2022

City of Dillingham & Curyung Tribal Council
Multi-Jurisdictional Hazard Mitigation Plan

CITY OF DILLINGHAM AND CURYUNG TRIBAL COUNCIL
2022 MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

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LIST OF ACRONYMS AND ABBREVIATIONS

ºF	degrees Fahrenheit
ADNR	Alaska Department of Natural Resources
AECOM	AECOM Technical Services, Inc.
BCA	benefit-cost analysis
BRIC	Building Resilient Infrastructure and Communities
CFR	Code of Federal Regulations
DGGS	Division of Geological and Geophysical Surveys
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	geographic information system
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
LHMP	Local Hazard Mitigation Plan
M	magnitude
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
NFIP	National Flood Insurance Program
PGA	peak ground acceleration
SFHA	Special Flood Hazard Area
SNAP	Scenarios Network for Alaska + Arctic Planning
U.S.	United States
UAF	University of Alaska Fairbanks
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

1.0 INTRODUCTION

1.1 COMMUNITY OVERVIEW

Dillingham is in Southwestern Alaska at the extreme northern end of Nushagak Bay, at the confluence of the Wood and Nushagak Rivers. Dillingham is 360 miles southwest of Anchorage and is not accessible by road (Figure 1). Traditionally Yup'ik, the town is considered a bush Alaska town, with approximately 2,350 year-round residents, and is approximately 67 percent Native Alaskan. Due to its location on the shores of the Nushagak River, Dillingham is considered a small transportation and social life hub. Commercial fishing of salmon and other fish camps typically run from June until September.

In this plan, Dillingham refers to all city and tribal lands and people.

1.2 HAZARD MITIGATION PLANNING

As defined in Title 44 of the Code of Federal Regulations (CFR), Subpart M, Section 206.401, hazard mitigation is "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." As such, hazard mitigation is any work to minimize the impacts of any type of hazard event before it occurs. Hazard mitigation aims to reduce losses from future disasters. It is a process that identifies and profiles hazards, analyzes the people and facilities at risk, and develops mitigation actions to reduce or eliminate hazard risk. The implementation of the mitigation actions—which include short- and long-term strategies that may involve planning, policy changes, programs, projects, and other activities—is the end result of this process.

Over the past two decades, local hazard mitigation planning has been driven by a federal law, known as the Disaster Mitigation Act of 2000 (DMA 2000). On October 30, 2000, Congress passed the DMA 2000 (Public Law 106-390), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Title 42 of the United States Code Section 5121 et seq.) by repealing the act's previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). This new section emphasized the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. This new section also provided the legal basis for the Federal Emergency Management Agency's (FEMA's) mitigation plan requirements for the Hazard Mitigation Assistance (HMA) grant programs.

1.3 2022 MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN SYNOPSIS

To meet the requirements of the DMA 2000, Dillingham is writing a new Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). This is being done as a joint effort between the City of Dillingham and the Curyung Tribal Council. The City of Dillingham has previous Local Hazard Mitigation Plans (LHMP) from 2008 and 2016; the update of the 2016 LHMP is incorporated into this MJHMP.

The goal of this planning process is to assess risks posed by hazards and to develop prioritized action plans to reduce risks in Dillingham. The 2022 MJHMP is organized to follow FEMA's Local Mitigation Plan Review Tool and Tribal Mitigation Review Tool (Appendix B); both demonstrate how hazard mitigation plans meet the DMA 2000 regulations. As such, specific planning elements of this review tool are in their appropriate plan sections.

The 2022 MJHMP structure has been updated to include the following sections:

- **Section 1 Introduction**, which provides an overview of the City of Dillingham and Curyung Tribal Council and provides information on hazard mitigation planning.
- **Section 2 Planning Process**, which provides an overview of the planning process, starting with a timeline. It identifies planning team members and describes their involvement with the planning

process. This section also details stakeholder outreach, public involvement, and continued public involvement. It provides an overview of the existing plans and reports, details how those documents were incorporated into the 2022 MJHMP and provides a plan update method and schedule. Supporting planning process documentation is provided in Appendix C.

- **Section 3 Hazard Identification**, which provides a description of each of the eight hazards addressed in this plan. Hazard figures are provided in Appendix A.
- **Section 4 Risk Assessment**, which provides hazard impact tables or descriptions for land area, population centers, and critical facilities. An overall summary of vulnerability for each hazard is also provided.
- **Section 5 Mitigation Strategy**, which provides a description of Dillingham's hazard mitigation capabilities as well as its mitigation strategy, including goals, potential mitigation actions, and prioritized action plan.
- **Section 6 Plan Review**, which provides an overview of development changes that have occurred since the 2016 LHMP, the progress in local mitigation efforts, and changes in priorities for mitigation actions.
- **Section 7 Plan Adoption**, which includes information about the formal adoption for both the City of Dillingham and the Curyung Tribal Council.
- **Section 8 Appendices**, which includes Appendix A (Figures), Appendix B (FEMA Documentation), and Appendix C (Planning Process).

2.0 PLANNING PROCESS

This section addresses Element A of the Local and Tribal Mitigation Plan regulation checklists.

Regulation Checklist – 44 CFR 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 §201.6(c)(1))
A2. Does the Plan document an opportunity for neighboring communities, local 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? (Requirement §201.6(b)(2))
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))
A5. Is there discussion of how the Community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

Regulation Checklist – 44 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? (Requirement 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"? (Requirement 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? (Requirement 44 CFR §201.7(c)(1)(ii))
A4. Does the plan describe the review and incorporation of existing plans, studies, and reports? (Requirement 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? (Requirement 44 CFR § 201.7(c)(1)(iv))
A6. Does the plan include a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within the plan update cycle)? (Requirement 44 CFR § 201.7(c)(4)(i))
A7. Does the plan include a discussion of how the tribal government will continue public participation in the plan maintenance process? (Requirement 44 CFR § 201.7(c)(4)(iv))

2.1 OVERVIEW OF THE 2022 MJHMP PLANNING PROCESS

The development of the 2022 MJHMP was a collaborative effort between the City of Dillingham, Curyung Tribal Council, AECOM Technical Services, Inc. (AECOM), and knowledgeable members of the city,

tribe, and community to form a planning team. The planning process officially kicked off in May 2022 and ended in October 2022. A timeline of the major planning tasks and milestones by month, including when the planning team met, is provided in Table 2-1. A list of the planning team members and how they contributed to the development of the plan is provided in Table 2-2.

Table 2-1: MJHMP Timeline

Date	Tasks	People Involved
May 2022	First MJHMP planning team meeting, project overview Initial information collected: hazards to be profiled, critical facility information	MJHMP project managers, planning team, consultant
June 2022	Critical facilities map reviewed and approved	MJHMP project managers
June 2022	Initial public outreach and stakeholder involvement	MJHMP project managers, consultant
June/July 2022	Hazard profiles drafted Hazard figures created; hazard impact assessments drafted	consultant
July 2022	Integration of MJHMP into other planning documents determined	MJHMP project managers, consultant, planning team
July 2022	Draft mitigation actions developed	consultant
August 2022	Second planning team meeting, draft mitigation actions reviewed, prioritization action plan developed	MJHMP project managers, consultant, planning team
September 2022	Internal Draft MJHMP	MJHMP project managers, consultant, planning team
September / October 2022	Public Draft MJHMP Follow-up public outreach and stakeholder involvement	MJHMP project managers, consultant, public
[October 2022]	Final Draft MJHMP	MJHMP project managers, consultant, Alaska Division of Homeland Security and Emergency Management (DHS&EM), FEMA Region X
[month year]	Adoption of Final MJHMP	MJHMP project managers, Curyung Tribal Council, Dillingham City Council, consultant

Table 2-2: Planning Team

Name	Title/Affiliation[1]	Contribution
Courtenay Carty	Tribal Administrator, Curyung Tribal Council, MJHMP project manager	Served as the MJHMP project manager. Led planning team meetings; reviewed and commented on hazard figures, risk assessment tables, mitigation strategies, and the Internal Draft MJHMP.

Table 2-2: Planning Team

Name	Title/Affiliation[1]	Contribution
Desi Bond	Environmental Coordinator, Curyung Tribal Council	Participated in planning team meetings and/or reviewed planning team documents; reviewed and commented on hazard figures, mitigation strategies, and the Internal Draft MJHMP.
Patty Buholm	Directory of Planning & Grants Management, Planning Department, City of Dillingham, MJHMP project manager	Served as the MJHMP project manager. Led planning team meetings; reviewed and commented on hazard figures, risk assessment tables, mitigation strategies, and the Internal Draft MJHMP.
Scott Runzo	Fire Department Coordinator, City Fire Department, City of Dillingham	Participated in planning team meetings and/or reviewed planning team documents; reviewed and commented on hazard figures, mitigation strategies, and the Internal Draft MJHMP.
Jessica Evans	Land Use Planner, AECOM	Consultant; prepared plan, including hazard figures, risk assessment tables, mitigation strategies, and Draft and Final LHMP.

Notes: [1]There are no departments or agencies in the Curyung Tribal Council

2.2 OPPORTUNITIES FOR STAKEHOLDERS

On July 5, 2022, the MJHMP project manager reached out to stakeholders via email (Appendix C) about the 2022 MJHMP and invited them to participate in the planning process. Stakeholders included Alaska DHS&EM (Hazard Mitigation Plan Manager), Bristol Bay Native Corporation (general), Bristol Bay Native Association (Environmental Program Manager), Bureau of Indian Affairs (Supervisory Tribal Operations Specialist), City of Aleknagik (mayor) Aleknagik Tribal Council (Tribal Administrator), Aleknagik Natives Limited (Chief Executive Officer), Alaska Native Tribal Health Consortium (Environmentally Threatened Communities Department), Alaska Department of Transportation and Public Facilities (Public Information Officer and Special Projects), Nushagak Cooperative (Chief Executive Officer/General Manager), Choggiung Limited (Land Manager), Peter Pan Seafoods (Office Manager), OBI Seafoods (general), Bristol Bay Economic Development Corporation (Administrative Assistant), Bristol Bay Area Health Corporation (Facilities Division Manager), Alaska Public Health Dillingham office (Public Health Officer), Dillingham City School District (Superintendent), Southwest Region School District (Superintendent), Vitus Energy (Plan Manager), State of Alaska Fish and Game (Information Officer), and Ekuk Village Council (President).

The Bristol Bay Area Health Corporation (Safety Officer/Emergency Management Officer) expressed interest in reviewing the draft MJHMP. No other stakeholder comments were received.

The MJHMP project manager reached out to the stakeholders again via email on September 26, 2022, inviting them to review and provide comments about the Public Draft MJHMP (Appendix C). [Summary of stakeholder comments].

2.3 PUBLIC INVOLVEMENT

The Curyung Tribal Council defines public as members of the Curyung Tribe. On July 5 and 6, 2022, the City of Dillingham and the Curyung Tribal Council (respectively) posted information about the 2022 MJHMP kickoff on the city's and tribe's Facebook pages. Also on July 5, the city posted the information on the city's website. In addition, flyers were printed and hung in areas of the community where announcements are typically made: two stores, the city office, and the library. The flyers were also sent to

the local radio stations to be read on the air. One member of the public expressed concern about erosion along a creek near their home; this concern was incorporated into the plan. Another member of the public expressed concern about wildfire, emergency preparedness, and hazardous materials spills. The individual provided the planning team with information that was incorporated into the hazard profiles and recommended mitigation actions.

On September 26, 2022, the City of Dillingham and the Curyung Tribal Council posted information about the Public Draft MJHMP and comment period on their Facebook pages and the city website. Flyers were hung in the community as well. [Summary of public comments].

Screenshots of Dillingham's social media outreach and copies of the flyers are provided in Appendix C.

2.4 REVIEW AND INCORPORATION OF EXISTING PLANS AND REPORTS

A list of the major relevant plans and reports reviewed and incorporated into the 2022 MJHMP is provided in Table 2-3.

Table 2-3: Existing Plans and Reports

Plans and Reports	Information to be Incorporated into the 2022 MJHMP
Alaska State Hazard Mitigation Plan (2018)	Information on statewide trends and the nature for all hazards are incorporated into the hazard profile and risk assessment sections.
Statewide Threat Assessment: Identification of Threats from Erosion, Flooding, and Thawing Permafrost in Remote Alaska Communities (Denali Commission 2019)	Background information on erosion, flooding, and permafrost thaw is incorporated into the hazard profiles.
Draft Dillingham Coastal Hazard Analysis (Arctic Coastal Geoscience Laboratory and University of Fairbanks [UAF], draft dated March 2022)	Background information on erosion, flooding, climate change, and permafrost thaw is incorporated into the hazard profiles.
Dillingham Bank Stabilization: Condition of Improvements (U.S. Army Corps of Engineers [USACE] 2019)	Background information on erosion is incorporated into the hazard profile.
City of Dillingham Comprehensive Plan (City of Dillingham, 2010)	Reviewed to ensure consistency. Background flood and erosion information is incorporated into the hazard profiles. Incorporated mitigation recommendations into the mitigation strategy.
Alaska Baseline Erosion Assessment—Dillingham Alaska (USACE 2006)	Background information on erosion is incorporated into the hazard profile.
Erosion Exposure Assessment—Dillingham (State of Alaska Division of Geological and Geophysical Surveys [DDGS] 2021)	Background information on erosion is incorporated into the hazard profile.
City of Dillingham Land Use Plan (City of Dillingham 2006)	Reviewed to ensure consistency.
Ordinance No. 2021-07 (City of Dillingham 2021)	Information on how the city of Dillingham manages floodplains was incorporated into the mitigation strategy, flooding hazard profile, and National Flood Insurance Program (NFIP) information.

Table 2-3: Existing Plans and Reports

Plans and Reports	Information to be Incorporated into the 2022 MJHMP
Flood Record: Dillingham (USACE 2017)	Background information on flooding is incorporated into the hazard profile.
Dillingham Downtown Streets Rehabilitation Project (Alaska Department of Transportation and Public Facilities 2008)	Reviewed to ensure consistency.
City of Dillingham Emergency Operations Plan (City of Dillingham 2018)	Background information on flooding and erosion is incorporated into the hazard profiles.

2.5 CONTINUED PUBLIC PARTICIPATION

A copy of the 2022 MJHMP will remain available at both the city and tribal offices, as well as at the State of Alaska Division of Community and Regional Affairs online community planning library, along with contact information. The city Planning Director and the Tribal Administrator will use the city and tribe Facebook pages, the city webpage, flyers, and public meetings as necessary to notify the public of, and seek input on, any changes or updates to the 2022 MJHMP, including prioritized action plan and the 2027 MJHMP kickoff.

2.6 OTHER ONGOING TRIBAL EFFORTS

For the Curyung Tribal Council, once the 2022 MJHMP is completed, Curyung intends to apply for available Hazard Mitigation Grant Program (HMGP) funding and will work closely with the FEMA Region X Tribal Liaison in doing so. In addition, on completion of the 2022 MJHMP, information will be incorporated into future planning efforts and the creation of local plans.

2.7 PLAN UPDATE METHOD AND SCHEDULE

The 2022 MJHMP will be monitored, evaluated, and updated by the MJHMP project manager(s), specifically the city Planning Director and the Tribal Administrator. Should the 2022 MJHMP project manager(s) no longer be involved with the 2022 MJHMP, the project manager(s) and/or mayor and tribal First Chief will select new MJHMP project manager(s) to oversee the annual reviews and plan update.

The MJHMP project manager(s) will get input from specific planning team members as needed. The MJHMP project manager(s) will complete the Annual Review Tracker every January and after any major disaster to ensure that the 2022 MJHMP is relevant and effective in achieving the plan's goals. Annual review will be tracked in a table in this document (Table 2-4). FEMA-funded mitigation projects will continue to be tracked and reviewed using FEMA Mitigation Progress Report forms; progress summaries will be included in the Annual Review Tracker (Table 2-4) at the beginning of each year.

Four years after the 2022 MJHMP's adoption:

- The mayor and the tribal First Chief or designees will complete the Annual Review Tracker.
- The mayor and the tribal First Chief or designees will reconvene the planning team and update membership, if necessary.
- The mayor and the tribal First Chief or designees will review Table 2-4, which provides annual summaries of the disasters that have occurred; new permanent information that becomes available; implementation measures; and public outreach and response to determine the hazards to be included in the next MJHMP.
- The mayor and the tribal First Chief or designees will develop a new work plan.

- With support from the planning team, the mayor and the tribal First Chief or designees will begin the plan update process, which is expected to take up to 6 months.

Table 2-4: Annual Review Tracker

Year	Disasters that Occurred	Mitigation Actions Implemented	New Relevant Studies/Reports to Include in 2027 MJHMP	Public Outreach Conducted	Changes Made to 2022 MJHMP
2023					
2024					
2025					
2026					

3.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

This section addresses Element B of the Local and Tribal Mitigation Plan regulation checklists.

Regulation Checklist – 44 CFR 201.6 Local 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 each jurisdiction(s)? (Requirement § 201.6(c)(2)(ii))
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement § 201.6(c)(2)(i))

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? (Requirement 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? (Requirement 44 CFR § 201.7(c)(2)(i))

Hazard identification consists of describing the nature of the hazard, disaster history, location, extent/severity, and probability of future events in Dillingham (which as noted in Section 1, includes all city and tribal lands and people). Hazard identification profiles have been developed for each of the eight hazards addressed in Section 3.1 through Section 3.8: climate change, earthquake, erosion, flood, permafrost degradation, severe weather, volcano, and wildfire. The hazards profiled for this MJHMP are discussed in alphabetical order and not hazard classification. The order does not signify level of risk.

Hazardous substances, although not discussed in this plan, are also a concern for the community. Primarily, the risk of an ammonia spill. Ammonia is used is the fish canneries for refrigeration and as a preservative. Ammonia can be absorbed into the body by inhalation, ingestion, eye contact, and skin contact. It is flammable and poses an explosion hazard. Eight ammonia spills have been recorded in the Alaska Department of Environmental Conservation's spills database, the first in 1998 and the most recent in 2021. All occurred in fish canneries. Ten of the spills released less than 100 pounds, one release was 1,500 pounds.

3.1 CLIMATE CHANGE

Table 3-1: Climate Change

Profile	Description
Nature	Climate is defined as the average statistics of weather, which includes temperature, precipitation, and seasonal patterns in a particular region. Climate change refers to the long-term and irrevocable shift in these weather-related patterns. The Fourth National Climate Assessment Report (2018) states that Earth's climate is now changing at a faster rate than at any time in the history of modern civilization, primarily due to human activities. The disruption in the climate is already impacting the way people live, the food they grow, their health, the wildlife, the availability of water, and much more. The impacts of global climate change are being felt today, from sea level rise and storm surge in coastal areas; increased riverine flooding and stormwater inundation; more frequent and prolonged higher temperatures (leading to heat events, wildfires, and permafrost thaw); and more severe and frequent extreme weather events. Changing climate conditions are more pronounced in the polar regions. Alaska is often identified as being at the forefront of climate change because it is warming faster than any other state and faces multiple issues associated with a changing climate. These climate change impacts in Dillingham include: • An increase of ocean temperature, impacting marine ecosystems and Alaska's fisheries; • Flooding and erosion of coastal and river areas related to changes in sea ice and an increase in storm intensity; • An increase in ocean acidification, which will impact marine organisms and thereby disrupt the marine food web; • An increase in the size and frequency of wildfires and droughts; • Thawing permafrost, melting glaciers, and the associated effects on the state's infrastructure and hydrology; and • An increase of health threats, such as injuries, smoke inhalation, damage to vital infrastructure, decrease of food and water security, and new infectious diseases.
Location	All of the Dillingham community is susceptible to climate change. The community's shoreline is most vulnerable to storm surge, sea level rise, and riverine erosion while the entire area is vulnerable to increased temperature and precipitation and as such permafrost thaw.
History	According to the 2018 National Climate Assessment, the rate at which Alaska's temperature has been warming is twice as fast as the global average since the middle of the twentieth century. Statewide annual average temperatures from 1925 to the late 1970s were variable with no clear pattern of change. However, over the past 40 years (from late 1970s through 2016), statewide annual average temperatures began to increase with an average rate of 0.7 degrees Fahrenheit (ºF) per decade. The temperature increase was especially strong in the Arctic due to the polar amplification of global warming. In King Salmon (Approximately 70 miles from Dillingham), the Alaska Climate Research Center has observed a change of annual average temperature from 32.4ºF in 1950 to 35.2ºF in 2020 (8.6% increase). During that period, the Alaska Climate Research Center also observed a change of annual precipitation from 21.0 inches to 22.9 inches (9% increase).
Extent / Severity	The UAF Scenarios Network for Alaska + Arctic Planning (SNAP) models climate data for mid-range global emissions. SNAP temperature models show that Dillingham will experience a temperature increase of 5.9ºF by the end of the century. Likewise, precipitation models show that for the same reporting period, Dillingham will experience an average precipitation increase of 3.8 inches (Table 3-2).

Table 3-1: Climate Change

Profile	Description
Recurrence Probability	Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods of time ranging from decades to millions of years. It may be a change in average weather conditions or in the distribution of weather around the average conditions (i.e., more or fewer extreme weather events). According to the National Aeronautics and Space Administration, "the current warming trend is of particular significance because most of it is extremely likely (i.e., greater than 95% probability) to be the result of human activity since the mid-twentieth century and proceeding at a rate that is unprecedented over decades to millennia." The National Aeronautics and Space Administration also states that "scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities."

Table 3-2: Mean Annual Temperature and Precipitation Predictions

	2010-2019	2050-2059	2090-2099
Mean Annual Temperature	37.4°F	40.8°F	43.3°F
Mean Annual Precipitation	26.3 inches	28.0 inches	30.1 inches

3.2 EARTHQUAKE

Table 3-3: Earthquake

Profile	Description
Nature	An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of Earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and can cause massive damage and extensive casualties in a few seconds. Common effects of earthquakes are ground motion and shaking; surface fault ruptures; and ground failure. Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can amplify ground motions. In addition to ground motion, several secondary hazards can occur from earthquakes, such as the following: • Surface Faulting: Surface faulting is the differential movement of two sides of a fault at the Earth's surface. Displacement along faults—in terms of both length and width—varies but can be significant (e.g., up to 20 feet), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures including railways, highways, pipelines, tunnels, and dams. • Liquefaction: Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (i.e., horizontal movements, typically 10 to 15 feet, but up to 100 feet), flow failures (i.e., massive flows of soil, typically hundreds of feet, but up to 12 miles), and loss of bearing strength (i.e., soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property. • Landslides/Debris Flows: Landslides/debris flows occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter. The two most common measures of earthquake intensity used in the U.S. are the Modified Mercalli Intensity scale, which measures felt intensity; and peak ground acceleration, which measures instrumental intensity by quantifying how hard the earth shakes in a given location. Magnitude (M) is measured by the amplitude of the earthquake waves recorded on a seismograph using a logarithmic scale.
Location	As shown in Figure 2, the nearest fault line to Dillingham is the Denali fault approximately 105 miles away, which is an undifferentiated quaternary fault (i.e., one event per 1,600,000 years).
History	Since 1950, there have been 16 earthquakes M 5.0 or greater that occurred within 150 miles of Dillingham. The most recent was a M 5.2 in 2019; no damage occurred.

Table 3-3: Earthquake

Profile	Description
Extent / Severity	The strength of an earthquake's ground movement can be measured by peak ground acceleration (PGA). PGA measures the rate in change of motion relative to the established rate of acceleration due to gravity (g = 980 centimeters per second). PGA is used to predict the risk of damage from future earthquakes by showing earthquake ground motions that have a specified probability (e.g., 10%, 5%, or 2%) of being exceeded in 50 years. The ground motion values are used for reference in construction design for earthquake resistance and can also be used to assess the relative hazard between sites when making economic and safety decisions. The current U.S. Geological Survey (USGS) seismicity model for Alaska was developed in 2007. The PGA values in Dillingham for a 5% probability of exceedance in 50 years are shown in Figure 2. Based on this model, the entire community is in the perceived "Moderate" shaking zone, with moderate potential for damage.
Recurrence Probability	As shown in Figure 2, the seismic PGA for Dillingham has a 5% probability of moderate shaking in the next 50 years. Based on these data, there is a 5% chance of an earthquake occurring in Dillingham that will exceed 8.17 PGA in 50 years.

3.3 EROSION

Table 3-4: Erosion

Profile	Description
Nature	Erosion is the wearing and transportation of land. Erosion is typically gradual land loss through wind or water scour. In developed regions, erosion undermines buildings and infrastructure. Erosion can be experienced from coastal, riverine, or wind sources. Erosion forces are embodied in waves, currents, and winds; surface and groundwater flow; and freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location. In the U.S., Alaska is unique because of how permafrost thaw interacts with flooding and erosion to exacerbate the impacts of these hazards. Frozen ground can disintegrate under the compounding influences of permafrost thaw, flooding, and erosion in an escalating feedback loop that can result in damage that is much greater than would be expected from the individual processes alone. Dillingham is vulnerable to both riverine and coastal erosion. Riverine erosion is often initiated by high sediment loads or heavy rainfall. This generates high volume and velocity run-off that concentrates in the lower drainages in the river's catchment area. Erosion occurs when the force of the flowing water exceeds the resistance of the riverbank material. The water continues to increase its sediment load as it flows downstream. Eventually, the river deposits its sediment in slower moving sections such as dams or reservoirs. The river may eventually change course or develop a new channel. Riverine erosion results from the force of flowing water in and adjacent to river channels. This erosion affects the bed and banks of the channel and can alter or preclude any channel navigation or riverbank development. In less stable braided channel reaches, erosion and deposition of material are a constant issue. In more stable meandering channels, episodes of erosion may only occur occasionally. Riverine erosion in Dillingham threatens both critical and noncritical facilities. Coastal erosion is a common term used to describe the retreat of the shoreline along the ocean. It describes the attrition of land resulting in loss of beach, shoreline, or dune material from natural activity or human influences and rarely causes death or injury. However, erosion causes property destruction, prohibits development, and impacts community infrastructure. Erosion can occur rapidly as the result of floods, storms, or other events; or slowly as the result of long-term environmental changes such as melting permafrost. Erosion is a natural process, but its effects can be easily exacerbated by human activity. Coastal erosion can occur from rapid short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding; or from human activities including boat wakes and dredging. The most dramatic erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions. Coastal erosion occurs over the area from roughly the top of the shore into the nearshore region to about 30-foot water depth. It 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. Dillingham sits at the confluence of the Wood and Nushagak rivers, which is greatly affected by ocean currents and surges. The multi-year impact of waves, tidal current, coastal storms, storm surge, and flooding causes severe coastal erosion. The fall storm season has the greatest impact. In winter, bottom shore-fast ice inhibits the vulnerability. Climate change increases the threat of erosion from rising sea levels and loss of permafrost. Rising sea levels create larger waves, which, when combined with high tides, can reach higher elevations, which contribute to significantly higher rates of coastal erosion. Higher sea levels also can lead to significant beach and bluff erosion. Coastal erosion may also be due to multi-year impacts and long-term climatic change such as sea-level rise; lack of sediment supply; subsidence; or long-term human factors such as aquifer

Table 3-4: Erosion

Profile	Description
	depletion or the construction of shore protection structures and dams. Attempts to control erosion using shoreline protective measures such as groins, jetties, seawalls, or revetments can lead to increased erosion.
Location	Dillingham has experienced extensive erosion along the entire shoreline of the Nushagak River. The historic and predicted shorelines after erosion are shown in Figure 3 and Figure 4, and shoreline change from 1952 through 2018 is shown in Figure 5. The areas in Dillingham that are most threatened by erosion are along Wood River near the city sewage lagoon, on the shoreline near the hospital campus, and the city harbor and lowlands to the west of Kanakanak road, where the waves enter the harbor and continually erode the west bank. Erosion has also been reported along Amau Creek in residential areas.
History	Dillingham has experienced significant erosion loss over the past 70 years. The annual amounts of rain, wind, and waves that assail the shoreline combined with tidal fluctuations induce large amounts of erosion, particularly during severe storm events. Historic erosion events occurred in 1980, 1993, 2005, and (most recently) in 2008. During recent years, ice and debris jammed a large culvert under Kanakanak Road in front of the hospital. The jam resulted in the formation of a pond which nearly topped the road before workers were able to clear it. The paved gravel causeway is more than 20 feet above a stream bed. Had the water topped the causeway it would have failed, in which case erosion would have destroyed more than 40 feet of road, isolating Kanakanak Hospital from vehicular traffic from the rest of the community. Mitigation measures that have been put in place include: a sheet-pile seawall from just east of the city dock and extending 1,600 feet east to Snag Point, as well as a 429-foot sheet-pile seawall at the front of the small boat harbor and 184-feet of rock riprap revetment to protect the east side of the harbor mouth. These measures are shown in Figure 6. A bank stabilization report done by the USACE in 2019 notes that the erosion at Snag Head continues to be problematic. As of 2016, Dillingham is utilizing stake ranging to monitor erosion. Stake ranging uses a permanent landmark or stake to measure the distance to the eroding feature. Three stake ranging sites are set up in Dillingham. Measurements are collected every 1-3 months and before and after large storms. The stakes are located on top of a beach ridge fronting the coastline.
Extent / Severity	In 2006, USACE completed a community erosion assessment for Dillingham, and in 2022, the UAF Arctic Coastal Geosciences Laboratory provided a draft of their Coastal Hazard Analysis report. The reports note that the west side of the boat harbor is eroding at a rate of approximately 11-19 feet per year. A 2021 report from the Alaska DGGS concludes that erosion ranges from 3 to 9.8 feet per year along most of the shoreline fronting Dillingham but reaches up to 16.4 feet per year on the shoreline adjacent to the wastewater lagoon. The statewide threat assessment conducted by the Denali Commission in 2019 places Dillingham in erosion severity group 1, where the threat is commonly immediate to critical infrastructure. Damages resulting from a compounding erosion would impact community sustainability, present life safety concerns, affect access to emergency services, and/or require support from outside the region to assist the community in responding to the event. Communities that are included in group 1 should direct resources toward determining the best response to the threat.
Recurrence Probability	Extensive erosion is generally caused by storm surge which occurs during large fall storms with high tides. Based on studies conducted by USACE and UAF, annual erosion will continue to each year and will vary by location.

3.4 FLOODING

Table 3-5: Flooding

Profile	Description
Nature	A flood occurs when the existing channel of a stream, river, canyon, or other watercourse cannot contain excess runoff from rainfall or snowmelt, resulting in overflow onto adjacent lands. Secondary hazards from floods can include: • Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features; • Impact damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters (debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater effects); • Destruction of crops, erosion of topsoil, and deposition of debris and sediment on croplands; and • The release of sewage and hazardous or toxic materials when wastewater treatment plants are inundated, storage tanks are damaged, and pipelines are severed. Three primary types of flooding occur in the community of Dillingham: rainfall-runoff, snowmelt, and storm surge. Floods usually occur during spring break-up and fall storms. Flooding of the Nushagak and Wood rivers occurs in late summer and early fall from a combination of high tides and strong winds from the south and southwest. More forceful storms may occur in winter months; however, Nushagak Bay is ice-covered and resistant to wave buildup from September to April of each year. Extreme ice jamming is rare but a possibility. The magnitude of flooding that is used as the standard for floodplain management in the U.S. is a flood with a probability of occurrence of 1% in any given year. This flood is also known as the 100-year flood (i.e., base flood). The 100-year flood (1%) and the 500-year flood (0.2%) are considered Special Flood Hazard Areas (SFHAs) and identified in a Flood Insurance Rate Map (FIRM).
Location	As shown in Figure 7, among the areas of the community that were mapped by FEMA in 1974, low-lying areas along the shoreline on the east side of town, between the townsite and the airport, and southwest of the airport are in the 100-year floodplain. There are three areas in the 500-year floodplain: to the east of 3rd Avenue, at the end of Main Street, and at the beginning of 1st Avenue. The majority of the population center is in areas of minimal flooding. The FIRMs and Flood Insurance Studies for the City of Dillingham show identified SFHAs for Wood River, Nushagak River, Amau Creek, Snake River, and Scandinavian Creek.
History	The USACE Floodplain Manager's June 2017 report for Dillingham noted their worst flood event was a November 1929 storm, concurrent with high tides, which flooded the lower areas of Dillingham to an elevation of 30 feet. The community's last significant coastal flood event occurred in 1980-1981, although other coastal flood events were recorded in 1962, 1983, 2005 and (most recently) in 2008. Highly localized flooding has occurred around creeks within the community as a result of blocked culverts and/or beaver dams, particularly in times of high run-off. Additionally, very high tides frequently combine with onshore winds and lead to temporary flooding along low-lying portions of the main road, impeding traffic. Spring snowmelt causes flooding on the north side of the core town site. Septic systems in this area have been known to flood and back up when the ground is frozen, and it rains or warms enough for snow to melt. The flood-prone area is less than a half mile from the city's main well. The Alaska Rural Water Association ranked the well's contamination susceptibility as High. This indicates that while the well has low contamination susceptibility; the aquifer has very highly susceptibility to contamination.

Table 3-5: Flooding

Profile	Description
Extent / Severity	Various factors such as rainfall intensity and duration, watershed conditions (slope, soil type, presence of vegetation), and the existence of flood control features, both natural and human-built, determine the severity of floods. Factors that contribute to riverine flooding frequency and severity include rainfall intensity and duration; antecedent moisture conditions; watershed conditions, including terrain steepness, soil types, amount, vegetation type, and development density; flow velocity; and the availability of sediment for transport and the bed and embankment watercourse erodibility. The City of Dillingham FIRM (Figure 7) identifies 1,338 acres (6%) with a 1% annual chance of flooding, and 8 acres (>1%) with 0.2% annual chance of flooding. In addition, the statewide threat assessment conducted by the Denali Commission in 2019 places Dillingham in flood severity group 3, where 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.
Recurrence Probability	Many flood damages are predictable based on seasonal weather patterns such as sea storms, rainfall, and freeze/thaw patterns. Most of the annual precipitation is received from April through October, with August being the wettest. This rainfall leads to flooding in early/late summer and/or fall. Spring snowmelt increases runoff, which can cause excessive surface flooding. It also breaks riverine winter ice cover, exacerbating localized ice-jam flood or coastal ice override damage impacts.

3.5 PERMAFROST DEGRADATION

Table 3-6: Permafrost Degradation

Profile	Description
Nature	Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32°F for 2 or more years (perennially frozen). Permafrost can exist as massive ice wedges and lenses in poorly drained soils or as relatively dry matrix in well-drained gravel or bedrock. During the summer, the surficial soil material thaws to a depth of a few feet, but the underlying frozen materials prevent drainage. The surficial material that is subject to annual freezing and thawing is referred to as the "active layer." Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Permafrost and periglacial hazards are caused by the effects of changing permafrost and the landscape processes that result from extreme seasonal freezing and thawing. Permafrost is found in nearly 85% of the state. It is thickest and most extensive in the Arctic north of the Brooks Range; present virtually everywhere and extending as much as 2,000 feet below the surface of the Arctic Coastal Plain. South of the Brooks Range, permafrost becomes increasingly thinner and more discontinuous—broken by pockets of unfrozen ground known as taliks—until it becomes virtually absent in Southeast Alaska, with the exception of pockets of high-elevation alpine permafrost 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; thawing causes landslides, ground subsidence, and erosion, as well as lake disappearances, new lake development, and saltwater encroachment into aquifers and surface waters. Usteq, from the Yup'ik word meaning "surface caves in," is a catastrophic form of permafrost thaw collapse that occurs when frozen ground disintegrates under the compounding influences of thawing permafrost, flooding, and erosion.
Location	According to mapping done by SNAP, most of Dillingham (81% of land area) is in an area of isolated permafrost (0 to 10% cover) with low thaw susceptibility (Figure 8). Current modeling for lake thermokarst terrain coverage is high. Dillingham reports that most permafrost degradation issues occur along the road to Aleknagik, where the road is seeing damage from thawing soil.
History	There are no written records in Dillingham defining permafrost impacts. However, planning team members stated that since the 2016 LHMP, thawing permafrost has increased coastal and riverine erosion and led to a greater number of sinkholes developing in and surrounding the community and primarily occurring within the road system. Along the road to Aleknagik, the community reports that the road suffers damage from permafrost degradation.
Extent / Severity	Damage to existing infrastructure as a result of thawing permafrost is likely known. The permafrost temperature may be below 28°F, but risk of damage also may be extremely high even in the areas with cold permafrost if large near-surface bodies of ground ice (e.g., ice wedges) are affected or may be affected in the future by thermokarst and/or thermal erosion. The statewide threat assessment conducted by the Denali Commission in 2019 places Dillingham in permafrost severity group 3, where the risk of damage due to thawing permafrost is low or nonexistent. Underlying permafrost is sporadic; nonexistent or underlying soils are ice-poor, thaw stable materials such as sandy gravels. No or minor damage has been reported.
Recurrence Probability	Dillingham experiences permafrost damage annually to those structures and roads adjacent to the community's wetlands. Future damage resulting from permafrost is likely to occur in the next 5 years.

3.6 SEVERE WEATHER

Table 3-7: Severe Weather

Profile	Description
Nature	Severe weather occurs throughout Alaska with extremes includes thunderstorms; lightning; hail; heavy and drifting snow; freezing rain/ice storm; extreme cold; and high winds. Severe weather events can include the following: • A winter storm is an event in which the main types of precipitation are snow, sleet, or freezing rain and can be accompanied by high winds, cold temperatures, and storm surge. A winter storm can range from a moderate snow over a few hours, to blizzard conditions with blinding wind-driven snow that lasts several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. In more temperate continental climates, these storms are not necessarily restricted to the winter season and may occur in the late autumn and early spring as well. • Heavy snow and rain occur frequently in coastal areas, and snowfall can accumulate 4 inches or more in 12 hours or less. • Freezing rain and ice storms occur when rain or drizzle freezes on surfaces and can cause damage to powerlines, pipelines, and other infrastructure. • Extreme cold varies according to normal regional climate. Alaska's extreme cold usually involves temperatures between -20 to -50ºF. Excessive cold may accompany winter storms, occur after storms, or can occur without storm activity. • High winds in Alaska can equal hurricane force but are under a different classification because they are not cyclonic nor possess other hurricane characteristics. Strong winds occasionally occur over the interior due to strong pressure differences, especially where influenced by mountainous terrain; however, the windiest places in Alaska are generally along the coastlines. • Thunderstorms typically last 20 to 30 minutes and can produce hazards including lightning, heavy rain, snow, updrafts, downdrafts, aircraft turbulence and icing, damaging hail, high winds, and flash flooding. Thunderstorms are generally associated with warmer summer months. They are relatively uncommon and do not occur uniformly throughout the state. There have been observations of an increase in thunderstorm activity in certain areas. Lightning strikes are hazardous to human health, can start wildfires, and can damage infrastructure. • Storm surge is caused by coastal storms when a low-pressure weather system draws water toward the storm's center, which creates a bulge of water that moves with the storm. Flooding occurs when the bulge or storm surge meets up with land and is worse when the timing of its arrival coincides with a high tide. Other factors that influence the amount of flooding experienced is the shape and orientation of the coast relative to the oncoming storm.
Location	All of Dillingham is vulnerable to the effects of severe weather.
History	Notable severe weather events from 2000 through 2021 include: • January 2000: Freezing rain was reported in several areas, including Dillingham and King Salmon, along the Bristol Bay coast, and Bethel (inland from the Kuskokwim Delta coast). • January 2002: A strong, North Pacific low and its associated frontal system were responsible for heavy snow across the southwest Alaska mainland and the Aleutians. Flight Service personnel in Dillingham reported 14 inches of snow overnight. • February 2002: A low became complex with several centers. The associated front moved northeast across the Aleutians, preceded by brisk southeast winds. Dillingham reported 8-12 inches of new snow. Local newspapers later ran a story on this snowfall around Dillingham. • January 2004: Gusty north wind up to 48 mph in Dillingham blew airline freight containers into two parked aircraft, causing an estimated $40 of damage.

Table 3-7: Severe Weather

Profile	Description
	• February 2009: An intense, hurricane-force storm moved across into the eastern Bering Sea. This storm produced blizzard conditions along the Bering Sea coast from Bristol Bay north across the Kuskokwim Delta. Wind gusts were reported in excess of 100 mph in the Pribilof Islands and in Bristol Bay. Extensive damage occurred to many homes and buildings. This storm also produced a storm surge in the Bristol Bay region in Dillingham. • February 2013: A low passed south of Bristol Bay and put Dillingham in a cold air advection which enhanced the already strong pressure gradient and dynamic lifting. This resulted in at least six locations reporting heavy and/or blowing snow of 1/4 mile visibility. Dillingham reported blizzard conditions with north winds gusting 43 mph, producing 1/4 mile visibility in heavy snow and blowing snow. There were no reports of damage or injuries. • December 2021 (most recent): A north-to-south oriented frontal boundary brought periods of heavy snow, avalanche conditions, lowered visibilities, high winds, and strong surf over the course of several days. Strong upper-level dynamics and a deep moisture fetch made this an impactful storm for southern Alaska. Dillingham reported frequent low visibilities with winds to 35-53 mph in combination with moderate to heavy snow for a span of 12 hours. Due to these conditions, power was knocked out, trees were toppled, and phone service was cut off for about a week.
Extent / Severity	Dillingham falls within the transitional climate zone, characterized by tundra interspersed with boreal forests and weather patterns of long, cold winters and shorter, warm summers. Heavy fog is common in July and August. Winds of up to 60-70 mph may occur between December and March. The Nushagak River is ice-free from June through November.
Recurrence Probability	Based on historical occurrences, Dillingham can expect to experience high wind conditions approximately 10-15 days each year. Extreme cold can occur annually for several days at a time. Heavy snow can be expected to occur approximately 3-4 days per season.

3.7 VOLCANO

Table 3-8: Volcano

Profile	Description
Nature	A volcano is a vent or opening in the earth's crust from which molten lava (magma), pyroclastic materials, and volcanic gases are expelled onto the surface. The vent may be visible as a small bowl-shaped depression at the summit of a cone or shield-shaped mountain. Through a series of cracks in and beneath the volcano, the vent connects to one or more linked storage areas of molten or partially molten rock. There are four general volcano types: • Lava domes are formed when lava erupts and accumulates near the vent. • Cinder cones are shaped and formed by cinders, ash, and other fragmented material accumulations that originate from an eruption. • Shield volcanoes are broad gently sloping volcanic cones with a flat dome shape that usually encompass several tens or hundreds of square miles, built from overlapping and inter-fingering basaltic lava flows. • Composite or stratovolcanoes are typically steep-sided large dimensional symmetrical cones built from alternating lava, volcanic ash, cinder, and block layers; most composite volcanoes have a crater at the summit containing a central vent or a clustered group of vents. There are three types of volcanic eruptions, described below. Some volcanoes may exhibit only one type of eruption during an event, while others may display an entire sequence of all three types in one event. • Magmatic eruptions are the most well observed eruptions. Magmatic eruptions produce juvenile clasts (composed fragments) during explosive decompression from gas releases. Magnetic eruption subtypes include Hawaiian, Strombolian, Vulcanian, Peléan, and Plinian. • Phreatomagmatic eruptions are volcanic eruptions resulting from the interaction between magma and water. Grain deposits from phreatomagmatic explosion involving high water to magma ratios are extremely fine-grained and distinctly poorly sorted, while deposits resulting from low water to magma ratios are commonly coarse and relatively well sorted. Phreatomagmatic eruption subtypes include Surtseyan, Submarine, and Subglacial. • Phreatic eruptions are steam-blast eruptions. These eruptions occur when cold groundwater or surface water comes into contact with hot rock or magma. Phreatic eruptions blast out steam, water, ash, volcanic bombs, and volcanic blocks, but no new magma. Other hazards potentially caused by a volcanic eruption include: • Volcanic ashfall, • Lava flows, • Lahars (debris flows), • Volcanic gas, • Pyroclastic surges or flows, and • Volcanic landslides.
Location	The closest volcano to Dillingham is Togiak volcano, which is 65 miles northwest and has no eruptive history. There are seven volcanoes on the Alaska Peninsula within 200 miles of Dillingham being monitored by the Alaska Volcano Observatory, and there are 25 unmonitored volcanoes. The closest volcano to Dillingham on the Alaska Peninsula is Ukinrek Maars, which is 110 miles southeast and last erupted in 1977 (Figure 9).

Table 3-8: Volcano

Profile	Description
History	The Alaska Volcano Observatory is monitoring seven volcanoes within 200 miles of Dillingham, shown in Figure 9: • Martin (125 miles southwest): No eruptive history; last non-eruptive history in 2006. • Mageik (127 miles southwest): No eruptive history; last non-eruptive history in 2005. • Trident (126 miles southwest): Last eruptive history in 1953-1974; last non-eruptive activity in 2005. • Novarupta (120 miles southwest): Last eruptive history in 1912; last non-eruptive activity in 2017. • Griggs (129 miles southwest): No eruptive history; last non-eruptive history in 1965. • Katmai (145 miles southwest): Last eruptive history in 1912; last non-eruptive activity in 2003. • Snowy Mountain (153 miles southwest): No eruptive history; last non-eruptive history in 2001. No eruptive history has been recorded since the 2016 LHMP.
Extent / Severity	As shown on Figure 9, all of the Dillingham area is susceptible to moderate tephra ashfall. According to the Alaska Volcano Observatory, ash accumulation of 0.25 inch to 1 inch is likely from moderate tephra ashfall.
Recurrence Probability	Given the proximity of several active volcanoes on the Alaska Peninsula and history of past events, it is probable that Dillingham will have an ashfall event within the next 50 years.

3.8 WILDFIRE

Table 3-9: Wildfire

Profile	Description
Nature	A wildfire—sometimes referred to as a wildland fire—is a fire in an area of combustible vegetation occurring in rural areas. Wildfires can be caused by human activities (such as unattended burns, campfires, or off-road vehicles without spark-arresting muffles); or by natural events, such as lightning, drought, or infestation. Wildfires can be classified as forest; urban; tundra; or interface or intermix fires; and prescribed burns. The following three factors contribute significantly to wildfire behavior and can be used to identify wildfire hazard areas: • Topography describes slope increases, which influences wildfire spread rate increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridge tops may mark the end of wildfire spread because fire spreads more slowly or may even be unable to spread downhill. • Fuel is the type and condition of vegetation that plays a significant role in wildfire spread occurrence. Certain plant types are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available as fire fuel (referred to as the "fuel load"). The living-to-dead plant matter ratio is also important. Certain climate changes may increase wildfire risk significantly during prolonged drought periods as both living and dead plant matter moisture content decreases. Both the horizontal and vertical fuel load continuity is an important factor. • Weather is the most variable factor affecting wildfire behavior. Temperature, humidity, wind, and lightning can affect ignition opportunities and fire spread rate. Extreme weather (such as high temperatures and low humidity) can lead to extreme wildfire activity. Climate change increases fire to vegetation ignition susceptibility due to longer dry seasons. By contrast, cooling and higher humidity often signal reduced wildfire occurrence and easier containment. Indirect wildfire effects can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large intense fires can harm soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and exacerbate river and stream siltation thereby increasing flood potential, harming aquatic life, and degrading water quality. Vegetation-stripped lands are more susceptible to increased debris flow hazards.
Location	As shown in Figure 10, most of the population center in Dillingham has moderate or high wildland fuel risk, with some small areas of very high risk. The areas of moderate risk are closer to the river, and the high and very high risk areas occur further inland. The west side of Dillingham is in the wildland-urban interface. These areas, which are primarily residential, are at higher risk from fires in Alaska. The east of Dillingham is bordered by the Nushagak River, which may provide some protection from wildfires on that side.

Table 3-9: Wildfire

Profile	Description
History	The Alaska Interagency Coordination Center tracks wildfires throughout the state. Every year there are wildfires across Alaska. The closest large fire to Dillingham was the Snake River fire in 2012, which burned over 16,000 acres and was approximately 5 miles south of Dillingham. Other nearby fires since 1990 include: • Iowithla River in 2022 (most recent) (10 miles northeast), which burned over 42,000 acres; • Dillingham Landfill in 2022 (5 miles north), which burned over 3 acres; • Tuklung River in 2022 (33 miles southwest), which burned over 6,500 acres; • Levelock in 2019 (55 miles east), which burned over 9,300 acres; • Lower Klutuk in 2019 (49 miles northeast), which burned over 5,900 acres; • Ongivinuk River in 2019 (44 miles northwest), which burned over 2,500 acres; • Copenhagen Creek in 2015 (34 miles east), which burned over 5,100 acres; • Keefer Cutoff in 2015 (28 miles east), which burned over 240 acres; • Gechiak Lake in 2015 (63 miles northwest), which burned over 18,700 acres; • Tvativak in 1997 (35 miles southwest), which burned over 2,400 acres; and • Twin in 1990 (50 miles northwest), which burned over 12,700 acres.
Extent / Severity	Much of Dillingham is vulnerable to wildfires. As shown in Figure 10, 71% of the land area in Dillingham is in a high/very high wildfire risk area.
Recurrence Probability	Recorded wildfires within 50 miles of Dillingham have an average recurrence rate of approximately every 3 to 8 years, although this may increase with a warming climate and an increase of dry fuels.

4.0 RISK ASSESSMENT

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

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B3. Is there a description of each identified hazard's impact on the Community as well as an overall summary of the Community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

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? (Requirement 44 CFR § 201.7(c)(2)(ii))

4.1 HAZARD IMPACT

A hazard impact assessment predicts the current or expected impact of a hazard on a community or given area. The analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage.

For this 2022 MJHMP, a conservative exposure-level analysis was conducted to assess the risks associated with the identified hazards. Due to a combination of a lack of adequate information and methodology, a semi-quantitative hazard impact assessment has been prepared for earthquake, erosion, flooding, permafrost degradation, volcano, and wildfire. A qualitative hazard assessment has been prepared for climate change and severe weather. Erosion data from the 2021 DGGS report were used to determine the area for the erosion hazard (shown in Figure 11). The area of uncertainty of the 2078 shoreline at a 90 percent confidence interval is shown.

For the 2022 MJHMP, hazard impact assessments were prepared for the community's land area, population center, and critical facilities (Table 4-1). Land area of 23,082.25 acres was determined using a geographic information system (GIS). The population center, which is a geographical point that describes a center point of Dillingham's population, of 2,788.74 acres was determined using GIS. The critical facilities include a list of facilities that provide services and functions essential to Dillingham, especially during and after a disaster. Common types of critical facilities include fire stations; police stations; hospitals; schools; water and wastewater systems; and utilities. Critical facilities may also include places that can be used for sheltering or staging purposes, such as community centers and libraries. Critical facilities may also include large public gathering spots and places of worship. For the 2022 MJHMP, 54 public and private critical facilities were collected from the planning team (Figure 12, Figure 13, and Figure 14). Critical facility coordinates were then geocoded to a location, and the resulting geographic features were used for hazard impact assessment. Facility-specific information was given to the city and the tribe and will be kept on file.

The overall results of the hazard assessments are provided below. This analysis is a simplified assessment of the potential effects of the hazards on land area (Table 4-2), population center (Table 4-3), and critical facilities (Table 4-4) at risk, without consideration of the probability or level of damage. In addition, elevation data were not available; therefore, additional analysis will need to be conducted to develop a more accurate understanding of hazard vulnerabilities.

Table 4-1: Total Land Area, Population Center and Critical Facilities

Category	Acres
Land Area	23,082.25
Population Center	2,788.74
Critical Facilities	54

Table 4-2: Total Acres of Land in a Hazard Area

Hazard Area	Acres	Percent of Total Acres
Climate Change	23,082.25	100
Earthquake (Moderate)	23,082.25	100
Erosion Forecast 2018 - 2078	363.30	1.57
Erosion Forecast Uncertainty	*475.24*	*2.06*
Flooding		
100-year Floodplain	1,337.77	5.7
500-year Floodplain	8.09	>1
Permafrost Distribution		
Absent (0%)	569.58	2.47
Unfrozen Below	3,643.51	15.78
Isolated (0-10%)	18,868.47	81.74
Severe Weather	23,082.25	100
Volcano (Low-Moderate)	23,082.25	100
Wildfire		
Moderate	6,721.96	29.12
High	15,810.88	68.50
Very High	549.41	2.38
Extreme	0	0

Table 4-3: Total Number of Acres of Population Center in a Hazard Area

Hazard Area	Acres	Percent of Total Acres
Climate Change	2,788.74	100
Earthquake (Moderate)	2,788.74	100
Erosion Forecast 2018 - 2078	65.50	2.35
Erosion Forecast Uncertainty	*110.07*	*3.95*
Flooding		

Table 4-3: Total Number of Acres of Population Center in a Hazard Area

Hazard Area	Acres	Percent of Total Acres
100-year Floodplain	257.86	9.2
500-year Floodplain	4.11	>1
Permafrost Distribution		
Absent (0%)	0	0
Unfrozen Below	702.88	25.20
Isolated (0-10%)	2,085.86	74.80
Severe Weather	2,788.74	100
Volcano (Low-Moderate)	2,788.74	100
Wildfire		
Moderate	384.57	13.79
High	2,293.67	82.25
Very High	110.51	3.96
Extreme	0	0

Table 4-4: Total Number of Critical Facilities in a Hazard Area

Hazard Area	Number	Percent of Total Facilities
Climate Change	54	100
Earthquake (Moderate)	54	100
Erosion Forecast 2018 - 2078	2	4
Flooding (100-year Floodplain)	7	13
Permafrost Degradation		
Unfrozen Below	34	63
Isolated (0-10%)	20	37
Severe Weather	54	100
Volcano (Low-Moderate)	54	100
Wildfire		
Moderate	16	30
High	30	56

4.2 OVERALL SUMMARY OF VULNERABILITY

A list of the key issues, or overall summary of vulnerability, for each hazard profiled in the 2022 MJHMP is provided in Table 4-5.

Table 4-5: Overall Summary of Vulnerability

Hazard	Vulnerability
Climate Change	All of Dillingham (100% of land area, population center, and critical facilities) is vulnerable to climate change. SNAP temperature models show that all of Dillingham will experience a temperature increase of 5.9ºF by the end of the century, while precipitation models show that for the same reporting period, Dillingham will see an average precipitation increase of 3.8 inches. In the summer, extreme heat can trigger a variety of heat stress conditions, such as heat stroke. Drier, hotter conditions can also make wildfires more frequent and intense. Wildfires can burn homes, businesses, and critical facilities; interrupt transportation and utilities; reduce air quality; and result in death of people and animals. Mega storms that are linked to climate change can cause severe flooding. Along the coast, deadly and destructive storm surges may push farther inland than they once did, which means more frequent nuisance flooding. Thawing permafrost can exacerbate riverine erosion and cause land loss and damage to structures. It can also cause some structures to shift on foundations and/or sink, causing damage.
Earthquake	The entire community of Dillingham (100% of land area, population center, and critical facilities) is vulnerable to ground shaking from an earthquake, and the entire community is in moderate perceived ground shaking hazard areas. Those that live in moderate shaking potential areas will have a perception of severe shaking and can expect earthquake events. According to USGS, this could mean potentially moderate damage to modern structures.

Table 4-5: Overall Summary of Vulnerability

Hazard	Vulnerability
Erosion	Riverine erosion along the Nushagak River is a major concern for the community of Dillingham. Less than 2% of the land area (363 acres) and less than 3% of the population center (65 acres) are susceptible to erosion, and those areas are all along the river shoreline. Two critical facilities, the sewage lagoon and a boat launch, are in danger of immediate damage. The DGGS reports that southwest of the boat harbor, erosion is forecast to reach 17 buildings between 2038 and 2078 (Figure 15, Figure 16, Figure 17, and Figure 18). These are either identified as residences or unspecified. East of Snag Point, rapid and consistent erosion of a peat meadow is encroaching on the wastewater lagoon and nearby water and sewer lines. The planning team reports the sewage outfall pipe is currently experiencing erosion impacts (Figure 19). Erosion is forecast to undermine the entire pipe and reach the wastewater lagoon by 2058. However, the peat meadow fronting the lagoon infrastructure transitions into a vegetated hill covered with fill from the lagoon's construction that can significantly change erosion rates. The total estimated replacement cost of infrastructure exposed to erosion is $14.5 million (± $4.3 million) by 2078. The UAF report concludes that erosion at the Kanakanak Hospital directly threatens the campus sewage lagoons, burial sites, and archaeology. Erosion rarely causes death or injury. However, erosion does destroy property, development, and infrastructure. The primary impact from erosion is loss of land for use as boat launches, development, and subsistence activities. Structures that are in the path of erosion often need to be relocated to avoid heavy damage, and fuel headers can be damaged or need replacement. Erosion can cause increased sedimentation of river deltas and hinder channel navigation, affecting marine transport. Other impacts include reduction in water quality due to high sediment loads, loss of native aquatic habitats, and economic impacts associated with the costs of erosion control measures. Not only do thawing permafrost and high river flow rates (such as during breakup) contribute to increased erosive scour, but climate change also accelerates the normal process along Alaska's rivers. Warmer temperatures degrade permafrost that helps bind together the soil, and heavy rains produce more floods and swollen rivers that wash away the soil.
Flooding	Dillingham is most vulnerable to flooding caused by snowmelt and storm surge. Approximately 6% of Dillingham's land area (1,338 acres), 9% of the population center (258 acres), and 7 critical facilities (including Bristol Alliance Fuels and its dock, boat launch, downtown fire station, fuel storage, Icicle compound, and Peter Pan compound) are in the 100-year floodplain. Less than 1% of Dillingham's land area and population center (8 acres and 4 acres, respectively) and no critical facilities are in the 500-year floodplain. Floods can block roadways and cause erosion, mudflows, debris flows, and water damage to structures and result in land loss, injury, and even death. People that are most vulnerable to flooding are generally those that live in the SFHA. There are 7 structures insured by NFIP in Dillingham, and none of them are considered Repetitive Loss properties (i.e., any insurable building for which two or more claims of more than $1,000 were paid by the NFIP in any rolling 10-year period since 1978).

Table 4-5: Overall Summary of Vulnerability

Hazard	Vulnerability
Permafrost Degradation	Approximately 81% (18,868 acres) of the land area, 75% of the population center (2,086 acres), and 20 critical facilities in Dillingham are in isolated permafrost coverage. Permafrost coverage that is unfrozen below includes approximately 15% of the land area (3,644 acres), 25% of the population center (703 acres), and 34 critical facilities. Permafrost thaw can cause damage to structures as the ground shifts below foundations. Facilities like cemeteries and solid waste landfills can become ponded, which can expose gravesites and disperse solid waste. Roads can experience seasonal frost heaves and require repair. In addition, permafrost thaw can create unstable banks and exacerbate erosion. Dillingham residents are noting that changes to the cryosphere are worsening every year. Roads in the community have needed repairs as the ground has shifted below them.
Severe Weather	All of the community of Dillingham (100% of land area, population center, and critical facilities) is vulnerable to severe weather. The area is most vulnerable to high winds during winter storms and storm surge in the spring and fall when there is less sea ice. Winds may sweep up loose snow and produce blinding blizzards and dangerous wind chills. A major storm can last for several days and be accompanied by high winds; freezing rain or sleet; heavy snowfall; and cold temperatures. A storm may knock down trees and powerlines, cause roofs to collapse, and lead to dangerous driving conditions causing drivers to be stranded. Dillingham has a history of storm damage, including damaged powerlines that led to extensive periods of time without electricity.
Volcano	Ashfall is a public health hazard when humans inhale fine ash. Ash will also interfere with the operation of mechanical equipment including aircraft. In Alaska, this is a major problem because many of the major flight routes are near historically active volcanoes. Ash accumulation may also interfere with the distribution of electricity due to shorting of transformers and other electrical components (ash can conduct electricity). Based on modeling, all of Dillingham (100% of land area, population center, and critical facilities) is in a moderate ashfall hazard area. Even a small ashfall event could cause significant damage to the built environment (e.g., clogged filters and damaged parts of vehicles and machinery; clogged filters of air-ventilation systems; roof collapse; cellular and radio communication interruption) and the natural environment (e.g., habitat damage, water pollution, weather pattern shifts). In addition, an ashfall event could cause respiratory problems, eye problems, and skin irritation for humans.

Table 4-5: Overall Summary of Vulnerability

Hazard	Vulnerability
Wildfire	Much of Dillingham is vulnerable to wildfires. As described in Table 4-2, 71% of the land area (16,360 acres), 86% of the population center (2,404 acres), and 56 critical facilities of Dillingham are in a high/very high fuel risk area. During the summer, the entire community is vulnerable to wildland fire because most structures are constructed of wood and other flammable materials. Standing timber and other natural fuels interface with the community. History has demonstrated that fire bands can be carried by local winds up to 0.5 mile, jumping human-made fire lines and spreading fire across large areas. Most areas of Dillingham are immediately adjacent to wildland areas and could be threatened by uncontrolled fire. Without mitigation or preparation efforts, the impacts of a wildland interface fire in Dillingham could grow into an emergency or disaster. In addition to impacting people, wildland fires may severely impact subsistence stockpiles and pets. These situations may require emergency life support, evacuation, and alternative shelter. Indirect impacts of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, which increases flood and landslide potential; harms aquatic life; and degrades water quality.

4.3 NFIP INSURED STRUCTURES

The NFIP, managed by FEMA, provides flood insurance to property owners and businesses. According to FEMA Region X, there are seven NFIP-insured structures in Dillingham. Of these, none are considered Repetitive Loss properties. The Curyung Tribal Council participates in the NFIP through the city.

5.0 MITIGATION STRATEGY

This section addresses Element C of the Local and Tribal Mitigation Plans regulation checklists.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C1. Does the Plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement § 201.6(c)(3))
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement § 201.6(c)(3)(i))
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element C: Mitigation Strategy
C1. Does the plan include a discussion of the tribal government's pre and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including an evaluation of tribal laws and regulations related to hazard mitigation as well as to development in hazard-prone areas? (Requirement 44 CFR §§ 201.7(c)(3) and 201.7(c)(3)(iv))
C2. Does the plan include a discussion of tribal funding sources for hazard mitigation projects and identify current and potential sources of Federal, tribal, or private funding to implement mitigation activities? (Requirement 44 CFR §§ 201.7(c)(3)(iv) and 201.7(c)(3)(v))
C3. Does the Mitigation Strategy include goals to reduce or avoid long-term vulnerabilities to the identified hazards? (Requirement 44 CFR § 201.7(c)(3)(i))
C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure? (Requirement 44 CFR § 201.7(c)(3)(ii))
C5. Does the plan contain an action plan that describes how the actions identified will be prioritized, implemented, and administered by the tribal government? (Requirement 44 CFR § 201.7(c)(3)(iii))
C6. Does the plan describe a process by which the tribal government will incorporate the requirements of the mitigation plan into other planning mechanisms, when appropriate? (Requirement 44 CFR § 201.7(c)(4)(iii))
C7. Does the plan describe a system for reviewing progress on achieving goals as well as activities and projects identified in the mitigation strategy, including monitoring implementation of mitigation measures and project closeouts? (Requirement 44 CFR §§ 201.7(c)(4)(ii) and 201.7(c)(4)(v))

5.1 AUTHORITIES, POLICIES, PROGRAMS, AND RESOURCES

The City of Dillingham and Curyung Tribal Council existing authorities, policies, programs, and resources available for hazard mitigation are provided in Table 5-1 (human and technical resources), Table 5-2 (financial resources), and Table 5-3 (planning and policy resources). The ways in which Dillingham is looking to expand and improve on its hazard mitigation authorities, policies, programs, and resources are provided in Table 5-4.

Table 5-1: Human and Technical Resources for Hazard Mitigation

Staff/Personnel	Department/Agency	Principal Activities Related to Hazard Mitigation
Planner(s) and technical staff with knowledge of land development, land management practices, human-caused hazards, and natural hazards	City of Dillingham, Planning Department; Curyung Tribal Council Environmental Coordinator	Anticipates and acts on the need for new plans, policies, and code changes. Applies the approved plans, policies, code provisions, and other regulations to proposed land uses.
Engineer(s), building inspectors / code enforcement officers or other professional(s), and technical staff trained in construction requirements	City of Dillingham, Planning Department	Oversees the effective, efficient, fair, and safe enforcement of the building codes.
Engineers, construction project managers, and supporting technical staff	City of Dillingham, Planning Department	Provides direct or contract civil, structural, and mechanical engineering services, including contract, project, and construction management.
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff	City of Dillingham, Public Works Department	Maintains and operates a wide range of local equipment and facilities and assists members of the public. This includes providing sufficient clean fresh water, reliable sewer services, street maintenance, storm drainage systems, street cleaning, streetlights, and traffic signals.
Floodplain Administrator	City of Dillingham, Planning Department	Enforces its floodplain requirements through the floodplain ordinance (Ordinance No. 2021-07).
Emergency Manager, Fire Department Coordinator, Volunteer Fire Chief	City of Dillingham, Volunteer Fire Department and Rescue Squad	Maintains and updates Dillingham's Emergency Operations Plan. In addition, coordinates local response and relief activities in the Emergency Operations Center; works closely with local, state, and federal partners to support planning and training and to provide information and coordinate assistance.
Procurement Services Manager	City of Dillingham, Finance Department; Curyung Tribal Council Financial Manager	Provides a full range of municipal financial services and administers several licensing measures.
Fire Department Coordinator, Volunteer Fire Chief	City of Dillingham, Volunteer Fire Department and Rescue Squad	Provides fire protection services in the community.

Table 5-1: Human and Technical Resources for Hazard Mitigation

Staff/Personnel	Department/Agency	Principal Activities Related to Hazard Mitigation
Public Information Officer	City of Dillingham, Administration Department; Curyung Tribal Council Tribal Administrator	Coordinates and facilitates a public information program regarding activities of Dillingham; actively promotes the services and successes of operating departments and the benefits to residents; proactively establishes and maintains productive relationships between the city and tribe and any media; and performs related duties as required.
Police Chief	City of Dillingham, Public Safety Department	Provides law enforcement services in Dillingham.

Table 5-2: Financial Resources for Hazard Mitigation

Type	Source	Purpose	Amount
General Fund	Dillingham City Manager; Curyung Tribal Council Administrator	Program operations and specific projects.	Variable
General Obligation Bonds	Dillingham City Manager	General obligation bonds are appropriately used for the construction and/or acquisition of improvements to real property broadly available to residents and visitors. Such facilities include but are not limited to libraries, hospitals, parks, public safety facilities, and cultural and educational facilities.	Variable
Lease Revenue Bonds	Dillingham City Manager	Revenue bonds are used to finance capital projects that: 1) have an identified budgetary stream for repayment (e.g., specified fees, tax receipts); 2) generate project revenue but rely on a broader pledge of general fund revenues to reduce borrowing costs; or 3) finance the acquisition and installation of equipment for the local jurisdiction's general governmental purposes.	Variable
Tribal Resilience Program	U.S. Department of Energy; Bureau of Indian Affairs	This grant program funds tribal projects which support tribal resilience planning as tribes incorporate science (including Traditional Ecological Knowledge) and technical information to prepare for the impacts of extreme events and harmful environmental trends.	Project-specific

Table 5-2: Financial Resources for Hazard Mitigation

Type	Source	Purpose	Amount
Energy Infrastructure Deployment on Tribal Lands	U.S. Department of Energy; Office of Indian Energy	This grant supports Indian tribal energy development, efficiency, and use; reduces and stabilizes energy costs; and enhances and strengthens Indian tribal energy and economic infrastructure relating to natural resource development and electrification. Grants may include: the installation of energy efficiency measure(s) and/or energy generating system(s) for Tribal buildings; deploying community-scale energy generating system(s) on Tribal lands; and installing energy system(s) for autonomous operation to power a single or multiple essential tribal loads for emergency situations or for tribal community resilience.	Project-specific
Renewable Energy Fund	Alaska Energy Authority	Provides funding for the development of qualifying and competitively selected renewable energy projects in Alaska. The program is designed to produce cost-effective renewable energy for both heat and power for Fiscal Year 2019; $11 million has been allocated by the governor to fund the Renewable Energy Fund. This program runs through 2023.	Project-specific
HMA: Hazard Mitigation Grant Program	FEMA	Supports pre- and post-disaster mitigation plans and projects. Available to communities in Alaska after a presidentially declared disaster has occurred in Alaska.	Project-specific
HMA: Building Resilient Infrastructure and Communities (BRIC)	FEMA	Focuses on reducing the nation's risk by funding public infrastructure projects that increase a community's resilience before a disaster affects an area.	Project-specific
HMA: Flood Mitigation Assistance	FEMA	Funds projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the NFIP.	Project-specific
Homeland Security Preparedness Technical Assistance Program	FEMA/Department of Homeland Security	Builds and sustains preparedness technical assistance activities in support of the four homeland security mission areas (i.e., prevention, protection, response, recovery) and homeland security program management.	Project-specific
Assistance to Firefighters Grant Program	FEMA; U.S. Fire Administration	Provides equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards. Available to fire departments and nonaffiliated emergency medical services providers.	Project-specific

Table 5-2: Financial Resources for Hazard Mitigation

Type	Source	Purpose	Amount
Community Action for a Renewed Environment	U.S. Environmental Protection Agency	Through financial and technical assistance, this program offers an innovative way for a community to organize and take action to reduce toxic pollution (e.g., stormwater) in its local environment. Through this program, a community creates a partnership that implements solutions to reduce releases of toxic pollutants and minimize exposure to them.	Project-specific
Community Block Grant Program Entitlement Communities Grants	U.S. Department of Housing and Urban Development	Acquisition of real property; relocation and demolition; rehabilitation of residential and nonresidential structures; construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers; and the conversion of school buildings for eligible purposes.	Project-specific

Table 5-3: Planning and Policy Resources for Hazard Mitigation

Name	Description	Hazards Addressed	Emergency Management
City of Dillingham Comprehensive Plan	Describes hazard areas and lists goals and policies to reduce the potential risk of death, injuries, and economic damage resulting from natural and human-caused hazards.	Erosion, Flooding	Mitigation, Preparedness, Response
City of Dillingham Emergency Operations Plan (in progress)	The plan describes Dillingham's organizational structures, roles, and responsibilities; protocols for providing emergency response and short-term recovery; the purpose, situation, and assumptions; concept of operations, organization, assignment of responsibilities, and plan development and maintenance; authorities; and references.	Earthquake, Erosion, Flooding, Severe Weather, Volcano, Wildfire	Response, Recovery
City of Dillingham Ordinance No. 2021-07	Regulates the process to manage development in flood hazard areas, which includes permitting, in order to promote the public health, safety, and general welfare and to minimize public and private losses due to flooding in flood hazard areas.	Flooding	Mitigation, Preparedness, Response
Dillingham Municipal Code	Promotes public health, safety, and general welfare through laws enforced locally. Building permits are issued and based on the current edition of the building code and local amendments, which encompass building, electrical, mechanical, plumbing, state energy requirements, and state accessibility laws. The City of Dillingham can update and revise local amendments as needed or required.	Erosion, Flooding	Mitigation

Table 5-3: Planning and Policy Resources for Hazard Mitigation

Name	Description	Hazards Addressed	Emergency Management
Public Outreach	The City of Dillingham uses a Facebook page and their website, and Curyung Tribal Council uses a Facebook page, to provide outreach to the community on relevant events, activities, and planning processes happening in Dillingham. Additionally, both the city and the tribe use local radio stations and post flyers around the community to provide outreach.	All	All Phases
NFIP	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.	Flood	Mitigation

Table 5-4: Ability to Expand Resources

Capability	Type/Description	Expansion
Human and Technical	Mitigation Specialist	Appoint or assign someone with the city and tribal governments to oversee hazard mitigation grant opportunities, including notifying departments/agencies of upcoming grant cycles, and spearheading Notice of Intents applications, grant applications, and grant management requirements.
Financial	HMA funding	Apply for BRIC and HMGP funding as it becomes available. The focus should be on projects that mitigate critical infrastructure, provide protection for disadvantaged areas, and address climate change.
Planning and Policy	Climate Action Plan	Develop a Climate Action Plan to reduce or continue to reduce greenhouse emissions through a series of local transportation, land use, building energy, water, waste, and green infrastructure programs and policies.

5.2 NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION

The NFIP aims to reduce the impact of flooding on residential and nonresidential buildings by providing insurance to property owners and encouraging communities to adopt and enforce floodplain management regulations. Participation in the NFIP is based on an agreement between local communities and the federal government.

The City of Dillingham joined the NFIP in August 1975 and was mapped to a FIRM on September 30, 1982. As a participant of the NFIP, the city enforces a floodplain management ordinance and participates in FEMA's Community Assisted Visits, which occur on a 3- to 5-year cycle. The city updated their floodplain regulations in 2021 to be in compliance with the NFIP (Ordinance 2021-07). The Curyung Tribal Council participates in the NFIP through the city.

5.3 MITIGATION GOALS

Mitigation goals are defined as general guidelines that explain what an agency wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing a community-wide vision. FEMA's 2022 Building Resilient Infrastructure and Communities priorities are the basis for the three goals (Table 5-5) for the 2022 MJHMP.

Table 5-5: Mitigation Goals

Goal #	Description
1	Enhance climate protection and adaptation efforts
2	Create a healthy and safe Community
3	Protect critical facilities and infrastructure against hazards

5.4 RECOMMENDED MITIGATION ACTIONS

Mitigation actions help achieve the goals of the MJHMP. The recommended mitigation actions provided in Table 5-6 include: education and awareness, structure and infrastructure projects, preparedness and response, local plans and regulations, and floodplain management (which includes preventive property protection, natural resource protection, structural projects, and public information). The list addresses hazards that impact the critical facilities listed in Figure 12, Figure 13, and Figure 14 and takes into consideration the built environment. This list addresses every hazard profiled in this plan and is based on the plan's risk assessment as well as lessons learned from recent disasters. It was developed using FEMA success stories and best management practices; FEMA job aids; local and regional plans and reports; and input from planning team members and sustainability practitioners.

Table 5-6: Recommended Mitigation Actions

No.	Project Name	Hazard Mitigated	Project Description	Type of Development	BCA Considerations[1]
1	Community planning	All	Establish a formal role for the Hazard Mitigation Planning Team to develop a sustainable process to implement, monitor, review, and evaluate community wide mitigation actions and apply for grants.	New and Existing	1, 5, 7
2	Natural hazard community outreach	All	Provide outreach activities to educate and promote recognizing and mitigating all natural and manmade hazards that affect the community. Develop, produce, and distribute information concerning mitigation, preparedness, and safety procedures for all identified natural hazards. Outreach could include hazard workshops, print materials, and online and social media venues.	New and Existing	4, 5, 7
3	Critical facility auxiliary power	All	Determine which critical facilities require auxiliary power in order to remain functional during de-energization or public safety power shutoff and/or general loss of power and install auxiliary power systems. Auxiliary power systems may include back-up generators, local Solar Photovoltaic-plus-storage, and microgrids.	New and Existing	1, 2, 3, 6, 7, 9, 10
4	Climate action planning	Climate change	Consider climate change in new and existing planning processes to reduce greenhouse emissions through a series of local transportation, land use, building energy, water, waste, and green infrastructure programs and policies.	New and Existing	6, 8
5	Sea level rise zoning	Climate change	Continue working with partners to monitor sea level rise, designate high-risk areas, and specify the conditions for the use and development of specific areas.	New	1, 5, 6, 8
6	Seismic retrofits	Earthquake	Seismically retrofit existing critical facilities to make them more resistant to earthquakes.	Existing	1, 7, 9, 10
7	Earthquake-resistant pipes replacement	Earthquake	Replace aging critical pipes in areas of extreme or violent shaking hazard to improve seismic reliability and safeguard critical water distribution lines against the potential destructive impacts of large-scale earthquakes.	Existing	1, 7, 9, 10
8	Erosion mapping	Erosion	Continue to work with current partners to map and evaluate the location and degree of erosion issues along the Dillingham waterfront. Widely share results of this work with the public and landowners to better inform the community about the location and intensity of the problem.	Existing	1, 4, 5, 6, 7, 8

Table 5-6: Recommended Mitigation Actions

No.	Project Name	Hazard Mitigated	Project Description	Type of Development	BCA Considerations[1]
9	Revetment walls	Erosion, Flooding	Install or reinforce revetment walls or other permanent structures designed to prevent flooding and erosion along the waterfront (particularly in areas that have critical facilities) that are affected by wave attack and/or erosion. Develop mitigation initiatives such as: riprap (large rocks), sheet pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials to provide riverbank protection. Specific locations include but are not limited to: Sewer Lagoon, Small Boat Harbor, Snag Point Bulkhead, Amau Creek, and Kanakanak Beach.	Existing	1, 3, 5, 6, 7, 8, 9, 10
10	Culvert installation and upgrades	Flooding	Install or upgrade culverts to increase drainage capacity or efficiency. Such upgrades may include increasing size, implementing ice thawing capability, installing debris cribs over culvert inlets, and/or hardening culvert entrance bottoms with asphalt, concrete, or rock.	New and Existing	1, 3, 5, 6, 7, 8, 9, 10
11	Critical utility system elevation	Permafrost degradation	Elevate new and existing critical utility systems, such as emergency power, electrical and steam power, communication and information technology/data, and medical and mechanical equipment onto piles grounded in bedrock to avoid slumping from permafrost thaw.	New and Existing	1, 2, 3, 7, 9, 10
12	Cryosphere community planning	Permafrost degradation	Promote permafrost sensitive construction practices in permafrost areas. Identify and map existing ground failure areas with associated damage to assist in new critical facility siting and existing facility relocation siting.	New	5, 8
13	Power line improvements	Severe weather	Increase power line wire size and incorporate quick disconnects (breakaway devices) to reduce ice load and windstorm power-line failure during severe wind or winter ice storm events.	New and Existing	1, 2, 3, 7, 9, 10
14	High wind reinforcement	Severe weather	Reinforce critical facilities and homes against high winds.	Existing	1, 2, 3, 7, 9, 10
15	StormReady program	Severe weather	Complete certification for the StormReady program. The program encourages communities to take a proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations.	New and Existing	1, 4, 5, 7

Table 5-6: Recommended Mitigation Actions

No.	Project Name	Hazard Mitigated	Project Description	Type of Development	BCA Considerations[1]
16	Wastewater treatment upgrades	Volcano, Wildfire	Evaluate capability of potable water and/or wastewater treatment plants to deal with high turbidity from ash fall events, and upgrade water and wastewater treatment facilities as necessary.	Existing	3, 5, 7, 9, 10
17	Air quality education and personal protective equipment	Volcano, Wildfire	Prepare materials to inform the public on personal safety during periods of air quality. Acquire appropriate personal protection equipment, such as N95 facemasks, to provide to the most vulnerable community members.	Existing	1, 4, 5, 7
18	Water storage tanks	Wildfire	Install more water storage tanks and floating pumps to be available for use during periods of prolonged droughts and also to be used for firefighting capabilities.	New and Existing	1, 3, 6, 7, 9, 10
19	Community defensible space	Wildfire	Continue to create defensible space around the population center by reducing the wildland fuel load and altering vegetative patterns. Efforts to create defensible space may include one or more of the following: mechanical/manual treatment, mowing/mastication, hand thinning/brushing, chaining, seeding, and controlled burn.	New and Existing	1, 4, 5, 6, 8, 9, 10
20	Firewise USA program	Wildfire	Complete application for the Firewise program. Hold Firewise workshops to educate residents and contractors concerning fire resistant landscaping. Promote Firewise building siting, design, and construction processes and materials. The Firewise USA recognition program is administered by the National Fire Protection Association and provides a collaborative framework to help residents in a community get organized, find direction, and take action to increase the ignition resistance of their homes and community and to reduce wildfire risks at the local level.	Existing	1, 4, 5, 7

Notes:
[1]The considerations for the benefit-cost analysis (BCA) were based on experience and best judgment, including benefits of losses avoided and qualitative benefits such as quality of life and natural and beneficial functions of ecosystems. Considerations include: 1) creates safer communities, 2) speeds up recovery, 3) lessens financial impacts, 4) increases public awareness, 5) strengthens community partnerships, 6) addresses priority hazards and/or multiple hazards, 7) capital expenditures, 8) costs for environmental planning, design, and review, 9) maintenance costs, and/or 10) project life expectancy.

5.5 PRIORITIZED ACTION PLAN

A prioritized action plan is an itemized list of recommended mitigation actions that a community/agency hopes to put into practice to reduce its risks and vulnerabilities.

For the 2022 MJHMP, the planning team created a two-tier prioritization process based on the following:

- High priority mitigation actions are those that address hazards of immediate concern and are also cost-effective (positive cost-benefit ratio) and have an identified funding source.
- Medium mitigation actions are those that address hazards that are not of immediate concern and/or those that are of immediate concern but are not cost effective or do not have an identified funding source.

The community determined the hazards and threats of immediate concern based on the 2022 MJHMP's hazard profiles, risk assessment, and capability assessment to be erosion, flooding, severe weather, and wildfire.

The results of the above prioritization process are provided in Table 5-7. For each mitigation action listed, potential funding sources, responsible departments or agencies, and implementation timelines have been identified.

Table 5-7: Prioritized Action Plan

No.	Project Name	Priority	Potential Funding Source	Responsibility	Timing
1	Community planning	High	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	0 to 5 years
2	Natural hazard community outreach	High	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	0 to 5 years
3	Critical facility auxiliary power	High	FEMA BRIC/HMGP	City of Dillingham, Curyung Tribal Council	3 to 6 years
4	Climate action planning	Medium	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	Ongoing
5	Sea level rise zoning	Medium	City of Dillingham, Curyung Tribal Council, University of Alaska Fairbanks	City of Dillingham, Curyung Tribal Council, University of Alaska Fairbanks	Ongoing
8	Erosion mapping	High	City of Dillingham, Curyung Tribal Council, University of Alaska Fairbanks	City of Dillingham, Curyung Tribal Council, University of Alaska Fairbanks	Ongoing
9	Revetment walls	Highest	FEMA BRIC/HMGP	City of Dillingham, Curyung Tribal Council	0 to 5 years
10	Culvert installation and upgrades	Medium	FEMA BRIC/HMGP	City of Dillingham, Curyung Tribal Council	3 to 6 years
14	High wind reinforcement	Medium	FEMA BRIC/HMGP, Bristol Bay Housing Authority	City of Dillingham, Curyung Tribal Council, Bristol Bay Housing Authority	Ongoing
15	StormReady program	High	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	Ongoing
17	Air quality education and personal protective equipment	Medium	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	0 to 5 years
18	Water storage tanks	Medium	City of Dillingham, Curyung Tribal Council	City of Dillingham, Curyung Tribal Council	3 to 6 years
19	Community defensible space	Medium	City of Dillingham, Curyung Tribal Council, Alaska Department of Natural Resources (ADNR)	City of Dillingham, Curyung Tribal Council, ADNR	Ongoing
20	Firewise USA program	High	City of Dillingham, Curyung Tribal Council, ADNR	City of Dillingham, Curyung Tribal Council, ADNR	Ongoing

5.6 PLAN INTEGRATION

Information about how the 2022 MJHMP will be integrated into Dillingham's relevant plans and programs moving forward is provided in Table 5-8.

Table 5-8: Integration of 2022 MJHMP

MJHMP Section	Existing Plan/Policy/Program	Process / Timeframe
Section 3 – Hazard Identification	City of Dillingham Comprehensive Plan	Update of the City of Dillingham Comprehensive Plan to address hazards in the MJHMP that are not currently included in the plan. Consider creating a hazard profiles section in the Comprehensive Plan.
Section 4 – Risk Assessment	City of Dillingham Emergency Operations Plan	Incorporate based risk assessment findings into the City of Dillingham Emergency Operations Plan to help identify and ensure critical resources to maintain operations internally and externally.

5.7 MONITORING MITIGATION GOALS AND ACTIONS

Mitigation goals and actions identified in this MJHMP will be monitored during the annual review. This process is described in detail in Section 2.7.

In general, during each annual review, each department or agency currently administering a mitigation project will need to submit required documentation to the MJHMP project manager for review. FEMA-provided quarterly reports are most used as they provide information on the status of the mitigation project, detail any changes made to the project, and describe implementation problems and appropriate strategies to overcome them. The MJHMP project managers will follow the FEMA Grants Management Final Closeout Checklist to ensure all program-specific closeout requirements are met. Other reporting forms that may be used include administration plans or agency-specific reporting tools.

6.0 PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

This section addresses Element D of the Local and Tribal Mitigation Plans regulation checklists.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element D: Plan Review, Evaluation and Implementation
D1. Was the plan revised to reflect changes in development? (Requirement § 201.6(d)(3))
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement § 201.6(d)(3))
D3. Was the plan revised to reflect changes in priorities? (Requirement § 201.6(d)(3))

Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element D: Plan Updates
D1. Was the plan revised to reflect changes in development? (Requirement 44 CFR § 201.7(d)(3))
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement 44 CFR §§ 201.7(d)(3) and 201.7(c)(4)(iii))
D3. Was the plan revised to reflect changes in priorities? (Requirement 44 CFR §201.7(d)(3))

6.1 CHANGES IN DEVELOPMENT

The 2016 LHMP was updated to reflect the following changes that affect development:

- Some critical facilities have changed since the 2015 MJHMP. A few commercial buildings have been excluded, and others included based on relevance determined by the planning team. Some state and federal facilities, such as the U.S. post office and the Alaska Department of Fish and Game, were excluded for jurisdiction. This plan includes more access points, such as private airstrips and a cultural site. Linear features, such as roads, sewer lines, and telephone lines were excluded from this plan.
- The only commercial development that has occurred since the 2015 MJHMP is the OBI Seafood power plant at Wood River, which ramped up joined to the power grid. The area of the power plant is within the 100-year floodplain and could be at risk for flooding from the Wood River.
- There has been no significant residential development since the 2015 MJHMP. Some new housing has been added sporadically through the community. Residential areas in the community are generally spread out and are in the wildland-urban interface. Any new residential development outside of the city center is at risk for wildland fire.

6.2 PROGRESS IN LOCAL MITIGATION EFFORTS

Dillingham reviewed the 2016 LHMP's mitigation strategy and documented progress made toward each local mitigation effort, provided in Table 6-1. Mitigation actions that had not be implemented were considered for the 2022 MJHMP (Table 5-6).

Table 6-1: Progress in Local Mitigation Efforts

Action #	Action	Status
MH 1.1	Identify and pursue funding opportunities to implement mitigation actions.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 1.2	Public education regarding City of Dillingham participation in NFIP and use and availability of flood insurance.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 1.3	Educate residents about safe well, sewer, and septic installations.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 1.4	Public education "infomercials" on local radio.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 1.5	Provide two annual weather safety talks.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 1.6	Promote FireWise building design, siting, and materials use for construction.	Ongoing. Mitigation action included in the 2022 MJHMP.
MH 1.7	Increase culvert sizes to increase their drainage capacity or efficiency.	Ongoing. Mitigation action included in the 2022 MJHMP.
MH 1.8	Harden culvert entrance bottoms with asphalt, concrete, rock, or similar material to reduce erosion of scour.	Ongoing. Mitigation action included in the 2022 MJHMP
MH 2.1	Support updates to the FEMA Flood Insurance Rate Maps.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 2.2	Update and enforce floodplain management ordinances.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 2.3	Conduct community alert tests for the National Oceanic and Atmospheric Administration warning tones (contact the National Oceanic and Atmospheric Administration, City Police and Fire Departments, and Volunteer Fire Departments to coordinate test).	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
MH 2.4	Complete Memorandum of Understanding with KDLG regarding communication in the event of an emergency.	Ongoing. The community continues to maintain partnerships with the Dillingham City School District, which operates KDLG.
MH 2.5	Design an evacuation plan for the core town site.	Ongoing. The city is in the process of updating its 2018 Emergency Operations Plan.
MH 3.1	Develop new water source in Neqleq Subdivision.	Ongoing. The project is being evaluated by the Alaska Native Tribal Health Consortium.
MH 3.2	Tie new water source in Neqleq Subdivision to the rest of the City's water system.	Ongoing. The project is being evaluated by the Alaska Native Tribal Health Consortium.
MH 3.3	Purchase and install underground water supply tanks in specified locations.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.

Table 6-1: Progress in Local Mitigation Efforts

Action #	Action	Status
FL 5.1	Construct breakwater and seawalls in Dillingham harbor. Construct West side revetment and breakwater, proposed by USACE.	Ongoing. Harbor upgrades were constructed in 2019, although additional improvements are being evaluated.
FL 5.2	Extend seawall in front of the harbor east toward the Peter Pan dock. Construct East side ("city dock" side) revetment armoring the outside of the harbor & providing beach access, proposed by USACE.	Ongoing. Harbor upgrades were constructed in 2019, although additional improvements are being evaluated.
FL 5.3	Renew contract every five years to remove sedimentation from the small boat harbor.	Ongoing. Harbor upgrades were constructed in 2019, although additional maintenance needs are being evaluated.
FL 5.4	Request that USACE go back to on-land dredge spoils disposal versus pumping the sediment back into the bay.	Ongoing. Harbor upgrades were constructed in 2019, although additional maintenance needs are being evaluated.
FL 5.5	Stabilize the eroding bank in the vicinity of the recreation area.	Ongoing. Bulkheads were constructed in 2019, although additional improvements are being evaluated.
FL 5.6	Map and evaluate the location and degree of erosion issues along the Dillingham waterfront.	Ongoing. The city and tribe are partnering with organizations to monitor erosion at the waterfront.
FL 5.7	Develop and implement practical erosion mitigation plans.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
FL 5.8	Construct the extension of the North Shore Bulkhead (construct west and east seawalls).	Ongoing. Bulkheads were constructed in 2019, although additional improvements are being evaluated.
FL 5.9	Replace riprap removed by storms at the north end of the Snag Point sheet-pile bulkhead.	Ongoing. Bulkheads were constructed in 2019, although additional improvements are being evaluated.
UC 10.1	Improve water lines to south side of the harbor.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.
UC 10.2	Identify possible locations of underground water tanks and property ownership.	Deferred, mitigation action no longer considered relevant and/or a priority and not included in the 2022 MJHMP.
UC 10.3	Purchase and install underground water supply tanks.	Deferred, mitigation action no longer considered relevant and/or a priority and not included in the 2022 MJHMP.
UC 10.4	Obtain MOA or agreements with property owners to install underground water tanks.	Deferred, mitigation action no longer considered relevant and/or a priority and not included in the 2022 MJHMP.
UC 10.5	Conduct residential audits for wildland and building fire hazards.	Ongoing. Mitigation action modified and included in the 2022 MJHMP.

In addition, supporting local plans, studies, and programs were reviewed to determine additional progress in local mitigation efforts. Relevant ongoing actions are provided in Table 5-6 as well.

6.3 CHANGES IN PRIORITIES

The 2016 LHMP's mitigation strategy was prioritized using the STAPLEE (social, technical, administrative, political, legal, environmental, and economic), which FEMA recommended (FEMA 386-9) as a prioritization method in the early- to mid-2000s. While the STAPLEE has been replaced in the 2022 MJHMP by a more streamlined prioritization process, the priorities (listed below) have not changed:

- To build a culture and practice of disaster resilience by addressing hazards of immediate concern, a mitigation project must have social support.
- To be implemented in a timely manner, a mitigation project must be economically feasible and have an identified funding source.

7.0 PLAN ADOPTION

This section addresses Element E of the Local and Tribal Mitigation Plans regulation checklists.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element E: Plan Adoption
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5)) E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))

Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element E: Plan Adoption
E1. Does the plan include assurances that the tribal government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend its plan whenever necessary to reflect changes in tribal or Federal laws and statutes? (Requirement 44 CFR § 201.7(c)(6)) E2. Does the plan include documentation that it has been formally adopted by the governing body of the tribal government requesting approval? (Requirement 44 CFR § 201.7(c)(5))

7.1 ASSURANCES

The adoption resolution for Curyung Tribal Council includes assurances that the tribal council will comply with applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding (including 2 CFR Parts 200 and 3002) and will amend its plan whenever necessary to reflect changes in tribal or federal laws and statutes.

7.2 FORMAL ADOPTION

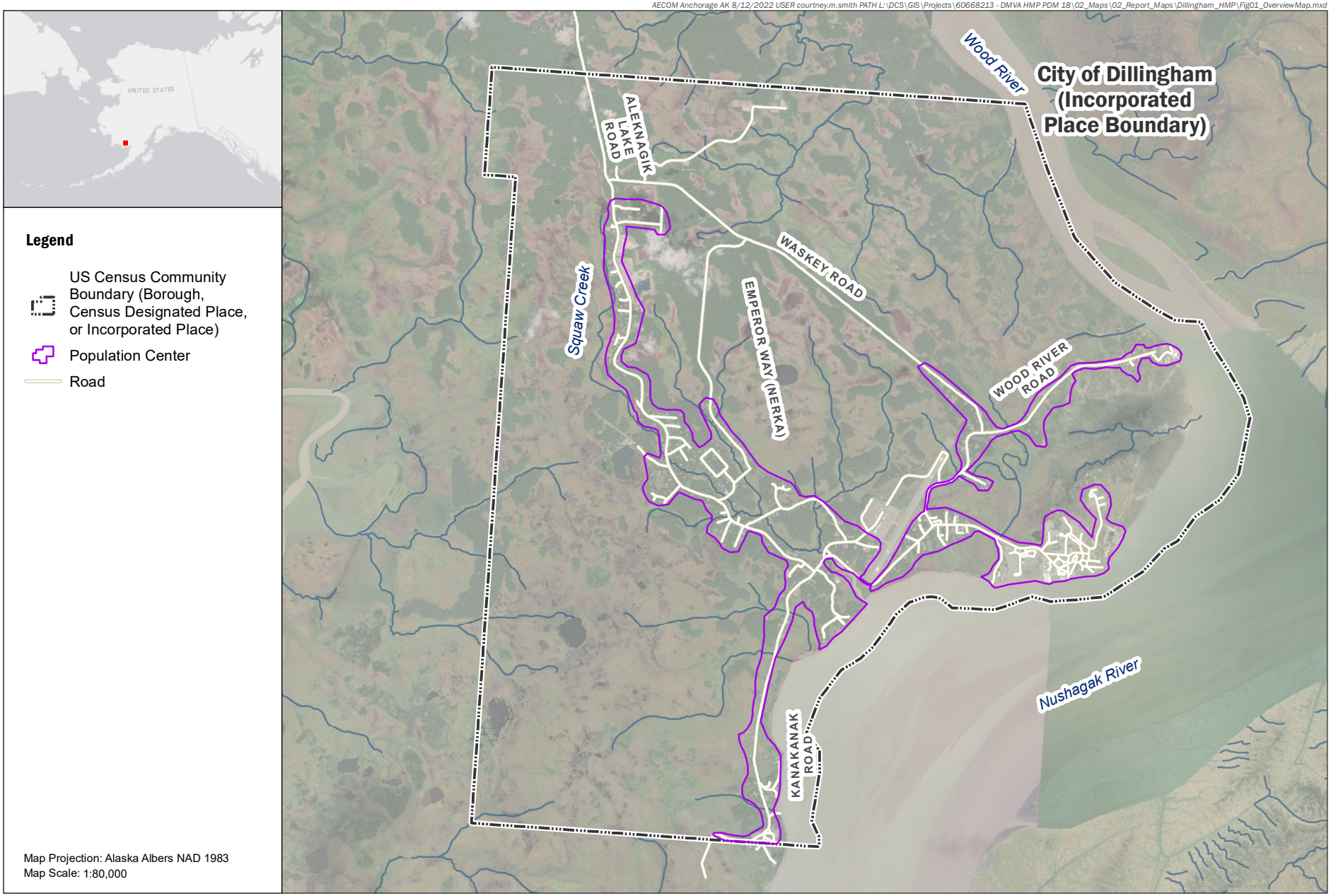
The 2022 MJHMP was formally adopted on [date] by the Dillingham City Council. A copy of the adoption resolution is kept on in on file with the community and the Alaska DHS&EM.

The 2022 MJHMP was formally adopted on [date] by the Curyung Tribal Council. A copy of the adoption resolution in on file with the community and the Alaska DHS&EM.

8.0 APPENDICES

APPENDIX A—FIGURES

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig01_OverviewMap.mxd



US Census TigerLine (2021)
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User

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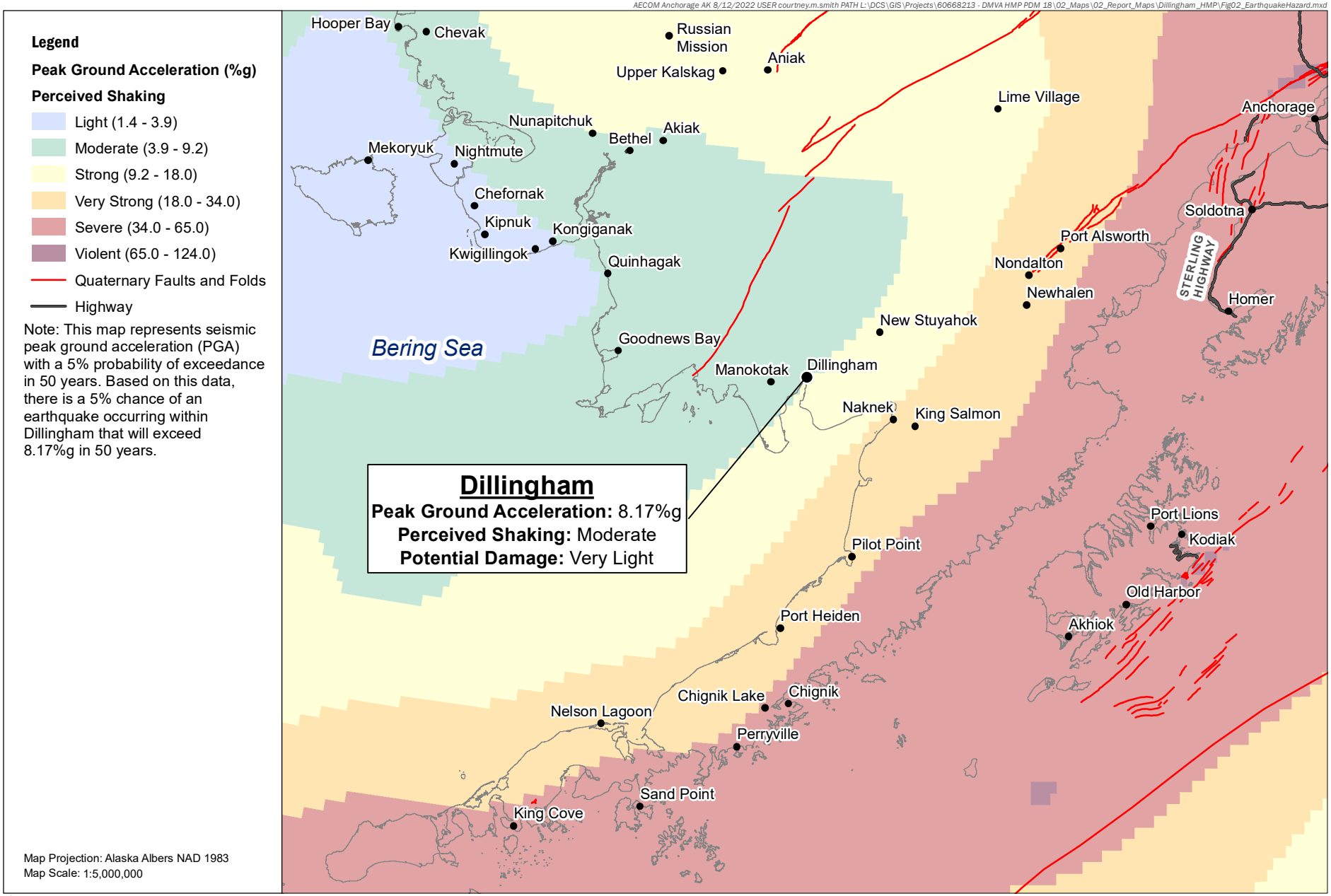
Multi-Jurisdictional Hazard Mitigation Plan

OVERVIEW MAP

Figure 1

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig02_EarthquakeHazard.mxd



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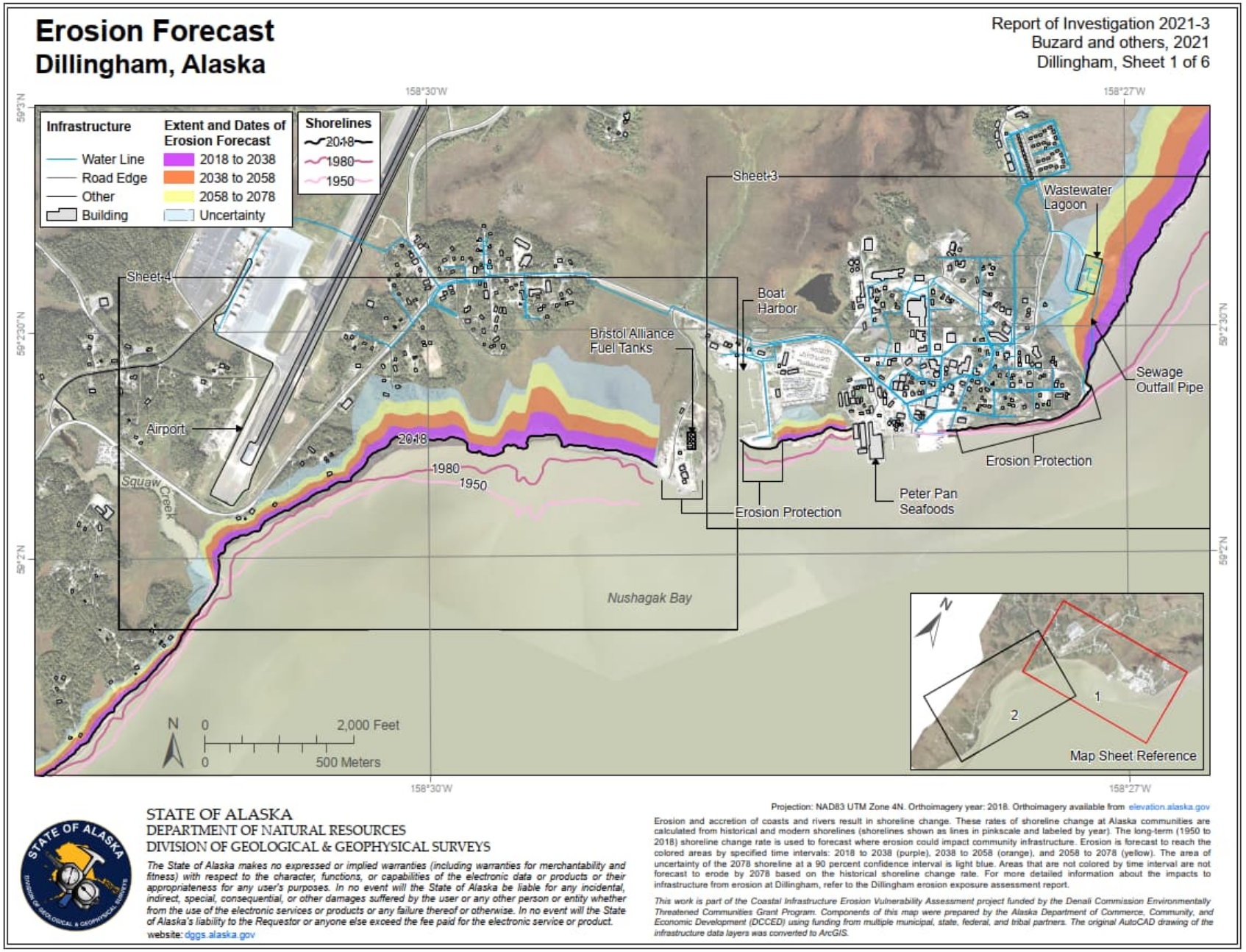
Multi-Jurisdictional Hazard Mitigation Plan

EARTHQUAKE HAZARD AREAS

Figure 2



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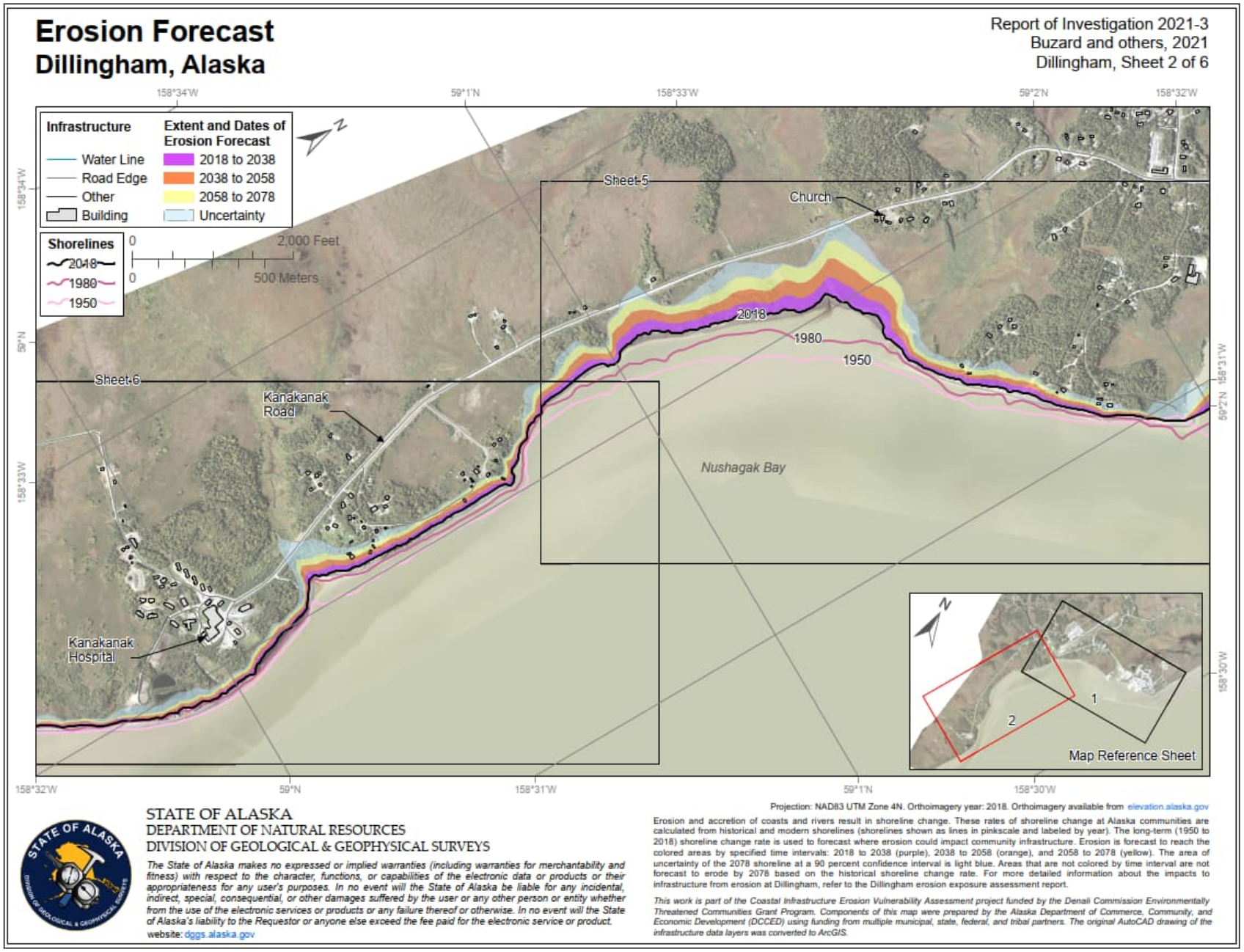
Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pinkscale and labeled by year). The long-term (1950 to 2018) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to reach the colored areas by specified time intervals: 2018 to 2038 (purple), 2038 to 2058 (orange), and 2058 to 2078 (yellow). The area of uncertainty of the 2078 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2078 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Dillingham, refer to the Dillingham erosion exposure assessment report.

This work is part of the Coastal Infrastructure Erosion Vulnerability Assessment project funded by the Denali Commission Environmentally Threatened Communities Grant Program. Components of this map were prepared by the Alaska Department of Commerce, Community, and Economic Development (DCCED) using funding from multiple municipal, state, federal, and tribal partners. The original AutoCAD drawing of the infrastructure data layers was converted to ArcGIS.

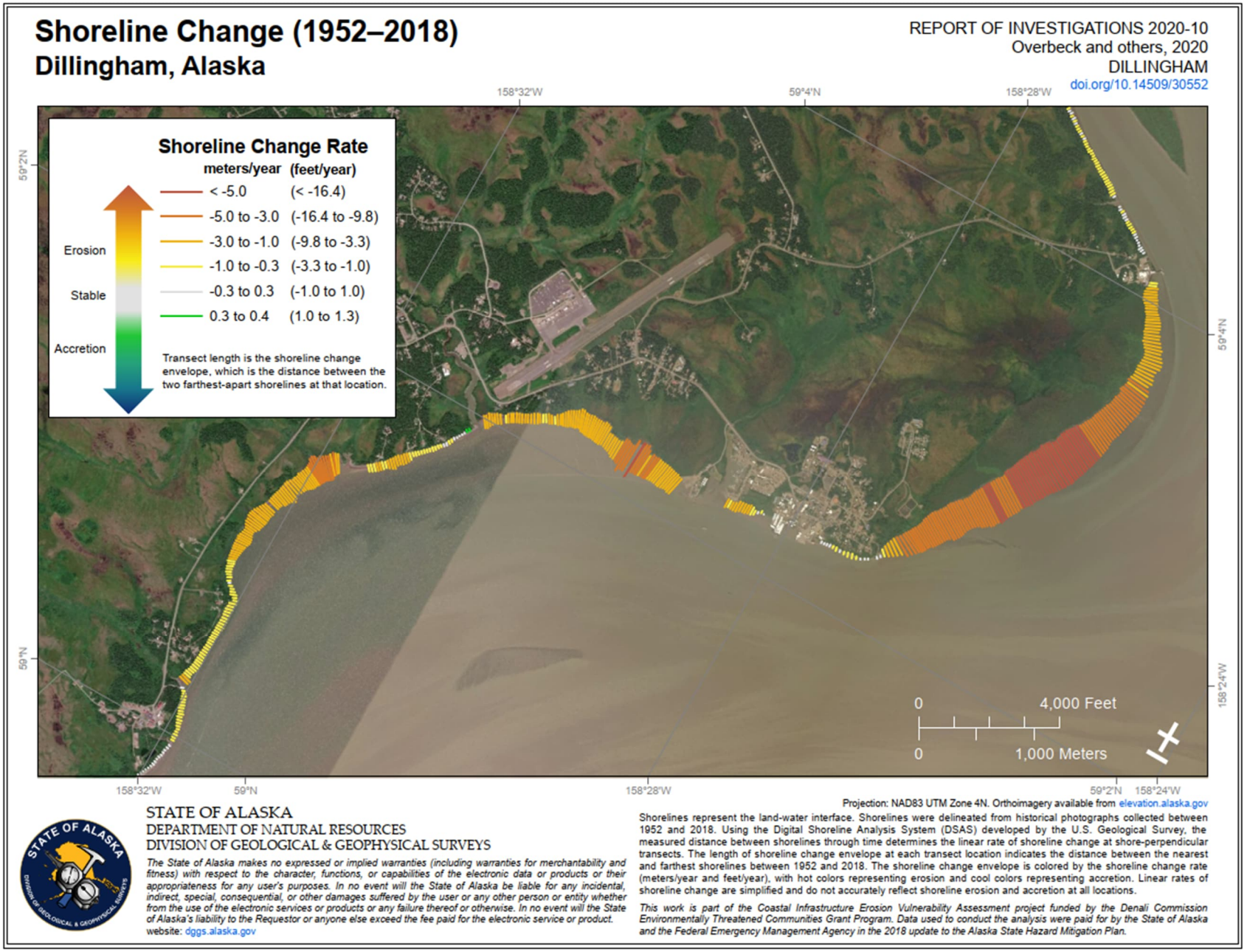
EROSION FORECAST (EAST)

Figure 3



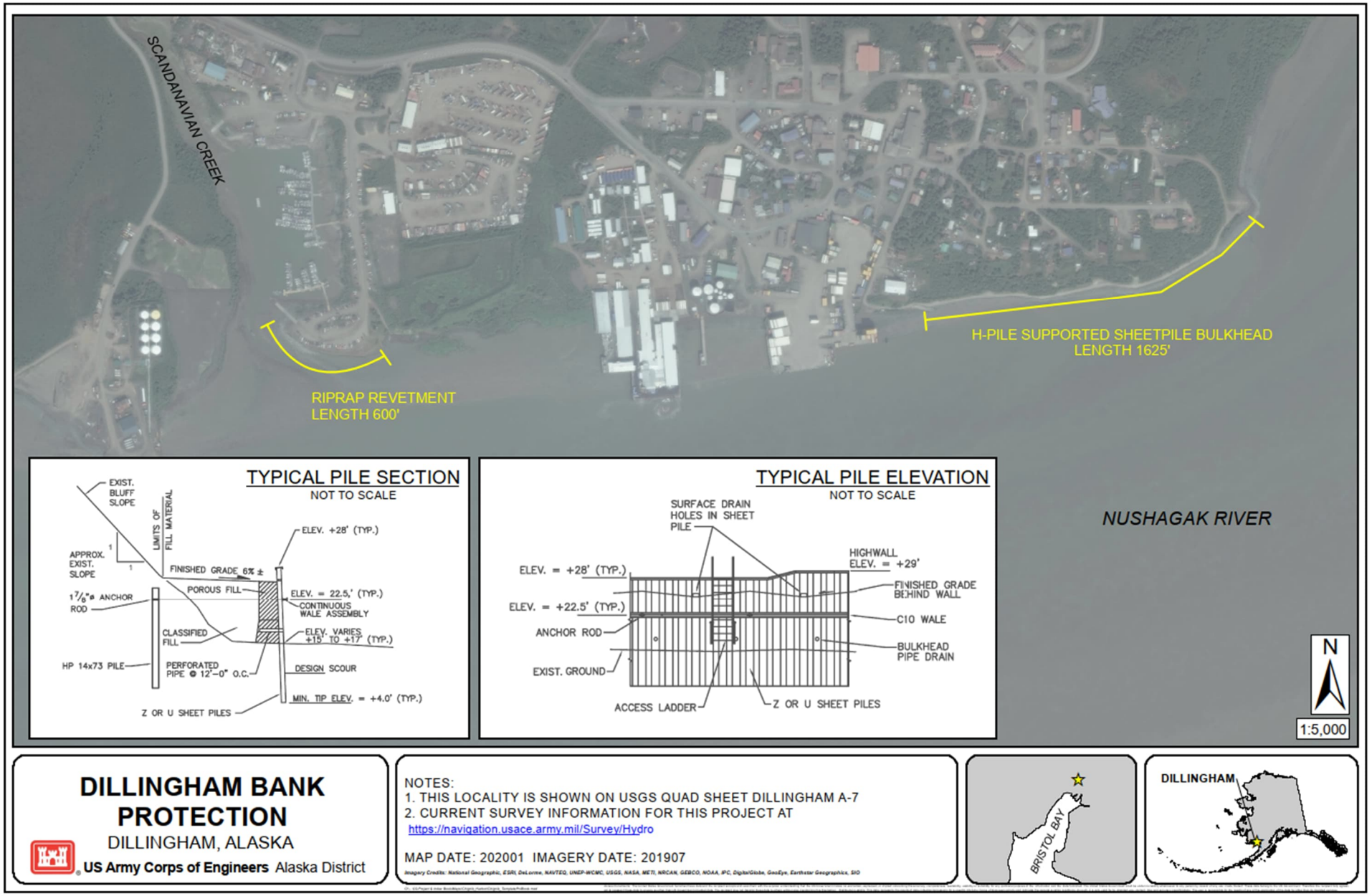
EROSION FORECAST (WEST)

Figure 4

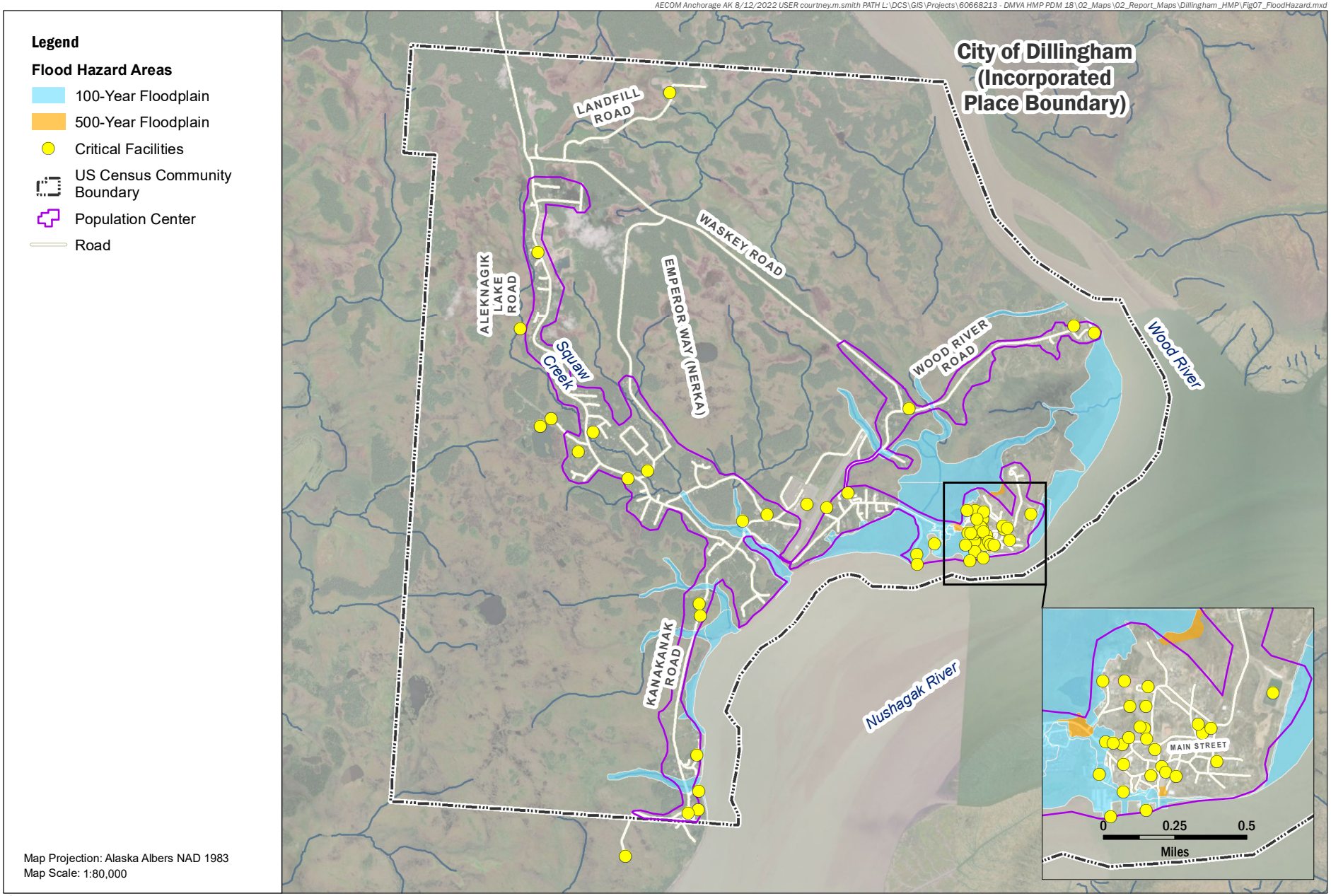


SHORELINE CHANGE (1952-2018)

Figure 5


SCANDANAVIAN CREEK
RIPRAP REVETMENT
LENGTH 600'
H-PILE SUPPORTED SHEETPILE BULKHEAD
LENGTH 1625'
NUSHAGAK RIVER
TYPICAL PILE SECTION
NOT TO SCALE
EXIST. BLUFF SLOPE
LIMITS OF FILL MATERIAL
APPROX. EXIST. SLOPE
ELEV. +28' (TYP.)
FINISHED GRADE 6% ±
POROUS FILL
ELEV. = 22.5,' (TYP.)
CONTINUOUS WALE ASSEMBLY
1 7/8"ø ANCHOR ROD
CLASSIFIED FILL
ELEV. VARIES +15' TO +17' (TYP.)
HP 14x73 PILE
PERFORATED PIPE @ 12'-0" O.C.
DESIGN SCOUR
MIN. TIP ELEV. = +4.0' (TYP.)
Z OR U SHEET PILES
TYPICAL PILE ELEVATION
NOT TO SCALE
SURFACE DRAIN HOLES IN SHEET PILE
HIGHWALL ELEV. = +29'
ELEV. = +28' (TYP.)
FINISHED GRADE BEHIND WALL
ELEV. = +22.5' (TYP.)
C10 WALE
ANCHOR ROD
BULKHEAD PIPE DRAIN
EXIST. GROUND
ACCESS LADDER
Z OR U SHEET PILES
N
1:5,000
DILLINGHAM BANK PROTECTION
DILLINGHAM, ALASKA
US Army Corps of Engineers Alaska District
NOTES:
1. THIS LOCALITY IS SHOWN ON USGS QUAD SHEET DILLINGHAM A-7
2. CURRENT SURVEY INFORMATION FOR THIS PROJECT AT
https://navigation.usace.army.mil/Survey/Hydro
MAP DATE: 202001 IMAGERY DATE: 201907
BRISTOL BAY
DILLINGHAM

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig07_FloodHazard.mxd



FEMA (1982); US Census TigerLine (2021)
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User

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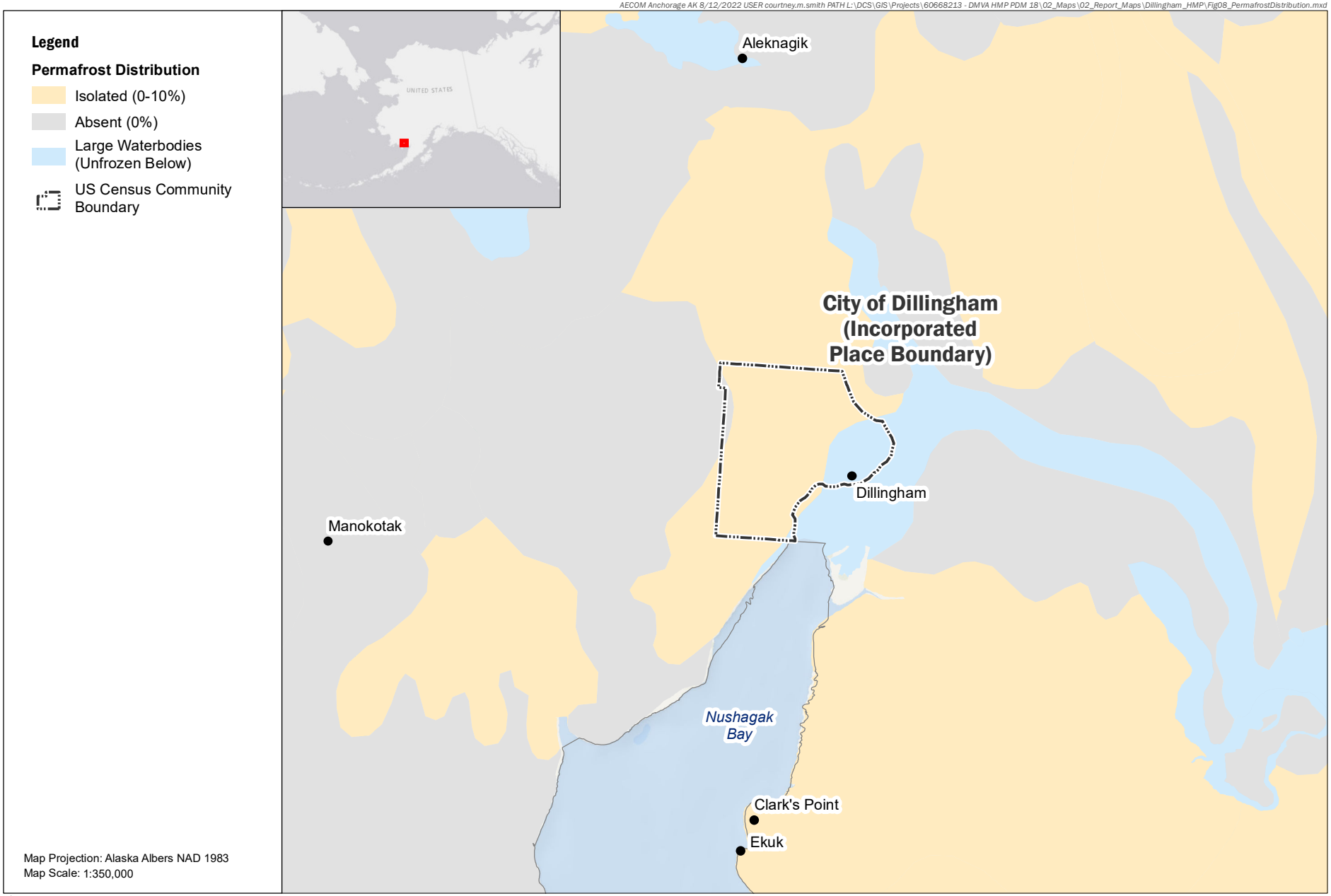
Multi-Jurisdictional Hazard Mitigation Plan

FLOOD HAZARD AREAS

Figure 7

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig08_PermafrostDistribution.mxd



Jorgenson et al. 2008; US Census TigerLine (2021)
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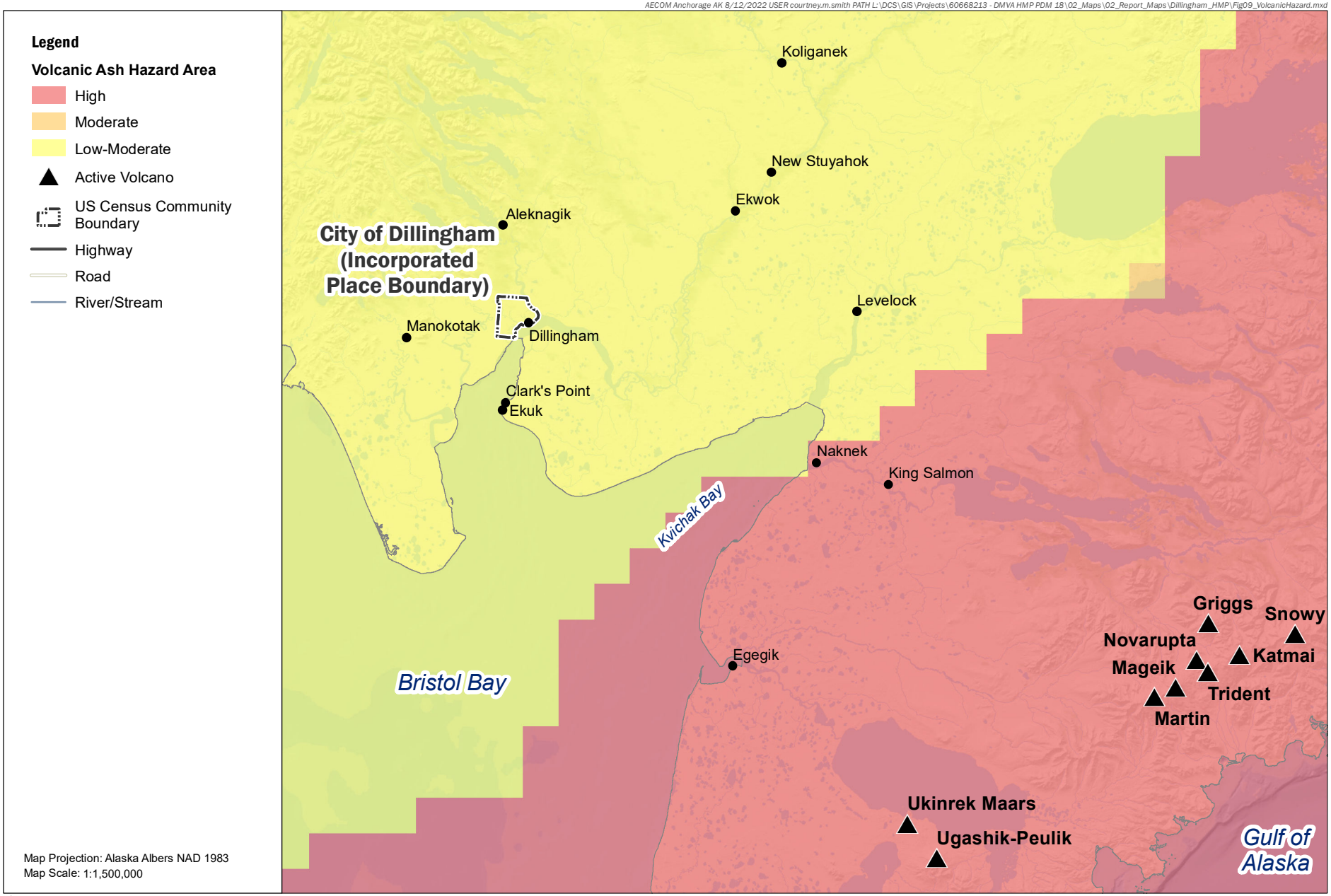
Multi-Jurisdictional Hazard Mitigation Plan

PERMAFROST DISTRIBUTION

Figure 8

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig09_VolcanicHazard.mxd



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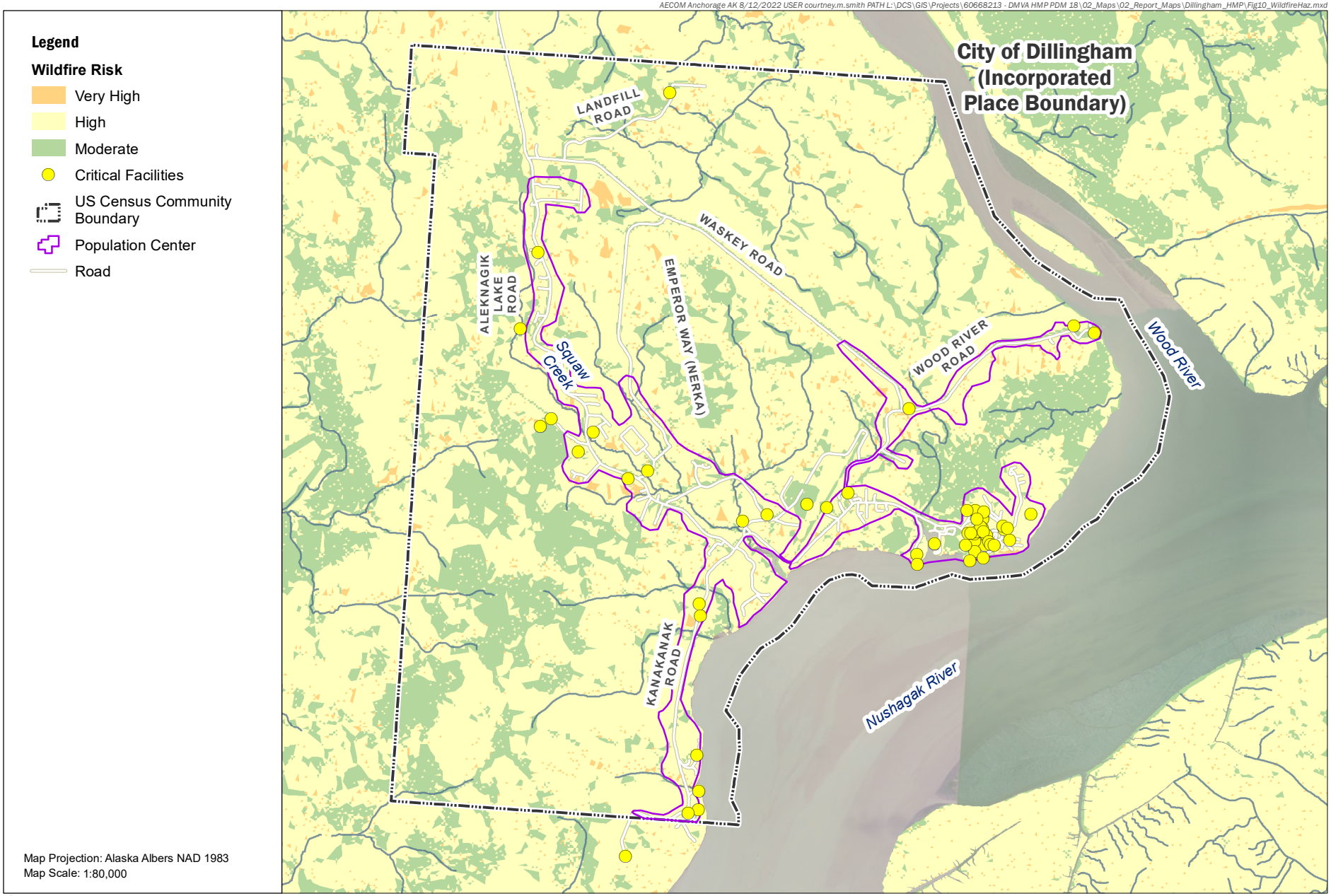
Multi-Jurisdictional Hazard Mitigation Plan

VOLCANIC ASH HAZARD AREAS

Figure 9

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig10_WildfireHaz.mxd



US Census TigerLine (2021)
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User

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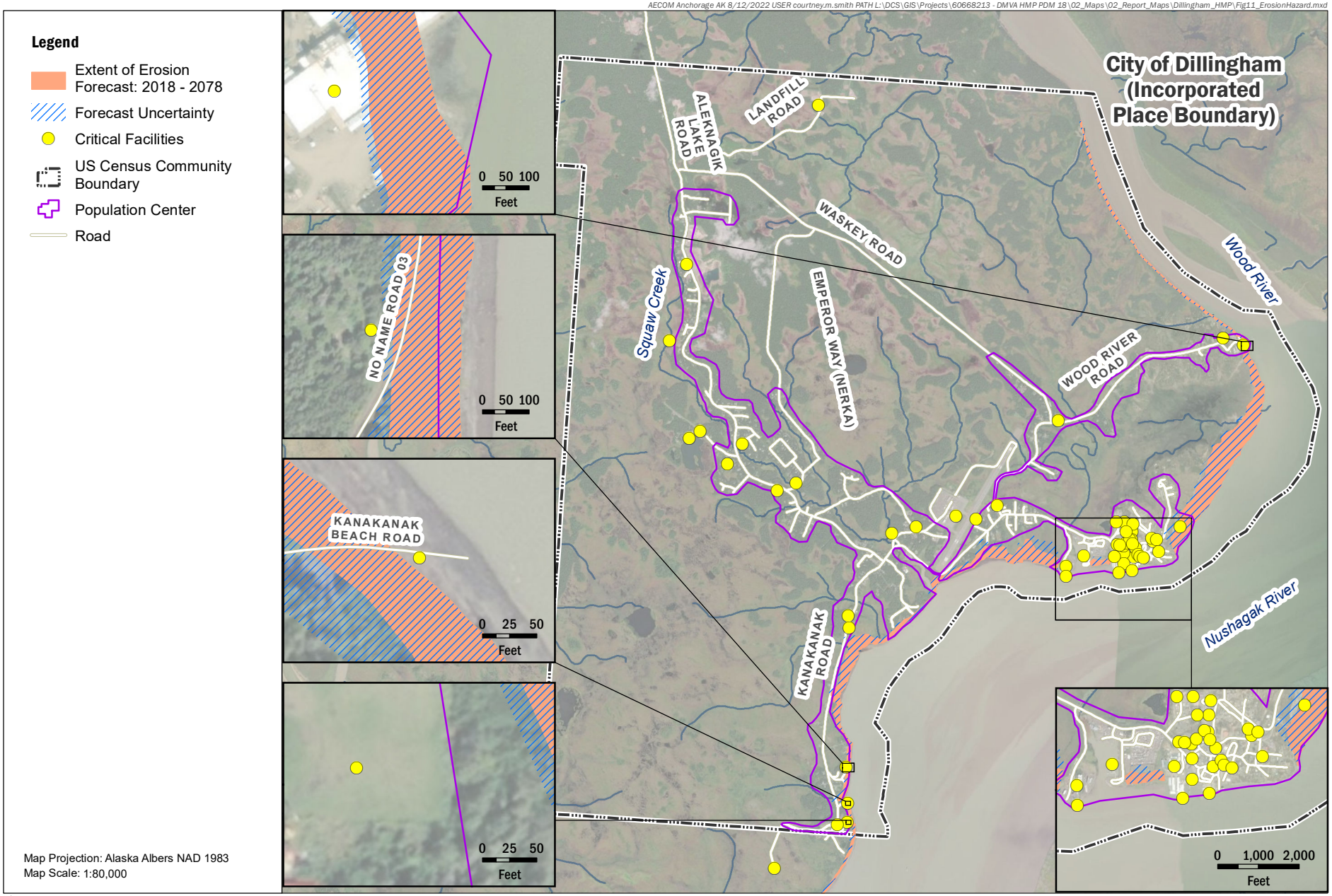
Multi-Jurisdictional Hazard Mitigation Plan

WILDFIRE HAZARD AREAS

Figure 10

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig11_ErosionHazard.mxd



DGGS (2021); US Census TigerLine (2021)
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User

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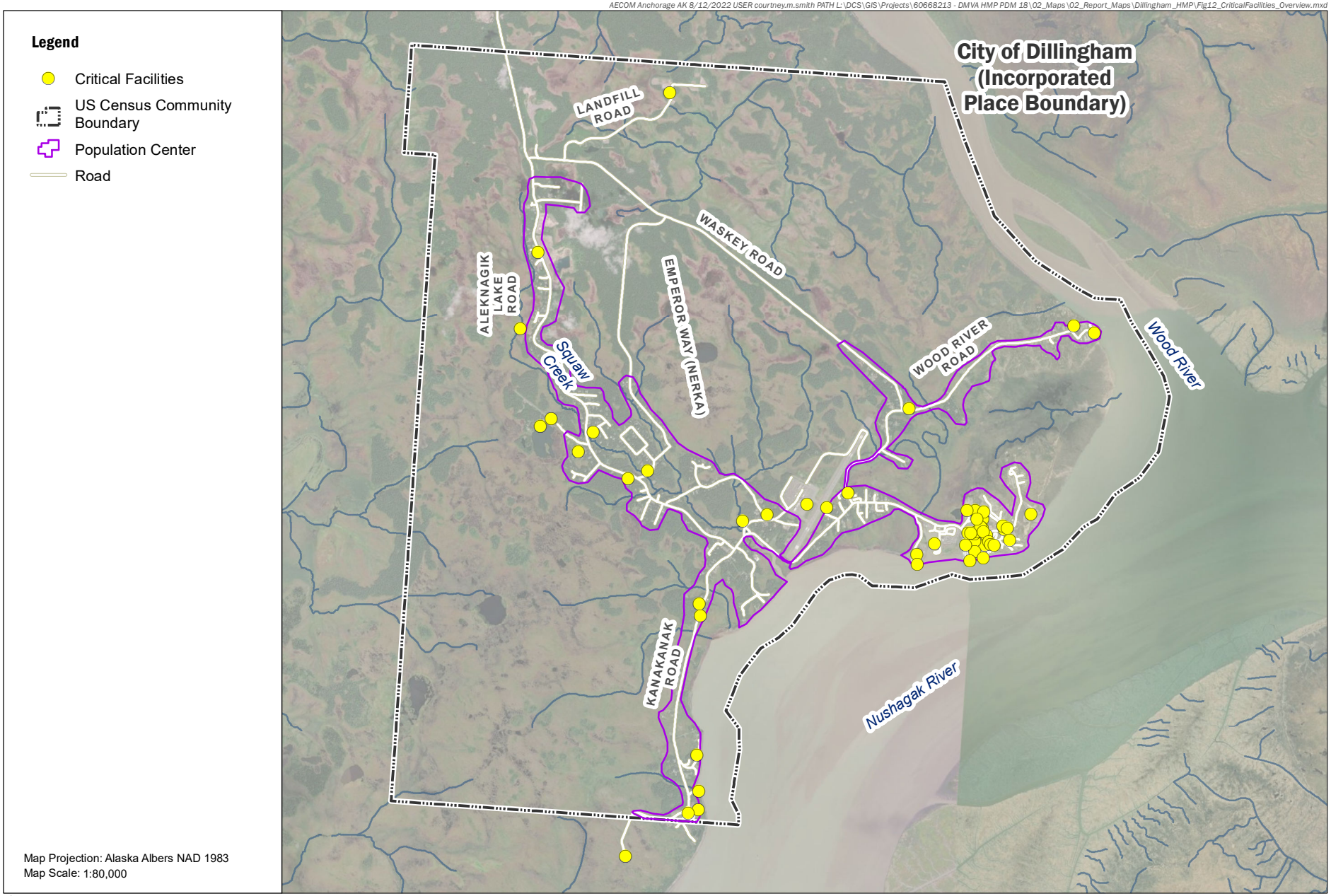
Multi-Jurisdictional Hazard Mitigation Plan

EROSION HAZARD AREAS

Figure 11

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig12_CriticalFacilities_Overview.mxd



US Census TigerLine (2021)
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User

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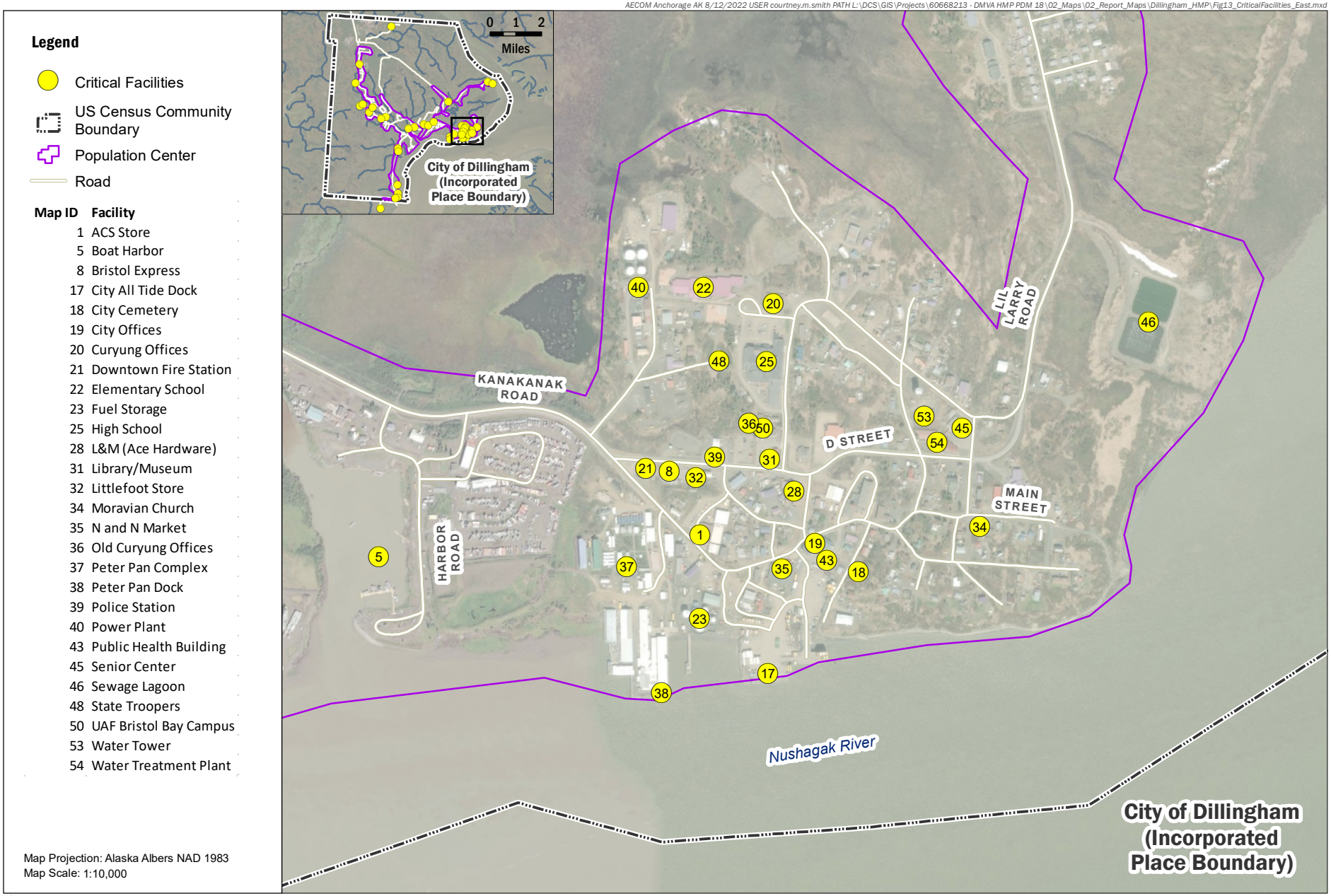
City of Dillingham and Curyung Tribal Council 2022
Multi-Jurisdictional Hazard Mitigation Plan

CRITICAL FACILITIES OVERVIEW

Figure 12

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig13_CriticalFacilities_East.mxd



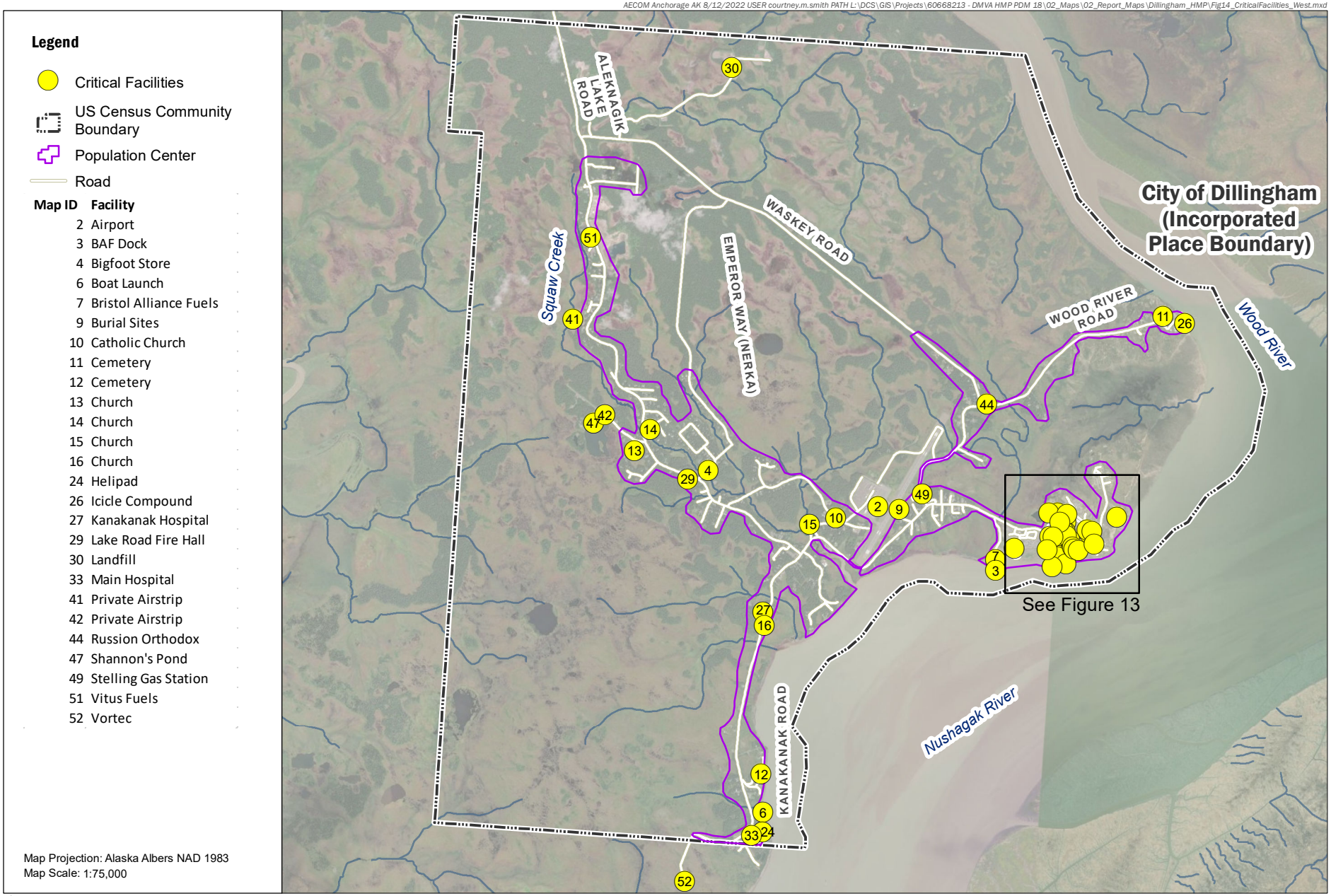
US Census TigerLine (2021)
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User

AECOM
City of Dillingham and Curyung Tribal Council 2022
Multi-Jurisdictional Hazard Mitigation Plan

CRITICAL FACILITIES (EAST)

Figure 13

AECOM Anchorage AK 8/12/2022 USER courtney.m.smith PATH L:\DCS\GIS\Projects\60668213 - DMVA HMP PDM 18\02_Maps\02_Report_Maps\Dillingham_HMP\Fig14_CriticalFacilities_West.mxd

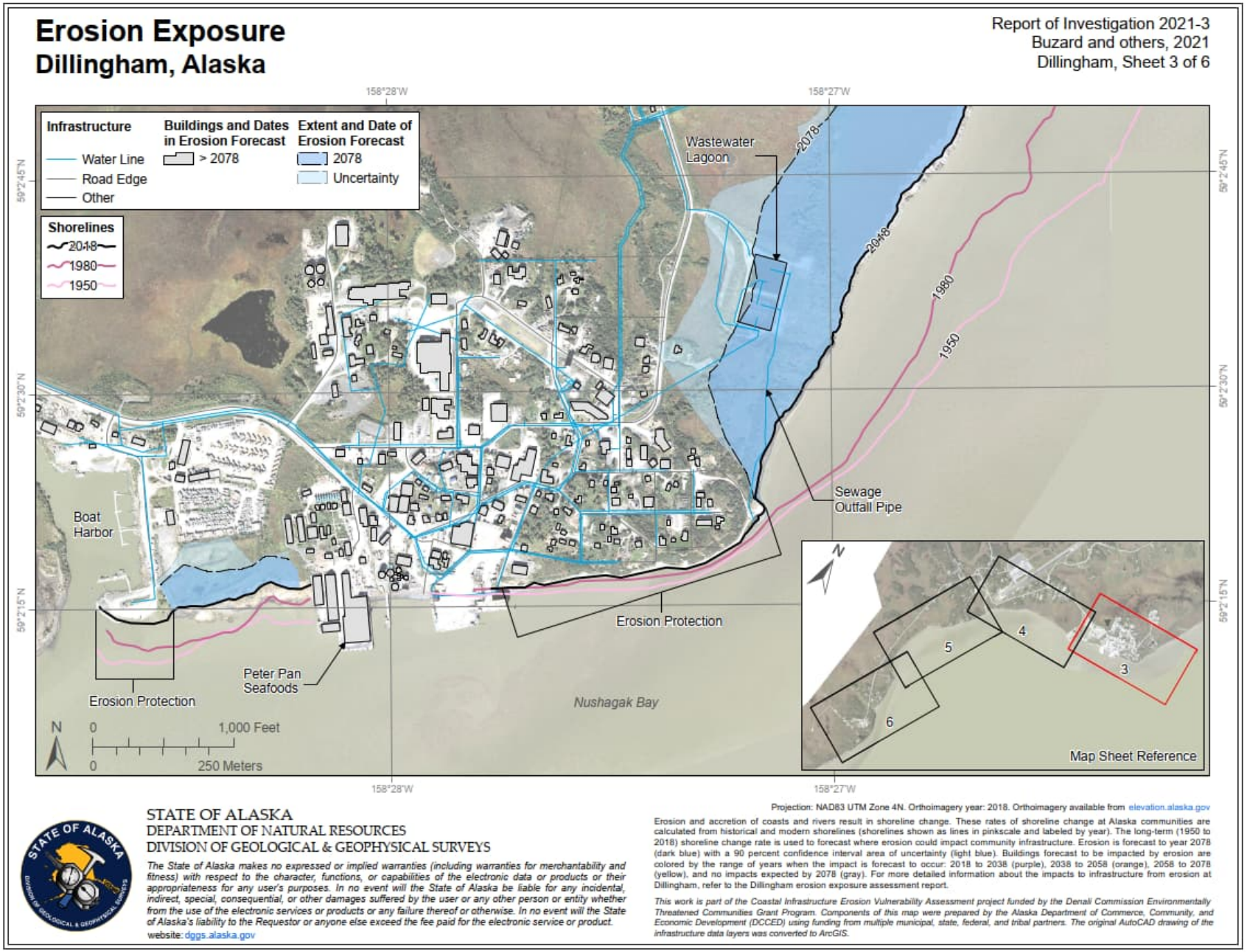


AECOM

City of Dillingham and Curyung Tribal Council 2022
Multi-Jurisdictional Hazard Mitigation Plan

CRITICAL FACILITIES (WEST)

Figure 14


Erosion Exposure
Dillingham, Alaska
Report of Investigation 2021-3
Buzard and others, 2021
Dillingham, Sheet 3 of 6
158°28'W
158°27'W
59°2'45"N
59°2'30"N
59°2'15"N
Infrastructure
Water Line
Road Edge
Other
Buildings and Dates in Erosion Forecast
> 2078
Extent and Date of Erosion Forecast
2078
Uncertainty
Shorelines
2018
1980
1950
Wastewater Lagoon
2078
2048
1980
1950
Sewage Outfall Pipe
Boat Harbor
Erosion Protection
Erosion Protection
Peter Pan Seafoods
Nushagak Bay
N
0
1,000 Feet
0
250 Meters
N
5
4
3
6
Map Sheet Reference
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
website: dggs.alaska.gov
Projection: NAD83 UTM Zone 4N. Orthoimagery year: 2018. Orthoimagery available from elevation.alaska.gov
Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pinkscale and labeled by year). The long-term (1950 to 2018) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to year 2078 (dark blue) with a 90 percent confidence interval area of uncertainty (light blue). Buildings forecast to be impacted by erosion are colored by the range of years when the impact is forecast to occur: 2018 to 2038 (purple), 2038 to 2058 (orange), 2058 to 2078 (yellow), and no impacts expected by 2078 (gray). For more detailed information about the impacts to infrastructure from erosion at Dillingham, refer to the Dillingham erosion exposure assessment report.
This work is part of the Coastal Infrastructure Erosion Vulnerability Assessment project funded by the Denali Commission Environmentally Threatened Communities Grant Program. Components of this map were prepared by the Alaska Department of Commerce, Community, and Economic Development (DCCED) using funding from multiple municipal, state, federal, and tribal partners. The original AutoCAD drawing of the infrastructure data layers was converted to ArcGIS.
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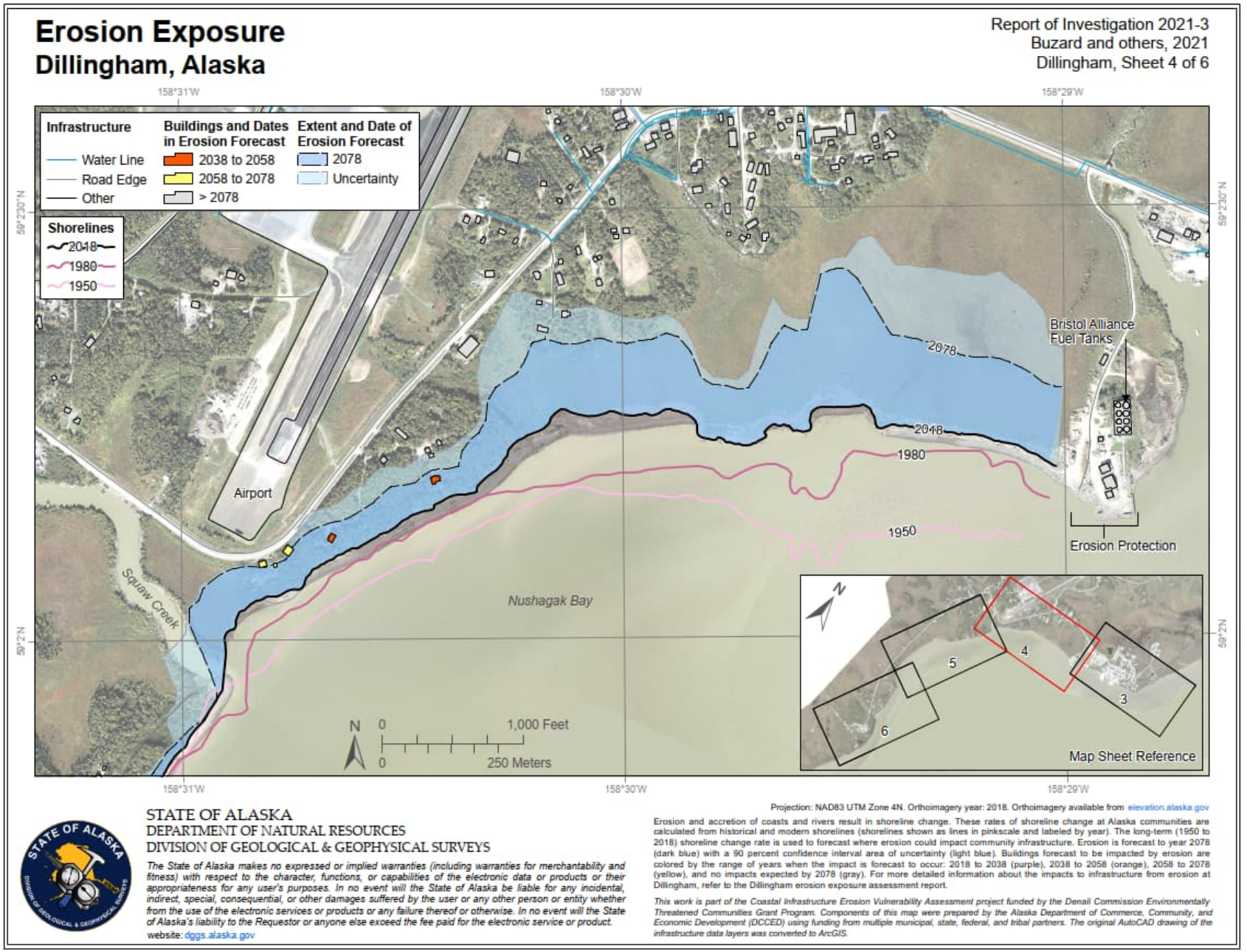

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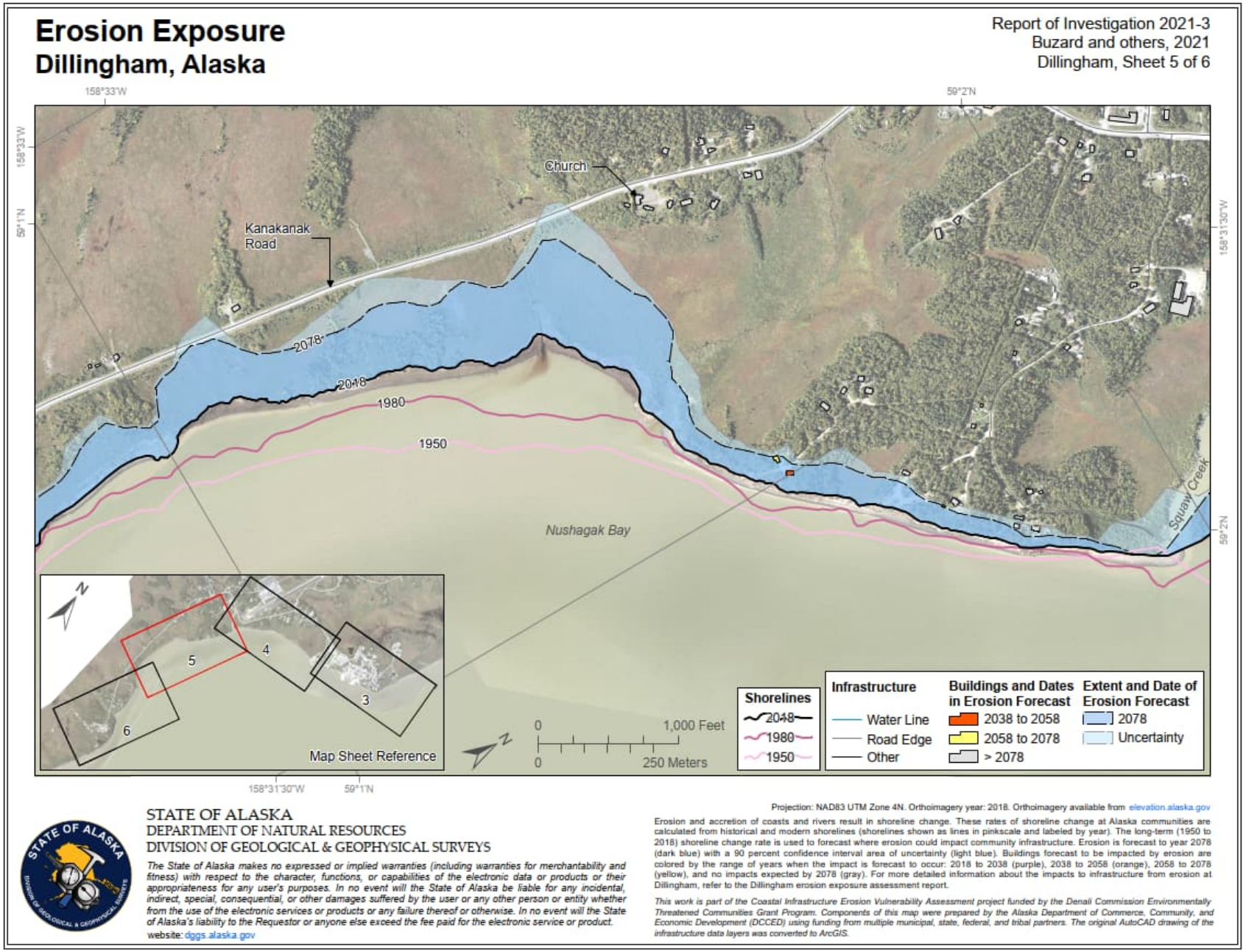
EROSION EXPOSURE B

Figure 16



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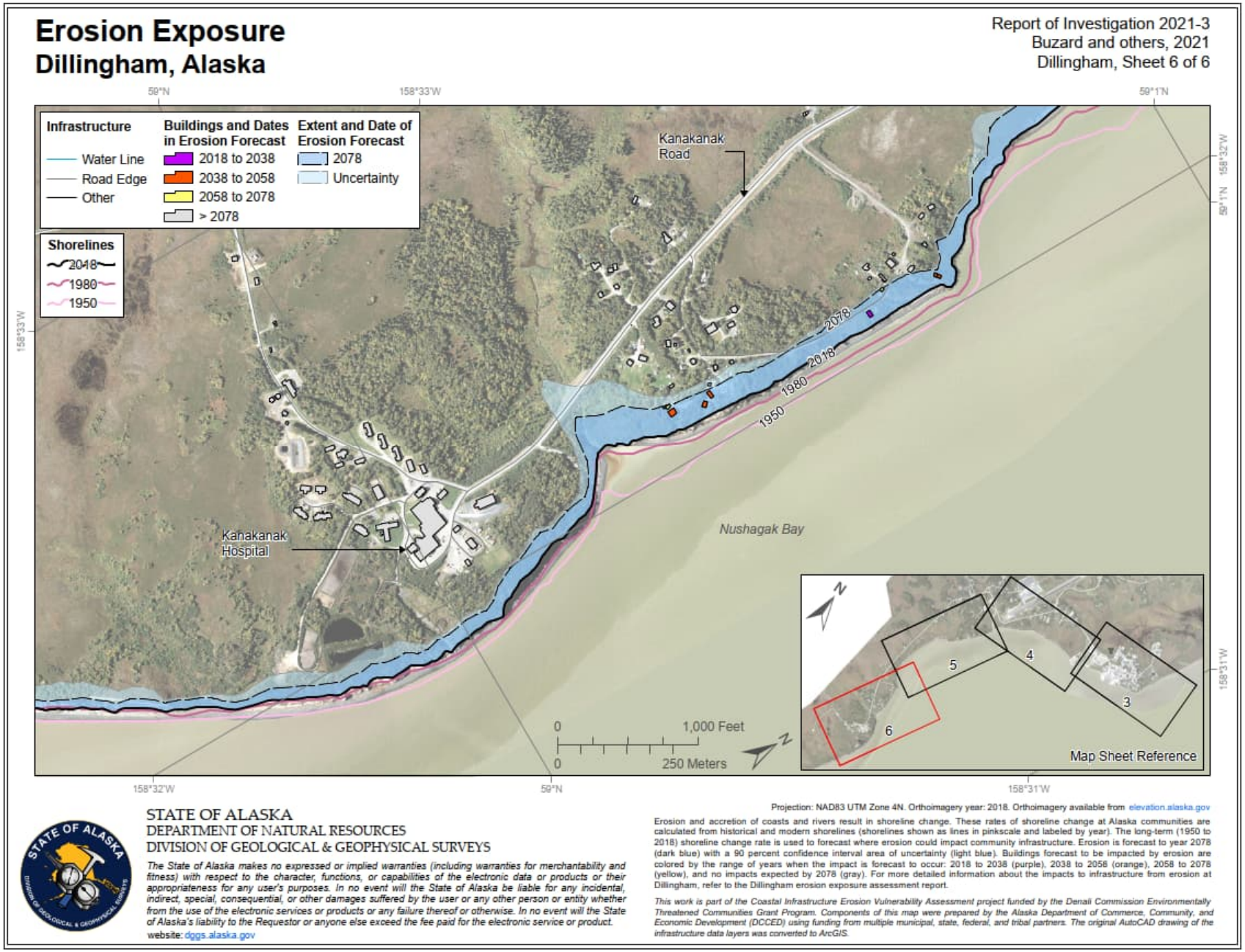
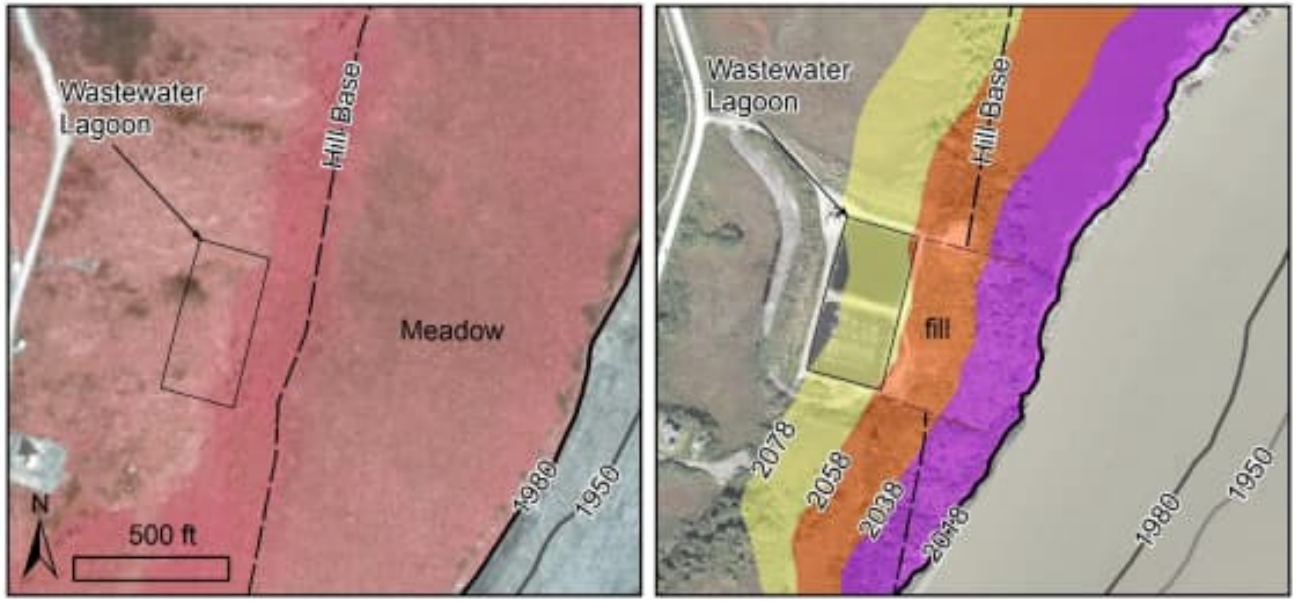


EROSION EXPOSURE D

Figure 18



Predicted erosion changes at Dillingham wastewater lagoon. (Left) The color-infrared image of the 1980 Dillingham coast shows the base of the hill. (Right) 2018 image of the same area. The wastewater lagoon is built into the hill and fill from the construction is deposited seaward. Erosion continues at a linear rate toward the hill's base and fill area, suggesting exposure by 2058. However, the fill area has different lithology and vegetation cover that can significantly change erosion rates.

APPENDIX B—FEMA DOCUMENTATION

[This appendix will include the FEMA review tools for Tribal and Local Hazard Mitigation Plans]

APPENDIX C—PLANNING PROCESS

[This appendix will include copies of the stakeholder emails and public outreach efforts]