations of fuel availability, weather, topography, and sources of ignition, wildland fires may occur near Wales.



Source: BLM 2020

Figure 3-25 Vegetation/Landcover Class and Ecoregions of Alaska

Figure 3-29 shows the historical and future flammability of Wales. This region has historically had Very Low flammability and is projected to continue to have Very Low flammability through 2099 under both emissions scenarios.

3.3.3.4 Extent (Magnitude and Severity)

Due to the few recorded historical wildland fire events as well as the criteria listed in Table 3-2, the extent of wildland/tundra fire events in Wales have been Negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10% of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

3.3.3.5 Impact

If wildfires are not adequately controlled, the impacts from them could become an emergency or considerable disaster. Even smaller wildfires can threaten lives, resources, and destroy properties. Livestock and pets are susceptible to wildfires as well. Wildfires can precipitate the need for emergency food and water, evacuation, and temporary shelters.

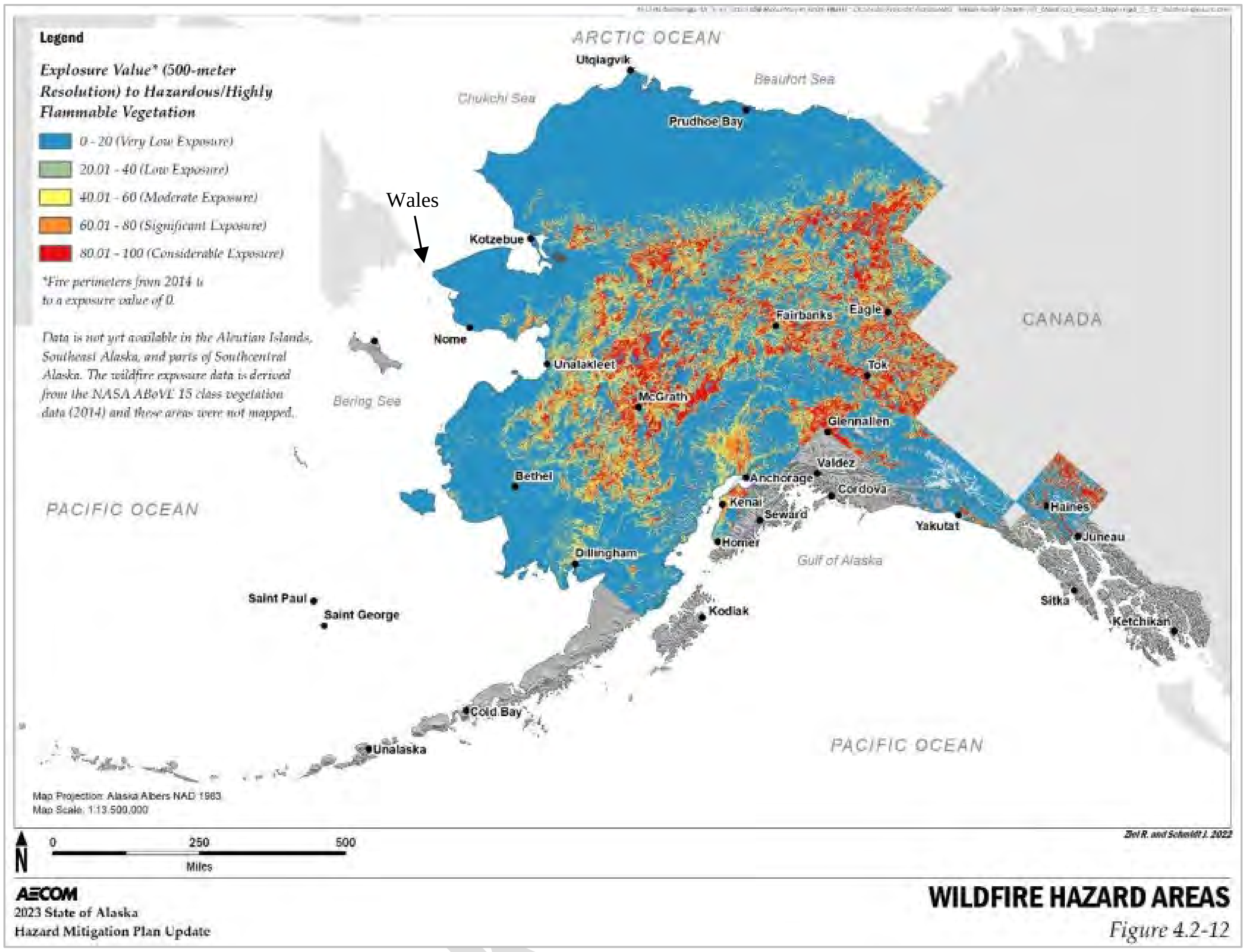
The effects of wildland fires can become catastrophic. They can destroy large swathes of forest and other vegetation, damage the soil, waterways, and the land itself. Some soils may lose their capacity to keep moisture and support life for years after an intense wildfire. Exposure of the land also leads to increased erosion and add to the siltation of rivers and streams. This increases the chances of flooding, degrades water quality, and can significantly harm aquatic life.

For many ecosystems, wildfires are actually critical features of the natural history. They can serve to help maintain renewal, biodiversity, and the ecological health of the land in general. This essential role which they serve for the local ecology has been incorporated into the planning process for fire management. Hence, the full range of fire management activities has been implemented in Alaska. This helps achieve the sustainability and health of the ecosystem. This includes the social consequences on firefighters in addition to ecological and economic factors. The natural and cultural resources that are potentially threatened, and other important values, all dictate the level and nature of the management response during a wildfire.

Wales has not been severely impacted by historical wildland fires. Secondary impacts have been a result of decreased air quality from smoke from distant fires.

3.3.3.6 Probability of Future Events

The 2023 State of Alaska SHMP identifies wildfire hazard areas across the State (Figure 3-26). Wales is located in an area with very low exposure value.



Source: DHS&EM 2023

Figure 3-26 Statewide Wildfire Hazard Areas

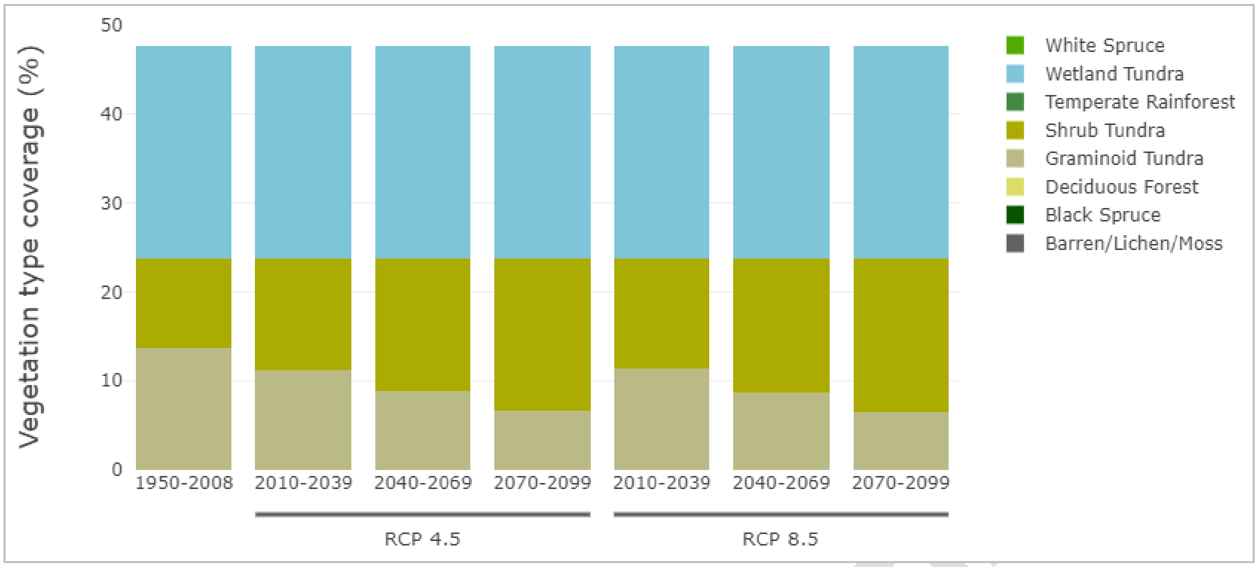
Based on previous occurrences and the criteria identified in Table 3-3, it is Unlikely that Wales will experience a wildland fire event in the next year. There is a less than 10% annual probability of occurring.

There is Code Red equipment for firefighting needs in Wales if they were to be impacted by a fire.

3.3.3.7 Future Conditions Including Climate Change

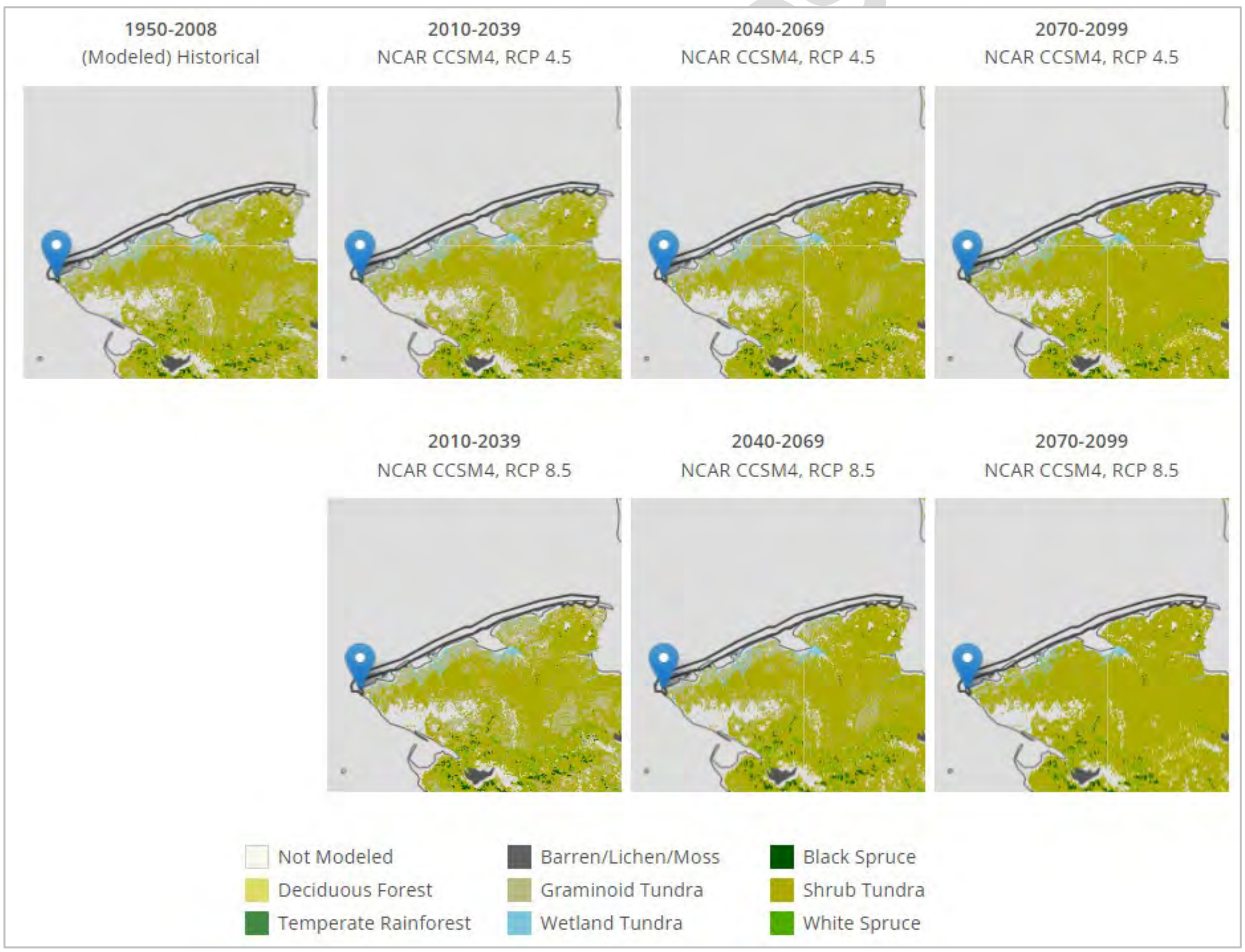
Figure 3-27 shows historical and projected changes in vegetation in Wales from 1950 through year 2099 using the NCAR CCSM4 model, with the same data represented in the form of a map in Figure 3-28. Future projections (2010-2099) are shown under two different scenarios of differing Representative Concentration Pathways (RCP), which is the trajectory of greenhouse gas concentrations in the atmosphere. Compared to current emissions, RCP 4.5 is a scenario representing a reduction in global emissions, while RCP 8.5 represents a scenario similar to, or possibly higher than, current global emissions trajectories.

In Wales, the predominant vegetation type is currently Wetland Tundra, followed by Shrub Tundra, and Graminoid Tundra (UAF/SNAP 2024a- Northern Climate Reports). Under both emission scenarios, this model does not predict a change in coverage of Wetland Tundra in the future, but predicts an increasing coverage amount of Shrub Tundra and a decreasing among of Graminoid Tundra in Wales.



Source: UAF/SNAP 2024a- Northern Climate Reports

Figure 3-27 Historical and Projected Changes in Vegetation Type Coverage in Wales

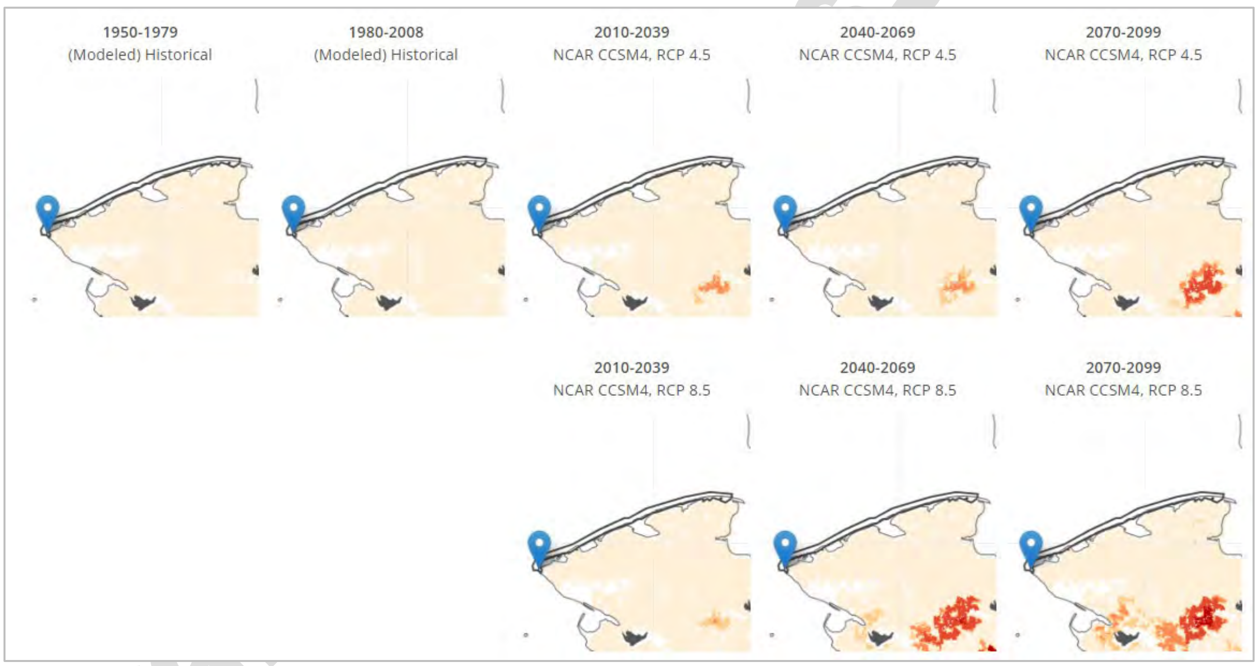


Source: UAF/SNAP 2024a- Northern Climate Reports

Figure 3-28 Projected Changes in Vegetation in Wales

Figure 3-29 depicts historical and future projections of the flammability in Wales using the NCAR CCSM4 model. This region has historically had Very Low flammability and future flammability is projected to stay the same through 2099 under both emissions scenarios (UAF/SNAP- Northern Climate Reports).

Category	Flammability	Interpretation
Not modeled or no data	-	This pixel was not modeled or is not included in the dataset
Very Low	<0.2%	Fire is absent or very rare
Low	≥0.2%, <0.5%	Fire is rare, and unlikely to be the primary driver of vegetation patterns on this landscape
Moderate	≥0.5%, <1%	Fire is frequent enough to partially define the vegetation patterns on this landscape
High	≥1%, <2%	Fire is more frequent and more dominant in determining vegetation patterns on this landscape
Very High	≥2%	Fire is highly frequent and dominates the vegetation patterns on this landscape



Source: UAF/SNAP 2024a- Northern Climate Reports

Figure 3-29 Historical and Projected Flammability Conditions for Wales (1950-2099)

Due to climate change, the nature or location of future wildland fires in Wales are not anticipated to change.

Changing Factor due to Climate Change	Description of Future Changes due to Climate Change
Extent (Magnitude and Severity)	Due to climate change, the extent (magnitude and severity) of wildland fires is expected to increase. Large wildfires have consumed more boreal forest in Alaska in the last ten years than in any other decade recorded, and the area burned annually is projected to double by 2050 (EPA 2022).

Changing Factor due to Climate Change	Description of Future Changes due to Climate Change
	Wales is surrounded by Bering Tundra, and has historically not been directly impacted by wildland/tundra fires. Most impacts to the community are a result of decreased air quality from smoke from distant fires.
Impact	Due to climate change, the impact of wildland fires to Wales may increase. A warmer, drier spring weather may increase fire risk and resulting in increased impacts, including smoke and air quality, from distant fires (UAF/SNAP).
Probability of Future Events	Wildfires are a natural disturbance in boreal forest and, more unusually, tundra ecosystems in Alaska. However, rapidly warming temperatures and extended dry periods in spring and summer increase the risk of large, severe wildfires that can threaten lives, infrastructure, and resources. Warmer, drier summers have increased the frequency of large fires over the last 20 years, including reburns of recently burned areas. By 2050, burned area is projected to increase 24 to 169% in Alaska (USDA 2024).

3.3.4 CHANGES IN THE CRYOSPHERE

The "cryosphere" is defined as those portions of Earth's surface and subsurface where water is in solid form, including sea, lake, and river ice, snow cover, glaciers, ice caps and ice sheets, and frozen ground (e.g., permafrost) (Figure 3-30). The components of the cryosphere play an important role in climate. Snow and ice reflect heat from the sun, helping to regulate the Earth's temperature. They also hold Earth's important water resources, and therefore, regulate sea levels and water availability in the spring and summer. The cryosphere is one of the first places where scientists are able to identify global climate change.

Hazards of the cryosphere can be subdivided into four major groups: Glaciers, Permafrost, Sea ice, Snow avalanches. Of these four major groups, all but glaciers pose a threat to Wales.

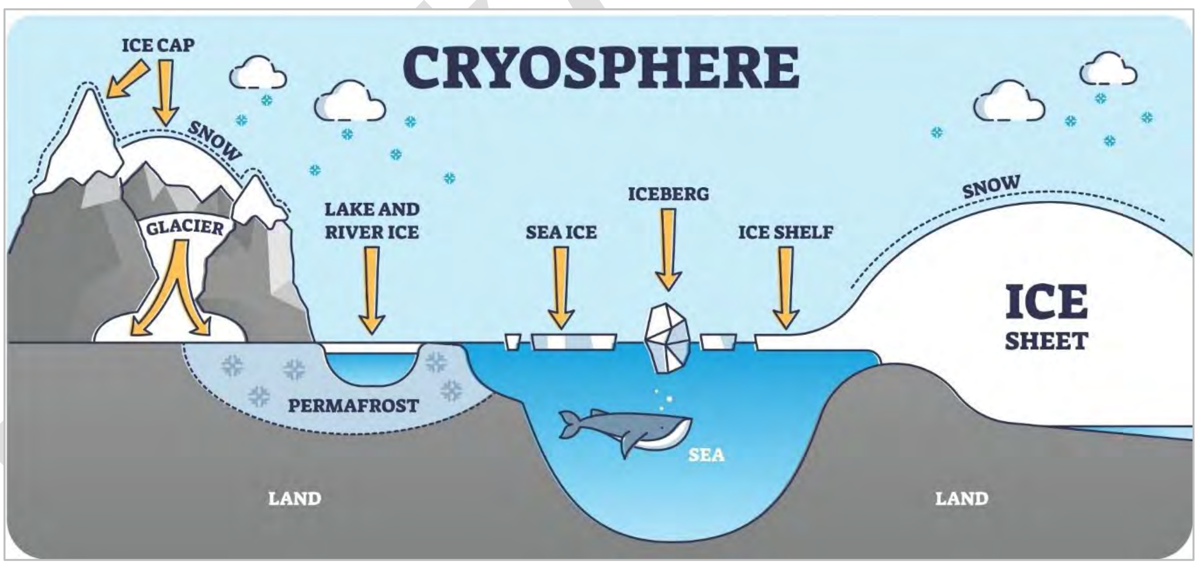


Figure 3-30 Components of the Cryosphere

3.3.4.1 Permafrost Degradation

Nature

Permafrost, defined as ground with a temperature that remains at or below freezing (32°F or 0°C) for two or more consecutive years, can include rock, soil, organic matter, unfrozen water, air, and ice.

Permafrost hazards are caused by the effects of changing perennially frozen soil, rock, or sediment (permafrost) and the landscape processes that result from extreme seasonal freezing and thawing.

In the U.S., the presence of widespread permafrost results in classes of geologic hazards, which are largely unique to Alaska. Permafrost is structurally important to the soils of Alaska, and thawing causes landslides, ground subsidence, and erosion as well as lake disappearances, new lake development, and saltwater encroachment into aquifers and surface waters.

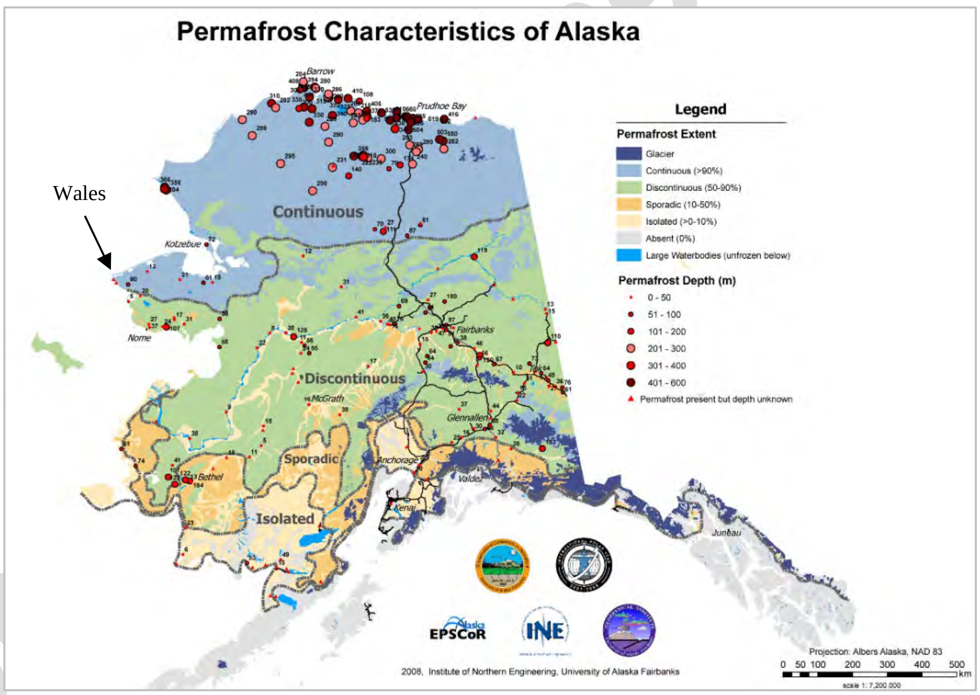
History

In Wales, permafrost degradation is leading to subsidence throughout the community.

Location

Permafrost is found beneath nearly 85% of Alaska. It is thickest and most extensive in arctic Alaska north of the Brooks Range, present virtually everywhere and extending as much as 2,000 feet below the surface of the Arctic Coastal Plain. Southward from the Brooks Range it becomes increasingly thinner and more discontinuous, broken by pockets of unfrozen ground known as taliks, until it becomes virtually absent in Southeast Alaska except for patches of high-elevation alpine permafrost.

According to Permafrost Characteristics Map of Alaska (Figure 3-31) developed for the National Snow and Ice Data Center/World Data Center for Glaciology, Wales has **continuous permafrost** (Jorgensen et al. 2008).

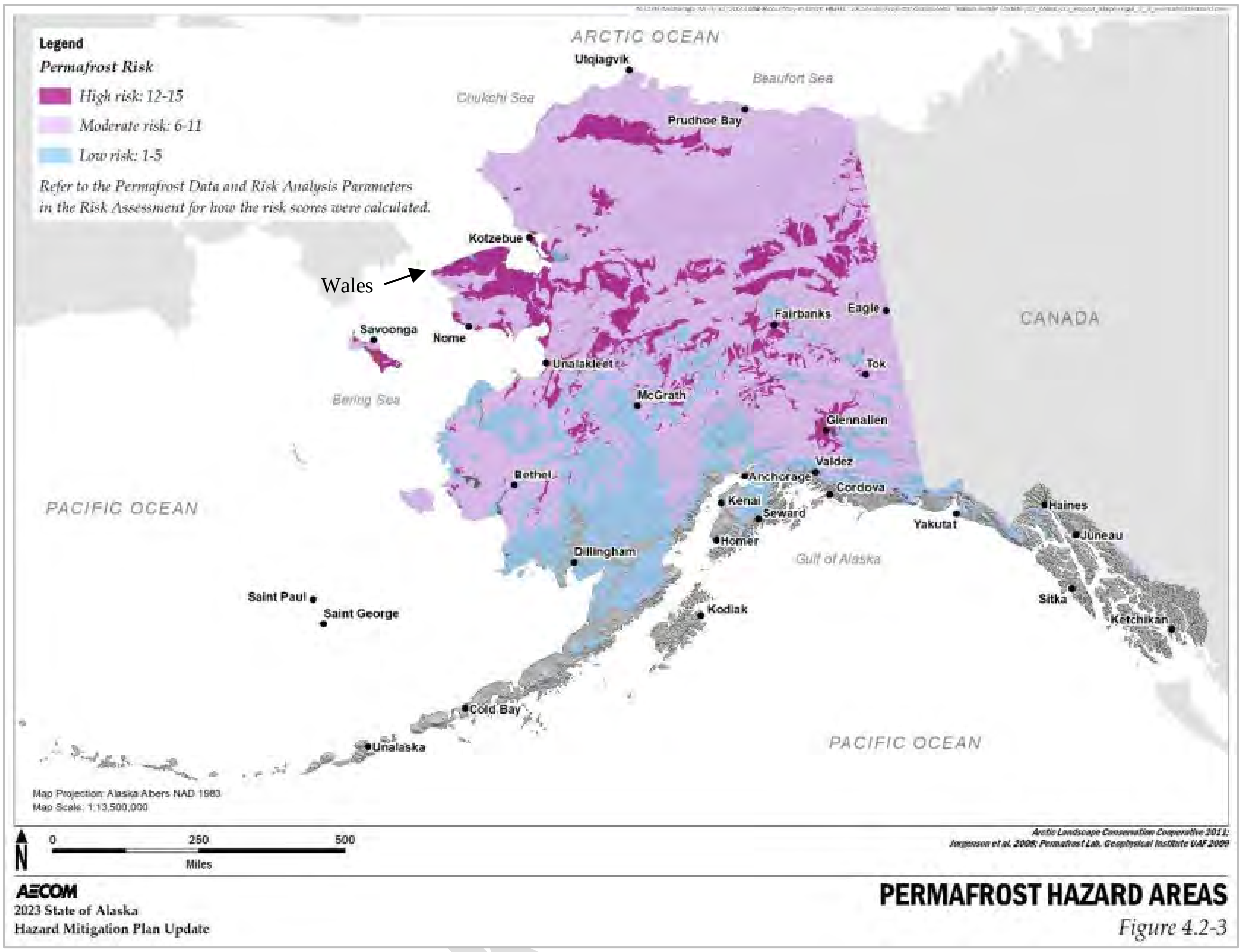


Source: Jorgenson et al. (2008)

Figure 3-31 Permafrost Characteristics of Alaska

The 2023 State of Alaska SHMP identifies statewide permafrost hazard areas (Figure 3-32). Wales is located in an area with **high permafrost risk**.

Subsidence due to permafrost thaw is evident in Wales. Subsidence is occurring on their traditional subsistence areas and trails and along the road to Tin City, another subsistence location for residents. Permafrost thaw is also leading to foundation sinking of homes in Wales.



Source: DHS&EM 2023

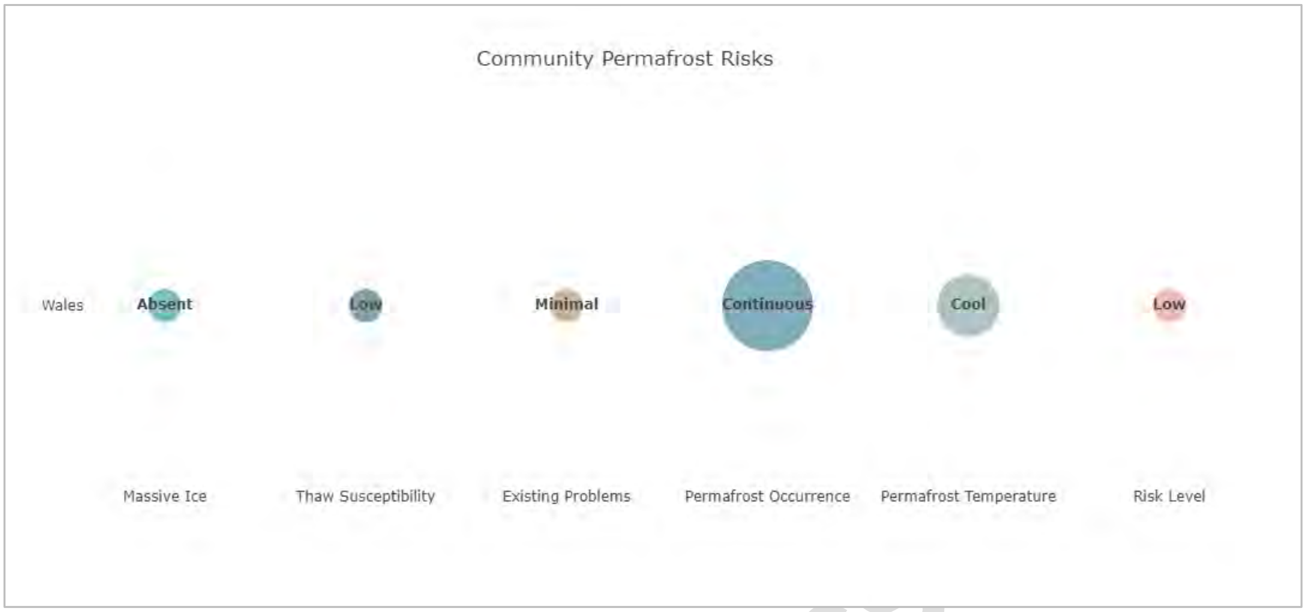
Figure 3-32 Statewide Permafrost Hazard Areas

Extent (Magnitude/Severity)

UAF/SNAP profiled permafrost characteristics and associated risks and hazards in rural Alaskan communities. The permafrost profile and risk level for Wales is outlined inFigure 3-33.

Wales is located in an area that has historically had **continuous permafrost**.

Based on past event history and the criteria identified in Table 3-2, the extent of permafrost hazards and resultant damages to people and infrastructure in Wales are considered Critical, where injuries and/or illnesses could result in permanent disability, a complete shutdown of critical facilities for at least two weeks, and more than 25% of property is severely damaged.



Note: general confidence for this analysis is low due to no reports with ground-ice data or an existing HMP. Estimation is based on general information on surficial geology and permafrost occurrence and analysis of available imagery.
Source: UAF/SNAP 2024f- Community Permafrost Data

Figure 3-33 Wales Permafrost Profile/Risk

Impact

Impacts associated with permafrost degradation include surface subsidence, and infrastructure, building, and/or road damage. In developed areas, ground failure as a result of thawing permafrost can be a result of improperly designed and constructed buildings, or buildings built on top of permafrost, and may impact buildings, communities, pipelines, airfields, roads, and bridges. This has the potential for extensive structure loss or costly repairs.

In Wales, subsidence is occurring on their traditional subsistence areas and trails and along the road to Tin City, another subsistence location for residents. Permafrost thaw is also leading to foundation sinking of homes in Wales.

Probability of Future Events

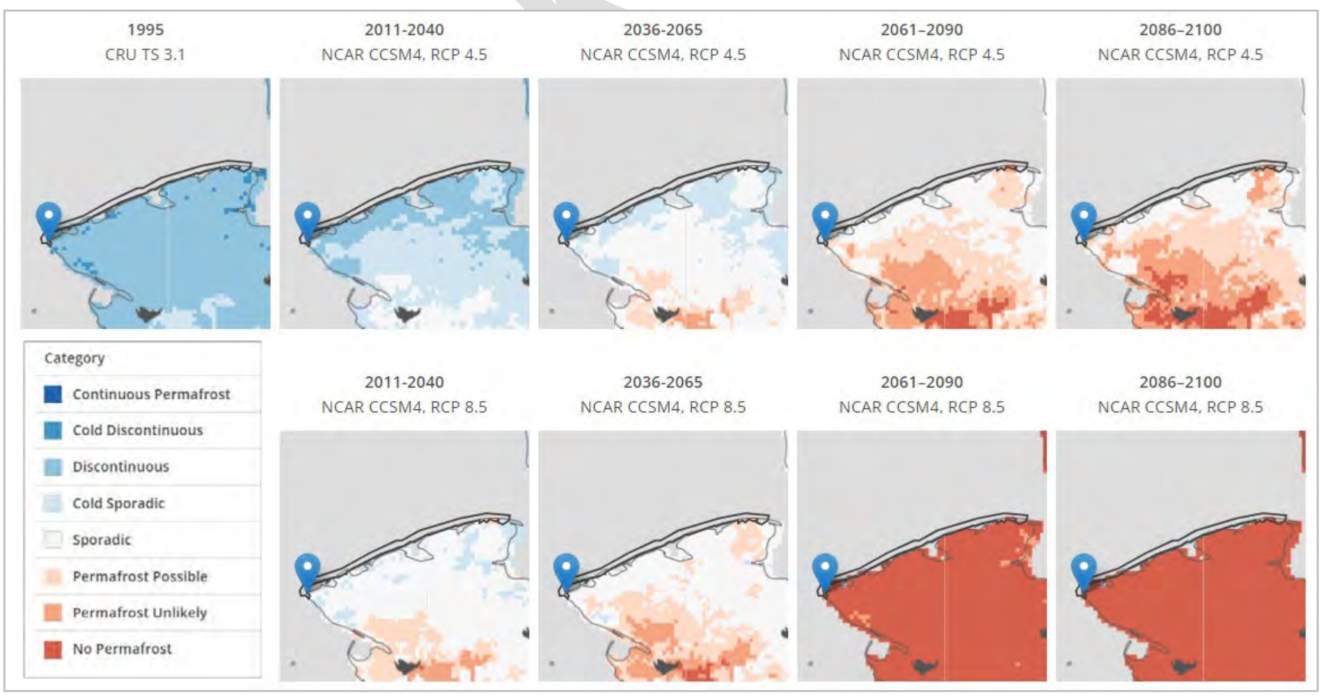
Climate models project that permafrost in Alaska will continue to thaw, and some models project that near-surface permafrost will be lost entirely from large parts of Alaska by the end of the century (USGCRP 2018). See Figure 3-34 for projections of future ground temperature and permafrost conditions in Wales.

Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a permafrost degradation hazard event within the next year. There is a greater than 90% annual probability of occurring

Future Conditions Including Climate Change

Permafrost Degradation	
Changing Factor	**Description of Changes Due to Climate Change**
Nature	Climate change is not anticipated to influence the nature of permafrost hazards in Alaska.

Permafrost Degradation	
Changing Factor	**Description of Changes Due to Climate Change**
Location	Climate change will impact permafrost locations across Alaska, but the most drastic changes will be seen in the northern/Arctic regions of the state.
Extent	Climate models project that permafrost in Alaska will continue to thaw, and some models project that near-surface permafrost will be lost entirely from large parts of Alaska by the end of the century (USGCRP 2018).
Impact	Impacts associated with permafrost degradation include surface subsidence, infrastructure, building, and/or road damage. Subsidence can be a result of improperly designed and constructed buildings, or buildings built on top of permafrost, and may impact buildings, utilities, pipelines, airfields, roads, and bridges. This has the potential for extensive structure loss or costly repairs. Additionally, in areas with permafrost degradation, the frequency and potential of rock falls or rock avalanches has increased (IPCC 2019). Landslides are projected to occur in areas where there is no history of previous events due to the destabilization of mountain slopes from thawing permafrost and glacial decline (IPCC 2019). In Wales, thawing permafrost will continue to lead to subsidence throughout the community.
Probability of Future Events	Climate models project that permafrost in Alaska will continue to thaw, and some models project that near-surface permafrost will be lost entirely from large parts of Alaska by the end of the century (USGCRP 2018). Figure 3-34 shows historic and projected average annual ground temperature in Wales. Wales has historically had continuous permafrost. Due to climate change, the permafrost profile in Wales is expected to change, but projections of category type change based on climate scenario.



Source: UAF/SNAP 2024a- Northern Climate Reports

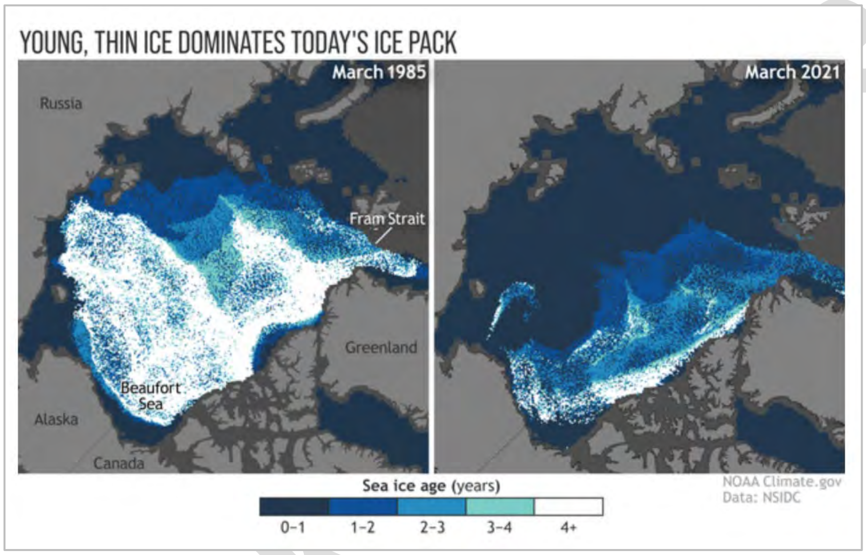
Figure 3-34 Mean Annual Ground Temperature in Wales (1995-2100)

3.3.4.2 Sea Ice Extent

Nature

Ice in the Arctic environment consists of shorefast "fast" ice and floating or "pack ice". Pack ice persists year-round in the Arctic, while fast ice forms each winter and melts during the short Arctic summer. All sea ice is dynamic and mobile, and subject to dispersal by winds and currents and open water may persist year-round.

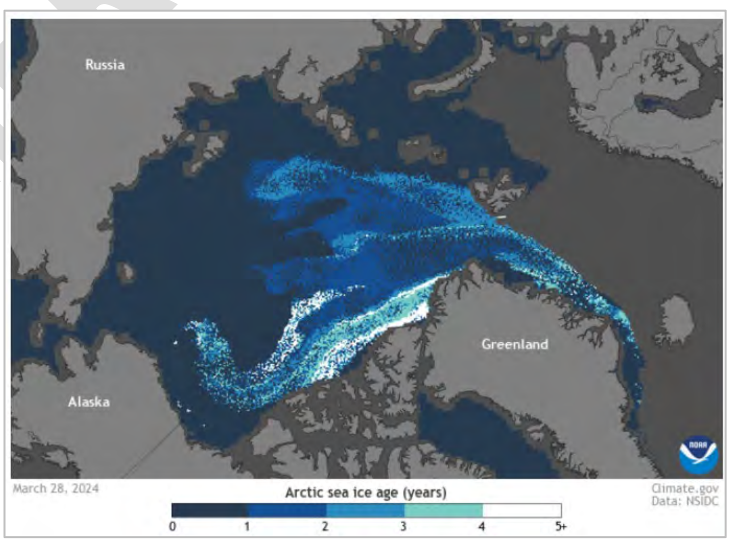
Sea ice can be described by its age, which is when the ice formed. First-year ice formed during the most recent winter and 2-year-old ice formed two winters ago, and so on. Ice thickness is strongly correlated with ice age. First year ice ranges from 4 to 12 inches thick, while multi-year ice ranges from 6 to 12 feet thick. This correlation means that older ice is typically thicker than younger ice.



Source: NOAA 2021

Figure 3-35 Age of Arctic Sea Ice in 1985 vs. 2021

Figure 3-36 shows the age of sea ice in the Arctic on March 28, 2024- note that the majority of ice is between 0-3 years old.

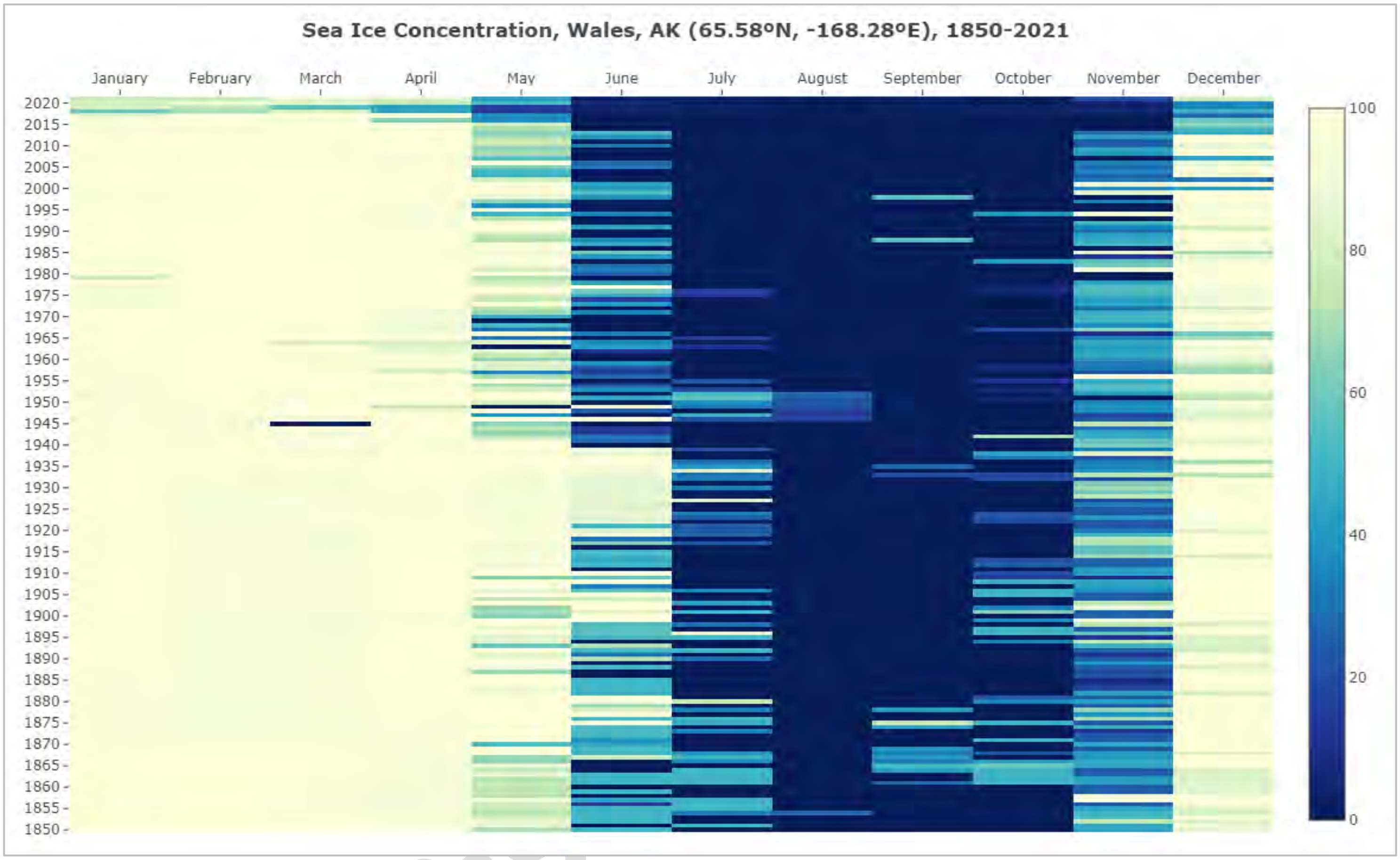


Source: NOAA 2023a

Figure 3-36 Age of Arctic Sea Ice on March 28, 2024

History

The historical sea ice extent in Wales from 1850-2021 is shown in Figure 3-37 and shows decreasing sea ice in recent years.



Note: Dark blue represents 0% ice, or open water. Light yellow represents 100% solid ice
Source: UAF/SNAP 2024- Historical Sea Ice Atlas

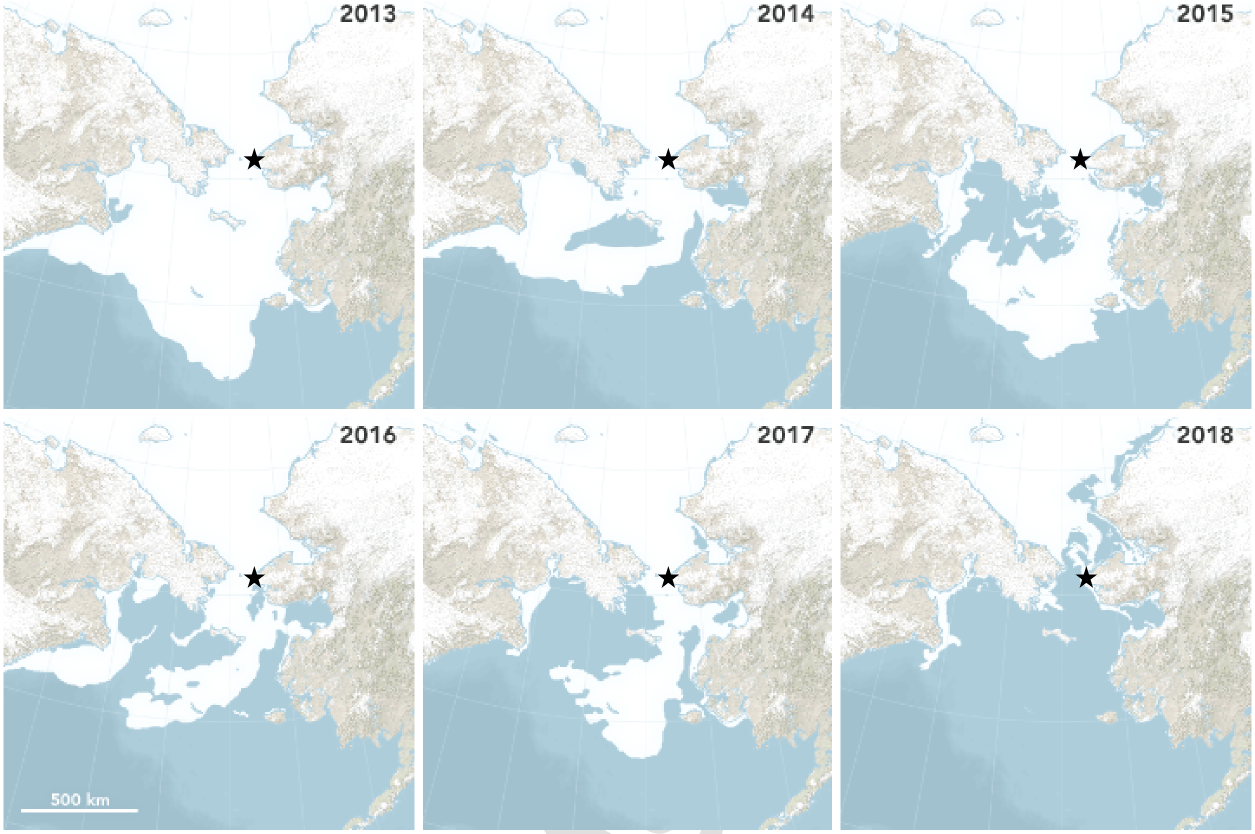
Figure 3-37 Historical Sea Ice Concentration in Wales (1850-2021)

Location

The Bering Sea experiences seasonal formations of shorefast ice in Wales.

From 2006-2009, the Sea Ice Group at the Geophysical Institute at UAF operated a coastal ice observatory in Wales, equipped with a coastal webcam and radar (UAF 2009). The webcam in Wales was mounted on top of the Kingikmiut School at the base of Cape Mountain. The camera was looking approximately WNW, and on a clear day, both Fairway Rock and the Diomede Islands were visible. The webcam images were updated every 5 minutes. Scientists from UAF came to Wales to perform regular ice coring and ice thickness profiles.

The Federal Aviation Administration operates airport webcams showing daily weather conditions that also show daily sea ice (compared to open water) looking west towards Diomede Islands (FAA WeatherCams).

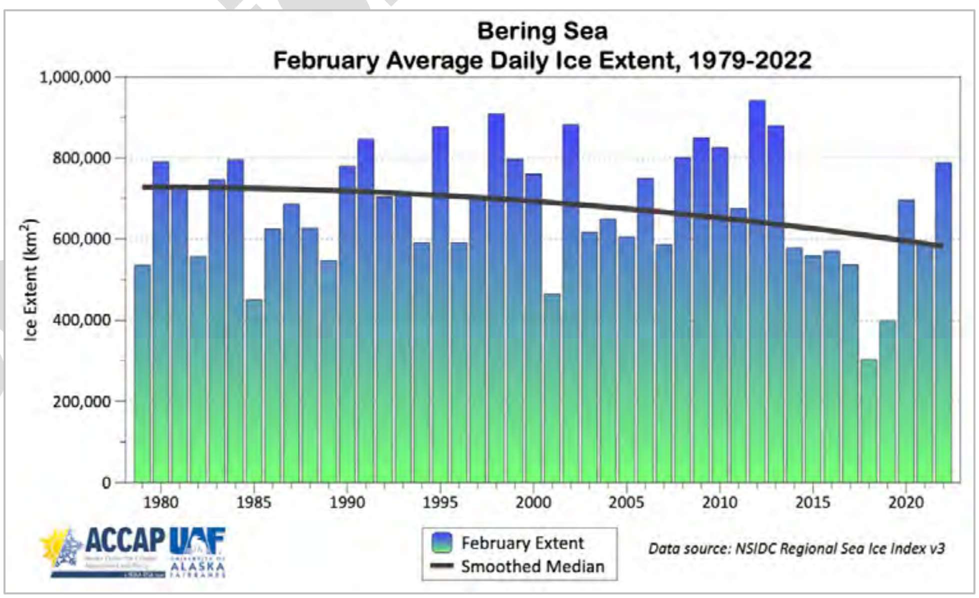


The graphic above shows the maximum ice extent in the Bering Sea during April from 2013-2018. Source: NASA 2019

Figure 3-38 Bering Sea Ice Extent 2013-2018

Extent (Magnitude/Severity)

Figure 3-39 shows the average daily sea ice extent in February in the Bering Sea from 1979-2022.



Source: ACCAP 2023

Figure 3-39 Bering Sea Average February Sea Ice Extent (1979-2022)

Impact

Declining sea ice is impacting subsistence in Alaska. Changing sea ice patterns affect marine mammals and their access to hunters. The loss of sea ice creates dangerous conditions for hunting and limits hunting success for subsistence foods.

Another impact of declining sea ice is the increased presence of polar bears on land. In the winter, polar bears hunt seals that are hauled out on the sea ice. Polar bear presence is closely correlated to sea ice extent. If sea ice melts earlier than it used to, then bears will come to shore sooner than they typically do.

Increased polar bear activity on land threatens the entire population of Wales. Tragically, in 2023, a mother and her son were killed when a polar bear attacked them near the school. There was little to no visibility due to blowing snow and the polar bear was not seen before the attack. The polar bear attempted to enter the school, but school officials quickly shut the doors before it could enter. This was the first polar bear attack in Alaska in 30 years. The community reported a polar bear sighting below the store on the ice on April 18, 2024.

In Wales, school officials perform daily patrols before and after school to ensure no animals are nearby when students are coming to and leaving school. Daily updates are posted in the community Facebook group.

Probability of Future Events

As global temperatures rise, and the extent of sea ice decreases, the probability of sea ice hazards increases. Based on previous occurrences and the criteria identified in Table 3-3, it is Highly Likely that Wales will experience a sea ice hazard event within the next year. There is a greater than 90% annual probability of occurring.

Future Conditions Including Climate Change

Sea Ice Extent	
Changing Factor	**Description of Changes Due to Climate Change**
Nature	Climate change, over time, could affect the nature and character of sea ice hazards, with a reduction of thick annual sea ice in the near-shore environment. Until that time, while sea ice is still thick enough to use as a transportation surface, there will be increased hazard of shifting and cracking (DHS&EM 2023).
Location	Sea ice hazards are associated near the shoreline, in locations where sea ice forms. Including the Bering and Chukchi Seas.
Extent	The continual loss of sea ice will increase the magnitude/severity of coastal erosion and storm surge during Bering Sea storms.
Impact	Sea ice and climate are intimately linked. There are three timeframes to consider concerning the impacts of sea ice as climate changes (DHS&EM 2023): 1. Long-term concerns: Regulation of the global climate 2. Intermediate-term concerns: Coastal erosion 3. Immediate concerns: Transportation Declining sea ice will also continue to threaten subsistence activities and food sovereignty in the community.

Sea Ice Extent	
Changing Factor	**Description of Changes Due to Climate Change**
Probability of Future Events	The probability of future sea ice hazards will continue to increase as global temperatures rise and the extent of sea ice decreases in the Bering Sea.

3.3.4.3 Snow Avalanche

Nature

A snow avalanche is a mass of snow, ice, and debris that releases and slides or flows rapidly down a steep slope, either over a wide area or concentrated in an avalanche chute or track. Avalanches reach speeds of up to 200 mph and can exert forces great enough to destroy structures and uproot or snap large trees. A moving avalanche may be preceded by an "air blast," which is also capable of damaging buildings. Snow avalanches commonly occur in the high mountains of Alaska during the winter and spring as the result of heavy snow accumulations on steep slopes.

Large avalanches have the potential to kill people and wildlife, destroy infrastructure, level forests, and bury entire communities. Significant avalanche cycles (multiple avalanches naturally releasing across an entire region) are generally caused by long periods of heavy snow, but avalanche cycles can also be triggered by rain-on-snow events, rapid warming in the spring, and earthquakes.

An avalanche releases when gravity-induced shear stress on or within the snowpack becomes larger than its shear strength. Triggers can be natural (e.g., rapid weight accumulation during or just after a snowstorm or rain event, warming temperatures, and seismic shaking) or artificial (e.g., human weight or avalanche-control artillery). There are four distinct avalanche types in Alaska that occur under varying snowpack and weather conditions. Each avalanche type is named based on its snow release characteristics.

Cornice Collapse occurs when an overhanging snow mass breaks, separates, or is released. Cornices form on ridge crests or shoulders adjacent to gullies due to wind blowing the snow. The cornice is an indicator of predominant wind directions, as the cornice is formed on the lee (i.e., downwind) side of topographic features. Over time, the cornice can develop weaknesses in its structure and its attachment to the slope may fail. A cornice collapse often triggers a loose snow or slab avalanche as it adds sudden and significant stress onto the snowpack below.

Loose Snow Avalanches, also known as point releases, initiate with a small amount of non- cohesive (loose) snow and quickly grow larger as they move downhill and entrain more snow. This type of avalanche typically carries relatively small amounts of powder snow and virtually no other debris. However, a loose snow avalanche may trigger a larger slab avalanche on the same slope.

A **Slab Avalanche** releases as a block of cohesive snow when snow particles have stuck together to form one or more resistant layers. There is a wide range of slab characteristics possible, running the gamut from "soft" slab (weakly cohesive snow) to "hard" slab (very cohesive snow), and from "storm" slab (release of recently deposited storm snow), to "persistent" and "deep persistent" slab (release of a slab that failed on a weak layer deeper down in the snowpack). Due to their large release masses, and because more snow is picked up along the way (snow entrainment), slab avalanches are the most destructive avalanche type. Human encounters with even small-sized slab avalanches are often fatal.

Slush Avalanches are fast-moving mixtures of snow and water. They release in isothermal snowpacks (snow temperature throughout the snowpack is 32°F) when liquid water permeates the snowpack and dramatically weakens the intergranular bond. Slush avalanches, therefore, typically occur in northern Alaska during the spring when warm temperatures and strong solar radiation quickly warm up the snowpack. Slush avalanches can release on slopes as gentle as 20 degrees. Their release is often slower than other avalanche types, but as the slushy snow runs downhill, they can reach speeds over 40 mph. Smaller, more fluid avalanches with higher water content are commonly referred to as slush flows.

An avalanche path comprises three main parts: starting zone, track, and run-out zone (Figure 3-40). Local topography determines the shape and size of each part. Steep gullies that contain a stream or creek in the summer often function as avalanche paths in the winter, but avalanches also release and run on simple and complex open slopes.

The starting zone is also called the release area. This is the upper part of the avalanche path, where snow accumulates (creating a slab or point source release area), and the avalanche begins its downhill movement. Starting zones are commonly located in the headwaters of a drainage where snow is accumulated on lee-side aspects of topographic features. Starting zones on open slopes are more difficult to identify. Sometimes multiple starting zones join into one track (e.g., several creeks funneling into one major gully).

The track is the middle part of the path, where the avalanche transports the released snow downhill to the deposition (runout) zone. The avalanche accelerates and reaches its maximum velocity in the track, and can also pick up more snow, adding to its mass. The track can be comprised of both confined gullies and unconfined open slopes. Tracks can also branch onto adjacent slopes, creating successive avalanches.

The run-out zone is the bottom part of the path, where the avalanche slows down and deposits debris. The avalanche impact pressure, which is a function of its snow density, volume (i.e., mass), and velocity, determines the amount of damage the avalanche could potentially cause. This measure is used for designing mitigation structures to protect infrastructure and buildings that are located in an avalanche risk zone.

Source: Avalanche Canada 2024

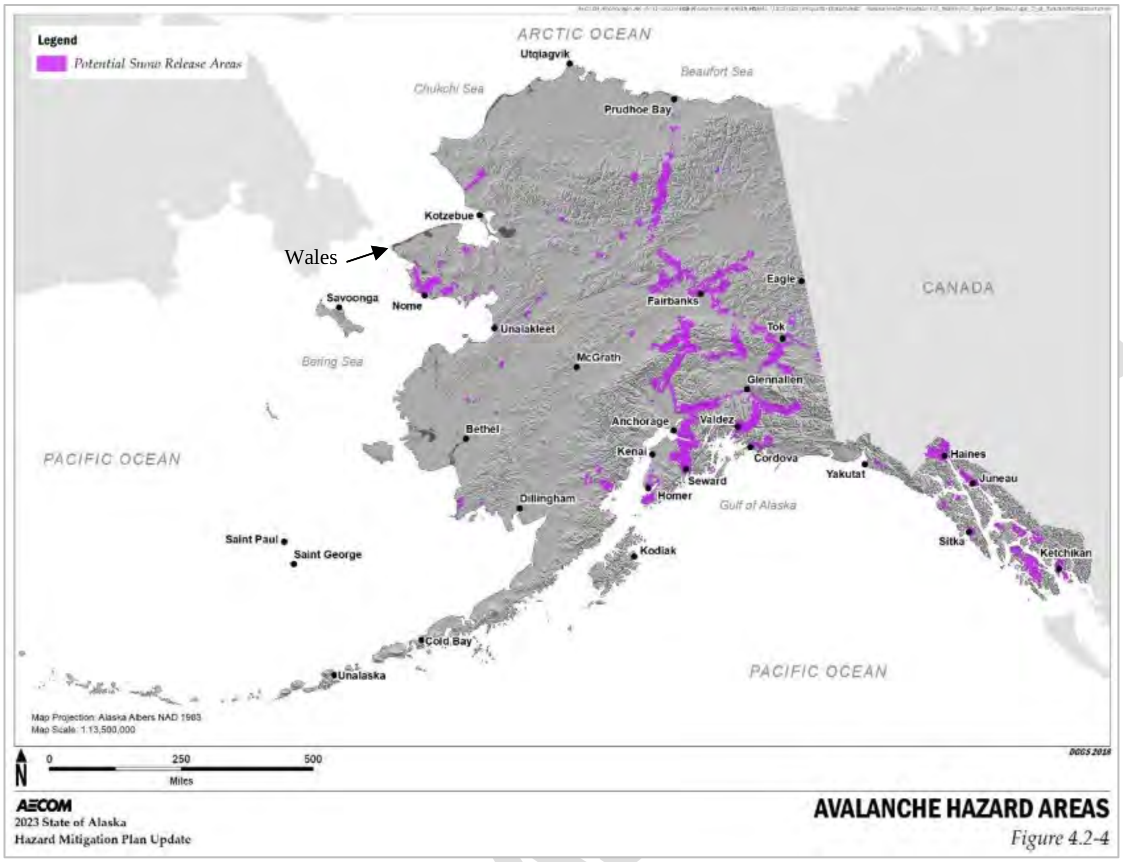
Figure 3-40 Path of an Avalanche

History

The Planning Team states that during the early 1900s, an avalanche killed a resident in Wales.

Location

The 2023 State of Alaska SHMP identifies statewide avalanche hazard areas (Figure 3-41). There are avalanche hazard areas in Wales, associated with Cape Mountain, shown in Figure 3-42 and Figure 3-43.



Source: DHS&EM 2023

Figure 3-41 Statewide Avalanche Hazard Areas

Source: CoastView 2024

Figure 3-42 Location of Cape Mountain in Proximity to the Village

Source: Buzard et al. (2021)- Erosion Exposure Assessment- Wales

Figure 3-43 Location of Cape Mountain in Proximity to the Village

Extent (Magnitude/Severity)

Avalanches can be incredibly destructive and have the potential to destroy everything in its path, and result in human deaths every year. Over the last 10 years (2012-2022), 27 people died in avalanches each winter in the United States (CAIC 2024). The number of people caught or buried in avalanches each year because most non-fatal avalanche incidents are not reported (CAIC 2024).

In Wales, avalanche hazard locations are associated with Cape Mountain, 3 miles SE of the community. There has been 1 fatality in Wales from an avalanche in the early 1900s. Therefore, based on past event history and the criteria identified in Table 3-2, the extent of avalanches and resultant damages to people and infrastructure in Wales are considered Critical, where injuries and/or illnesses could result in permanent disability, a complete shutdown of critical facilities for at least two weeks, and more than 25% of property is severely damaged.

Impact

Avalanches can be incredibly destructive and have the potential to destroy everything in its path, and result in human deaths every year. Between 2012 and 2022, 27 people died in avalanches each winter in the United States (CAIC 2024). The number of people caught or buried in avalanches each year is unknown because most non-fatal avalanche incidents are not reported (CAIC 2024).

An avalanche killed a resident in the early 1900s, but there have been no recent impacts from snow avalanches in Wales.

Probability of Future Events

As climate warming continues, there is an expectation of an increase in Alaska's vulnerability to snow avalanche hazards (DGGS 2024b).

Ballesteros-Canovas et al. (2018) predicts an increase in avalanche activity in the 2nd half of the 21st century, largely wet-snow avalanches due to increased air temperature and precipitation. However, as snow cover retreats upwards due to these same factors, the impacted area will also change to higher elevations (Ballesteros-Canovas et al. 2018).

Future Conditions Including Climate Change

Snow Avalanche	
Changing Factor	**Description of Changes Due to Climate Change**
Nature	Climate change is not anticipated to influence the nature of snow avalanche hazards in Alaska.
Location	Landslides and snow avalanches are projected to occur in areas where there is no history of previous events due to the destabilization of mountain slopes from thawing permafrost and glacial decline (IPCC 2019).
Extent	Avalanche activity is determined by a number of factors, including snowpack type, internal liquid volume, air temperature, precipitation, elevation, slope, ground cover, etc. An increase in liquid content within snowpack, from increased December-March air temperature and January-February increased precipitation, will lead to greater occurrence of wet snow avalanches, especially in late winter/early spring (Wever et al. 2016; Ballesteros-Canovas et al. 2018).
Impact	As snowpack experiences greater liquid volume, avalanche risk will increase (Ballesteros-Canovas et al. 2018). As snowpack retreats to higher elevations due to reduced snowpack and quickened melt from climate change, the impacted area will also shift upwards. Impacts in this scenario will likely be due to loss of water supply, affecting agriculture, culture, and tourism (IPCC 2019).
Probability of Future Events	As climate warming continues, there is an expectation of an increase in Alaska's vulnerability to snow avalanche hazards (DGGS 2024). Ballesteros-Canovas et al. (2018) predicts an increase in avalanche activity in the 2nd half of the 21st century, largely wet-snow avalanches due to increased air temperature and precipitation. However, as snow cover retreats upwards due to these same factors, the impacted area will also change to higher elevations (Ballesteros-Canovas et al. 2018).

3.3.5 NATURALLY OCCURRING URANIUM

3.3.5.1 Nature

Uranium (chemical symbol U) is a naturally occurring radioactive element. When refined, uranium is a silvery-white metal. Uranium has three primary naturally occurring isotopes: U-238, U-235, and U-234 (EPA 2024).

Uranium is present naturally in virtually all soil, rock, and water. Rocks break down to form soil, and soil can be moved by water and blown by wind, which moves uranium into streams, lakes, and surface water. More than 99% of the uranium found in the environment is in the form of U-238 (EPA 2024).

A person can be exposed to uranium by inhaling dust in air, or ingesting water and food. The general population is exposed to trace levels of uranium primarily through food and water (EPA 2024). People who live near federal government facilities that made or tested nuclear weapons, or facilities that mine or process uranium ore or enrich uranium for reactor fuel, may have increased exposure to uranium. Uranium that is depleted (U-235) is used in industrial settings (EPA 2024).

The EPA's maximum permissible contaminant level for uranium in drinking water is 30 micrograms per liter (µg/L).

3.3.5.2 History

Uranium was first detected in Wales' drinking water between 2008-2010 when routine tests of the main water source used by the school, the clinic and villagers report uranium levels that slightly exceed federal standards (ADN 2010).

The numbers bewildered Department of Environmental Conservation officials, who say excess uranium levels are unheard of in Alaska water supplies (ADN 2010).

Uranium exposure is an ongoing issue for Wales. Wales regularly tests their drinking water for levels of uranium.

3.3.5.3 Location

The uranium in Wales' drinking water is thought to be coming from enriched granite on Cape Mountain, which is also the source of nearby tin placer deposits that were mined from 1902 to 1990 (ADN 2010).

The largest known deposit of uranium in the state is on the eastern Seward Peninsula, north of the village of Elim, Szumigala said. A Canadian mining partnership performed exploratory drilling for uranium there from 2005 to 2008, he said.

A uranium deposit discovered in 1977 in western Alaska, by means of airborne radiometric data, is the largest known in Alaska on the basis of industry reserve estimates. At about latitude 65 degrees N, it is the most northerly known sandstone-type uranium deposit in the world. The deposit lies in Eocene continental sandstone near the eastern end of the Seward Peninsula, in the southern end of a graben that extends northward into the Death Valley depositional basin (USGS 1987). The most common uranium mineral is meta-autunite, but coffinite has been identified in the primary deposits.

The major radioactive minerals in placer concentrations from the Cape Mountain area in the western Seward Peninsula are monazite, xenotime, and zircon. The concentrates contain as much as 0.9% equivalent uranium and average about 0.03% equivalent uranium which, because of the monazite content of the concentrates, is ascribed mostly to thorium (Bates and Wedow 1963). The source of the radioactive minerals is likely the granite at Cape Mountain, although they may be genetically related to the tin deposits in the area (Bates and Wedow 1963).

Figure 3-44 shows the Alaska DEC's Drinking Water Protection Area in Wales. The red line is the community's water source, which is in Cape Mountain. As their water travels through the mountain, it is picking up traces of uranium and other minerals. The two wells are indicated by the blue glowing area at the base of the Mountain.

Source: Alaska DEC 2024

Figure 3-44 Alaska DEC Drinking Water Protection Area (Wales)

3.3.5.4 Extent (Magnitude/Severity)

In 2007, uranium was not detected in Wales' drinking water, but in 2010, the concentration was 32.5 µg/L, just slightly above EPA's maximum permissible contaminant level for uranium in drinking water of 30 µg/L. In Alaska DEC's 2020 Drinking Water Program Annual Compliance Report, Wales' water system is still labeled as being contaminated with "Combined Uranium" (DEC 2020).

More information on source water assessments in Wales can be found at: https://dec.alaska.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=3229&tinwsys_st_code=AK&wsnumber=AK2340191.

In 2024, Kawerak, Inc. received a grant from the American Red Cross to provide reserve osmosis/UV/heavy metal water filters to each household in the Kawerak region.

Based on past event history, potential impacts, and the criteria identified in Table 3-2, the extent of uranium exposure and resultant damages to people and infrastructure in Wales is considered Limited where injuries and/or illnesses do not result in permanent disability, critical facilities to be shut down for more than a week, and more than 10% of property or critical infrastructure being severely damaged. Further information is needed to accurately evaluate the extent of exposure to uranium on the residents of Wales.

3.3.5.5 Impact

Uranium decays by alpha particles. External exposure to uranium is therefore not as dangerous as exposure to other radioactive elements because the skin will block the alpha particles. Ingestion of high concentrations of uranium can cause health effects, such as cancer of the bone or liver. Inhaling large concentrations of uranium can cause lung cancer from the exposure to alpha particles (EPA 2024).

Most ingested uranium is eliminated from the body. However, a small amount is absorbed and carried through the bloodstream. Studies show that drinking water with elevated levels of uranium can affect the kidneys over time.

3.3.5.6 Probability of Future Events

As uranium exposure is an ongoing issue for Wales, it is Highly Likely that it will continue in the future. There is a greater than 90% annual probability of occurring.

3.3.5.7 Future Conditions Including Climate Change

Climate change is not anticipated to influence the nature, location, extent, impact, or probability of future uranium hazards in Wales.

3.3.6 FLOOD

3.3.6.1 Nature

Flooding is the accumulation of water in areas that typically do not hold water, or it can result from surplus water from streams, rivers, lakes, reservoirs, glaciers, or coastal water bodies overflowing onto the surrounding floodplains. Floodplains are the adjacent low-lying grounds adjacent to water bodies, formed mainly of sediment deposits from past flooding events.

Wales experiences coastal flooding. There are three primary types of flooding that can occur in Wales: rainfall-runoff, snowmelt, and storm surge.

Rainfall-Runoff Flooding: The most common type of flood, rainfall runoff magnitude is determined by rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed. Weather systems that bring strong persistent rainfall differentiate rainfall runoff from the other categories of flooding. Rainfall runoff flooding is more likely to occur in late summer to early fall.

Snowmelt Floods: Spring weather patterns and snowpack depths determine the immensity of this flooding occurrence. Snowmelt takes place in the spring, usually between the months of April through June.

Storm Surges: Storm surges are a coastal flood that occurs when the sea travels inland past the high-tide level, often accompanied by high winds, increasing the destructive force of the water. Storm surge is a significant cause of property damage in Alaska.

Due to the slow movement of ice over time, ice override does not pose an immediate threat, however it can move through structures, damage road systems, and impede travel. Ice override damage can be limited with the use of bulkheads or other or other structures to break-up the ice.

Conditions that have a high possibility of resulting in flooding in coastal areas include low atmospheric pressure, strong winds (blowing directly onshore or along the shore with the shoreline to the right of the direction of the flow), and consistent winds persisting from a consistent direction over a long distance across the open ocean (fetch).

Communities that are most susceptible to coastal flooding typically have gradually sloping bathymetry near the shore and exposure to strong winds with a long fetch over the water. Communities and villages along the west coast areas of Alaska, particularly the northwest Arctic Coast, have experienced significant damage from coastal floods. These locations will usually experience coastal flooding during the late summer or early fall. There is a decreased potential for ground failure as shore-fast ice (ice that is "fastened" to the coastline) forms along the coast before winter, but later freeze-ups and earlier fall/winter storms increase the potential of erosion, storm surge flooding and ice override events.

3.3.6.2 History

As a coastal community, Wales experiences seasonal Bering Sea coastal flooding.

The top 10 storm surge events from 1954-2004 are listed below, in order of maximum surge level.

Table 3-11 Top 10 Storm Surge Events in Wales from 1954-2004

Rank	Starting Date	Maximum Surge (ft MLLW)	Minimum Surface Pressure (mb)	Maximum Wind	
				Speed (mph)	Direction
1	11/10/74	5.37	957.7	54.1	S
2	11/12/96	5.33	998.1	46.5	SE
3	11/06/85	5.00	984.1	38.7	E
4	10/15/04	4.97	964.6	48.3	E
5	10/25/96	4.87	991.6	47.2	SSW
6	11/08/78	4.71	988.0	55.3	SSE
7	11/16/90	4.58	986.3	40.3	E
8	11/14/66	4.41	985.1	56.6	SSE
9	10/02/92	4.28	969.4	41.4	SE
10	11/19/04	3.82	979.2	37.6	E

Source: Chapman et al. (2009)

The USACE completed an erosion assessment for Wales during their 2009 Alaska Baseline Erosion Assessment. The Erosion Information Paper dated October 15, 2007, states:

> *Major floods in the area occurred in 1933 and 1969, although no water was reported to have entered the community. A 1974 storm caused minimal damage. A 1984 report prepared by the State of Alaska Department of Transportation and Public Facilities noted no significant erosion problems.* (USACE 2007)

The National Weather Service's Storm Events Database provides details of historic flood events (January 1996 – November 2023) and their impacts to Wales (Table 3-12). The NWS Storm Events Database has data dating back to January 1950 for many states, but it began collecting data for Alaska in January 1996.

Table 3-12 Historic Flood Events in Wales

Date	Event Type	Description/Magnitude of Event
11/14/1966	Storm Surge	Maximum surge: 4.41 ft MLLW
11/10/1974	Storm Surge	Maximum surge: 5.37 ft MLLW
11/08/1978	Storm Surge	Maximum surge: 4.71 ft MLLW
11/06/1985	Storm Surge	Maximum surge: 5.00 ft MLLW
11/16/1990	Storm Surge	Maximum surge: 4.58 ft MLLW
10/02/1992	Storm Surge	Maximum surge: 4.28 ft MLLW
10/25/1996	Storm Surge	Maximum surge: 4.87 ft MLLW
11/12/1996	Storm Surge	Maximum surge: 5.33 ft MLLW
10/15/2004	Storm Surge	Maximum surge: 4.97 ft MLLW
10/18/2004	Storm Surge/ Tide	A low-pressure center of 978 mb moved north over the central Aleutians on the evening of the 17th and deepened to 941 mb as it reached the Gulf of Anadyr the evening of the 18th, about 400 miles west of Nome. The great deepening of the storm was due to in influx of moisture from an ex-typhoon east of Japan (though the ex-typhoon itself continued east across the north Pacific) and then the cold air around an upper-level circulation of Far East Russia moving southeast into the low. On the 19th the storm began to slowly fill and decelerate, to 980 mb on the evening of the 20th 400 miles west of Kotzebue. The circulation around this storm covered western Alaska with 50 to 80 mph winds and was comparable or stronger than the November 1974 storm, though this current storm moved quicker over the Bering Sea and was located farther west than the 1974 storm. Nonetheless, a significant and damaging storm surge accompanied this storm in addition to high winds. In Wales, surge height estimated at 6 to 8 feet. Damages in Wales: wind blew off a portion of a roof from an Alaska Village Electric Corporation (AVEC) facility, as well as from a private residence. A guardrail from another home was also lost. At the village clinic, the fuel line was ruptured when the metal support for the fuel line running from the tank to the building toppled over in the wind. This spilled about 300 gallons of fuel. One of the two wind generators of the village was damaged. Ocean water rose about 6 to 8 feet, and reached an outbuilding of the school, damaging the skirting along the bottom of the structure, but the structure otherwise was intact. Gravel and insulation over the school's septic tank and leach field damaged and removed by wave and wind action. Two snowmachines belonging to the school were damaged from the combined effects of water and wind-blown sand. Total School damages $8.4K. At the Water plant sewage leach field gravel and insulation was eroded away and septic tank possibly affected. At the Community Center sewage leach field, gravel and insulation was eroded away. Septic tank possibly affected. Road damage at the south end of the village. There was soil erosion due to wind at the cemetery; Caskets are exposed. Wind damage to fence around the dump site by the airport. This event resulted in over $20M in damages in the region.
11/19/2004	Storm Surge	Maximum surge: 3.82 ft MLLW
11/09/2011	Coastal Flood	A 960 mb low over the southern Aleutians at 0300AKST on the 8th intensified to 945 mb near the Gulf of Anadyr by 2100AKST on the 8th. The low crossed the Chukotsk Peninsula as a 956 mb low at 0900AKST on the 9th, and moved into the southern Chukchi Sea as a 958 mb low by 2100AKST on the 9th. The low then tracked to the northwest and weakened to 975 mb about 150 miles north of Wrangel Island by 1500AKST on the 10th. The storm was one of the strongest storms to impact the west coast of Alaska since November 1974.

Date	Event Type	Description/Magnitude of Event
		At Wales, minor coastal flooding was observed during the afternoon and evening of the 9th by the school and old naval station. The water entered the creek and flooded the lagoon on the back side of the village. The water levels likely peaked during the late evening hours of the 9th. This event resulted in over $24M in damages in the region.
10/11/2017	Coastal Flood	Strong winds developed out ahead of an approaching 958 mb low pressure center along the west coast of Alaska on October 11. The strong winds continued into the 13th. Minor beach erosion also occurred along the coast. Low level areas of Wales saw elevated seas of 3 to 5 feet above normal tides. Wales AWOS reported 60 mph (52 kt).
09/17/2022	Coastal Flood	The extratropical remnants of Typhoon Merbok moved north through the Bering Sea from Thursday September 15th to Saturday September 17th. Strong south to southwest winds resulted in a significant storm surge that caused water levels to rise from 8 to 13 feet above the normal high tide line, with the highest water levels observed at Golovin. This resulted in major coastal flooding and the worst flooding in nearly 50 years. Fish camps and other structures along the coast used for hunting and gathering activities were damaged or destroyed across the region. A state disaster declaration was declared for this event.

Source: NWS 2024- Storm Events Database and Storm Prediction Center Product, Chapman et al. (2004)

3.3.6.3 Location

The 2023 State of Alaska SHMP identifies coastal flooding hazard areas across the state (Figure 3-45). Wales is located in an identified coastal flooding hazard area, but not in a riverine flooding hazard area.

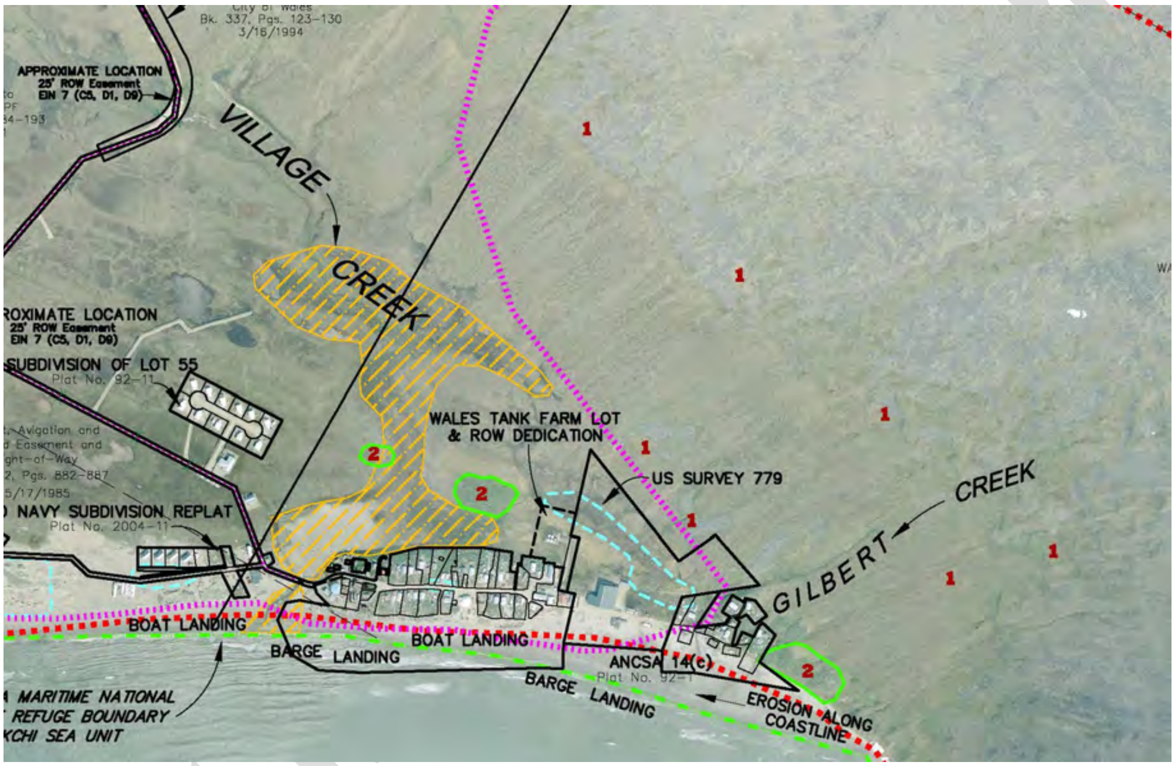
Source: DHS&EM 2023

Figure 3-45 Statewide Coastal Flooding Hazard Areas

Wales is located on the westernmost point of the American mainland, Cape Prince of Wales, on the western tip of the Seward Peninsula. The community is at the northern end of the Continental Divide where the Bering Sea and Chukchi Sea meet. Typical flood locations in Wales include storm surge along the beach in front of the community.

Wales was spared from significant damages from Typhoon Merbok as the storm came thorough the Bering Strait due to the location of the community behind the Cape Prince of Wales. This Cape protected the community from large storm surges and resulting erosion that impacted many communities in Western Alaska.

The DCRA's 2004 Wales Area Map (Figure 3-46) shows the location and extent of periodic flooding of Village Creek (in yellow).

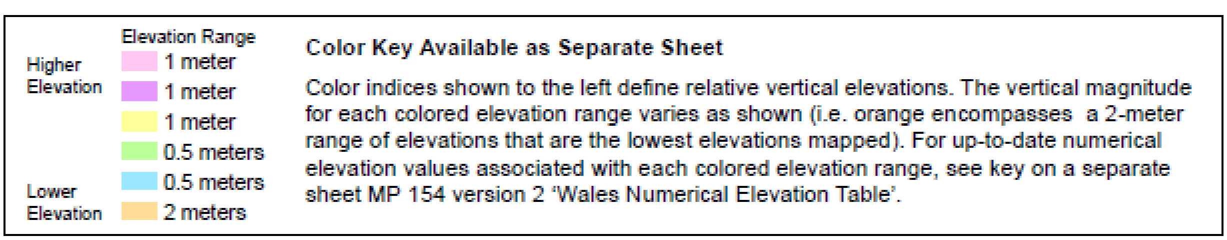


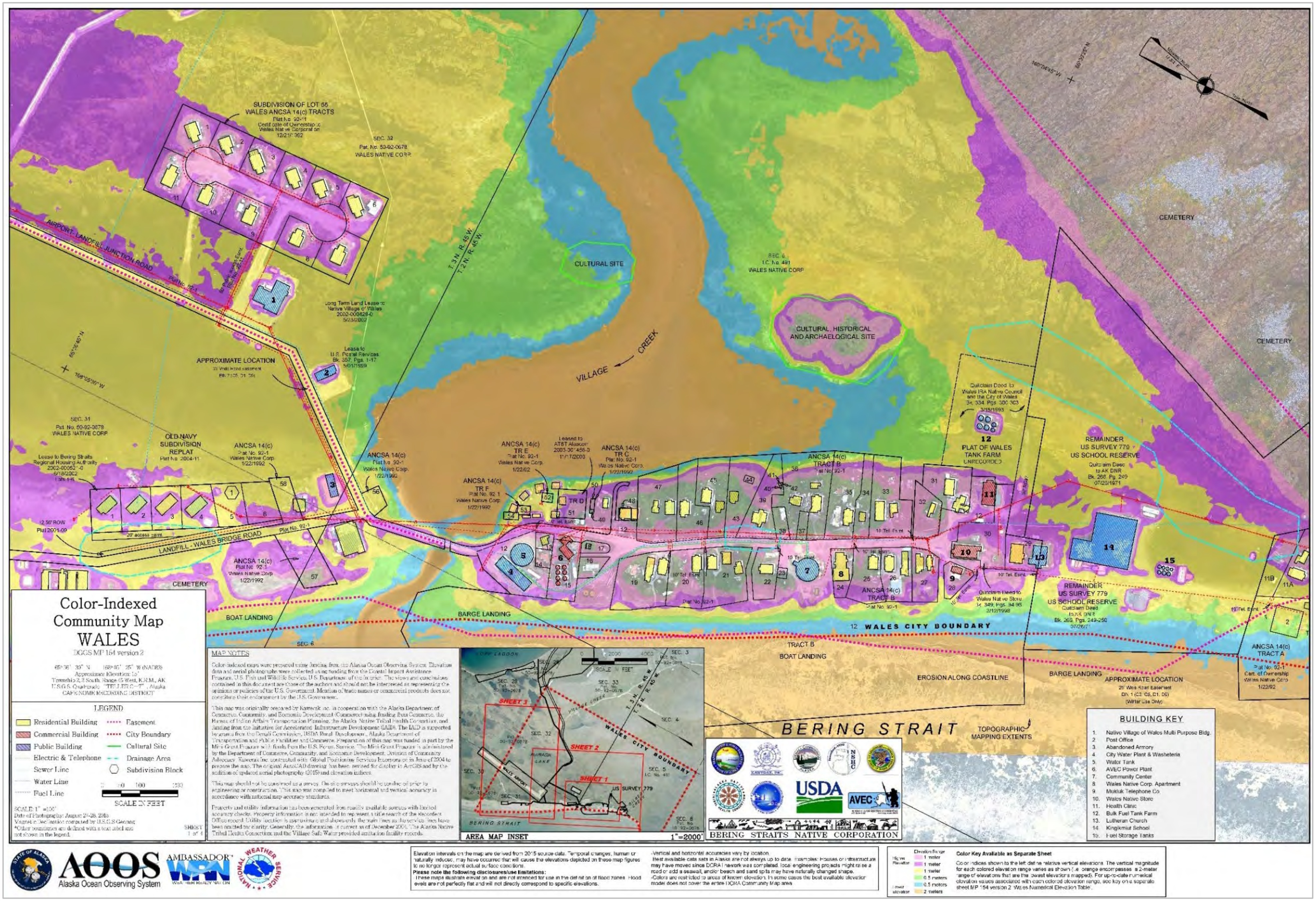
Source: DCRA 2004

Figure 3-46 Location and Extent of Flooding at Village Creek

In 2014 and 2017, DGGS released a series of color-indexed elevation maps for flood-vulnerable coastal communities in Western Alaska. These maps were not designed to function as flood inundation maps, but to serve as a temporary tool to communicate about elevations in at-risk coastal communities until true inundation mapping can be completed (Overbeck et al. 2017). The map for Wales was released in 2017, and is shown below.

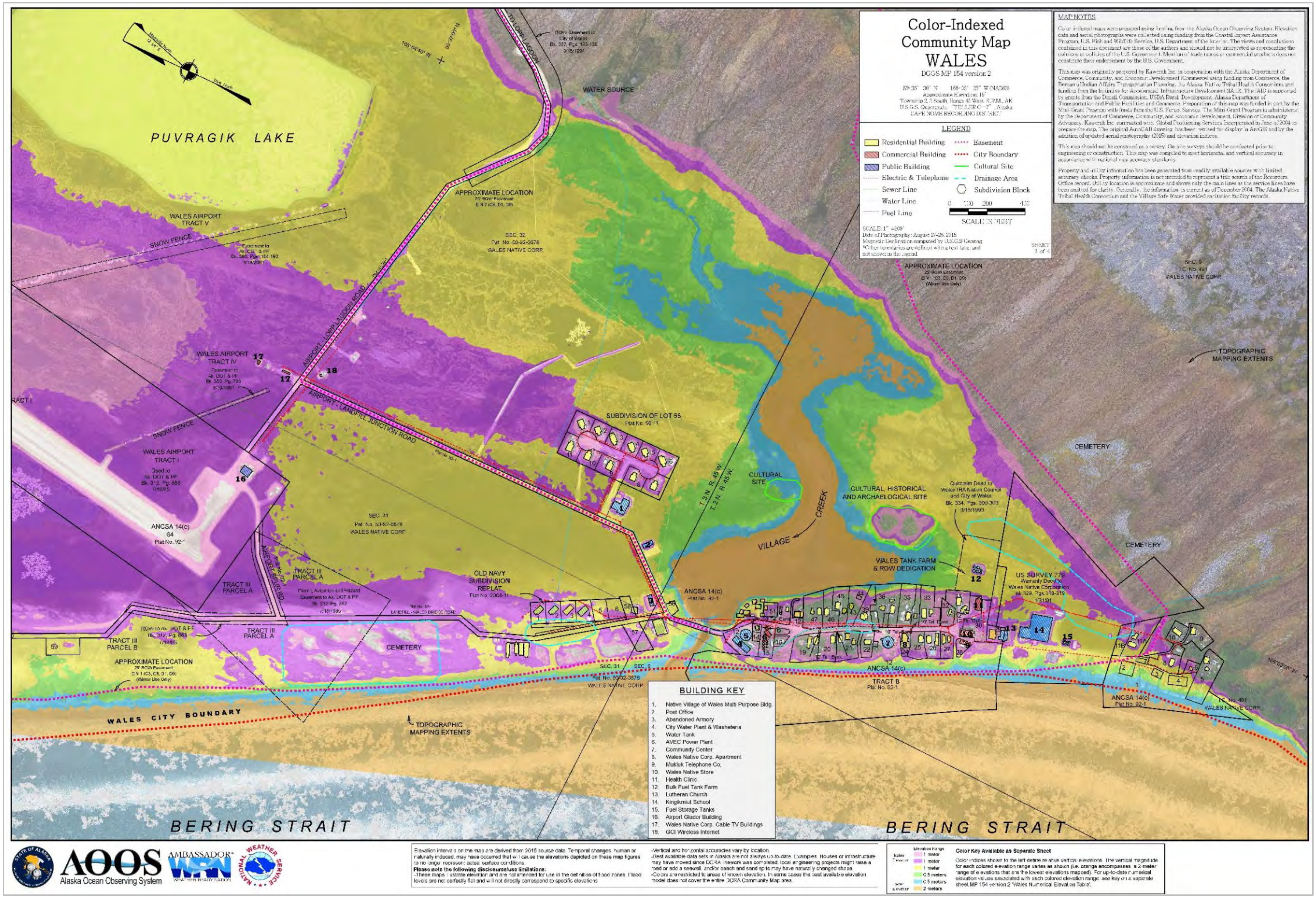
Areas in orange, blue, and green are below the modeled 1% (100-year) storm surge event.





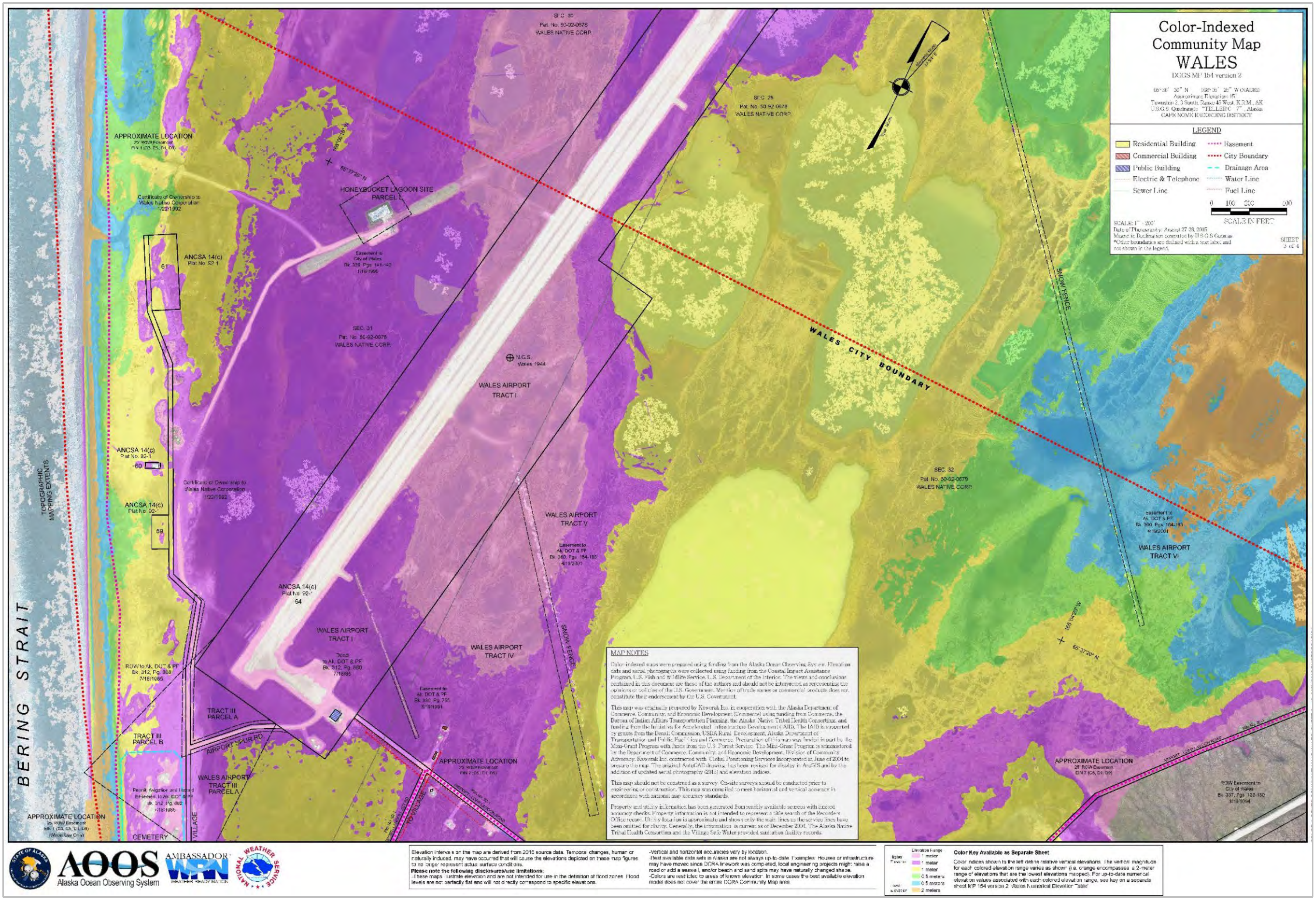
Source: Overbeck et al. (2017)

Figure 3-47 Wales Color-Indexed Elevation Map (1 of 5)



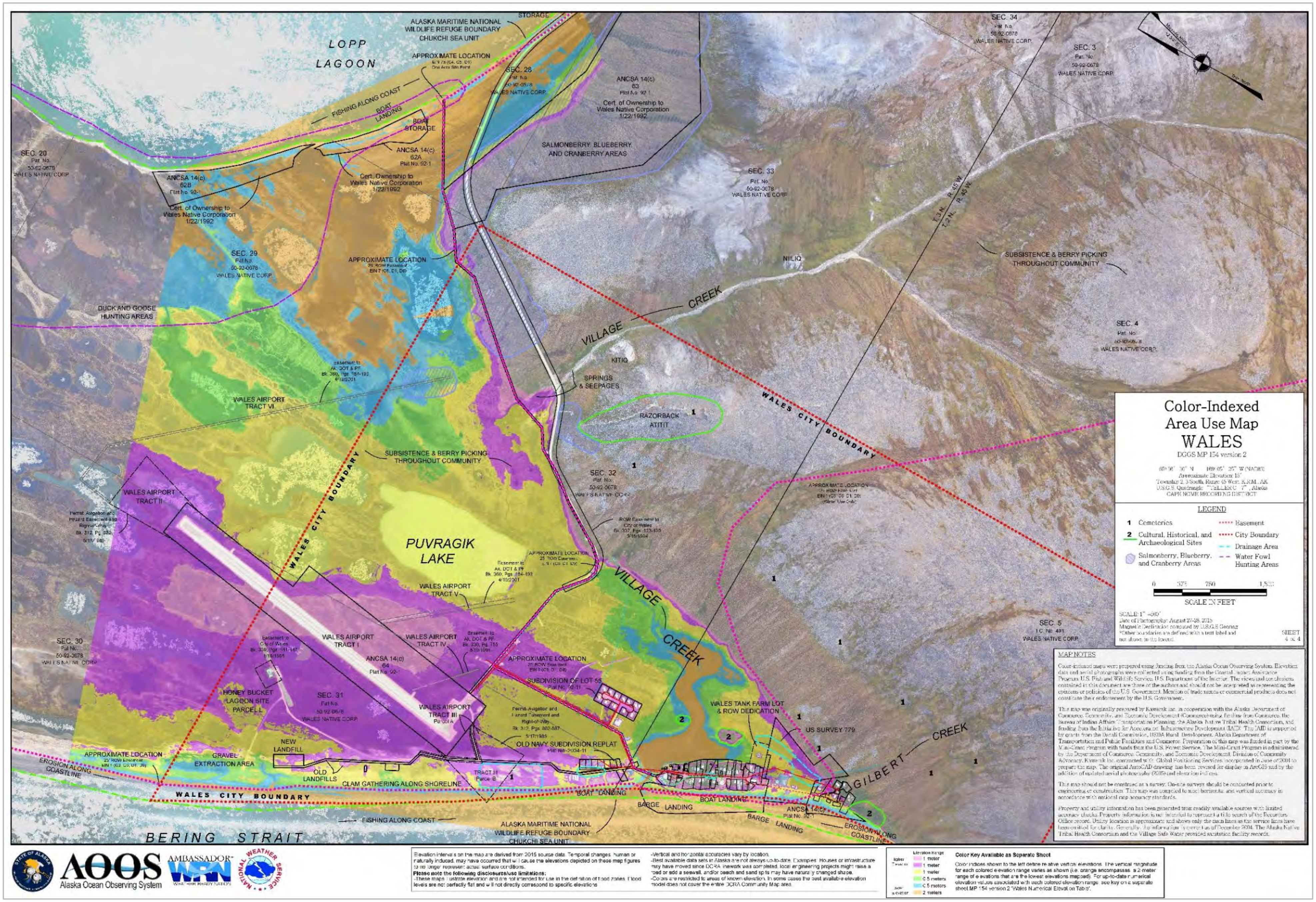
Source: Overbeck et al. (2017)

Figure 3-48 Wales Color-Indexed Elevation Map (2 of 5)



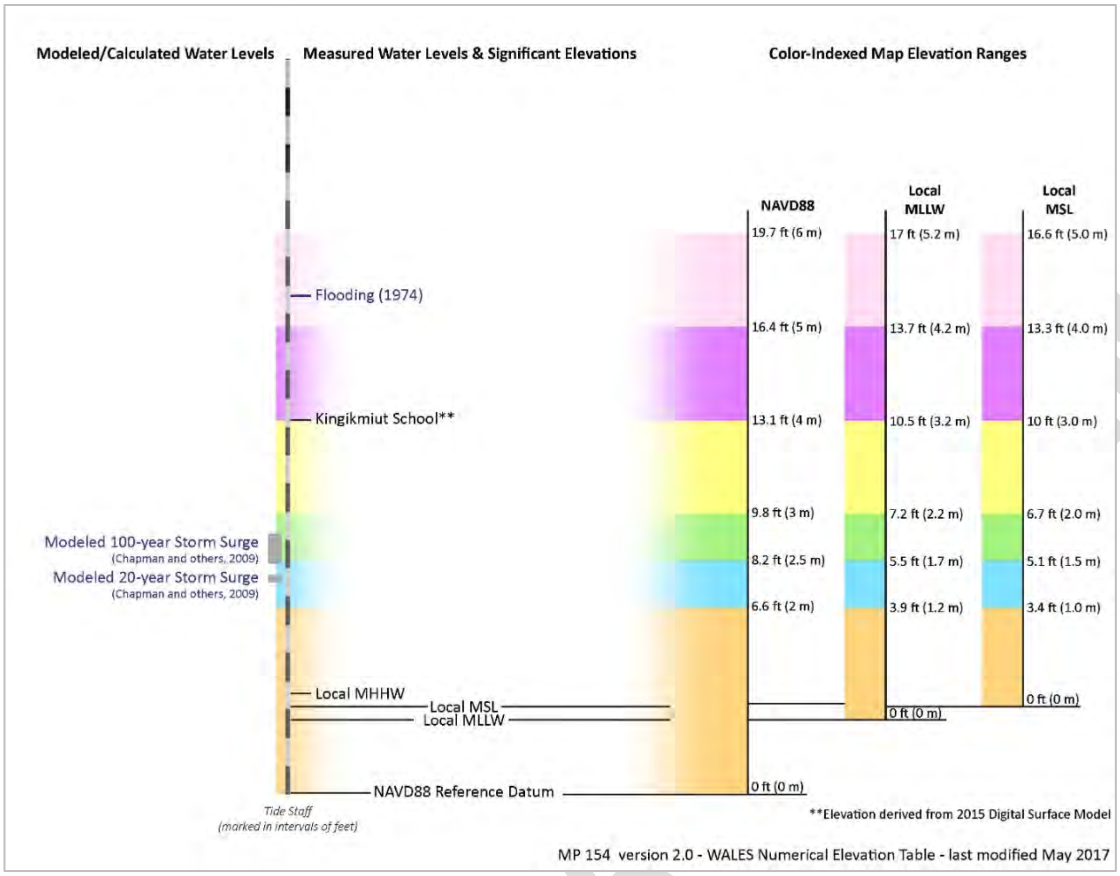
Source: Overbeck et al. (2017)

Figure 3-49 Wales Color-Indexed Elevation Map (3 of 5)



Source: Overbeck et al. (2017)

Figure 3-50 Wales Color-Indexed Elevation Map (4 of 5)



Source: Overbeck et al. (2017)

Figure 3-51 Wales Color-Indexed Elevation Map (5 of 5)

3.3.6.4 Extent (Magnitude and Severity)

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of recurrence.

The following factors contribute to coastal flooding frequency and severity:

- Time of year
- Atmospheric pressure
- Wind speed/strength
- Wind direction

The 2017 USACE Floodplain Manager's Report (USACE 2017) states:

- 1974 flood level: 14.0 MSL
- Recommended building elevation: 16.0 MSL
- The November 1974 flood level approximates the 100-year return interval storm

Harlan Legare, USACE, reviewed Howard Gray & Associates Wales Flood Hazard Area floodplain analysis and found:

"Howard Grey & Associates, memorandum of November 28, 1990, and concur that the 100-year flood plain elevation for the city of Wales is approximately at the 14-foot level. This is based strongly on the November 1974 storm. Climatological records show that this 3-day storm had sufficient time to produce significant storm surge and that it approximates a 100-year return interval event. New construction should be elevated 2 feet above the base flood elevation, if possible, because of the uncertainty of flood heights.

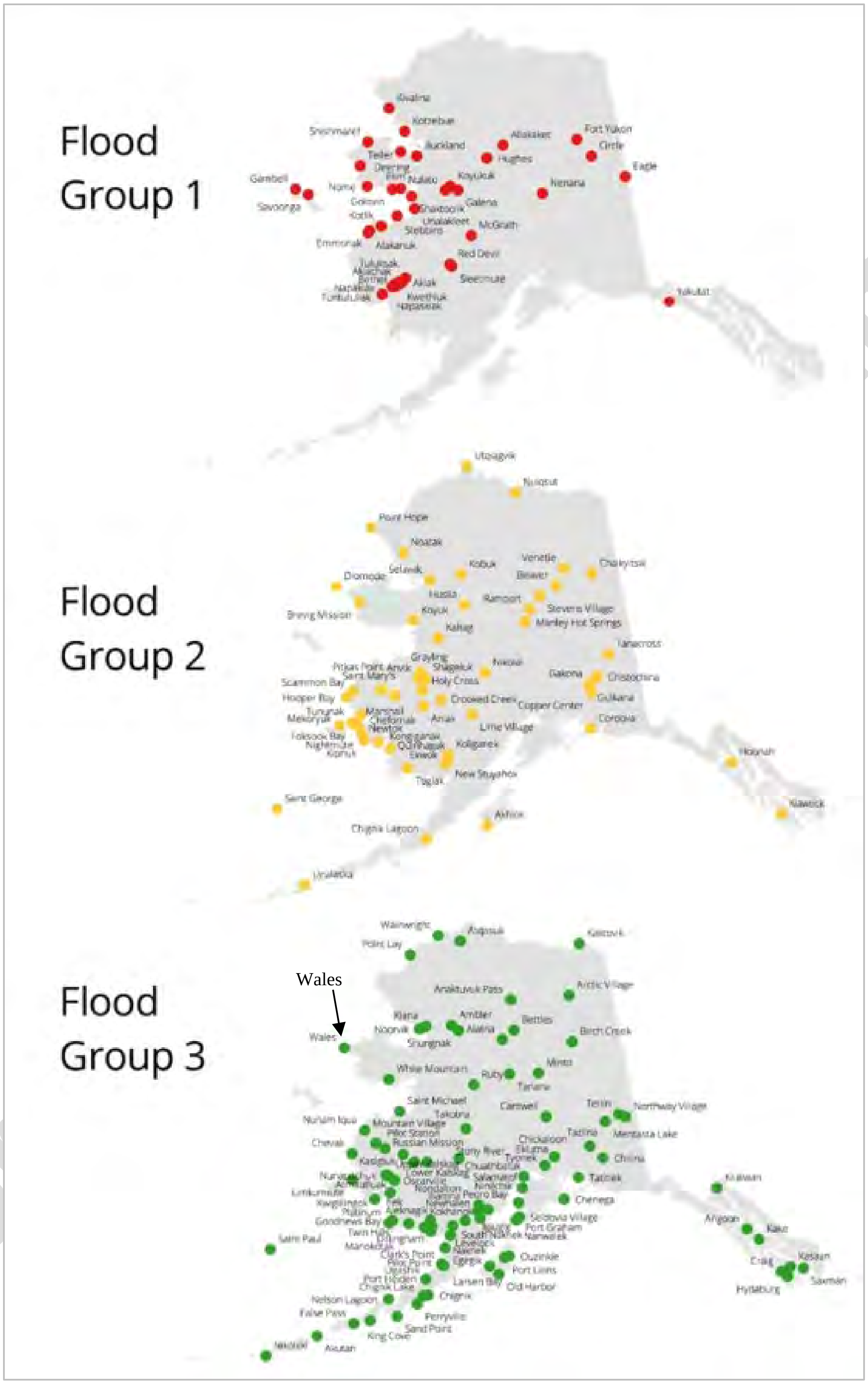
The fill used to elevate the structures should be protected from erosion, not only from possible flood flows, but also from daily foot traffic. A Corps of Engineers permit is needed if fill is to be placed in wetlands" (USACE 1992)

Figure 3-52 shows the extent of storm surge and resulting erosion in Wales on November 9, 2011.

Photo Credit: Ellen Richard

Figure 3-52 Storm Surge in Wales (November 9, 2011)

The Denali Commission 2019 Statewide Threat Assessment provides statewide risk ratings for flooding (Figure 3-53). Wales is located in Group 3, which are the communities that are least threatened by flooding. Group 3 indicated that there is no information available that indicates a threat to critical infrastructure or to the viability of a community, or there is low likelihood that a threat will detrimentally impact the community in the near term. If communities in Group 3 experience threats, they should notify officials and collect data to support understanding the impacts. The time to damage is predicted to be long for all communities in Group 3.



Source: Denali Commission 2019

Figure 3-53 Statewide Flooding Threat Risk Map

Based on past event history and the criteria identified in Table 3-2, the extent of flooding and resultant damages to people and infrastructure in Wales is considered Critical where injuries and/or illnesses could result in permanent disability, a complete shutdown of critical facilities may last for at least two weeks, and more than 25% of property would be severely damaged.

3.3.6.5 Impact

Floods may disrupt the normal function of a community by placing excessive pressure on emergency response and can bring a heavy economic burden to communities through the closure of vital infrastructure, communications, utilities, and transportation services. Additionally, floods can negatively impact subsistence activities, such as berry harvesting locations, that the community relies upon when these locations remain flooded for extended periods of time, topsoil layers become eroded, or locations become inundated with debris. This further threatens food sovereignty in the communities.

Flooding causes more deaths than any other natural hazard nationwide. Damage to infrastructure from floods may include the following:

- Floodwaters overtaking structures, causing water damage to structural elements and contents
- High-velocity flooding carrying debris and causing damage to structures, roads, bridges, culverts, and other features. Debris accumulation may create blockage to water movement and cause feature overtopping or backwater damages
- Flooding can inundate wastewater treatment plants of sewage lagoons causing the release of sewage, hazardous or toxic materials release. Storage tanks may be damaged, and pipelines severed all of which could be catastrophic to rural remote communities

Historic flood events in Wales have caused damages to roofs from high wind, ruptured fuel lines and fuel spills, damaged foundations/skirting of the school, damaged two school-owned snow machines, damaged roads, and exposed remains at the cemetery.

An excerpt from an article published in the Nome Nugget newspaper, Stanley Oxereok, the treasurer of the Native Village of Wales, provided details regarding the storm's impact in Wales:

> *"Stanley Oxereok went door to door doing damage assessments after the storm. "Everybody is OK. We had a little bit of damage, siding on a couple of houses, but nobody was hurt," he said. There was minor flooding and debris on the beach, and wind damage to a couple of houses. "That's pretty much it," he said."*

During Typhoon Merbok, the Planning Team states that in Wales, subsistence camps were damaged, the road/trails to subsistence areas were washed out, the creek became full of water but did not overflow, and debris was deposited on their beach.

3.3.6.6 Probability of Future Events

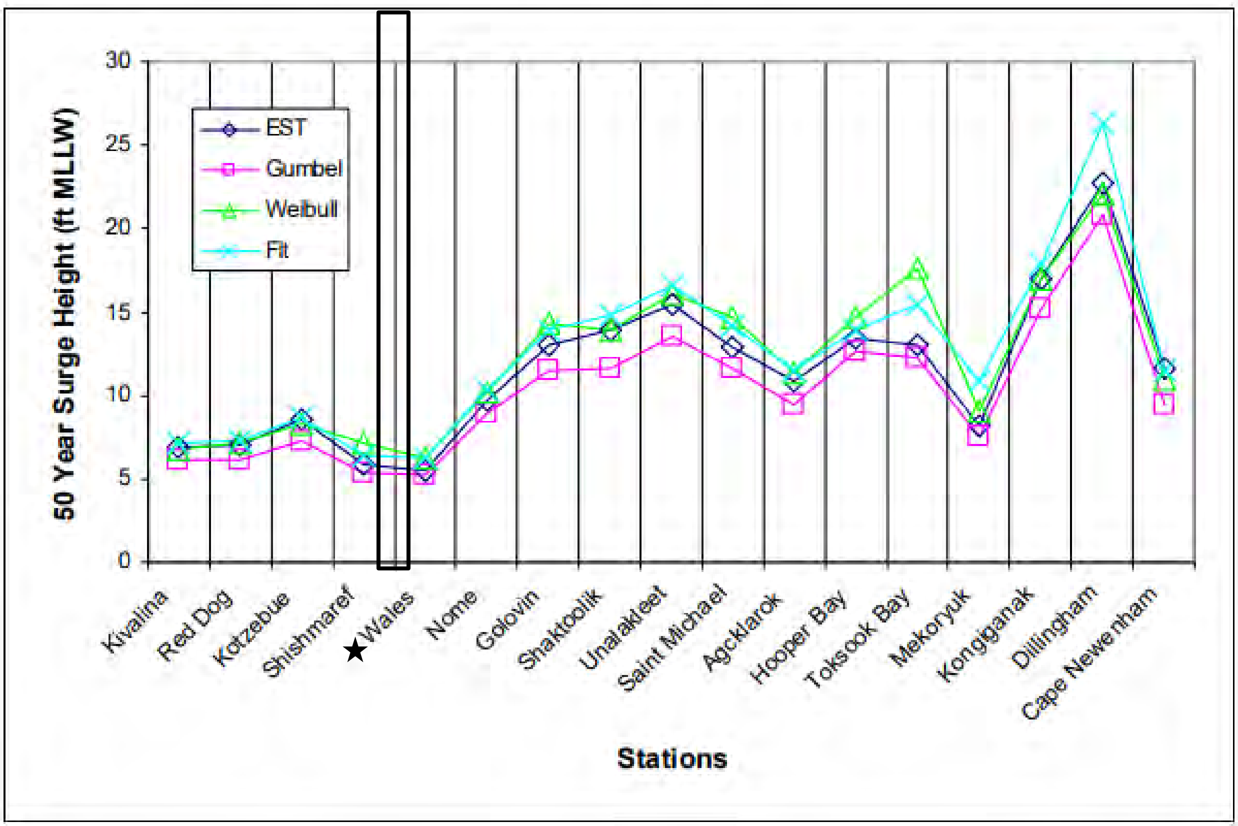
Flooding events are predictable based on seasonal Bering Sea storm patterns. Most of the annual precipitation occurs from April to October resulting in early/late summer and/or fall flooding. Ice melt occurs in the spring which may cause flooding due to runoff. These seasonal occurrences are based on rainfall and seasonal thaw patterns.

Chapman et. al (2009) ran four different models to estimate storm surge levels for different flood intervals in Wales- the results are below (Table 3-13 and Figure 3-54). Surge height is estimated in ft MLLW.

Table 3-13 Estimated Surge Level Based on Flood Frequency

	Return Interval						
Model	5 years	10 years	15 years	20 years	25 years	50 years	100 years
EST	3.63	4.48	4.84	5.04	5.14	5.53	5.96
Gumbel Distribution	4.15	4.61	--	--	5.04	5.27	5.46
Weibull Distribution	4.02	4.78	--	--	5.66	6.25	6.81
Log-Linear Fit	4.05	4.74	--	--	5.63	6.32	7.01
Average	**3.96 ft**	**4.65 ft**	**4.84 ft**	**5.04 ft**	**5.37 ft**	**5.84 ft**	**6.31 ft**

Note: The EST model assumes that future events will be statistically similar in magnitude and frequency to past events.
Source: Chapman et al. (2009)



Source: Chapman et al. (2009)

Figure 3-54 Estimated 50-year Surge Level in Wales

Based on previous occurrences and the criteria identified in Table 3-3, it is Likely that Wales will experience a flood event in the next year. There is between 50-89.9% annual probability of occurring.

3.3.6.7 Future Conditions Including Climate Change

Due to climate change, the nature or location of flooding events in Wales are not anticipated to change.

Changing Factor	Description of Future Changes due to Climate Change
Extent (Magnitude/ Severity)	Due to climate change, the extent of flooding events is expected to increase. Flooding and erosion of coastal and river areas affect over 87% of the Alaska Native communities (USGCRP 2018). A study by Melvin et al. (2016) projects that increases in floods will result in the largest climate-change related damages in Alaska. According to the States at Risk Climate Change Preparedness Report Card, Alaska's coastal floodplain is expected to expand by over 15,000 square miles, which accounts for the greatest increase of any state (States at Risk 2015). Similarly, the loss or retreat of shore-fast sea ice will expose coastlines to greater flood and erosion threat during seasonal coastal storms (USGCRP 2018). This will lead to intensified flooding events throughout the state.
Impact	As the extent of flooding is projected to increase, this will lead to a greater impact by flooding on Alaska's coastal communities, including damage to critical roadways and infrastructure, damage to homes and critical facilities, and increased loss of life. Throughout the end of the 21st century, coastal communities are projected to experience serious changes in tidal amplitudes and increased annual local sea levels, which were once 100-year events (IPCC 2019).
Probability of Future Events	Current research projects that climate change is impacting the return period and intensity of precipitation-based flooding events in arctic regions (Bachand and Walsh 2022). With increased precipitation, in addition to early ice melt and later freezing, and more severe coastal storm events, many locations in Alaska will feel the impacts of climate change. Coastal regions typically protected from storms by sea ice may begin experiencing flooding from these events. Increased precipitation throughout the state of Alaska, with higher changes north of the Brooks Range, will lead to increases in rainfall-runoff flood events as well as other flood related hazards (Lader et al. 2020).

3.3.7 TSUNAMI

3.3.7.1 Nature

A tsunami is a series of traveling waves of extremely long wavelength and period generated by a sudden vertical displacement of water. This displacement of water can be triggered by underwater volcanic eruptions, large landslides, or earthquakes at or below the ocean floor. In Alaska, seismically generated earthquakes near the subduction zone pose the primary tsunami threat to coastal communities.

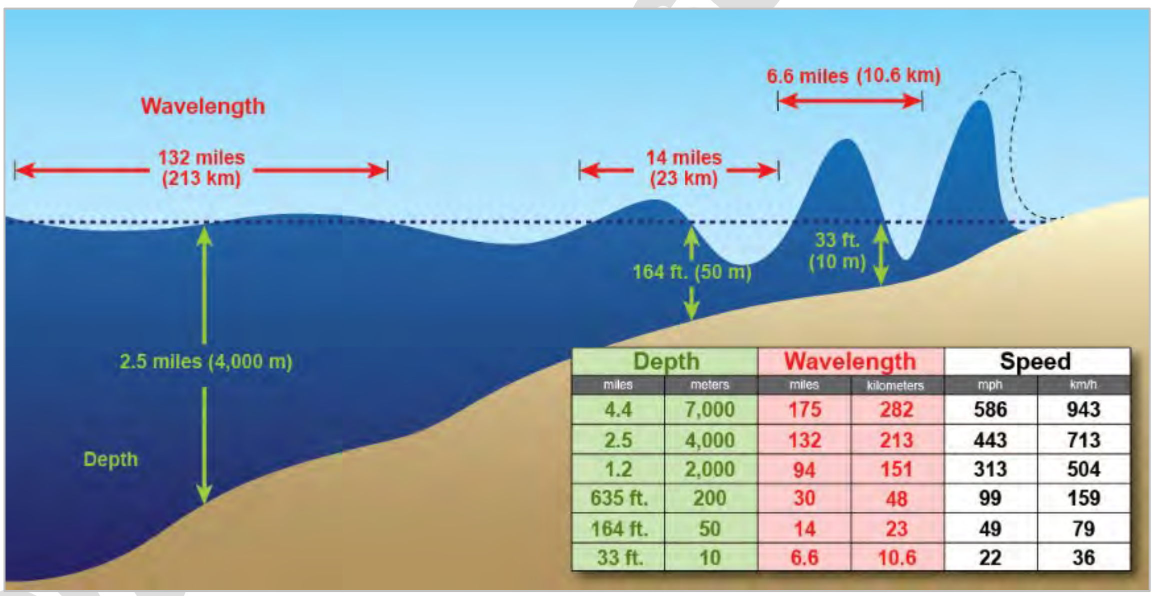
- **Seismically generated tsunamis** are generated by an earthquake event. Seismically-generated tsunamis in Alaska most commonly occur along the subduction zone in the Aleutian Islands. Earthquakes have also generated tsunamis in the back arc area in the Bering Sea and the eastern boundary of the Aleutian Arc plate. Seismically-generated tsunamis typically reach land 20 to 45 minutes after starting. Tectonic tsunamis originating in the vicinity of the Aleutian Islands, Alaska Peninsula, and the Gulf of Alaska are of particular concern to Alaskans because waves can reach coastal communities within minutes to hours after the earthquake and may require immediate evacuation.
- **Landslide generated tsunamis** can be generated by subaerial (land) or submarine (underwater) landslides. Landslides may be triggered by an earthquake and one earthquake may trigger multiple landslides and resulting tsunamis. These events are particularly dangerous because they are able to form the largest tsunami events as they possess the largest amount of kinetic energy, and they do not typically provide any warning before generating.
- **Volcanic generated tsunamis** are the least common type of tsunamis in Alaska, as only one volcanic eruption event has been confirmed in the state. In 1883, the Saint Augustine volcano triggered a tsunami when the north side of the mountain collapsed. The resulting tsunami inundated

Port Graham with waves that were 30 feet high. On January 15, 2022, a large submarine volcano in Tonga erupted, which triggered a widespread Pacific-wide tsunami. The eruption was heard throughout parts of Alaska, as far north as Fairbanks, nearly 6,000 miles away. The National Tsunami Warning Center issued a tsunami advisory for much of the Alaskan coastline, as unusual and strong currents with waves up to 3 feet were predicted. The community of King Cove recorded waves of just over 2 feet, but no significant damage was reported. The National Tsunami Warning Center stated that an evacuation warning would have been issued if waves reached 3.2 feet.

Many tsunamis are often undetected because of their long wavelengths. Some wavelengths are hundreds of miles long and only 3 feet high, and cannot be felt by mariners as it passes beneath their vessel. The wavelength of the tsunami waves and their period will depend on the generating mechanism and the dimensions of the source event. If the tsunami is generated from a large earthquake over a large area, its initial wavelength and period will be greater. If the tsunami is caused by a local landslide, both its initial wavelength and period will be shorter.

The speed that a tsunami will travel will depend on the depth of the water it is travelling through. The tsunami will travel faster in deeper water and will begin to slow down once the depth of the water decreases. In the deep ocean, they can travel at speeds over 500 mph and have the capacity to cross entire oceans in one day.

As a tsunami enters shallow waters and nears land, it begins to slow down, the wavelengths decrease, waves grow in height, and currents intensify (Figure 3-55). Once the tsunami makes landfall, its speeds slow down to 20-30 mph.



Source: NOAA 2023b

Figure 3-55 Cross Section of a Tsunami Propagation

3.3.7.2 History

Worldwide seismic activity and tsunamis have only begun being record in the early 1900s. There is a lack of record for historical tsunamis, including Alaska.

Paleotsunami studies conducted in this region demonstrate that significant tsunamis have occurred in this region in the past, and, therefore, can occur in the future (Medvedeva et al. 2023). A history of tsunamis along the Bering coast of the Kamchatka region over the past 4000 years indicates that the northern Kuril-Kamchatka Subduction Zone produces tsunamigenic earthquakes every few centuries (Medvedeva et al.

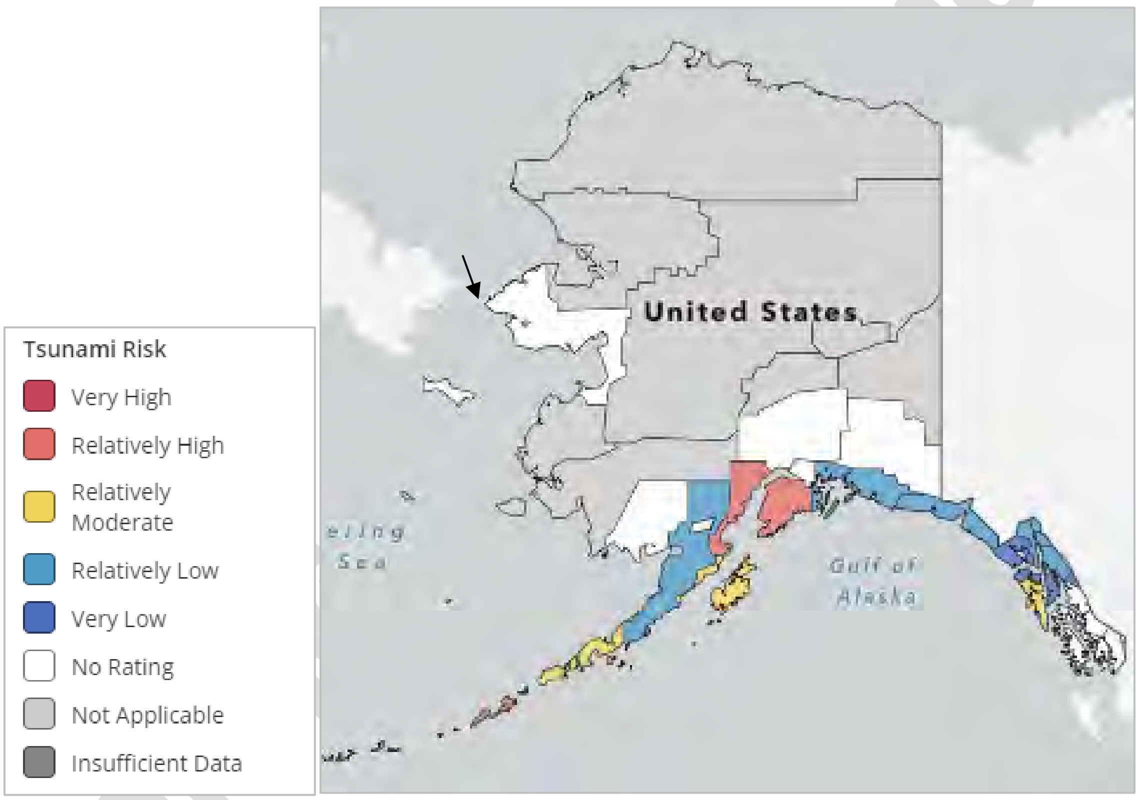
2023). Analyzing the 4500-year paleoseismic record, 12–15 tsunamis have been documented in the southwestern part of the Bering Sea (Medvedeva et al. 2023).

There has never been a tsunami observed in Wales, but members of the Planning Team recall that when they were young, they prepared for a tsunami following an earthquake and went to higher ground, but no tsunami came.

3.3.7.3 Location

Tsunami hazards for the Arctic region including the Bering and Chukchi Seas are traditionally considered as insignificant due to the low seismic activity in the region. Low population density and rare tide gauge network lead to the lack of information on tsunami hazards here (Medvedeva et al. 2023).

FEMA's National Risk Index provides the following map for the National Tsunami Risk (Figure 3-56). The tsunami risk for the Bering Strait region is labeled as having "No Rating".

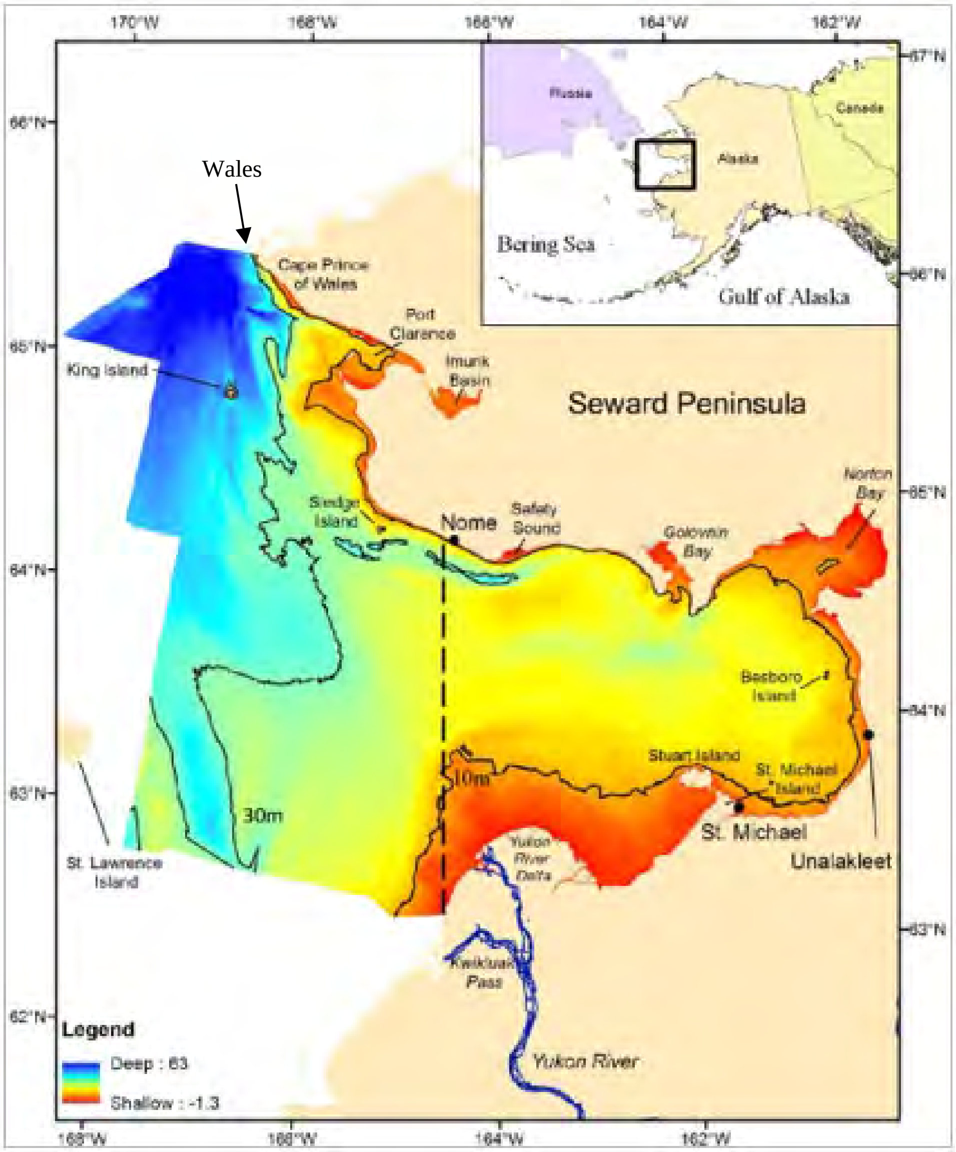


Source: FEMA National Risk Index 2024

Figure 3-56 National Tsunami Risk Map

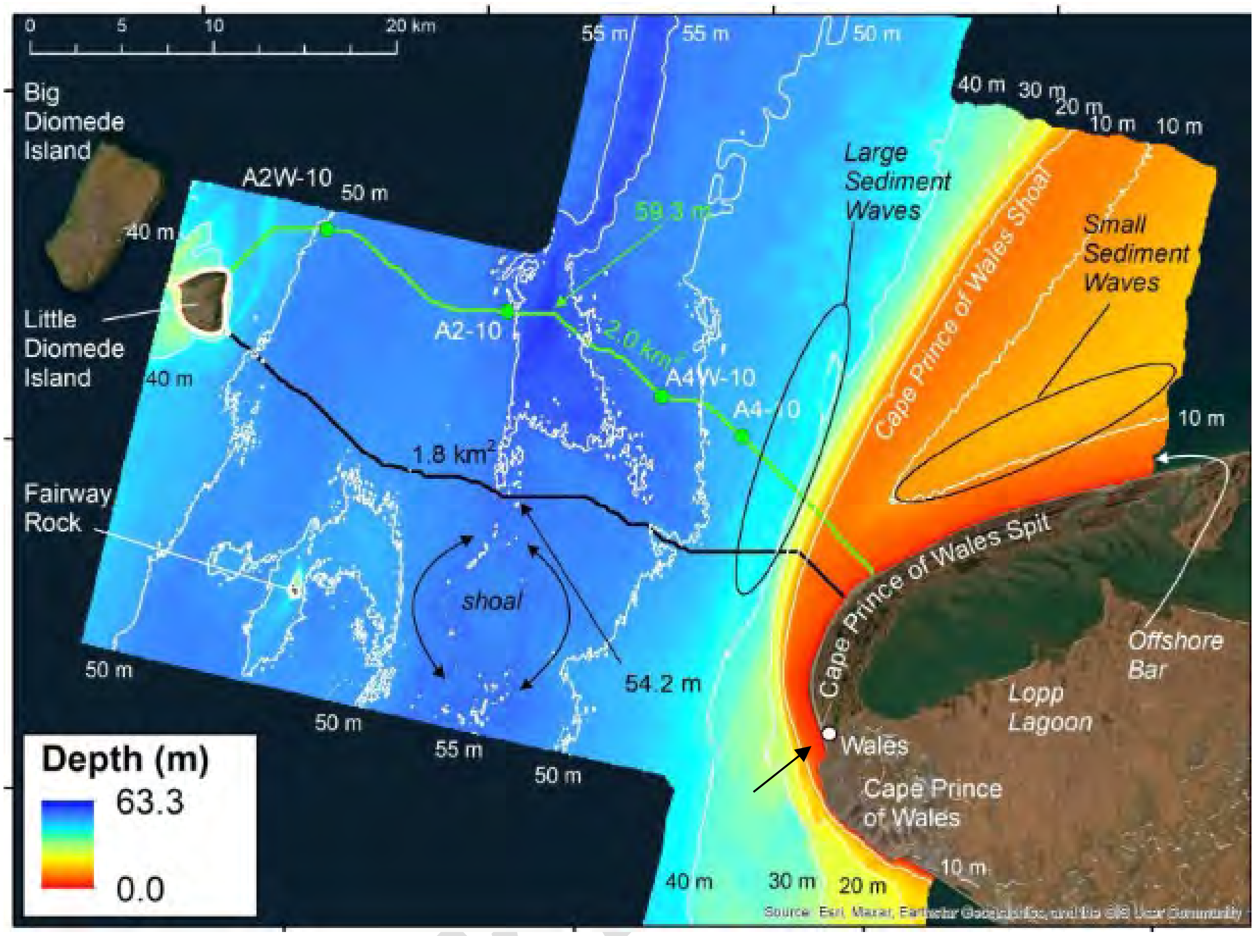
Tsunamis are not commonly reported in the Norton Sound region. This is thought to be due to the depth of the Sound and outlying Bering Sea, which may not allow for typical tsunami propagation. Compared to the average depth of the ocean, which is 12,100 feet (3,688 meters), Norton Sound is very shallow- with a maximum depth of 207 feet (63 meters) in the outer waters along the Bering Sea, while the Sound itself has an average depth of just 43 feet (13 meters) (Figure 3-57) (NOAA Fisheries 2022).

A tsunami would slow down in these shallower waters before it would enter deeper water again (north of Nome) before would reach Wales. Without inundation mapping, it is difficult to predict how a tsunami would actually propagate in this region.



Source: Prescott and Zimmermann 2015

Figure 3-57 Bathymetry of Norton Sound



Source: NOAA Fisheries 2023

Figure 3-58 Bathymetry of the Eastern Channel of the Bering Strait

3.3.7.4 Extent (Magnitude and Severity)

Using the criteria listed in Table 3-2 as well as the absence of recorded tsunami events and inundation mapping, the extent of tsunamis in Wales are considered to be Negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10% of property or critical infrastructure being severely damaged.

3.3.7.5 Impact

Potential impacts from a tsunami will vary and are dependent on many factors, but impacts range from barely detectable to completely destructive. Tsunamis have an effect on beaches once they hit the shore, and may also affect mouths of bays, tidal flats, and the shoreline of large coastal rivers. Tsunamis can diffract around islands and land masses and since they are asymmetrical, the waves may be much stronger in one direction than the other, further affecting the surrounding coastal features. Tsunamis propagate outward from their source, so coasts in the "shadow" of land masses are typically safe from the effects of the tsunami.

The Cape Prince of Wales and the shoal is shallow (Figure 3-58) and may act as a "shadow" and protect Wales from being directly hit by a tsunami.

DGGS has a library of tsunami inundation maps for many coastal communities that are threatened by tsunamis. A tsunami inundation map has not been made for Wales, nor any community along the West Coast of Alaska.

Wales has not been historically impacted by tsunamis, but without inundation mapping, the Planning Team wanted to identify it as a potential hazard.

3.3.7.6 Probability of Future Events

Based on previous occurrences and the criteria identified in Table 3-3, it is Unlikely that Wales will experience a tsunami event in the next ten years; there is a 1 in 10 years chance of occurring (1/10=10%); and the history of events is less than or equal to 10% likely per year.

The Planning Team states that they are concerned with future potential tsunamis that may impact Wales as they do not have inundation mapping and do not know the potential of a tsunami in Wales. The Planning Team expressed concerns that a tsunami would be devasting to the community.

3.3.7.7 Future Conditions Including Climate Change

Changing Factor	Description of Future Changes Due to Climate Change
Extent (Magnitude/Severity)	Sea level rise will affect water tables near coastlines and potentially lead to heightened tsunami inundation hazards (Dura et al. 2021).
Impact	Sea level rise due to climate change could significantly influence tsunami disasters as the sea level is a critical parameter affecting the intensity of tsunamis (Alhamid et al. 2022).
Probability	Due to climate change, impacts on melting permafrost and the projected increased frequency of rockslides and landslides from increased precipitation, the probability of future tsunami events as a result of these hazards may increase. Climate change is not anticipated to influence the probability of future earthquake-induced tsunamis.

3.3.8 EROSION

3.3.8.1 Nature

Erosion is defined as the wearing away of the ground surface as a result of the movement of wind, water, or ice. Erosion is a gradual process, but it can occur rapidly as the result of storms, floods, permafrost degradation, or another event. The effects from erosion can be seen over time as the result of long-term environmental changes such as melting permafrost.

Erosion poses a threat to communities where disappearing land threatens infrastructure and development. Wales is threatened by coastal erosion from strong Bering Sea storms.

Coastal erosion

Coastal erosion is described as the wearing or washing away of coastal lands. Coastal erosion occurs over the area near the top of the bluff out into the near-shore region to about the water depth of 30 feet. Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Bluff recession is the most visible aspect of coastal erosion because of the dramatic change it causes to the landscape. As a result, this aspect of coastal erosion usually receives the most attention from the community.

Coastal erosion can occur from rapid, short-term, daily, seasonal, or annual natural events such as wind, waves, storm surge, coastal storms, and/or flooding. Human activities such as boat wakes and dredging may also play a factor. The most intense erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions.

Coastal erosion may also be attributed to multi-year impacts and long-term climatic change. These impacts may include sea-level rise, subsidence, lack of sediment supply, or long-term human factors such as the construction of shore protection structures and dams, or aquifer depletion.

Groins, jetties, seawalls, or revetments are human attempts to control shoreline erosion. As a result, these structures may actually lead to increased erosion on the opposite side of the structure.

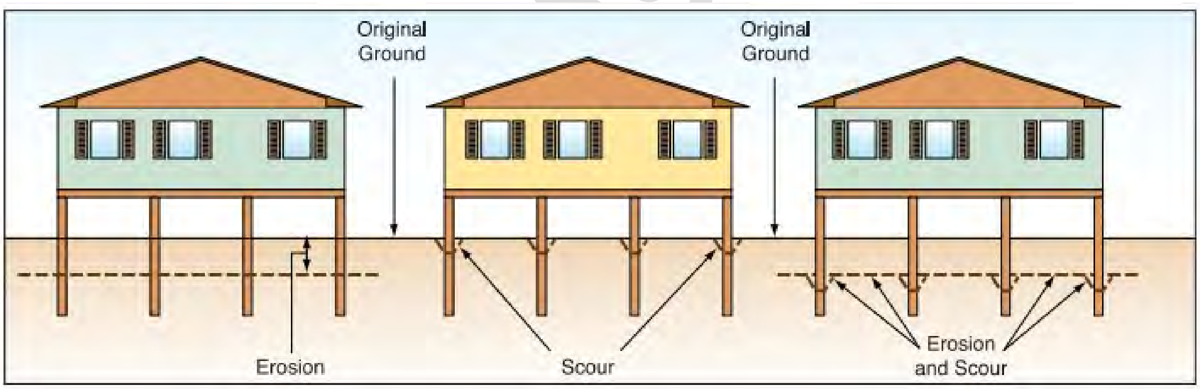
Damage from coastal erosion is typically a gradual event. However, significant storm events can cause the Earth beneath infrastructure and homes to weaken. In extreme but not unheard-of cases, homes built near the coast have fallen into the sea due to eroded cliffs.

Coastal scour

Scour occurs when floodwater passes around obstructions in the water column. As the water flows around an object, it must change direction and accelerate. Soil can be loosened and suspended by this process or by waves striking the object, and be carried away.

Scour effects are generally localized, ranging from small to large shallow conical depressions in the sand around individual structures. Effects from scour increase with increasing flow velocity and turbulence, and with increasing soil erodibility.

Figure 3-59 shows the differences between coastal erosion and scour. A building may be subject to either or both, depending on the building location.



Source: FEMA 2009- Erosion, Scour, and Foundation Design

Figure 3-59 Distinguishing Between Coastal Erosion and Scour

A combination of natural and human-induced factors influences the erosion process in Wales. For example, shoreline orientation and exposure to prevailing winds, open ocean swells and waves all influence erosion rates. These can be altered by human development by the addition of jetties, groins, and seawalls/revetments. Beach composition also influences erosion rates. A beach comprised of primarily large rocks and boulders is more resistant to erosion compared to a beach comprised of silt and sand. Other factors that may influence coastal erosion include:

- Geomorphology
- Nature of coastal topography
- Embankment or shoreline type
- Embankment and shoreline exposure to wind and waves
- Structure types along the shoreline

- Proximity to erosion-inducing structures
- High hazard zone encroachment
- Development density
- Elevation of river embankment; or coastal dunes and bluff

3.3.8.2 History

The USACE completed an erosion assessment for Wales during their 2009 Alaska Baseline Erosion Assessment. The Erosion Information Paper dated October 15, 2007, states:

> *A major coastal erosion event, reported to be the worst in the last 20 years, occurred during 2004. In this event, a strong storm from the Bering Sea brought high tides and winds causing flooding and erosion in 3 areas. Each area was approximately 20 feet in length and along a 6-foot-high shore bluff. The erosion caused by the 2004 storm left the* (old) *washeteria and* (now demolished) *city "Dome" buildings less than 100 feet from the active erosion area.*
>
> *Major floods in the area occurred in 1933 and 1969, although no water was reported to have entered the community. A 1974 storm caused minimal damage. A 1984 report prepared by the State of Alaska Department of Transportation and Public Facilities noted no significant erosion problems.*

The Planning Team shared that they have noticed changes in their beach due to erosion. They used to be able to play on the beach but now it is too gravely. They also shared that planes used to be able to land on the beach but now it is not wide enough for a plane to safely land on it.

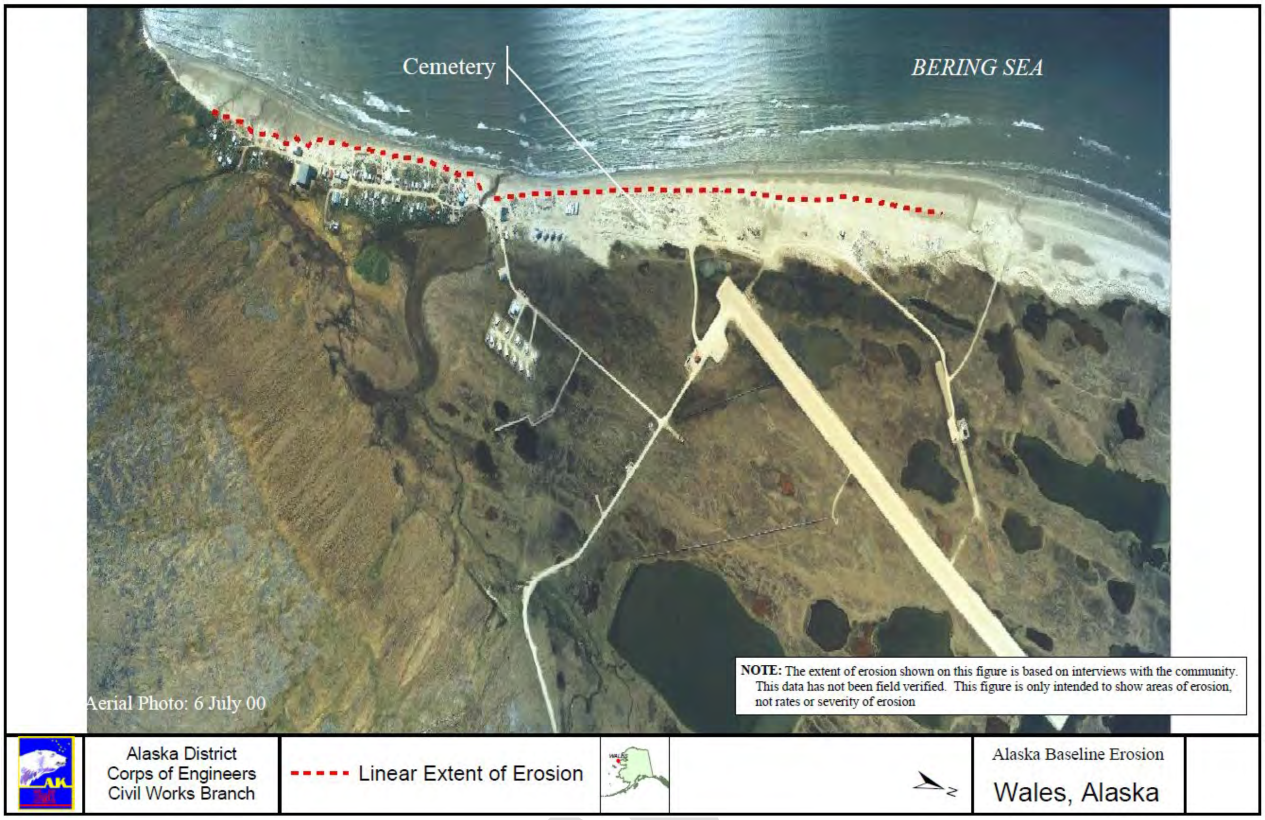
3.3.8.3 Location

In Wales, erosion occurs along the Bering Sea shoreline (Figure 3-60 and Figure 3-61) (USACE 2007). Strong storms, high tides, wind and waves, and flooding are causes of and factors contributing to erosion.

The Planning Team shared that the school, old church, clinic, washeteria, teacher housing, 4 homes, the cemetery, and subsistence trails are threatened by erosion in Wales. The cemetery is built on a sand dune and during the 1918 Influenza Pandemic, many residents died and were buried in a mass grave. Caskets have begun to be exposed due to erosion.

3.3.8.4 Extent (Magnitude and Severity)

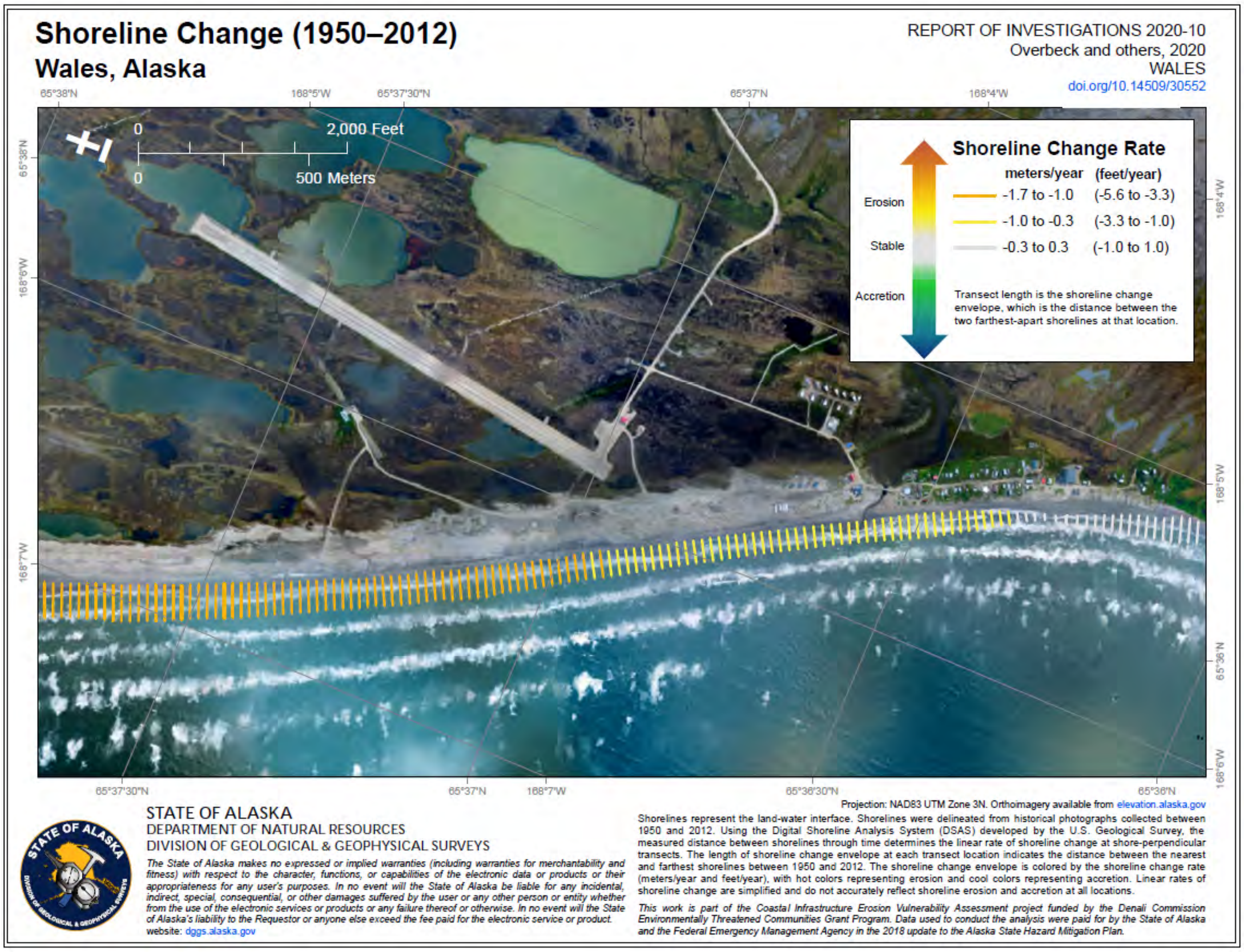
The linear extent of erosion in Wales is shown below. These areas were identified by members of the community. The map is intended to show areas of erosion in Wales and does not provide rates or severity of erosion (USACE 2007).



Source: USACE 2007

Figure 3-60 Linear Extent of Erosion in Wales (2007)

In 2020, DGGS published long-term shoreline change maps for 48 Alaska communities. In western Alaska, shoreline change was calculated by evaluating historical and recent aerial imagery of the communities (Overbeck et. al 2020). Shoreline change in Wales from 1950-2012 is shown in Figure 3-61, and the maximum rate of erosion during that time period is estimated at **-5.6 feet per year** (ft/yr) with an uncertainty of +/-0.3 ft/yr.



Source: Overbeck et al. 2020- Shoreline change at Alaska coastal communities

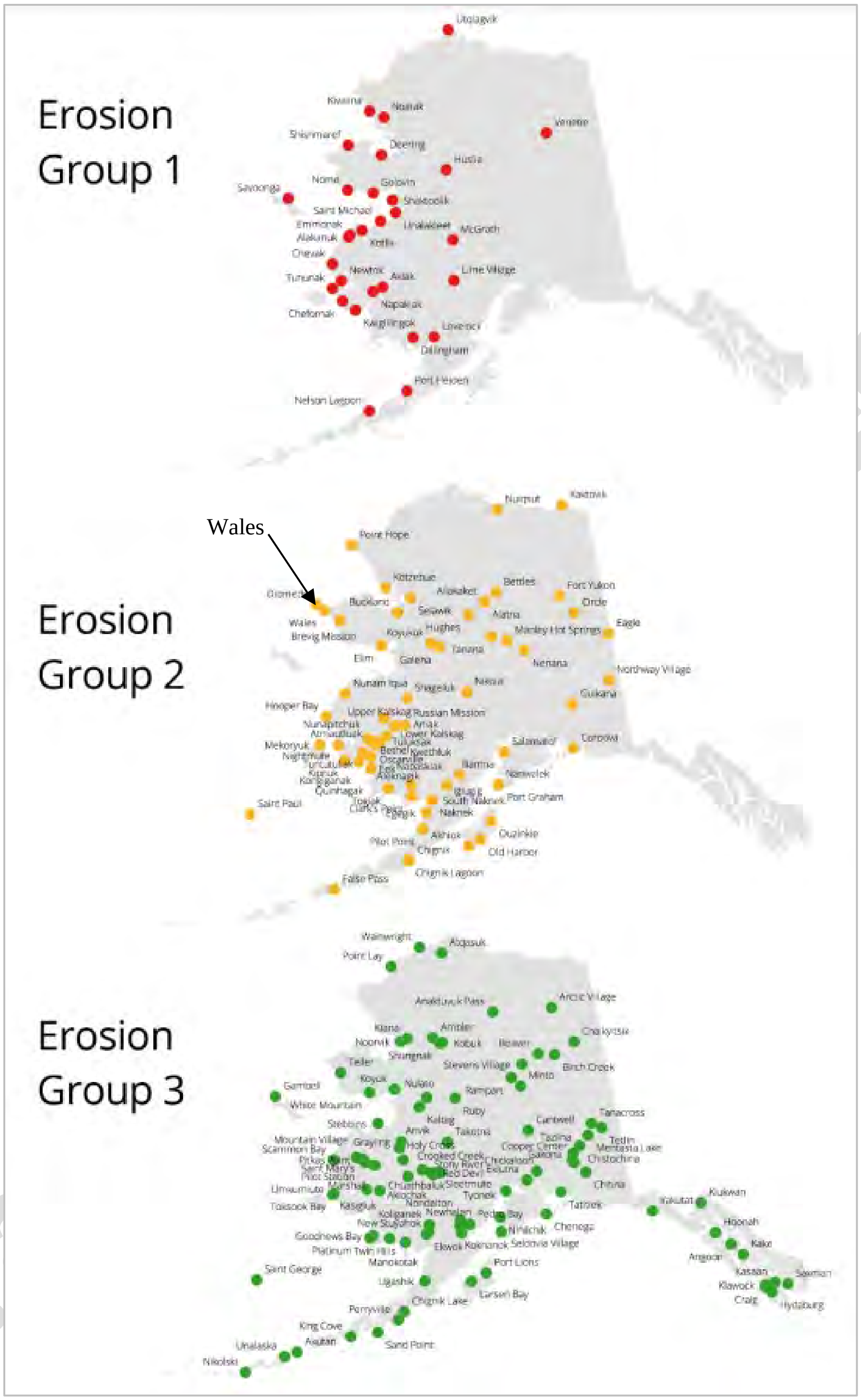
Figure 3-61 Shoreline Change in Wales (1950-2012)

A subsequent report by DGGS in 2021 (Erosion Exposure Assessment- Wales) summarizes the extent of erosion in Wales (Buzard et al. 2021). The report states:

> *Wales is located on the western tip of the Seward Peninsula, between the Bering Strait and the Chukchi Sea. The community is constructed on vegetated and non-vegetated sand dunes. Erosion in Wales occurs in the form of scouring during high water events such as storm surge that redistribute sand across the beach and dunes (U.S. Army Corps of Engineers [USACE], 2007).*
>
> *This coastal erosion process is non-linear because dunes can recover after storm events; sand transported to the nearshore during a storm is redistributed to the beach, and vegetation grows back. Dune and beach erosion disturb the land surface and can damage or undercut structures. Wales is exposed to erosion that may undermine infrastructure in the following 60 years, but we cannot forecast beach and dune erosion in Wales using the method by Buzard et al. (2021) because the model depends on linear erosion of a clearly identified shoreline. The shorelines delineated from aerial imagery show erosion could be up to 5.6 feet per year, but there is great uncertainty because the shorelines are not easy to identify due to wave action (Overbeck et al. 2020).*
>
> *Beach erosion and storm damage can be monitored with repeat beach elevation measurements using GPS or digital elevation models. DGGS extracted elevation profiles from a 2004 lidar*

> *digital elevation model at transects along the beach. DGGS also conducted GPS surveys in 2012 and 2015 along the same transects. At least three storms impacted Wales during this time: October 2004, September 2005, and November 2011 (USACE, 2009; Kawerak, 2012). Continued monitoring and a longer record of beach elevation can help identify whether and when infrastructure may become exposed to erosion.*

The Denali Commission 2019 Statewide Threat Assessment provides statewide risk ratings for erosion (Figure 3-62). Wales is located in Group 2, which are the communities that are moderately threatened by erosion. Group 2 indicates that the threat (erosion) is not expected to detrimentally impact critical infrastructure in the near term, but the community is still vulnerable to the threat. Damages resulting from a moderate flood or compounding erosion could impact operability for a limited period but would not impact the community's sustainability. An extreme event may cause damages like those described as the impact of a moderate event in Group 1. More research and data collection should be conducted to better understand the threat posed to the community. Note that a community can have a time factor of long or mid-term to be included in Group 2, depending on the severity of damage to critical infrastructure expected if an event occurs (Denali Commission 2019).



Source: Denali Commission 2019

Figure 3-62 Statewide Erosion Threat Risk Map

Based past erosion events, shoreline change mapping, the 2019 Denali Commission Statewide Threat Assessment, and the criteria identified in Table 3-2, the magnitude and severity of erosion impacts in Wales are considered Critical where injuries and/or illnesses could result in permanent disability, a complete shutdown of critical facilities may last for at least two weeks, and more than 25% of property would be severely damaged.

3.3.8.5 Impact

Impacts from erosion can range in severity and include loss of land and potentially any infrastructure built on the land. Other impacts include damage to public utilities (fuel headers and electric and water/wastewater utilities), loss of the Native aquatic habitats, high sediment loads reducing water quality, and economic impacts associated with the costs of trying to mitigate the impacts from erosion.

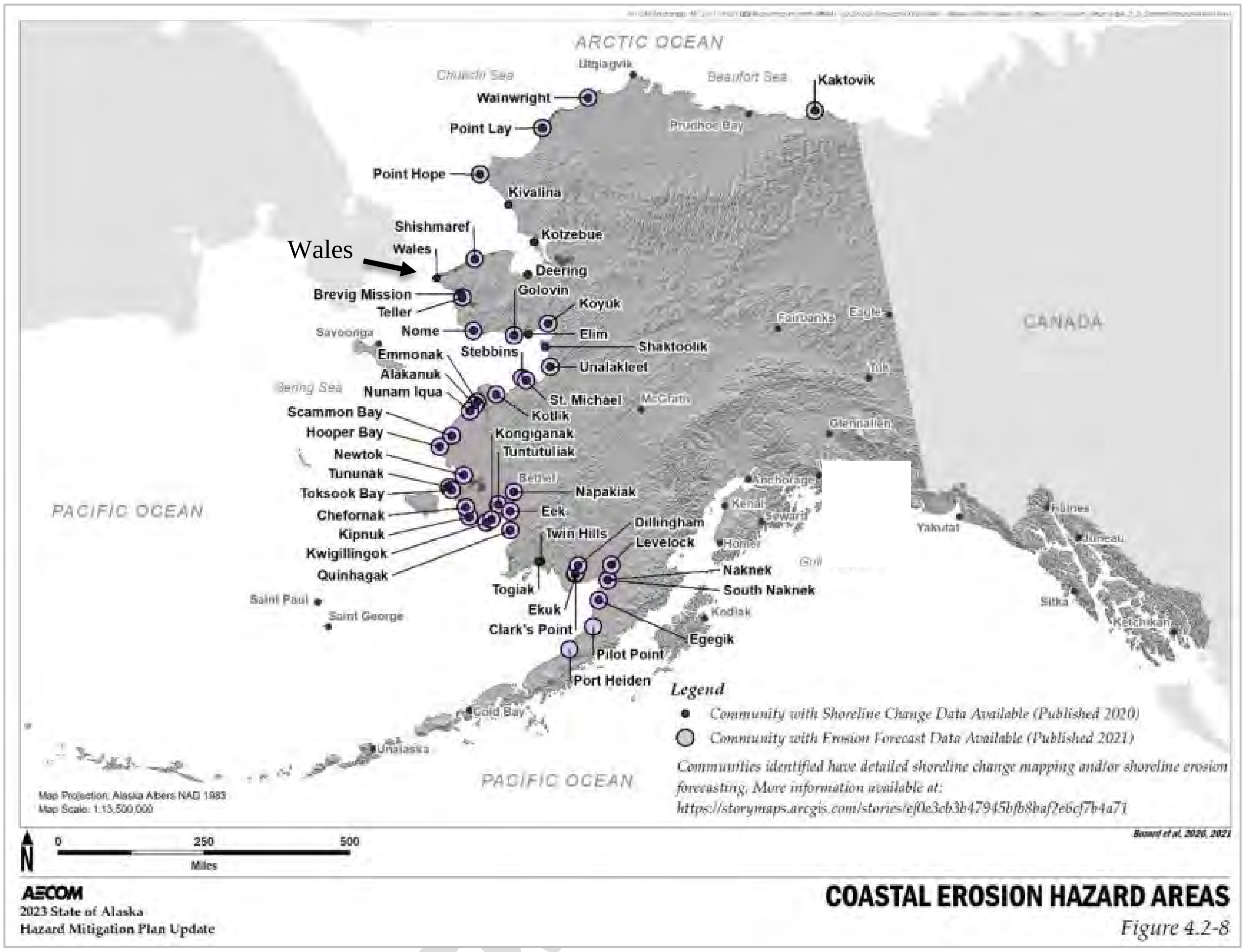
The 2007 USACE Erosion Assessment describes potential damages from erosion in Wales:

> *The cemetery, sewer lines, and septic leach fields (see Figure 3-60) are community buildings and associated improvements near the coast considered to be at risk from coastal erosion during strong storms. The community, except for a few buildings on the hillside is within the 100-year floodplain. There is at least one home at risk now built on the sand dune on the beach at about 50 feet or less from the coast. The homeowners have put out sandbags to help slow the erosion from their home.*
>
> *No protective measures have been installed to reduce erosion damage. Identified at-risk facilities have been considered for repair or relocation. The survey respondent stated that Federal Emergency Management Agency estimated costs for repairs at present levels of damage to be about $1,300 for fuel tanks, $ 3,500 for the cemetery, $4,200 for the washeteria leach field, and $4,100 for the city dome leach field.*
>
> Note: The estimates listed above are from 2007 and may be no longer accurate. The city dome was demolished in 2017.

The Planning Team shared that many facilities in Wales have been impacted by erosion including the school, old church, clinic, washeteria, teacher housing, 4 homes, the cemetery, and subsistence trails.

3.3.8.6 Probability of Future Events

The 2023 State of Alaska SHMP identifies coastal erosion hazard areas across the state. Wales is located in an identified coastal erosion hazard area.



Source: DHS&EM 2023

Figure 3-63 Statewide Coastal Erosion Hazard Areas

Based on the 2007 USACE baseline erosion assessment, historical impacts, erosion shoreline change report and the criteria identified in Table 3-3, it is Likely that Wales will experience erosion in the next year. There is between 50-89.9% annual probability of occurring.

3.3.8.7 Future Conditions Including Climate Change

Climate change is not anticipated to influence the nature of future erosion events in Wales.

Changing Factor due to Climate Change	Description of Future Changes due to Climate Change
Location	As the extent of erosion increases, new facilities may be impacted that are not currently impacted by erosion.
Extent (Magnitude/Severity)	Increased severity and magnitude of winter storms, loss of coastal sea ice, sea level rise, and increased precipitation are already increasing the severity and magnitude of erosion events in Alaska, and the trend is expected to continue. This will lead to increased damage to infrastructure, especially in Alaska's coastal villages (Larsen et al. 2008).

Changing Factor due to Climate Change	Description of Future Changes due to Climate Change
Impact	The primary climatic forces affecting erosion are changes in temperature, water levels, precipitation, vegetation loss/changes, and storms. All of these factors are anticipated to be affected by climate change, which will result in increased localized impacts from erosion in Alaska.
Probability of Future Events	Increased precipitation, increased frequency and intensity of winter storms, and sea level rise are all expected to continue, which will continue to increase erosion events in Alaska (Larsen et al. 2008).

3.3.9 LANDSLIDE

3.3.9.1 Nature

Ground failure is a blanket term used to describe any ground movement mechanisms including avalanche, landslide, subsidence, and unstable soils gravitational or other soil movement. Soil movement may be caused by activities such as rain, snow, and/or water saturation induced avalanches or landslides. Seismic activity, melting permafrost, river or coastal embankment undercutting, or in combination with steep slope conditions are also conditions for soil movement.

Landslides are a dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may also be triggered or exacerbated by indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

Additionally, avalanches and landslides often occur secondary to other natural hazard events, thereby exacerbating conditions, such as:

- Earthquake ground movement can trigger events ranging from rock falls and topples to massive slides.
- Intense or prolonged precipitation can cause slope over-saturation and subsequent destabilization failures such as avalanches and landslides.
- Climate change-related drought conditions may increase wildfire conditions where a wildland fire consumes essential stabilizing vegetation from hillsides significantly increasing runoff and ground failure potential.

The USGS identifies six landslide types, distinguished by material type and movement mechanism including:

1. **Slides**, the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; a *translational slide* originates from movement along a flat surface.
2. **Debris Flows** arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslides on a steep slope, and then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than

35 miles per hour (mph) for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.

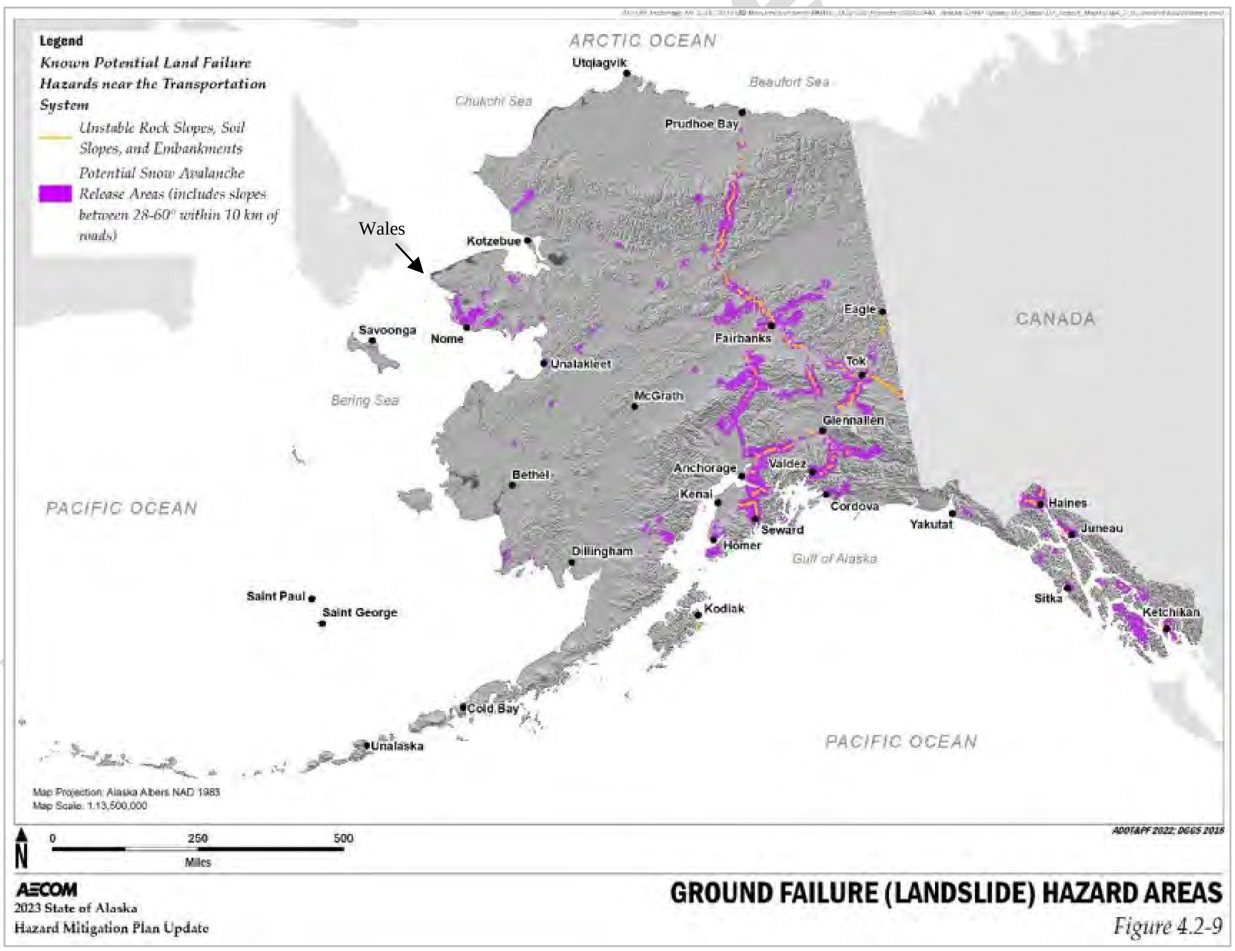
3. **Lateral Spreads** are a type of landslide generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
4. **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
5. **Topples** are rocks and boulders that rotate forward and may become falls.
6. **Complex** is any combination of landslide types.

3.3.9.2 History

There has not been a landslide documented in Wales, however, the Planning Team states that an avalanche on Cape Mountain resulted in a fatality in the early 1900s.

3.3.9.3 Location

The 2023 State of Alaska SHMP identifies land failure hazard locations across the state (Figure 3-64). These hazard areas are defined by any slopes between 28-60º within 10km of roads. Wales is located in a potential snow avalanche release and landslide area.



Source: DHS&EM 2023

Figure 3-64 Landslide Hazard Areas in Alaska

One of Wales' most notable landmarks is Razorback Mountain, which gently bends to 2,297-foot-high Cape Mountain that dives into the Bering Strait (Figure 3-65). At the base of the mountain, the sea laps at a giant slab of granite shaped like an axe blade. Cape Mountain has a geology comprised of granites and fine-grained porphyries.

Photo Credit: Christian Graham

Figure 3-65 Razorback Mountain in Wales

3.3.9.4 Extent (Magnitude and Severity)

Damage from landslides ranges from minor with minimal repairs required to a massive economic impact with the possible destruction of critical community infrastructure such as transportation or critical structures.

Based on the lack of landslide history and the criteria identified in Table 3-2, the extent of ground failure and resultant damages to people and infrastructure in Wales is considered to be Negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10% of property or critical infrastructure being severely damaged.

3.3.9.5 Impact

Impacts associated with landslides include surface subsidence, infrastructure, building, and/or road damage. Subsidence in bluffs may cause the ground to become less stable, potentially increasing the probability and impact of landsides.

3.3.9.6 Probability of Future Events

Based on previous occurrences and the criteria identified in Table 3-3, it is Possible that Wales will experience a landslide event in the next year. There is between 10-49.9% annual probability of occurring.

3.3.9.7 Future Conditions Including Climate Change

Climate change is not anticipated to impact the nature of future landslides in Wales.

Changing Factor due to Climate Change	Description of Future Changes due to Climate Change
Location	Landslides are projected to occur in areas where there is no history of previous events due to the destabilization of mountain slopes from thawing permafrost (IPCC 2019).
Extent (Magnitude and Severity)	Landslides are expected to increase in magnitude with increased areas of effect as permafrost thaws (IPCC 2019).
Impact	Landslides are projected to occur in areas where there is no history of previous events due to the destabilization of mountain slopes from thawing permafrost (IPCC 2019), which could increase future impacts to Wales.
Probability of Future Events	An increase in storms and rainfall as well as destabilization of mountain slopes is anticipated to support an increase in landslides.

3.4 SUMMARY OF VULNERABILITY

This section outlines the risk and vulnerability processes from various hazard impacts in determining potential losses for the community.

This section addresses the remaining portion of Element B of the Tribal and Local Mitigation Plans regulation checklists.

Regulation Checklist- 44 CFR § 201.7 Tribal Mitigation Plans
ELEMENT B. Hazard Identification and Risk Assessment
B3. Does the plan include a description of each identified hazard's impact, as well as an overall summary of the vulnerability of the tribal planning area? [44 CFR § 201.7(c)(2)(ii)]
Source: FEMA 2017 (Tribal)

Regulation Checklist- 44 CFR § 201.6 Local Mitigation Plans
ELEMENT B. Risk Assessment
B2. Does the plan include a summary of the jurisdiction's vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods? (Requirement 44 CFR § 201.6(c)(2)(ii)) B2-a. Does the plan provide an overall summary of each jurisdiction's vulnerability to the identified hazards? B2-b. For each participating jurisdiction, does the plan describe the potential impacts of each of the identified hazards on each participating jurisdiction? B2-c. Does the plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods?
Source: FEMA 2022 (Local)

3.4.1 OVERVIEW

A vulnerability analysis estimates the exposure extent that may result from a hazard event, within a given area and with a given intensity. This analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures. This then allows the communities to focus their efforts and attention on areas with the greatest risk of damage.

The Native Village and City of Wales are located in the same geographic area and thus experience the same vulnerability to hazards.

Table 3-14 shows the overview of the Native Village and City of Wales' hazard vulnerability.

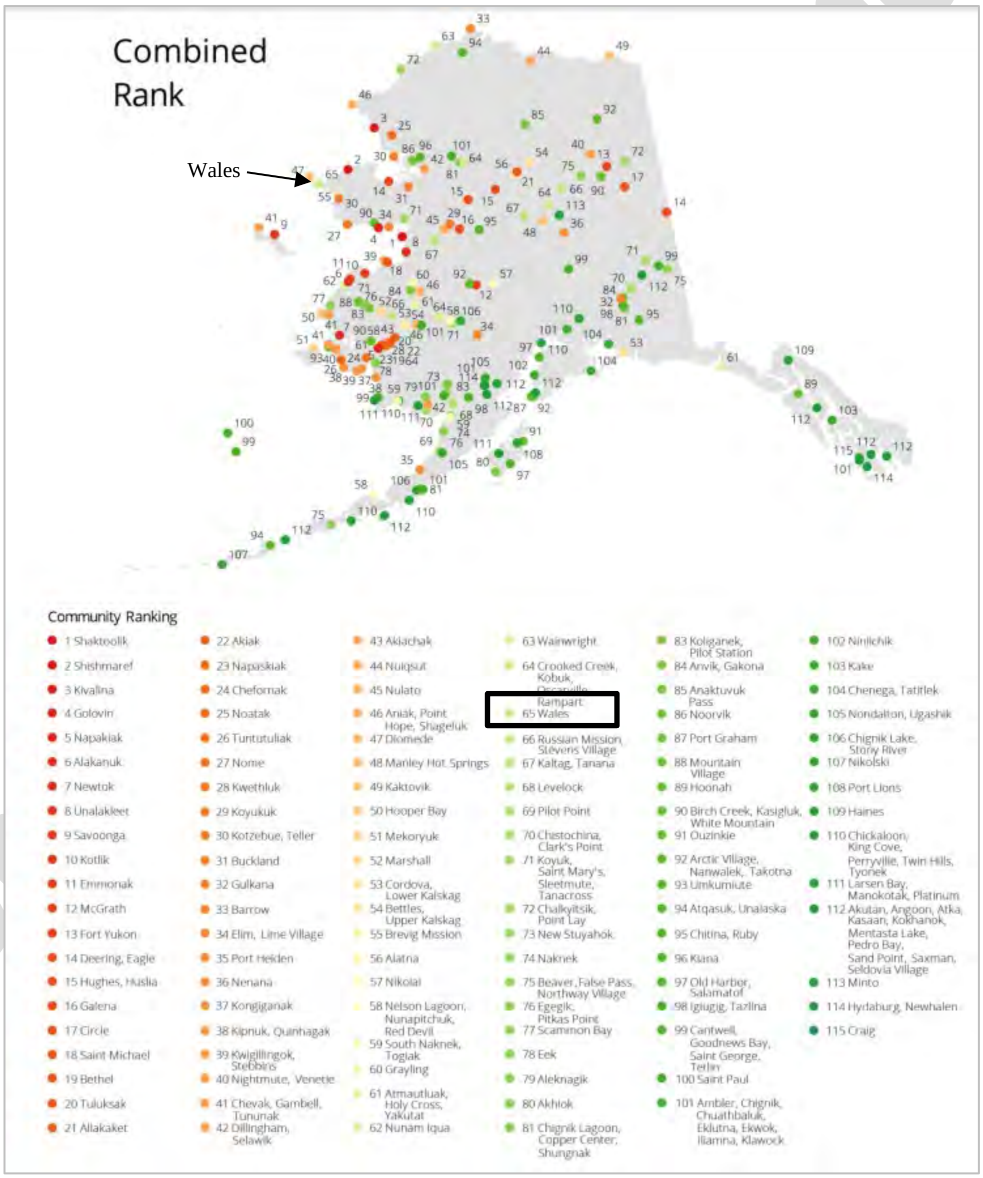
Table 3-14 Vulnerability Overview

Hazard	Area's Hazard Vulnerability			
	% of Jurisdiction's Geographic Area	% of Population	% of Residences	% of Critical Facilities
Earthquake	100	100	100	100
Severe Weather	100	100	100	100
Wildland/Tundra Fire	100	100	100	100
Changes in the Cryosphere	100	100	100	100
Naturally Occurring Uranium	100	100	100	100
Flood	30	10	10	25
Tsunami	30	10	10	25

Table 3-14 Vulnerability Overview

Hazard	Area's Hazard Vulnerability			
	% of Jurisdiction's Geographic Area	% of Population	% of Residences	% of Critical Facilities
Erosion	10	0	0	0
Landslide	5	0	0	0

The 2019 Denali Commission 2019 Statewide Threat Assessment provides a map of the combined threat for the 187 rural communities evaluated in the study (Figure 3-66). The communities with the greatest combined threat are dark red while the communities with the lowest combined threat are shown in dark green. The color gradient shown in the legend depicts the relative ranking of all communities. Overall, Wales ranked 65 out of 115 (yellow-green).



Source: Denali Commission 2019

Figure 3-66 Statewide Combined Threat Risk Map

3.4.2 CULTURAL AND SACRED SITE SENSITIVITY

Anyone desiring information concerning their respective culturally sensitive information must contact the Tribal office for assistance.

3.4.3 POPULATION AND BUILDING STOCK

Population data for Wales was obtained from the DCRA's 2022 certified population data.

Estimated replacement values for residential building structures were obtained from the 2021 US Census, which estimated the median home value per structure was $75,000. Replacement costs in Alaska typically exceed US Census structure estimates due to material purchasing, barge or airplane delivery, and construction in Alaska, therefore, residential replacement values are generally understated.

The United States Department of Housing and Urban Development (HUD) estimates an average 3-bedroom residential structure in Wales has a replacement value of $724,888 (HUD 2022). The more conservative HUD approximation for replacement value was used for this analysis. A total of 99 housing units were considered in this analysis.

Table 3-15 Estimated Population and Building Inventory

Population	Residential Buildings	
DCCED 2020 Data	**Total Housing Units (2021 Census data)**	**Total Value of Buildings***
168	99	US Census: $7,425,000 HUD: **$71,763,912** (used for analysis)

Sources: US Census 2021- Wales city population data, DCRA 2024, HUD 2022.

*The 2021 US Census estimates median house value at $75,000. However, the United States Department of Housing and Urban Development (HUD) determined that the average structural replacement value of a 3-bedroom residential building in Wales is $724,888 per structure.

3.4.4 VULNERABILITY ASSESSMENT METHODOLOGY

To complete this analysis, the Planning Team, along with Fairweather Science, used the 2004 DCRA community profile as the basis for critical facilities in Wales. The Planning Team provided information on newly constructed facilities and these critical facilities were then mapped in relation to a potential hazard's threat exposure and vulnerability.

Hazard	Methodology
Earthquake Severe Weather Wildland/ Tundra Fire	It is assumed that the entire Planning Area is threatened by earthquakes, severe weather, and wildland/tundra fires. DGGS's Quaternary Fault and Folds Database was used to determine which faults are near the Villages and an earthquake risk map (Figure 3-10) was used to determine the potential PGA and resultant damages/intensity in Wales.
Changes in the Cryosphere	Permafrost hazard areas were determined by using a permafrost zones layer on ArcGIS. Any facilities with underlying permafrost were labeled as threatened by thawing permafrost.
	Sea ice hazards are not anticipated to cause infrastructure damage. Impacts from the decrease in sea ice extent is discussed with impacts to subsistence and food sovereignty.
	Snow avalanche hazard areas were determined by the Planning Team and through historical event locations.

Hazard	Methodology
Naturally Occurring Uranium	Uranium hazard areas were determined through DEC's Drinking Water Program reports. Uranium exposure is a public health concern, but is not anticipated to cause infrastructure damage.
Flood	At the time of this Risk Assessment, Wales does not have a Flood Insurance Study to identify the 1% percent (100-year) annual chance of flood. Critical facilities threatened by flooding were determined by the Planning Team, historically flooded locations/facilities, and agency reports.
Tsunami	At the time of this Risk Assessment, Wales does not have tsunami inundation mapping. The same methodology used to determine flood hazard areas was used to estimate potential damages from a tsunami until formal inundation mapping is completed.
Erosion	Erosion hazard areas were determined by the Planning Team, agency reports (DGGS, USACE), and other scientific studies.
Landslide	Landslide hazard areas were determined by the Planning Team as well as historical landslides in Alaska DOT's historical landslide inventory (none were documented in Wales).

An analysis was conducted to assess the risks of each identified hazard. This analysis looked at the potential effects of each hazard on values of critical facilities at risk without considering the probability or level of damage. The analysis also represents the number of people at risk from each hazard but does not estimate the number of potential injuries or deaths.

3.4.5 DATA LIMITATIONS

The provided vulnerability estimates use the best data currently available, and the methodologies used result in a risk approximation. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inevitable in any loss estimation. This is due in part from incomplete scientific knowledge or data concerning hazards and their effects on the built environment. As well as the use of approximations and simplifications, when necessary, for a comprehensive analysis.

It should be noted that the results from the quantitative vulnerability assessment are limited to the exposure of people, buildings, and critical facilities and infrastructure to the identified hazards. It was beyond the scope of this MJHMP to develop a more detailed or comprehensive assessment of risk. A more comprehensive assessment may include loss of facility/system function, annualized losses, people injured or killed, shelter requirements, and/or economic losses. Such impacts may be addressed with future updates of this MJHMP or other planning documents.

3.4.6 ASSET INVENTORY

Assets that may be affected by hazard events include population, residential buildings, and critical facilities and infrastructure.

A critical facility is defined as a facility that provides essential products and services to the public. Critical facilities assist in preserving the quality of life in Wales and fulfilling important public safety, emergency response, and disaster recovery functions.

The critical facilities profiled in this plan include the following:

- Government facilities
- Emergency response services
- Educational facilities
- Medical facilities
- Roads and bridges
- Transportation facilities
- Utilities
- Community facilities

Critical facilities and infrastructure in Wales are listed in Table 3-16.

Table 3-16 Critical Facilities and Infrastructure in Wales

							Hazards Vulnerable to			
	# of Occupants	Facility Name	Address/ Lat/Long	Facility Type	Facility Owner	Facility Value	Earthquake, Severe Weather, Wildfire, Cryosphere[1]	Flood, Tsunami	Erosion	Landslide
Government	7	Tribal Office	65°36'38"N 168°05'23"W	W2	NVOW	$500,000	x			
Government	2	City Office	65°36'32"N 168°05'28"W	W2	COW	$500,000	x			
Government	1	Post Office	65°36'38"N 168°05'22"W	W2	Gov't	$250,000	x			
Government	6	Wales Native Corporation Office	65°36'24"N 168°05'18"W	W2	WNC	$750,000	x	x		
Emergency Response	0	Fire Dept- Code Red	65°36'41"N 168°05'18"W	N/A	COW	$75,000	x			
Education	42	Kingikmiut School	65°36'18"N 168°05'09"W	W2	BSSD	$17,000,000	x	x	x	
Medical	1	Toby A. Health Clinic	65°36'21"N 168°05'10"W	W2	NSHC	$1,500,000	x	x	x	
Medical	5	New Clinic	65°36'42"N 168°05'20"W	W2	NSHC	$3,000,000	x			
Roads/ Bridges	0	15.5 miles of road				$9,100,000	x			
Roads/ Bridges	0	Village Creek Bridge	65°36'34"N 168°05'29"W		COW	$50,000	x			
Transportation	0	Wales Airport	65°37'22"N 168°05'42"W	Airport	DOT	$17,000,000	x			
Transportation	1	Airport Maintenance Shop	65°36'59"N 168°05'37"W	W2	DOT	$1,758,077	x			
Transportation	0	Lopp Lagoon Boat Launch	65°37'35"N 168°02'25"W	N/A	COW	$750,000	x			
Utilities	0	Groundwater Wells 1 & 2	65°36'56"N 168°04'26"W	N/A	COW	$120,000	x			x
Utilities	0	500-gallon water storage	65°36'31"N 168°05'27"W	PWTS	COW	$85,000	x			
Utilities	0	BSSD water storage tanks	65°36'16"N 168°05'10"W	PWTS	BSSD	$500,000	x	x		
Utilities	0	Septic Systems x2	65°36'14"N 168°05'05"W	WWTS	COW	$225,000	x			
Utilities	0	Landfill (Class 3 9932-BA001)	65°37'12"N 168°06'18"W	N/A	COW	$25,000	x	x		
Utilities	0	Wales Tank Farm	65°36'22"N 168°05'06"W	PWTS	COW	$1,000,000	x			
Utilities	0	Power Plant	65°36'30"N 168°05'26"W	EPPS	AVEC	$800,000	x			
Utilities	0	Windmills (non-operable)	65°36'57"N 168°05'13"W	EPPS	KEA	$800,000	x			
Utilities	0	AT&T Alascom	65°36'57"N 168°05'18"W	CBO	AT&T	$500,000	x			
Utilities	0	GCI	65°36'58"N 168°05'22"W	CBO	GCI	$250,000	x			

							Hazards Vulnerable to			
	# of Occupants	Facility Name	Address/ Lat/Long	Facility Type	Facility Owner	Facility Value	Earthquake, Severe Weather, Wildfire, Cryosphere[1]	Flood, Tsunami	Erosion	Landslide
	0	Sewage Lagoon	65°37'23"N 168°06'01"W	PWSO	COW	$1,000,000	x			
Community	1	Multi-Purpose Building	65°36'41"N 168°05'20"W	W2	NVOW	$2,500,000	x			
	0	Storage Vans by Multi x2	65°36'41"N 168°05'20"W	N/A	NVOW	$100,000	x			
	1	Washeteria (existing)	65°36'32"N 168°05'28"W	W2	COW	$2,500,000	x	x	x	
	1	Washeteria (new)	65°36'31"N 168°05'28"W	W2	COW	$4,000,000	x			
	5	Teacher Housing 4-plex	65°36'19"N 168°05'08"W	W2	WNC	$350,000	x	x	x	
	3	Teacher Housing 2-plex	65°36'19"N 168°05'08"W	W2	BSSD	$350,000	x	x	x	
	0	Community Plot	65°36'59"N 168°05'21"W	Gravel	TRI-Entities	$100,000	x			
	1	Morgue	65°36'43"N 168°05'20"W	W2	NSHC	$150,000	x			
	1	ARCS	65°36'44"N 168°05'20"W	W2	WNC/COW	$250,000	x			
	2	Church	65°36'20"N 168°05'12"W	W2	Wales Lutheran	$300,000	x	x	x	
	2	Parsonage	65°36'20"N 168°05'13"W	W2	Wales Lutheran	$300,000	x	x		
	1	Wales Native Store	65°36'21"N 168°05'14"W	W2	NVOW	$500,000	x	x		
	0	Cemetery	65°36'48"N 168°05'46"W	N/A	COW	undefined	x	x	x	
	0	Culturally Sacred or Significant Sites	The locations of these sites are sensitive. Contact the Tribal office if you need further information or assistance.							
	0	Subsistence Camps								
Total:	83				Total:	**$68,938,077**				

[1] – Earthquake, Severe Weather, Wildfire, and Cryosphere hazards impact the entire community of Wales.
Uranium in drinking water is a public health concern, but impacts are not anticipated to cause infrastructure damage.

Figure 3-67 Map of Critical Facilities in Wales

3.4.7 VULNERABILITY EXPOSURE ANALYSIS

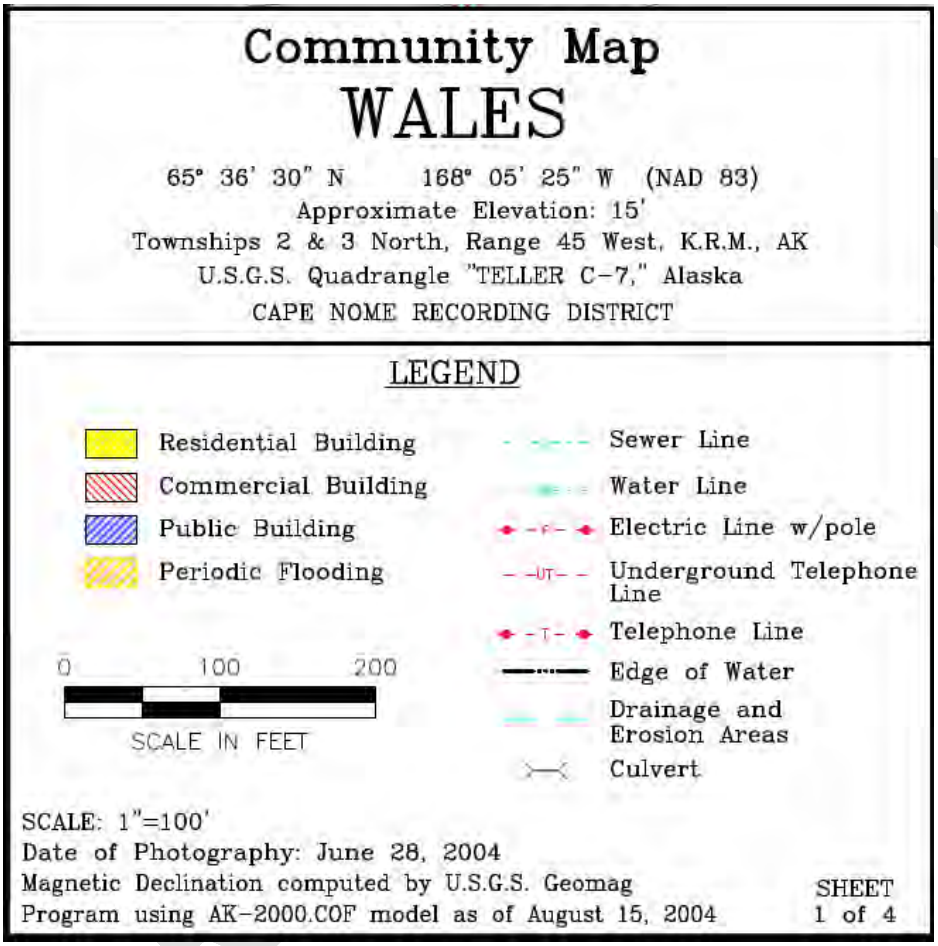
Table 3-17 summarizes the results of the vulnerability exposure analysis for loss estimations in Wales.

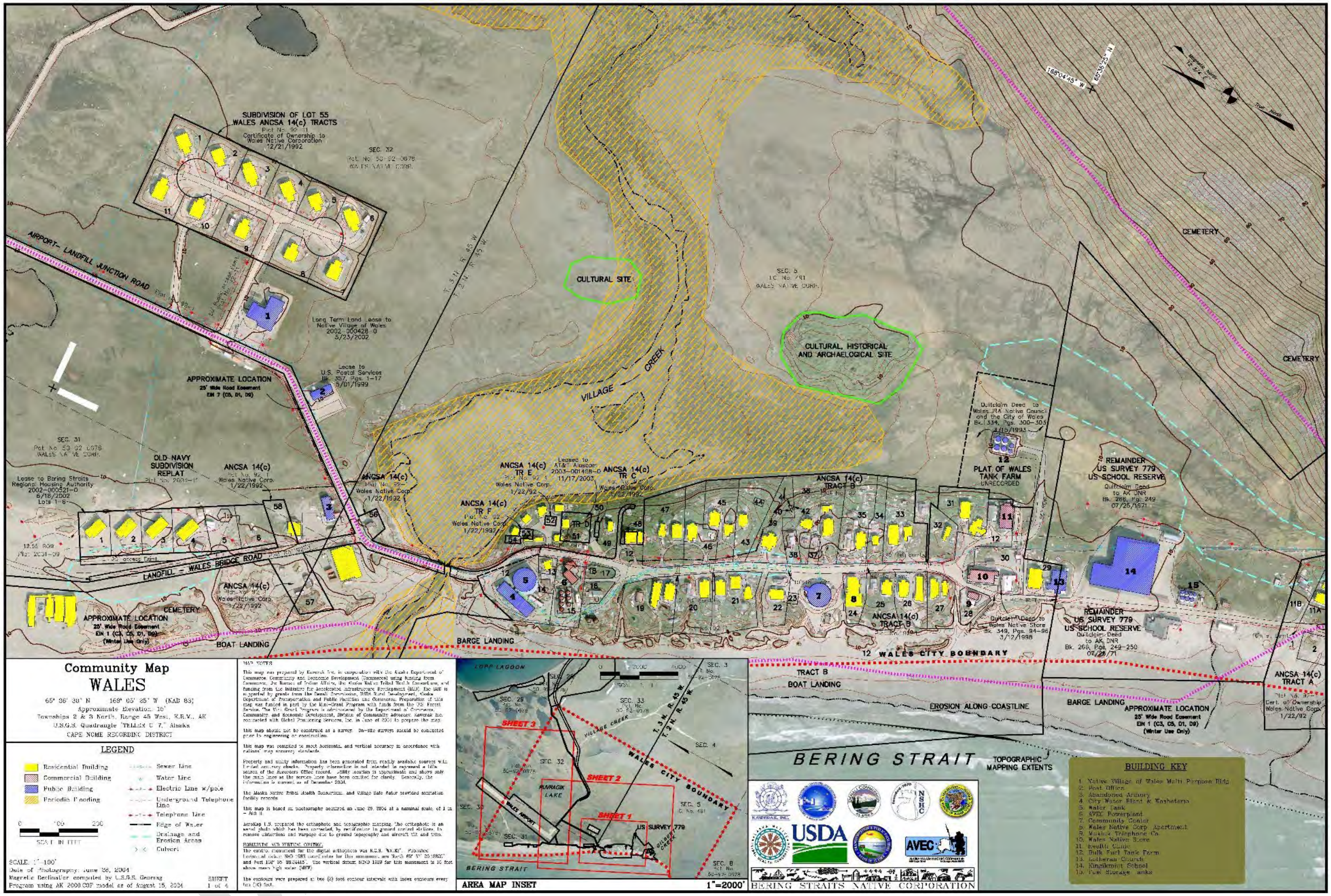
Table 3-17 Vulnerability Exposure Analysis

	Government Facilities	Emergency Response	Education Facilities	Medical Facilities	Roads/Bridges	Transportation Facilities	Utilities	Community Facilities
Earthquake	# of CFs: 4 Value: $2,00,000	# of CFs: 1 Value: $75,000	# of CFs: 1 Value: $17,000,000	# of CFs: 2 Value: $4,500,000	# of CFs: 15.5 miles of road, 1 bridge Value: $9,150,000	# of CFs: 3 Value: $19,508,077	# of CFs: 14 Value: $5,305,000	# of CFs: 15 Value: $11,650,000
Severe Weather	# of CFs: 4 Value: $2,00,000	# of CFs: 1 Value: $75,000	# of CFs: 1 Value: $17,000,000	# of CFs: 2 Value: $4,500,000	# of CFs: 15.5 miles of road, 1 bridge Value: $9,150,000	# of CFs: 3 Value: $19,508,077	# of CFs: 14 Value: $5,305,000	# of CFs: 15 Value: $11,650,000
Wildland/ Tundra Fire	# of CFs: 4 Value: $2,00,000	# of CFs: 1 Value: $75,000	# of CFs: 1 Value: $17,000,000	# of CFs: 2 Value: $4,500,000	# of CFs: 15.5 miles of road, 1 bridge Value: $9,150,000	# of CFs: 3 Value: $19,508,077	# of CFs: 14 Value: $5,305,000	# of CFs: 15 Value: $11,650,000
Changes in the Cryosphere	# of CFs: 4 Value: $2,00,000	# of CFs: 1 Value: $75,000	# of CFs: 1 Value: $17,000,000	# of CFs: 2 Value: $4,500,000	# of CFs: 15.5 miles of road, 1 bridge Value: $9,150,000	# of CFs: 3 Value: $19,508,077	# of CFs: 14 Value: $5,305,000	# of CFs: 15 Value: $11,650,000
Uranium	Uranium in drinking water is a public health concern, but impacts are not anticipated to cause infrastructure damage.							
Flood	# of CFs: 1 Value: $750,000	-	# of CFs: 1 Value: $17,000,000	# of CFs: 1 Value: $1,500,000	-	-	# of CFs: 2 Value: $525,000	# of CFs: 7 Value: $4,300,000
Tsunami	# of CFs: 1 Value: $750,000	-	# of CFs: 1 Value: $17,000,000	# of CFs: 1 Value: $1,500,000	-	-	# of CFs: 2 Value: $525,000	# of CFs: 7 Value: $4,300,000
Erosion	-	-	# of CFs: 1 Value: $17,000,000	# of CFs: 1 Value: $1,500,000	-	-	-	# of CFs: 5 Value: $3,500,000
Landslide	-	-	-	-	-	-	# of CFs: 1 Value: $120,000	-

3.4.8 LAND USE IN WALES

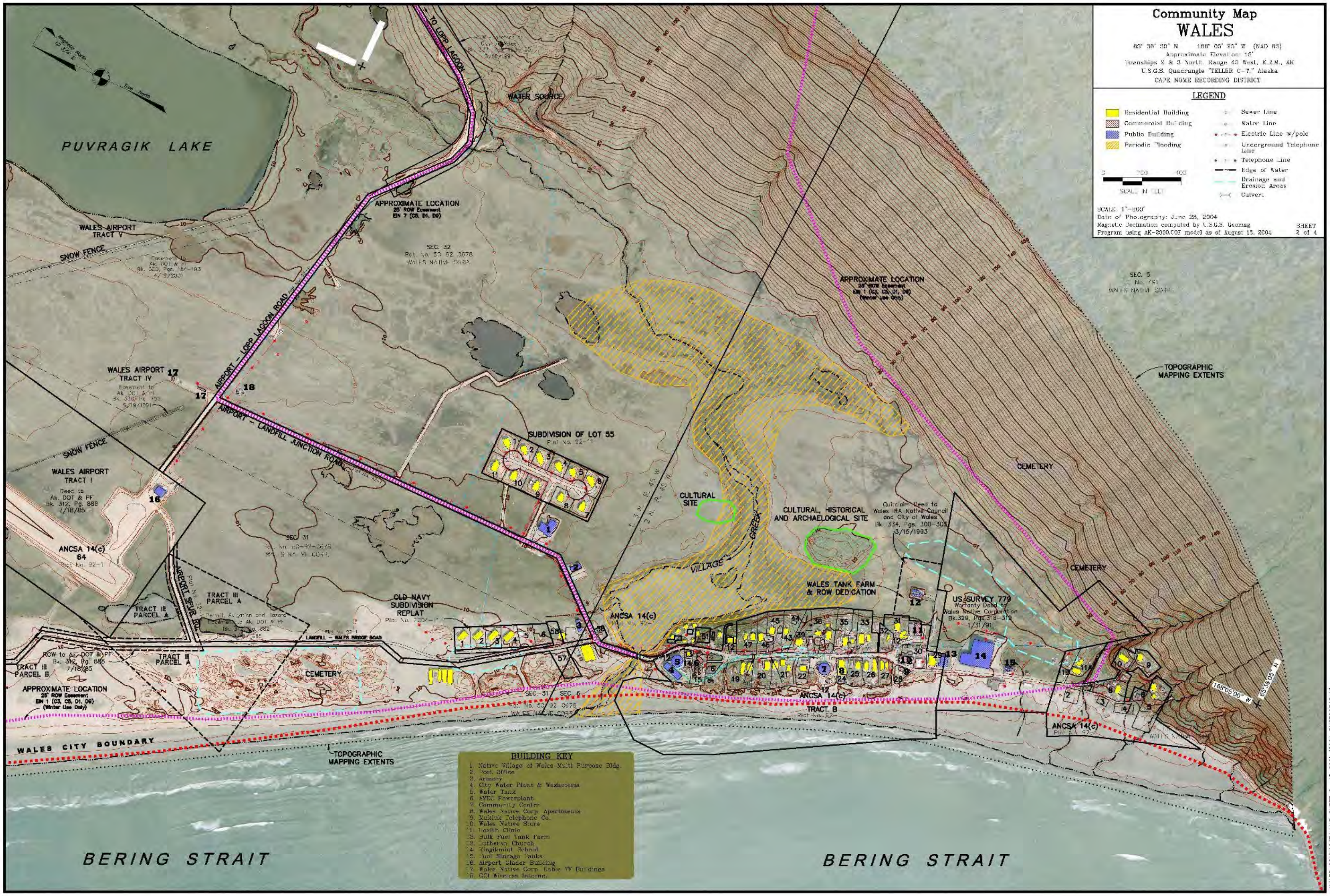
Figure 3-68 to Figure 3-71 shows the 2004 DCRA community profile maps of Wales. The legend for these maps is below.





Source: DCRA 2004

Figure 3-68 Wales Community Map (2004) (1 of 3)

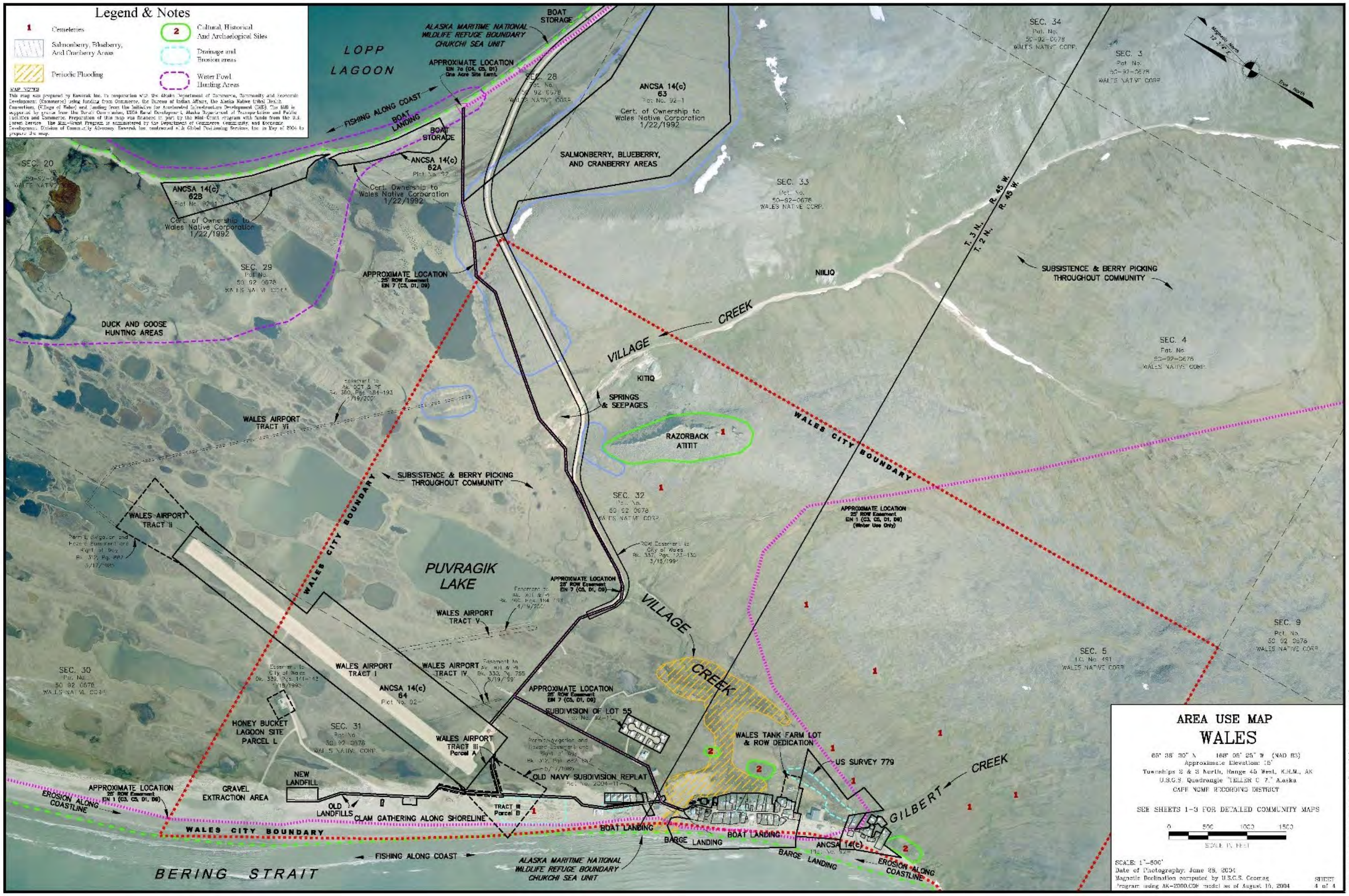


Source: DCRA 2004

Figure 3-69 Wales Community Map (2004) (2 of 3)

Source: DCRA 2004

Figure 3-70 Wales Community Map (2004) (3 of 3)



Source: DCRA 2004

Figure 3-71 Wales Area Map (2004)

3.4.9 FUTURE DEVELOPMENT

The Native Village and City of Wales aim to maintain and upgrade their aging infrastructure. Table 3-18 contains a list of the community's completed capital improvement projects from 1997-2010. This information is no longer tracked by DCRA.

Table 3-18 Wales' Completed Capital Improvement Projects (1997-2010)

Fiscal Year	Project Description/Comments	Total Cost	Contractor	Lead Agency
2010	Lagoon Repair and Expansion - Comments: Design & construction of a washeteria, water treatment plant & associated wastewater treatment & disposal systems as the long-term alternative to meeting the sanitation needs.	$783,990	City of Wales	DEC/VSW
2009	Heavy Equipment Purchase- Legislative Grant	$300,000	City of Wales	DCRA
2009	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$126,175	BSRHA	HUD
2009	Community Facilities Repair and Maintenance and Equipment and Parts Purchase - Comments: Legislative	$57,646	City of Wales	DCRA
2008	Well Water Supply Main	$418,020		ANTHC
2008	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$112,569	BSRHA	HUD
2007	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds Indian Housing Block Grant	$130,446	BSRHA	HUD
2006	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$129,826	BSRHA	HUD
2006	Community Facilities and Equipment - Comments: Capital Matching	$50,176	City of Wales	DCRA
2006	City Facilities Repair and Maintenance - Comments: Legislative Grant	$25,000	City of Wales	DCRA
2005	Washeteria Water Supply/Septic System - Comments: OTHER FUNDING: EPA/IG - 2005 -$168,700.	$225,000		DEC/VSW
2005	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$128,307	BSRHA	HUD
2004	Connect two wells to the WTP.	$384,700		DEC/VSW
2004	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$138,496	BSRHA	HUD
2003	Village-Sized Wind-Diesel Systems - Comments: OTHER FUNDING: USDOE, ASTF, AVEC, KEA. Development of high penetration system in Wales. Project is designed to develop and test system that will maximize the displacement of diesel fuel by wind energy. Diesel fuel displacement is expected to be 40 to 0% for power production, with excess energy used to provide heat at the school.	$1,437,000	Statewide application	AEA-AEEE
2003	Razorback Water Transmission Line - Comments: OTHER FUNDING: EPA/IG - 2003 - $180,000. Construct 5200' raw water transmission line and well structure.	$240,000		DEC/VSW
2003	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$153,264	BSRHA	HUD

Fiscal Year	Project Description/Comments	Total Cost	Contractor	Lead Agency
2003	Sanitation Facilities Improvement Project - Comments: HIS Housing	$97,120		DEC/VSW
2003	CP&I/Street Upgrades - Comments: Capital Matching	$26,316	City of Wales	DCRA
2002	Airport Snow Removal Equipment	$1,269,496	AKDOT/PF	FAA
2002	Rehabilitate Snow Removal Equipment Building	$488,581	AKDOT/PF	FAA
2002	Indian Housing Block Grant - Comments: NAHASDA administration, operating & construction funds	$136,927		HUD
2002	Pumphouse and Watering Point - Comments: IHS $112.9. Two ground water wells were drilled, and test pumped in July 2001. This project will construct a large pump house with a watering point and a small wellhead enclosure over these wells. In addition, a power line to the well site will be installed.	$112,986		ANTHC
2002	Emergency Service Equipment Purchase - Comments: Capital Matching	$18,350	City of Wales	DCRA
2002	Bulk Fuel Business Plan and Conceptual Design - Comments: Other Funding = AVEC $5,000.	$5,250	AVEC	Denali
2001	Road to Tin City, Ph I - Comments: 6.5 mi. to Tin City to access dock & airport.	$9,000,000	Kawerak	BIA
2001	Multi-purpose Community Center - Comments: Norton Sound Fisheries Disaster Multipurpose Community Center	$1,000,000		EDA
2001	CF&E/Dumpsite Improvement -Comments: Capital Matching	$5,658	City of Wales	DCRA
2000	Solid Waste Improvement Plan	$112,986		DEC/VSW
1997	Install 150 KW Windpower Project - Comments: OTHER FUNDING: EPA $289; U.S. Dept. of Energy $132K; Kotzebue and AVEC funds $90K	$688,797	Kotzebue Electric Association	AEA-AEEE

Source: 2011-2016 Wales LEDP

The Native Village of Wales, City of Wales, and the Wales Native Corporation developed the following priority projects in their 2011-2016 LEDP:

1. Bulk fuel
2. New clinic
3. HBH Lagoon/Dumpsite
4. Seawall Lagoon, Boat Harbor and Fishing
5. Cemetery
6. Repair Housing
7. Public Safety
8. Heavy Equipment/Storage
9. Water & Sewer Line
10. Renovate Church
11. Youth Center
12. Long & Short-Term Housing
13. New Power Plant/Wind Solar Energy
14. Gravel Business
15. Grader
16. Snow Fencing
17. Tourism

3.4.10 Subsistence and Food Sovereignty in Rural Alaska

Food security, more specifically, food sovereignty, and climate change are two of Alaska's most daunting challenges. Alaska is warming twice as fast as the global average, which affects the ability to access traditional hunting, fishing, and gathering areas. Between 2000 and 2010, over 30% of Alaska Natives were consistently food insecure and were twice as likely to be food insecure when compared to white populations (Alaska Food Systems 2023).

Alaskans import 95% of their store-bought food, which is shipped through long supply chains. In rural Alaska, once supplies enter the state, they are flown into the villages and deliveries are weather-dependant. Extreme weather events and seasonality make rural communities, far beyond the end of the road, susceptible to weeks without food delivery, and the food that arrives often has a high spoilage rate due to long travel time and poor storage conditions (UAF AFPC 2023).

Alaska's supply chain is vulnerable and in turn, food supply is unstable- this was most recently highlighted by the 2018 earthquake in Southcentral Alaska that disrupted air traffic and the COVID-19 global pandemic with its associated supply chain breakdowns. The Port of Alaska in Anchorage is the state's primary inbound cargo-handling facility and nearly 80% of the goods entering the state comes through the Port of Alaska.

On February 9, 2022, Alaska Governor Mike Dunleavy issued Administrative Order 3311 establishing the Alaska Food Security and Independence Task Force. The task force was charged with being "responsible for recommendations on how to increase all types of food production and harvesting in Alaska, and to identify any statutory or regulatory barriers preventing our state from achieving greater food security (UAF AFPC 2023). A subsequent report was drafted over three months by the University of Alaska Fairbanks and the Alaska Food Policy Council (AFPC) on behalf of the Alaska Food Security and Independence Task Force and was released in March 2023. The report discussed the food insecurity issues in Alaska and provided recommendations for improving Alaska's food security and independence which draw a roadmap for the State administration, legislators, and Alaska's food producers to make Alaska more food secure the next time the supply chain is disrupted (UAF AFPC 2023).

Climate change in impacting the quality and quantity of many berry species that Alaskans rely on. A shifting climate has led to many changes that could influence berry species, including rising temperatures, longer growing seasons, shorter snow-covered seasons, and altered precipitation patterns. It can also lead to changes in the pollinators that the berry plants depend on, and in the populations of the animals and microbes that consume or protect the plants. The effects of those changes are complicated, and the overall impact can be positive or negative (Mulder et al. 2023).

In Wales, the quantity and quality of berries that the community relies upon for subsistence has been severely impacted by climate change. The Planning Team shared that women in the Village used to pick berries 12+ hours a day and now, berries do not grow where they used to. They are having to go to higher elevations and further away from the Village to find berries. They also shared that that they used to be able to go on long hunting trips (~4 days at a time), now the weather has changed so much, they are lucky to get 1-2 good days in a row.

In order to increase food sovereignty in Wales, the Planning Team plans to apply for funding for a community garden or greenhouses, drying racks, or other resources to allow the community to grow their own food.