King Cove-Cold Bay: Assessment of Non-Road Alternatives

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Aleutians East Borough, Alaska

FINAL

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Executive Summary

King Cove, Alaska, population 800, is located in the Aleutians East Borough (AEB) in southwest Alaska. The area is remote and located where the North Pacific Ocean meets the Bering Sea. The area is known for harsh weather; high winds, rough seas, and fog or persistent clouds occur frequently. These conditions are not necessarily unusual for other small, rural communities in Alaska, but King Cove is different in one key respect: it lies 18 miles from the Cold Bay Airport, which has a 10,000-foot jet-capable runway originally built by the military and now maintained as an emergency landing location on the great circle routes between North America and Asia. Several plane crashes, many harrowing tales, and near misses trying to get patients evacuated to Anchorage for medical emergencies by small plane or by boat from King Cove to Cold Bay have highlighted the difficulty of travel in the area, particularly under emergency circumstances. The Cold Bay Airport is close, but sometimes inaccessible. King Cove, the borough, and Alaska's Congressional delegation have pushed Congress for a road connection through the Izembek National Wildlife Refuge and Izembek Wilderness along a narrow isthmus that separates the rich tidal marshes of the Bering Sea and Pacific Ocean water. It is an area that is critical habitat for wildlife, including almost the entire global population of black brant. The U.S. Department of the Interior (DOI) has decided against the road option. This document reviewed past studies and the latest thinking on potential non-road alternatives. It is designed to filter past work on non-road-access alternatives and present the most promising in each of three non-road transportation modes: marine vessel, fixed-wing aircraft, and helicopter.

This *Assessment of Non-Road Alternatives* for medical evacuation (medevac) from King Cove to Cold Bay and on to Anchorage examines three modes of transportation as selected by DOI: (1) ice-capable marine vessel, (2) fixed-wing aircraft/new airport, and (3) helicopter/heliport. Variations within each alternative address the location of the facilities and, to a lesser extent, type of equipment and facilities. This assessment provides a high-level overview of the three non-road-access options and does not provide a recommendation, but presents conceptual information on the locations, costs, risks, and dependability of each. This report does not identify the actual steps needed for implementing a selected alternative such as additional analysis under the National Environmental Policy Act or similar regulation.

The proposed marine vessel is a 150-foot ferry capable of carrying vehicles and passengers year-round in expected seas (based on wave records over a 5-year time period), including capability of moving through bay ice 12 inches thick (OASIS Environmental, Inc. 2003). The vessel would require modifications at the Cold Bay dock and a new dock on the King Cove side, where it would reside. The vessel port could include a rock breakwater, depending on the location chosen. It is assumed the ferry would operate for general use, not just medevac use, and would transport passengers, cargo, and vehicles to and from Cold Bay but would be available for medevac trips to Cold Bay,

where patients would transfer to a medevac flight or commercial flight to Anchorage. This would be necessary when flights were not possible in and out of the King Cove Airport.

The identified airport location is north of King Cove and north of mountainous terrain in an area with few obstructions, at the end of the existing King Cove road system. It could be designed for service by small jet (longer, paved runway) or turbo-prop aircraft (shorter, gravel runway). Implementation of this alternative is assumed to mean closure of the existing King Cove Airport, which is located in mountainous area where turbulence is common and terrain hazards compound weather issues. Medevac flights would respond when called from Unalaska (190 miles away) or Anchorage (620 miles), and take patients from the new airport directly to Anchorage.

The helicopter option assumes a helicopter would be leased by a government entity and based at a new heliport, with hangar and lighting, located at King Cove, on the King Cove road system, or at a new location on the southern edge of Cold Bay (the water body). The helicopter would transport patients to the Cold Bay Airport, where they would transfer to a medevac flight or commercial flight to Anchorage.

The table below summarizes life-cycle costs and operating factors, such as medevac time, risks to the project, and dependability, for the alternatives addressed in this document. Capital and operations and maintenance costs assume a 75-year life cycle. The net present value (NPV) for each alternative incorporated conceptual-level construction cost estimates and 75-year operating costs in 2015 dollars. The document provides greater detail.

Table ES-1. Summary of Costs and Operating Factors

	Marine *150-ft ice-capable monohull ferry*			Airport *New airport located NW of Mt. Dutton*		Helicopter *Leased helicopter and crew with dedicated heliport*			
	1a NE Cold Bay Ferry	1b Lenard Harbor Ferry	1c Direct Ferry (KC-CB)	2a 5,000-ft Runway (Learjet)	2b 3,500-ft Runway (King Air)	3a NE Cold Bay Heliport	3b Lenard Harbor Heliport	3c Peninsula Heliport	3d King Cove Heliport
Life-cycle Costs *(75 years)*									
Capital Cost *($ millions)*	41.8	29.9	39.0	84.0	47.0	2.8	2.8	28.3	2.8
Operations and Maintenance Cost ($)	872,300	925,600	1.14 M	674,700	223,300	2.34 M	2.25 M	2.28 M	2.19 M
Net Present Value *($ millions)*	65.7	56.7	71.9	97.0	49.3	78.3	75.3	99.1	73.6
Operating Factors									
Medevac Time *(hrs)*	3.5	3.7	5.0	2.4	3.0	3.1	2.6	2.7	2.1
Risk Score	2.4	2.4	2.5	2.5	2.6	2.5	2.5	2.5	2.2
Annual Dependability	99.9%	99.9%	99.6%	94.9%	94.9%	82.6%	67.5%	67.5%	70%

Notes:
All costs are shown in 2015 dollars. See main document for explanation of cost estimates.
Medevac time is the elapsed travel time between the City of King Cove and Ted Stevens Anchorage International Airport. See main document for further explanation.
Risk score compiles multiple risk factors on a 1–4 scale (1=low, 2=moderate, 3=serious, 4=high) and averages them. Risk assessment is qualitative. Scoring allows for deriving the average and is not meant to imply precision in quantifying risk. See main document for explanation of methods.
Dependability shown is based largely on wind data thresholds. Other factors affect dependability and may differ between modes of travel. See main document for explanation.

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Acronyms and Abbreviations

AEB	Aleutians East Borough
AIP	Airport Improvement Program
ANC	Ted Stevens Anchorage International Airport
DOT&PF	Alaska Department of Transportation and Public Facilities
EIS	Environmental impact statement
FAA	Federal Aviation Administration
IFR	Instrument Flight Rules
ILS	Instrument Landing System
KUCB	Unalaska Community Broadcasting
NPV	Net present value
NWR	National Wildlife Refuge
O&M	Operations and maintenance
RNAV	Area Navigation
SRE	Snow removal equipment
USCG	U.S. Coast Guard
VFR	Visual Flight Rules

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1 Introduction

1.1 Background

The cities of King Cove and Cold Bay in southwestern Alaska lie 18 miles apart; see Figure 1. King Cove's population is about 800 year-round and expands to approximately 1,300 when the Peter Pan Seafoods processing plant is operating at full capacity.[1] While King Cove has the larger population, Cold Bay has the larger airport—an instrument-capable airport with a paved runway more than 10,000 feet long (one of the longest in the state) and a crosswind runway. It is a former military airport kept in service primarily as an emergency landing location on the long-haul great circle route between North American airport hubs and Asian airport hubs.

The communities of King Cove and Cold Bay are separated not only by miles. They are also separated:

- By the water body of Cold Bay, which is more protected than the open ocean, but still known for severe winds and waves, and infrequently for ice.
- By mountainous terrain, particularly near the City of King Cove and its small airport.
- By an isthmus 3 miles wide separating the head of Cold Bay, which opens to the Pacific Ocean, from the Bering Sea.
- By protected lands of the Izembek National Wildlife Refuge (NWR) and Izembek Wilderness on the isthmus and by the Alaska Peninsula NWR along the shoreline, as established by Congress.

King Cove, the Aleutians East Borough (AEB), and Alaska's Congressional delegation have worked since the 1980s to convince Congress, the U.S. Department of the Interior, and USFWS to allow and fund a road between the communities, principally for medical evacuation (medevac).

Congress, in the Omnibus Land Management Act of 2009, directed that the Department of the Interior should examine a road in an Environmental Impact Statement (EIS) and use the EIS to determine whether a land exchange to allow road access would be in the public interest of the people of the United States. A December 23, 2013, Record of Decision signed by Secretary of the Interior Sally Jewell found it would not be in the overall public interest because "construction of a road through the Izembek National Wildlife Refuge would lead to significant degradation of irreplaceable ecological resources that would not be offset by the protection of other land to be received under an exchange…(and)… because reasonable and viable transportation alternatives exist to meet the important health and safety needs of the people of King Cove."[2] Secretary Jewell received a request for reconsideration of the decision. After further consultation and visiting the site, Secretary Jewell signed a letter dated August 13, 2014, stating the Department of Interior would stand by its decision and would not re-open the record of decision. At the same time, she reiterated commitment to continuing to work with Alaskans "to evaluate and develop other

[1] The Peter Pan Seafoods processing plant in King Cove is the largest capacity salmon processor in the state, and it processes Bering Sea crab catches and multiple other species.
[2] Record of Decision, December 23, 2013.

transportation improvements for the residents of King Cove and Cold Bay." This document is a result of that request.

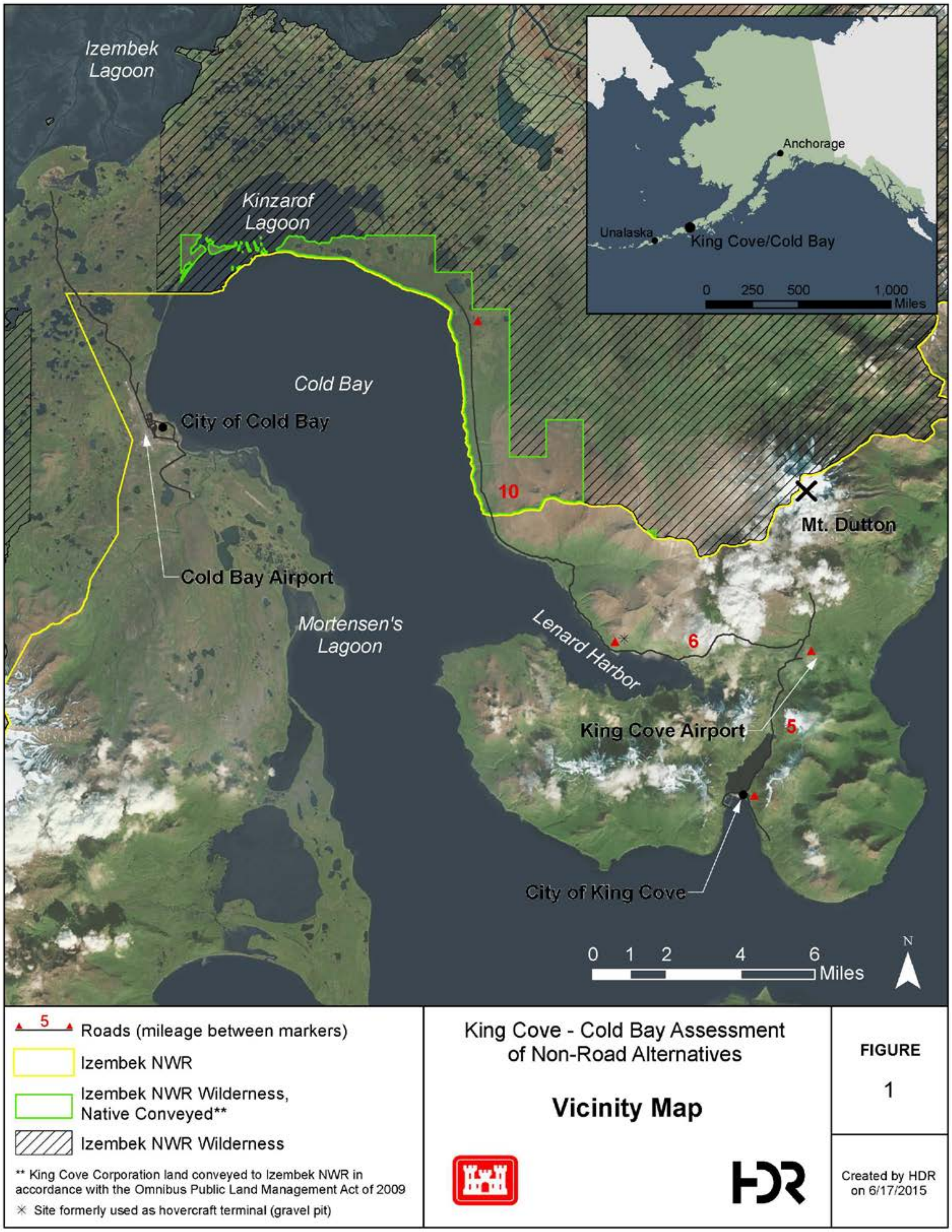

Figure 1. Vicinity Map

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Secretary Jewell requested assistance from the United States Army Corps of Engineers, Alaska District, to examine three non-road access alternatives in 2015. This document is the result of that request. It is designed to filter past work on non-road access alternatives and present the most promising in each of three non-road transportation modes:

- Marine vessel
- Fixed-wing aircraft
- Helicopter

1.2 Transportation Challenges

King Cove is an ocean-oriented community. However, there is no dependable and publicly available marine connection between King Cove and Cold Bay. The state-operated Alaska Marine Highway System ferry stops twice a month at King Cove and Cold Bay, May to October, with the only other marine connection consisting of fishing vessels that can sometimes be chartered between King Cove and Cold Bay. Fishing vessels can make the trip in most weather conditions but are not equipped to handle passengers, especially medevac passengers. Fishing vessels often are out of port on the fishing grounds or undergoing maintenance while in port. They must travel approximately 27 nautical miles from King Cove to Cold Bay, with roughly half that distance in open seas.

Another shortcoming in the marine connection between King Cove and Cold Bay is the inadequate infrastructure in place for passengers to disembark from vessels at the existing Cold Bay Dock. Passengers or medical evacuees must travel up a 20-foot ladder from the boat to reach the wharf deck. This can be dangerous, particularly for those who are not in good physical shape, especially when sea conditions cause the vessel to move with respect to the ladder used for disembarking. The state ferry that occasionally uses the dock during the summer has provisions for a ramp to allow vehicle and passenger transfer between the ferry and the dock. Sea and wind conditions at any time of year could preclude safe operation without a ramp similar to the state ferry at the Cold Bay Dock in its current configuration.

Regarding air transportation, the existing King Cove Airport lies north of town in a mountainous area. It has a single gravel runway 3,500 feet long. Terrain limits the available approaches and, in many wind conditions, creates turbulence that can cause unsafe flying conditions. Clouds also may form over or adjacent to the mountains, obscuring the runway. Scheduled air service to and from Cold Bay and other communities exists, but because of delays and cancellations due to wind, cloud cover, or snow and icing conditions compounded by winter darkness and mountainous terrain, scheduled air service is not considered to be as reliable as most air service elsewhere in the Lower 48. The scope of this assessment did not allow for analysis of other Alaska airports that have constraints similar to those attributed to King Cove.

Regarding the safety, reliability, and convenience of air travel, the Alaska Department of Transportation and Public Facilities (DOT&PF) published the 1994 *Alaska Intermodal Transportation Plan*, which noted:

1. A significant portion of the scheduled flights in and out of King Cove were cancelled due to unsafe flying conditions.
2. In addition to documented air crashes in King Cove, numerous incidents and near-misses occurred during operations around the airport, associated principally with weather.
3. Canceled flights due to unsafe flying conditions caused medical complications and fatalities for patients awaiting evacuation from King Cove.

Improvements to navigation aids installed at the airport or to the configuration of the existing airport would not adequately address these problems.

The AEB was the recipient of a $37.5 million federal appropriation for improving transportation between King Cove and Cold Bay and for improving medical care in King Cove. AEB purchased a $9 million hovercraft and constructed a landing for the hovercraft along the northeastern shore of Cold Bay. The vessel, the 93-foot *Suna-X*, operated from a landing site in Lenard Harbor while a road was under construction to the intended northeast landing site, and it had a landing site across the bay just south of the existing Cold Bay Dock. This allowed for a 14-mile hovercraft trip that could be completed in 17 minutes under favorable conditions. The hovercraft functioned as the primary marine connection between King Cove and Cold Bay and successfully evacuated 30 medical patients out of King Cove to the Cold Bay Airport from 2007 to 2010. Ultimately, however, local officials determined it was too costly to operate and could not operate in waves above 6 feet or winds above 30 miles per hour. The hovercraft was inoperable 30 percent of the time due to a combination of maintenance down-time and weather conditions beyond its operational capabilities.

The AEB moved the hovercraft to Akutan Island, where it ferried mail and seafood processing workers to a new airport on Akun Island about 6 miles away; however, the operation still required a large annual subsidy and was shut down in February 2014 to be replaced with helicopter service. In an April 2, 2014, article published by KUCB (Unalaska Community Broadcasting), AEB Administrator Rick Gifford was quoted as saying that the hovercraft service was unsustainable, costing about $3 million per year to operate. Further, he said that the helicopter service was cheaper, costing about $2 million per year, but not cheap enough. Gifford indicated that the AEB continues to look for access to the Akutan/Akun airport that it can support for the long term—perhaps via a ferry—but the capital costs of such an alternative are a major obstacle.

This document examines options for using the new road for access to a new marine terminal, a new airport, or a new heliport north of Mount Dutton, at the end of the road. Variations on these alternatives also are considered as ways to solve the long-standing problem of unreliable access across the bay or to Anchorage, primarily for medevac purposes.

2 Objectives, Scope of Work, and Methods

The U.S. Department of the Interior, through the U.S. Fish and Wildlife Service, has requested the U.S. Army Corps of Engineers, Alaska District, to assess three transportation modes that would not include a road through Izembek NWR. For each alternative, the assessment includes:

- **Description:** A narrative description of each alternative assessed, built off of multiple past studies but configured uniquely based on current conditions and understanding of the need, including a road that has been extended northward to a favorable airport and vessel launching area on the northeast side of the bay near the southern boundary of Izembek NWR.
- **Costs:** Costs of construction in projected 2015 dollars, and costs of maintaining the alternative over 75 years (standard annual operations and maintenance [O&M]). Replacement costs including major overhauls and replacement of system components are not included.
- **Risks:** Risks related to permitting, funding, and operating each alternative. Although each is given a numerical score, this is considered a qualitative risk assessment, a tool to help examine risks but not a determinant of which alternative is best overall.
- **Dependability:** The dependability of each alternative, defined as "the average percentage of time a minimum of four King Cove residents can successfully be transported to Cold Bay on a monthly basis for a one-year period." The document presents the amount of time in each month of a typical year that each alternative would be expected to operate as required, based primarily on monthly weather records.

Methods for assessing costs, risks, and dependability are further described below.

This document provides up-to-date information about marine, fixed- wing, and helicopter aircraft transportation modes. It specifically makes no recommendation regarding which mode might be most favorable, but presents high-level data to further the discussion.

2.1 Method Used to Assess Costs

Estimates of probable cost were developed for each alternative discussed in this document, assuming a 75-year life. These costs are considered Class 4 as defined by ASTM International (E2516-11), an organization that sets technical standards used globally. Class 4 costs, by definition, typically use stochastic methods and are used for projects that are in the conceptual phase of development. The alternatives herein fit into this conceptual category.

Many of the alternatives presented in this document use concepts (e.g., boats, helicopters) that have been evaluated in previous reports for transportation alternatives between King Cove and Cold Bay or in the region (e.g., Akutan). These earlier reports are more fully discussed below in Section 3. This report uses an analogous approach, which provides high-level estimates—not detailed estimates—by comparing costs for historical projects with similar features (e.g., Akutan Airport) to the project being estimated. Historical costs were brought forward to 2015 dollars using standard cost indices. This technique, which is also known as top-down estimating, is often used to estimate costs when only conceptual details about the project are available.

Capital and operations (including maintenance) costs are provided. For purposes of this document, construction of any alternative is assumed to occur in 2020, although some alternatives likely would take more than one construction season to complete. To allow comparison between alternatives, net present values for capital and operating costs are provided using a discount rate of 5 percent and an inflation rate of 2.7 percent. All costs are reported as 2015 dollars.

2.2 Method Used to Assess Risk

Risks for marine and aviation alternatives were assessed qualitatively using a risk assessment method developed by the Federal Aviation Administration (FAA) and incorporated into a risk assessment workbook published by the U.S. Forest Service and Department of the Interior, Bureau of Land Management. This method uses a matrix to relate the likelihood of an outcome with its consequences to determine the level of risk it represents. The matrix, along with definitions, appears in Appendix A.

The matrix combines the likelihood of an event (frequent, probable, occasional, remote, improbable) with the anticipated severity of the outcome or event (catastrophic, critical, marginal, negligible). These result in a combined level of risk, each assigned a score:

1. Low
2. Medium
3. Serious
4. High

Scoring multiple risks for each alternative this way enables the calculation of an average score, allowing for easy comparison among alternatives. However, the process is necessarily subjective, and the risks are not weighted for relative importance. This can be misleading if the exercise is viewed as being more than mostly qualitative. The exercise is meant as a tool for evaluating alternatives but is not meant to produce a final, definitive answer about which alternative is best. Further, the scope of this assessment did not allow for additional evaluations of risk, such as weighting various risks, assessing risk by season, or creating separate risk assessments for different types of risk. Appendix A presents lists of key risks associated with the alternatives—both the risks of implementing each alternative and the risks of operating them once the project is complete.

2.3 Method Used to Assess Dependability

The definition of dependability presented near the beginning of this section calls for an assessment by month. Dependability of any of the alternatives was determined to be primarily a function of wind and weather in any given month. Wind speed and direction were identified as most critical to the dependability of both the marine and fixed-wing aviation alternatives. Wind and other weather information drove dependability for the helicopter alternative.

The alternatives presented were conceptually designed with the area's weather in mind, so dependability of many of the alternatives is relatively high, based primarily on weather. The following sections on each alternative indicate annual dependability ranging from about 70 percent to virtually 100 percent. Many other factors may contribute to dependability, including maintenance issues with the equipment used, human factors such as illness of a pilot or how quickly a vessel operator can reach the vessel, and snow and ice on the road between the clinic in King Cove and the vessel port, airport, or heliport.

Several of the marine and aviation alternatives make use of the existing road between King Cove and the northeast shore of Cold Bay. Anecdotal evidence suggests that there are snow and avalanche hazards that could make portions of the road impassable at times. While this has been identified as a potential risk and could impact dependability, further investigation would be necessary to more accurately quantify the impacts on road travel. This study assumes that regular maintenance of the road, together with an appropriate level of staffing and equipment, would reduce the risk of an impassable road on dependability of medevac access. Thus, these hazards, when compared to wind, are not assumed to be a primary driver of the dependability of the alternatives considered.

Appendix B presents wind data used for all of the marine, airport, and helicopter alternatives.

2.4 Method Used to Assess Medevac Travel Time

The calculation of travel time was based solely on travel for medevac purposes. It was assumed that most medical evacuations would start from the King Cove clinic or from the population center at King Cove. However, the alternatives would operate differently from each other. The marine and helicopter alternatives would cross the water body of Cold Bay to meet a medevac aircraft at the Cold Bay Airport, and the airport alternatives would provide for the medevac aircraft to meet a vehicle on the eastern shore of Cold Bay, without a need to cross the bay. Because the alternatives would operate in different ways, the travel time was calculated for all from the City of King Cove to Ted Stevens Anchorage International Airport (ANC). From ANC, a patient could be delivered to any of three hospitals, all approximately equidistant from the airport. This analysis did not try to determine travel time from ANC to an Anchorage hospital.

Travel time was calculated by adding together each leg of the journey. The calculations assumed average speeds for automobile, ferry, aircraft, and helicopter transportation, and multiplied those speeds by the distance to be traveled under each mode. No time was included for transfers; the calculations are based solely on the times needed for each mode once underway. For the airport alternatives, it is assumed that the time on the road (estimated at 1 hour) would be equal to or greater than the time required for the medevac aircraft to arrive from its home base.

Appendix C presents the estimated medevac times from the City of King Cove to ANC for each alternative.

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3 Existing Information and Past Studies

This document is built upon existing information and past studies, and presents updates to previous studies. Most of the critical engineering research regarding airport and docking locations, marine vessel types, and weather issues was completed previously.

The annotated bibliography at the end of this document (see Section 7) is a list of past studies completed on the topic of transportation alternatives between King Cove and Cold Bay. Most of these were examined in preparation of the current document, but a few studies provided key information. The primary documents referenced were the following:

- "King Cove-Cold Bay Transportation Improvement Assessment: Available Marine Technologies Technical Memorandum" (Glosten Associates 1998) provided important background for the marine ferry alternative.
- "Technical Memorandum, King Cove-Cold Bay Transportation Improvement Assessment: Two Selected Marine Options" (Glosten Associates 1998) provided important design information about the marine ferry alternative.
- "Cold Bay Ferry Study" (Glosten Associates 1999) provided additional information specific to the ferry alternative.
- "King Cove-Cold Bay Transportation Improvement Assessment: Facilities Concept Report" (HDR and Parson Brinckerhoff 2000) provided extensive information on air and marine alternatives, including five appendices listed separately in the bibliography for this *Assessment of Non-Road Alternatives*.
- *King Cove Access Project Final Environmental Impact Statement* (U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service 2003) provided extensive information regarding both air and marine alternatives.

Existing planning studies also inform the current effort. According to the 1994 *Alaska Intermodal Transportation Plan*, DOT&PF, the AEB, and the Cities of King Cove and Cold Bay identified the need for improved access between King Cove and Cold Bay to increase the safety, reliability, and convenience of travel to and from King Cove by eliminating dependence on the city's inadequate air facilities; to reduce redundant infrastructure and associated costs; and to strengthen the regional economy. Since that time, the focus has narrowed somewhat to safety and medevac capabilities for King Cove. The Omnibus Public Land Management Act of 2009 (Public Law 111-11), as well as the 2003 EIS related to this issue, focused on a road to be "used primarily for health and safety purposes… and only for noncommercial purposes."

Past Marine Vessel Work. Some of the critical selection criteria established by the AEB for the marine route alternative were identified in the *Project Description for the King Cove Access Project, 7th Revision* (OASIS Environmental, Inc. 2003), and are summarized as follows:

- Reliability 95 percent of the year
- Capability of travel year-round, during all anticipated weather conditions. This includes significant wind and wave heights.

- Ability to travel through up to 12 inches of solid bay ice.
- Suitable for carrying passengers, as well as vehicles with "roll-on/roll-off" capability.
- Cost-effective and sustainable acquisition, operation, and maintenance.

Previous studies identified several potential marine vessel alternatives, including hydrofoils, high-speed catamarans, and ground-effect-type crafts. Many of them offered advantages and quick traverse times in fair weather and calm, ice-free seas. However, the ability to operate year-round and under adverse weather conditions common in this area eliminated many of the marine alternatives under consideration. The studies provided to the AEB identified two viable marine alternatives based on the above criteria:

1. Large purpose-built hovercraft capable of transporting passengers and vehicles
2. Ice-capable monohull ferry suitable for all expected weather and sea conditions

As discussed in Section 1.2, the AEB purchased a purpose-built hovercraft. It operated successfully for approximately 3 years between Lenard Harbor, near King Cove (see Figure 1), and the City of Cold Bay. But ultimately it was taken out of operation because it was too costly to maintain and, in part, because it could not operate about 30 percent of the time. This document reexamines primarily Option 2, the ice-capable monohull ferry.

An ice-capable monohull ferry of sufficient size has been identified as a viable alternative that could meet the marine transportation criteria developed by the AEB. The "Cold Bay Ferry Study" (Glosten Associates 1999) identified a concept vessel that could meet these criteria with a stated 100 percent operability in the weather and ocean conditions of Cold Bay. It is further described in Section 4.

Past Aviation Work. DOT&PF's *King Cove – Cold Bay Facilities Concept Report and Assessment of Transportation Need*, published in 2000, found that flight operations by Pen Air, the only commercial air carrier serving King Cove at that time, were restricted to operating in daylight hours under Visual Flight Rules (VFR). Due to the frequency of bad weather (i.e., non-VFR conditions), flights in and out of King Cove were often delayed or canceled. The report cited a letter written by Pen Air President Orin Seybert which stated that "Due to terrain there will never be other than VFR daylight-only operations possible, with better than average weather necessary."

The 2000 DOT&PF report determined that the best available alternative site for a new airport was located on the northeastern shore of Cold Bay, northwest of Mount Dutton.

4 Marine Alternative

4.1 Introduction to Ferry Concept

The ferry concept includes a vessel capable of transporting people and vehicles in virtually all weather conditions and the terminal (dock) facilities needed on both ends of its route. Although the ferry has a longer traverse time than the hovercraft, it appears to be more reliable based on anecdotal information about the approximate 30 percent downtime experienced by the hovercraft during its operation in Cold Bay. Ferries are used widely as a primary means of marine transportation in Alaska, as evidenced by the 3,500 miles of ferry routes and more than 30 communities serviced that make up the Alaska Marine Highway System. Three alternative ferry routes have been identified as viable for marine travel between King Cove and Cold Bay:

- Alternative 1a, Northeast Ferry (with a terminal on the northeast shore of Cold Bay)
- Alternative 1b, Lenard Harbor Ferry (with a terminal on the northern shore of Lenard Harbor)
- Alternative 1c, Direct Ferry (with a terminal in the City of King Cove)

See Figure 2 for the locations of the ferry terminals.

Each alternative would have a dedicated terminal built onto the existing Cold Bay Dock. Each would include a similar ferry terminal, built new, on the King Cove side of the bay. It is assumed that the ferry would be typically moored at the ferry landing on the King Cove side, as this would be most expedient in the event of a medevac situation. These alternatives are described further below.

The three routes provide different combinations of ferry travel time versus driving time to reach the ferry, and exposure to different risks. For example, Alternative 1c has a longer overall travel time and higher exposure to rough sea conditions, but eliminates the risks associated with impassable roads due to heavy snow or avalanches.

All alternatives use the existing Cold Bay Dock. Based on preliminary analysis, there does not appear to be a site within practical distance of the Cold Bay Airport that provides significant advantages or more protection from wind and wave action than the existing dock location. Further investigation is warranted to validate the preliminary assumptions used in this document.

While the primary purpose of the ferry under consideration is medevac, the vessel likely would be used to establish a regular, year-round ferry service between King Cove and Cold Bay. While it is unlikely that the ferry would be used to its full capability, it could make up to three daily round trips between King Cove and Cold Bay. The fares collected from an established ferry schedule would help offset the annual operating expenses associated with the ferry transportation alternative. It is also worth noting that the King Cove Airport is assumed to continue to function under this alternative. This means that, under many conditions, a medevac flight could occur from the King Cove Airport. The ferry would be particularly useful in conditions that were too turbulent, too cloudy, or at night, when use of the King Cove Airport would not be recommended.

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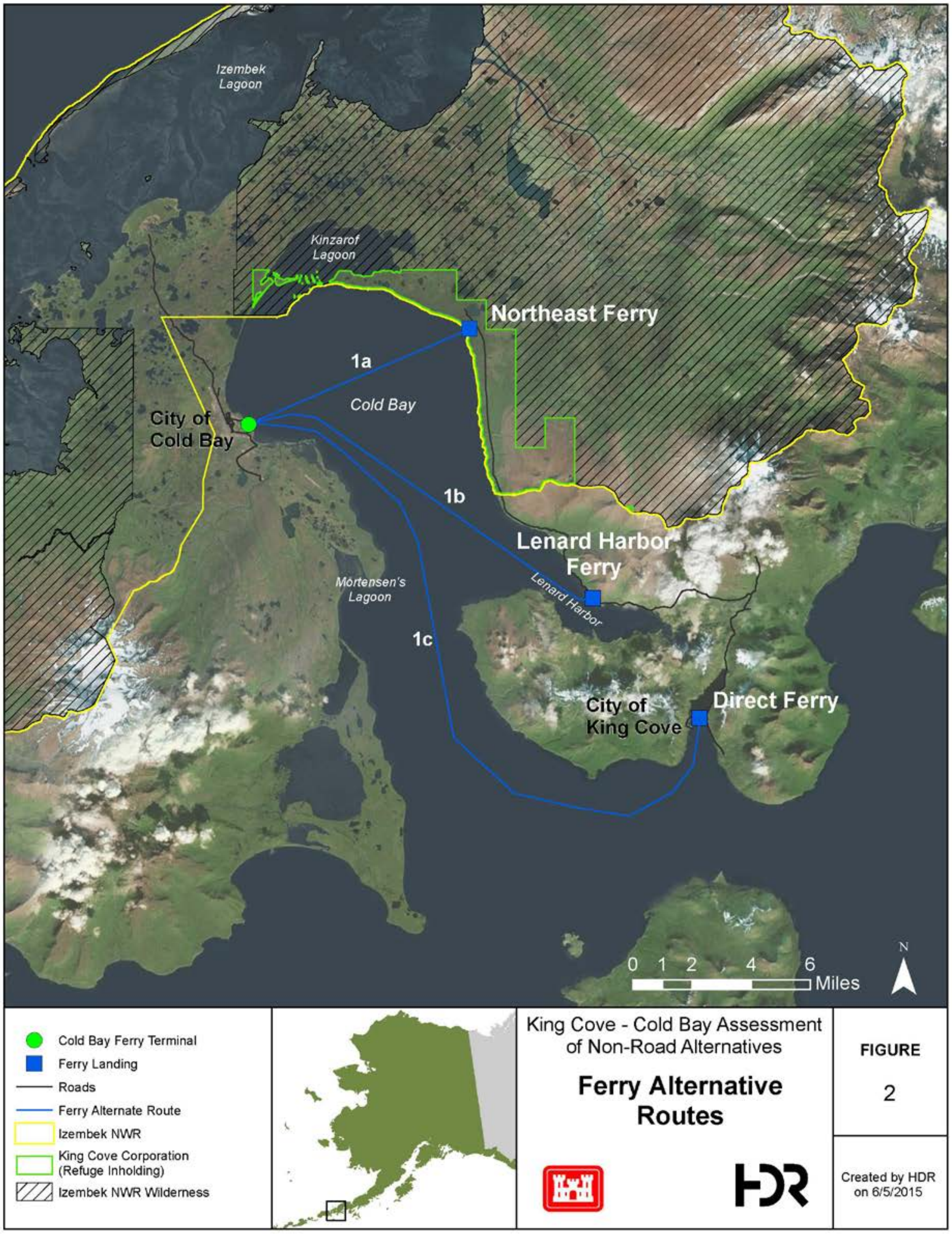

Figure 2. Ferry Alternative Routes

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4.2 Detailed Descriptions—Marine Alternatives

4.2.1 Facilities Common to all Marine Alternatives

The three alternative ferry routes are summarized in the following sections. Most components, including the vessel itself, Cold Bay dock modifications, and the basic mooring and terminal facilities on the King Cove side, would be the same.

The Vessel. The ferry vessel under consideration would have an approximate length of 150 feet, a beam of roughly 42 feet, and a draft of 12 to 14 feet. Sea conditions are the main driver in specifying a vessel of this size. The beam and length of the vessel were optimized based on the wave characteristics in Cold Bay to provide year-round capability and minimize passenger discomfort. The ferry could carry up to 150 passengers, in addition to 19 passenger vehicles and two large trucks. The hull would be strengthened to American Bureau of Shipping ice class A0 classification, capable of travelling through first-year sea ice up to 12 inches thick, and would be capable of operating in virtually all anticipated weather conditions within the waters of Cold Bay. It would likely have a dual-rudder/twin-screw configuration with engines producing approximately 1,200 horsepower. It would be an open deck design with a centrally located island to accommodate passengers and the pilothouse, as opposed to an enclosed ferry with overhead pilothouse. This would allow for ferrying over-height vehicles. Freeboard and bulwark height would be large to maintain the vessel's safe seakeeping capability in the expected sea conditions throughout the year, as well as to minimize shipping of green water and spray ice accumulation on the deck. This is the vessel described in the "Cold Bay Ferry Study" (Glosten Associates 1999).

Cold Bay Ferry Terminal. Figure 3 illustrates a concept for the Cold Bay ferry terminal. The Cold Bay terminal would make use of the first 1,200 feet of the existing Cold Bay Dock to access a new transfer ramp that would branch off the existing trestle and provide access to a floating barge (transfer platform). The barge would function as the landing area for the ferry ramp. The ferry would breast against new dolphins (piling structures bedded in the sea floor, either monopole dolphins with floating donut fenders or five-pile breasting dolphins), and would power in to wingwalls near the moored transfer barge during loading and offloading operations. The mooring site would be located far enough offshore to take advantage of existing bathymetry and eliminate the need for dredging. A breakwater would be required to minimize wave exposure, and would be approximately 900 feet long with a crest elevation +15 feet. The side slopes of the breakwater would range between 1.5H:1V and 2H:1V. The ferry would have ramps off both the bow and stern that could be set down on the transfer platform to allow for vehicle and passenger transfer. This configuration would allow for forward drive-on and drive-off of transported vehicles. Although not currently the case, this analysis assumes that the Cold Bay terminal would have vessel refueling capabilities for the ferry. This would most likely consist of a mobile tanker truck that could drive aboard the ferry to fill the tanks. It is assumed that a tanker truck with refueling capabilities can be made available in Cold Bay.

Ferry Terminal near King Cove. A configuration similar to the one described above for Cold Bay would be used for all three marine alternatives for the ferry terminal providing access from King Cove, although a new trestle would also be required at these locations. In all cases, power would be required for navigation and facility lights. It is assumed that power would be provided at outlying sites using a battery with light-emitting diode lights and provisions for small-scale solar and/or wind charging. Specifications and photographs of these systems are available online; see, for example, www.sealite.com.

It is also possible that a power line could be buried along the road from the existing King Cove Airport, but it is not included in the cost estimate due to the relatively high cost. For Alternative 1c, located at the City of King Cove, power is assumed to be readily available.

The following sections provide more detail on the terminal locations near King Cove, including figures showing conceptual layouts of marine terminal configurations.

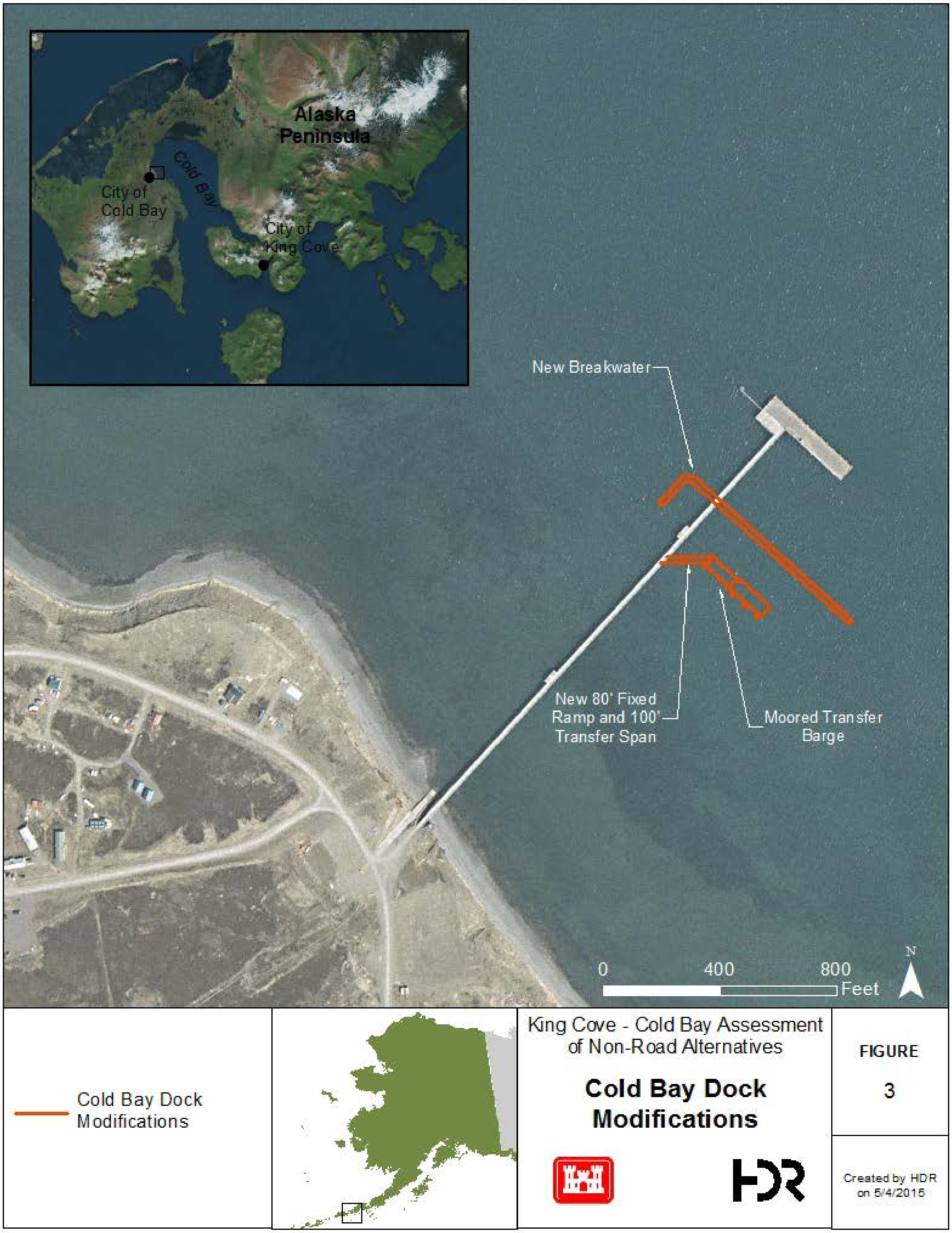

Figure 3. Cold Bay Dock Modifications

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4.2.2 Northeast Ferry (Alternative 1a)

The Northeast Ferry alternative would include a ferry terminal on the northeast shore of Cold Bay, just south of the Izembek NWR boundary, and would include modifications to the existing dock at Cold Bay. The new dock/trestle is anticipated to be about 1,000 feet long to suit existing bathymetry and prevent the need for dredging. A breakwater would be required to minimize wave exposure, and would be approximately 850 feet long with a crest elevation +15 feet. The side slopes of the breakwater would range between 1.5H:1V and 2H:1V. See Figure 4.

Access to the Northeast Ferry terminal would be via the recently constructed road that provides access to the unused hovercraft landing site on the northeast shore of Cold Bay. The route would consist of approximately 21 miles of travel by road, followed by 6 miles of ferry travel to the Cold Bay ferry terminal.

This alternative has a longer road and more exposure to avalanche hazards and hazardous road conditions than the Lenard Harbor Ferry alternative, but it provides the shortest ferry travel time and slightly less severe wind and wave exposure than the other ferry alternatives.

Total travel time from King Cove to ANC Airport for medevac purposes is estimated to be 3.5 hours. Appendix C provides a complete look at medevac travel times for the marine, airport, and helicopter alternatives.

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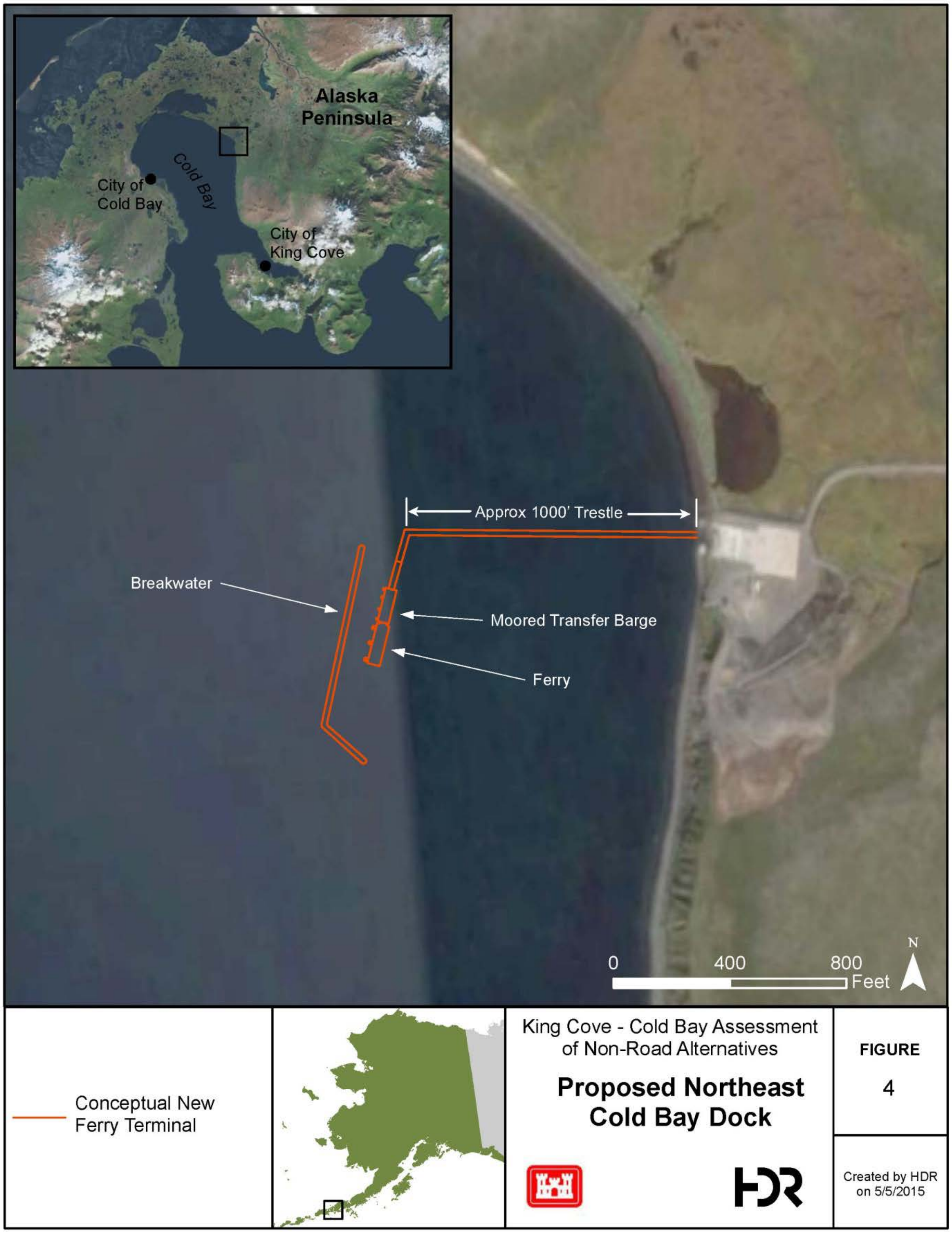

Figure 4. Proposed Northeast Cold Bay Dock

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4.2.3 Lenard Harbor Ferry (Alternative 1b)

The Lenard Harbor alternative would include a ferry terminal at Lenard Harbor and modifications to the dock at Cold Bay. The terminal at Lenard Harbor would be relatively protected from wind and wave exposure, and it is assumed it would not require a breakwater. The existing bathymetry is such that the new trestle would need to be approximately 300 feet long to eliminate the need for dredging. See Figure 5.

Access to the Lenard Harbor ferry terminal would be via the existing road between King Cove and Lenard Harbor. Travel from King Cove would include 11 miles on the road and a 14-mile ferry trip to Cold Bay.

Avalanche hazards and the potential for snow-covered roads exist along the road route between King Cove and Lenard Harbor, which could make the route impassable at times. However, it is assumed that the occurrence of avalanches is very infrequent. Most of the road is the same road used to access the existing King Cove Airport.

Total travel time from King Cove to ANC for medevac purposes is estimated to be 3.7 hours. Appendix C provides a complete look at medevac travel times for the marine, airport, and helicopter alternatives.

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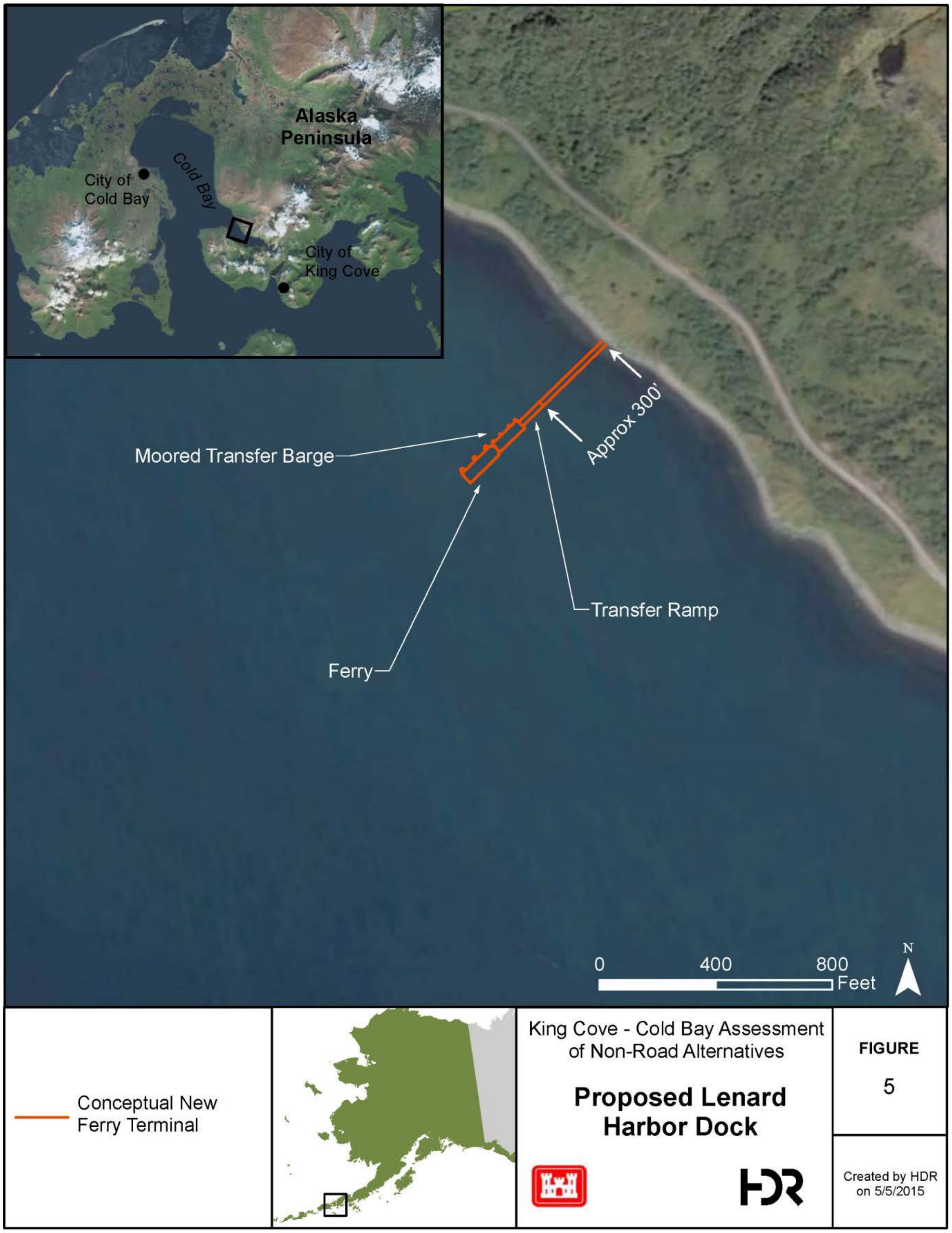

Figure 5. Proposed Lenard Harbor Dock

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4.2.4 Direct Ferry (Alternative 1c)

The Direct Ferry alternative would include a ferry terminal on the north shore of King Cove and modifications to the dock at Cold Bay. The existing bathymetry is such that the new trestle would need to be approximately 400 feet long to eliminate the need for dredging. A breakwater would be required to minimize wave exposure, and would be approximately 950 feet long with a crest elevation +15 feet. The side slopes of the breakwater would range between 1.5H:1V and 2H:1V. See Figure 6.

The terminal would be linked closely to existing King Cove infrastructure and would use existing roads, with virtually no road construction or road-based transportation time required. It would have immediate access to the existing electrical power supply in King Cove. The ferry route would include a stretch of approximately 13 miles in waters open to the Pacific Ocean between King Cove and Cold Bay, and it would have a the longest total transit time with more susceptibility to harsh sea conditions and passenger discomfort. The route would consist of approximately 27 miles total of ferry travel. The advantage to this alternative is the elimination of exposure to snow and ice, as well as to the avalanche risk for the road portion of the route that may be experienced in the other alternatives.

Total travel time from King Cove to ANC for medevac purposes is estimated to be 5 hours. Appendix C provides a complete look at medevac travel times for the marine, airport, and helicopter alternatives.

4.2.5 Comparison of Mode Options

Table 1 provides a comparative summary of the relative pros and cons of the three marine alternatives. This is meant to summarize the material above and to include relative information on the costs presented later in this document, but is not necessarily a complete list of criteria that should be used for selection of ferry terminal locations. Rather, it is a tool to present a quick snapshot of some relative advantages and disadvantages.

Table 1. Summary Comparison of Marine Alternatives

Alt	Description	Comfort / Rough Seas	Road Hazards[a]	Medevac Travel Time	Operations and Maintenance Cost	Capital Cost	Sum
1a	Northeast Ferry	0	-1	0	0	-1	-2
1b	Lenard Harbor Ferry	0	0	0	0	0	0
1c	Direct Ferry	-1	1	-1	-1	-1	-3

1=Favorable; 0=Neutral; -1=Unfavorable
[a] Road hazards such as snow/avalanche

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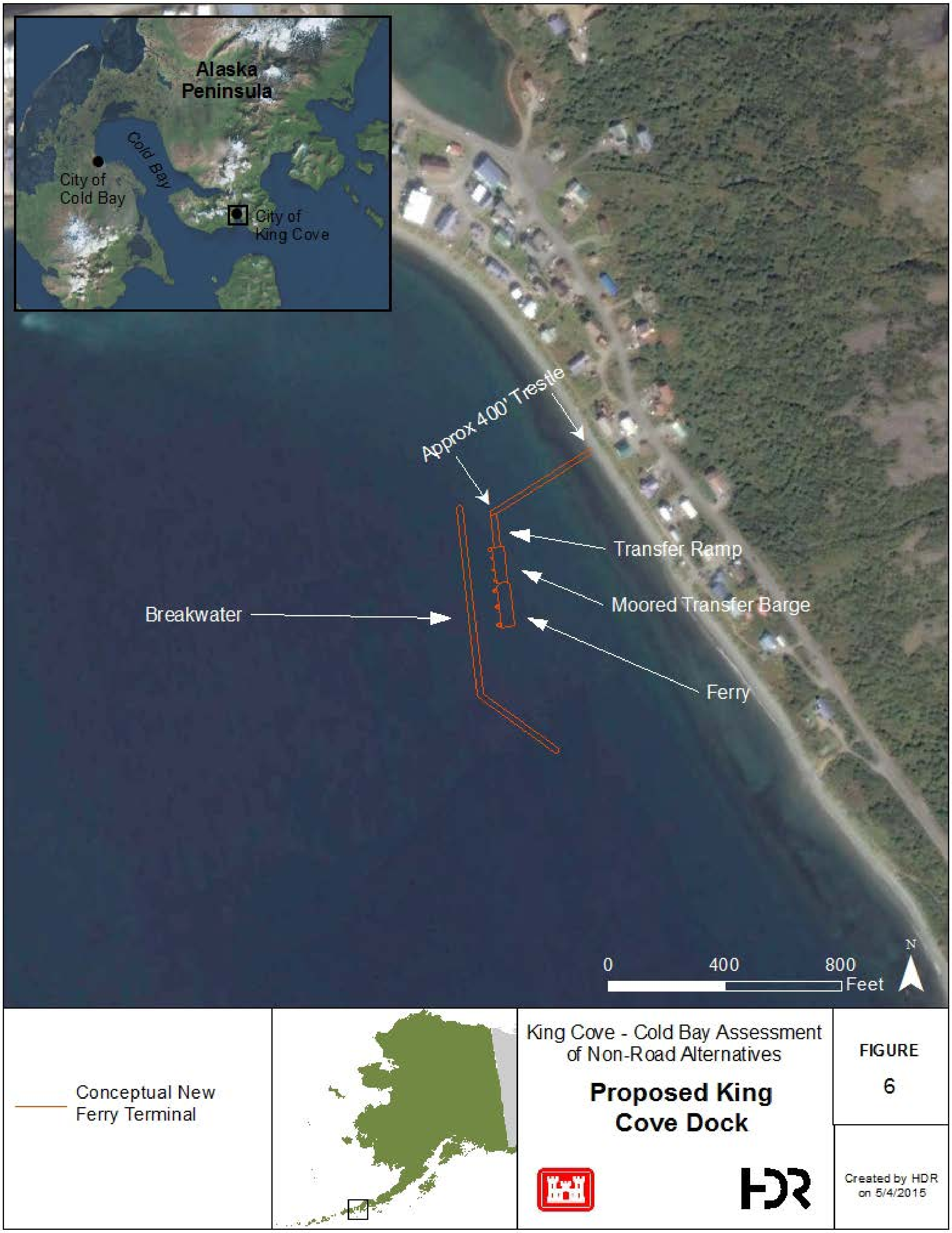

Figure 6. Proposed King Cove Dock

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4.3 Construction and 75-Year Life-Cycle Costs

Notes on methods used to determine costs for this document appear in Section 2. The capital costs are similar for all marine options, based on the assumption that the Direct (King Cove) and Northeast Ferry terminals would require a breakwater, while the Lenard Harbor Ferry terminal would be sufficiently protected to eliminate the need for a breakwater. The vessel type and modifications to the Cold Bay Dock are identical for all three options. It is assumed that existing roads would provide sufficient access without upgrades. Capital costs for the marine facilities and ferry vessel were based on the unit costs and quantities provided in the "King Cove Facilities Concept Report."

Table 2 summarizes the costs of the marine alternatives. The table reports capital costs in 2015 dollars and—for simplicity—uses the assumption that the ferry and docks would be built in 1 year, although vessel construction in reality would take longer. O&M costs shown are the costs projected for the first year of operations, in 2015 dollars. The O&M costs were bundled with the capital costs and applied over 75 years, accounting for inflation, and then brought back to 2015 dollars using a discount rate to provide a net present value (cost) of each alternative. Note that it is assumed the vessel life would be at least 75 years. The 75-year costs do not include provisions for periodic major replacements, such as engine replacement, as that level of analysis is beyond the scope of this study.

Table 2. Costs of the Marine Alternatives

Description	Alt 1a	Alt 1b	Alt 1c
Capital Costs (millions)	$41.8	$29.9	$39.0
Annual Operations and Maintenance Costs	$872,300	$925,600	$1.14 M
75-Year Life-Cycle Costs (2015 Net Present Value, millions)	$65.7	$56.7	$71.9

Notes:
All costs are presented in 2015 dollars. 75-year costs are escalated to 2095 and then brought back to 2015 dollars.
Capital costs include the ferry vessel and all dock/terminal components on both shores of Cold Bay, including provisions for electricity and (where applicable) a breakwater.
Vessel operating costs are based on an annual average of 1.5 round trips per day using a four-person crew. O&M costs also include (where applicable) road maintenance for any road dedicated to ferry access.

Annual O&M costs are based on the cost breakdowns provided in the "King Cove Facilities Concept Report" for the ice-strengthened ferry vessel, as well as maintenance costs for shoreside facilities. The additional wear and tear on the vessel associated with the Direct Alternative (Alternative 1c) has been captured by scaling up the hull and machinery maintenance costs based on the additional travel distance. Below is a list of items captured in the ongoing annual operating costs.

- Vessel hull maintenance costs, based on vessel weight
- Vessel machinery costs, based on propulsion and generator power output
- Crew costs to operate the vessel
- Fuel/lube oil costs as a function of travel distance and propulsion power
- Longshore/berthing costs
- Shoreside facilities maintenance

- Road maintenance (based on DOT&PF guidance and includes annual cost associated with grading, plowing, dust control, minor repairs, and similar activities necessary to keep the roads safe and operational).

4.4 Risks

Appendix A details key risks associated with the marine alternatives, including risks to implementing the alternative and risks of operating it once the project was complete.

Methods for assessing risk for all marine, airport, and helicopter alternatives are explained in Section 2. Multiple types of risks were identified and ranked using a matrix (shown in Appendix A). An average risk score was calculated. For the marine alternatives, the average risk scores were:

- Northeast Ferry (Alternative 1a): 2.4—medium-serious
- Lenard Harbor Ferry (Alternative 1b): 2.4—medium-serious
- Direct Ferry (Alternative 1c): 2.4—medium-serious

For all marine alternatives, the most important risks identified were related to operations at night and in extreme weather, permitting, and delays in getting the project built in an area with known important wildlife resources both on land and in the ocean. In addition, acquisition of the funding needed for construction and ability to financially sustain the operation in perpetuity are also important risks.

The principal risks to the marine alternatives are:

- Capital funding: This is critical to implementation of any of the marine alternatives.
- Operational funding: Annual O&M costs of the ferry system are unlikely to be offset by passenger fares. Inability to adequately fund annual operations was a primary factor in the AEB halt of the hovercraft marine connection in 2010.
- Regulatory permitting implications of installing a breakwater and construction of the ferry terminals: Effects to marine mammals and seabirds are an issue for the marine alternatives.
- No redundancy in the ferry system in the event of unplanned maintenance.

The most important risk *differences* among the marine alternatives are related to whether the ferry will be required to cross open water. Alternative 1c (Direct Ferry) has higher risk in a few key areas:

- Long travel time, which would put certain critical patients at greater risk of death or long-term complications. Recovering stroke victims, for example, have much better outcomes with prompt medical intervention at a hospital.
- Rough seas/open water travel, which could mean the vessel would not travel or could be at risk of capsizing if it did.

4.5 Dependability

Dependability of the marine alternatives would be based on:

- Wind speed (and related wave conditions) on the ferry route.
- Snow conditions, including snow and ice on the road and potential avalanche closure of the road (for Alternatives 1a and 1b).
- Downtime for maintenance of the ferry vessel, including maintenance of its ramps, and the trestles that allow vehicles and passengers to board.
- Unplanned maintenance and repair work that could take the ferry out of service

It is assumed the ferry would not operate in wind speeds exceeding 40 knots (46 MPH), based on operational restrictions and landing limitations in place at other ferry terminals in the region. Historic instantaneous wind data (see Appendix B) were examined to determine how often winds would exceed 40 knots (46 MPH). It is assumed that the vessel would be able to operate in any weather up to that speed, and this is the primary determinant of dependability. Table 3 indicates dependability by month based on wind speed.

Table 3. Marine Alternatives, Dependability by Month (%)

Alt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
1a	99.9	99.5	99.6	100	99.9	99.7	100	100	99.9	99.6	99.9	99.7	99.9
1b	99.9	99.5	99.6	100	99.9	99.7	100	100	99.9	99.6	99.9	99.7	99.9
1c	99.8	99	99.2	100	99.8	99.4	100	100	99.8	99.2	99.8	99.4	99.6

Note: No wind data were obtained for the open water portion of Alternative 1c. However, it is assumed that the impact of more wind and wave exposure would increase the inoperable time period by a factor of 2 in comparison with Alternatives 1a and 1b.

Based on 3 years of historical wind data available (see Appendix B), the percentage of time during an average year that wind speeds exceed 40 knots (46 MPH) is 0.128 percent. On that basis, the ferry has 99.6 percent to 99.9 percent dependability based on historic wind data and the proposed ferry route. However, for medevac purposes, the dependability of all transportation modes in the medevac chain should be considered for total dependability. For example, there may be rare times when winds are below the operating threshold for ferry travel, but exceed the safe air travel threshold at Cold Bay Airport based on combined wind direction and speed.

For purposes of this conceptual document, based on 40-knot (46-MPH) wind speed, it is assumed that dependability for Alternative 1c (Direct Ferry) would be slightly less than dependability for the other two marine alternatives. While Glosten Associates' *Marine Alternative Study* indicated the proposed ferry vessel should provide 100 percent weather capability in the waters of Cold Bay, this may not be the case in the open water stretch. The potential for more severe sea conditions with the seafaring capability of the monohull ferry vessel should be investigated in more detail should this alternative be carried forth into a full feasibility study.

Alternatives 1a and 1b (Northeast Ferry and Lenard Harbor Ferry) have a slightly higher weather dependability for the ferry route portion, but the risk of heavy snow on the road and of avalanches reduces the dependability of the road portion of these alternatives. The Direct Ferry from King Cove (Alternative 1c) would not require driving out of the community. Although the scope of this study did not include local stakeholder input, further investigation into the expected frequency of impassable road conditions on the access road from King Cove to the northeast shore of Cold Bay is recommended during more detailed studies to validate the assumptions used in this analysis and to determine with greater precision which route has the highest overall dependability. This could include gathering information from and possibly interviewing local residents based on their historical observations.

4.6 Other Marine Considerations

Ferry Revenue. It is likely that the ferry would not operate at capacity most of the time, and thus revenues would not cover the operating expenses. The "King Cove-Cold Bay Transportation Improvement Assessment: Facilities Concept Report" indicates that the ferry may be loaded to 16 percent of capacity on average, based on several trips per day and operating 5 days per week.

Smaller Landing Craft. There have been recent discussions about the possibility of using a much smaller landing craft to provide a marine link between King Cove and Cold Bay. This type of craft can land directly on the shore with minimal infrastructure needed, and can carry a vehicle as well as passengers. However, shore landings for this type of craft can often be carried out only in ideal conditions. Given the prevailing wind and sea conditions within Cold Bay, it is questionable how often the landing craft could be used in this fashion.

These smaller vessels typically are not ice-capable and thus would not be able to perform shore landings in ice conditions. While the vessel could be fitted with a deeper and heavier hull to accommodate light ice and heavier seas, it would then have a draft that prevented it from shore landings and would require some type of infrastructure on both ends of the route.

The landing craft would not meet the design criteria developed by AEB for the marine route alternative. At this time it appears that it would not be suitable for year-round medevac use. Further study of this option may be warranted, however, as a limited-purpose marine vessel for medevacs.

Special Purpose Medevac Boat. Another possible alternative that warrants further study is the use of a smaller, special purpose severe-duty rescue boat for the sole purpose of medevac. These rescue boats can come in a variety of configurations, such as self-righting or shore-landing-capable vessels. A vessel of this type would require significantly less capital investment in both the vessel and the terminal requirements, and lower maintenance costs.

There are, however, a few drawbacks to this alternative. The first is that these vessels are typically not ice-capable and thus not able to reach the shore in the event of bay ice. Another drawback to a smaller, special-purpose rescue boat is that passengers would be subjected to significantly more pitch and roll of the vessel and overall discomfort during inclement weather than with the larger monohull ferry vessel. Lastly, this alternative would have the sole purpose of medical evacuation. It would not be suitable for customary passenger travel and could not transport roll-on/roll-off cargo. Some rescue vessels have a bow ramp that could allow for transfer from the boat to a shore-based, ice-capable vehicle such as a small hovercraft or snowmobile in the event of significant bay ice. Specifications and photographs of this kind of boat and other specialty boats are available online; see, for example, www.safeboats.com or www.kvichak.com.

5 Airport Alternatives

5.1 Introduction to Airport Concept

The airport concept includes a new airport built for the City of King Cove that would function better in poor weather conditions, including instrument capability, than the existing airport. The one technically feasible site for a new airport that is away from mountain hazards and wind-channeling terrain and does not physically encroach into the Izembek NWR is located northwest of Mount Dutton and just east of the existing (abandoned) hovercraft landing. This site affords airspace with few obstructions on approaches from the north, west, or east. An approach from the south would be high over a mountain ridge west of Mount Dutton. Two airport alternatives, designed to accommodate two different medevac aircraft, are considered:

- Alternative 2a (5,000-foot paved runway)
- Alternative 2b (3,500-foot gravel runway)

These alternatives are further described below. See Figure 7.

The two airport alternative designs give specific consideration to accommodating aircraft used in the Aleutian Region for medevac operations. The typical destination for medevac flights from the Aleutian region is Anchorage. The primary medevac provider for the Aleutians, Guardian Flight, maintains a remote base at Unalaska. Guardian Flight would probably prefer to respond to medevac needs at King Cove from Unalaska. Guardian Flight uses both Learjet 35 aircraft (a small jet) and Beechcraft King Air aircraft (a twin-engine turboprop airplane), but because of the limited length of the runway at Unalaska (4,100 feet), Guardian Flight bases only the King Air there. A response with the Learjet 35 would come from Anchorage, possibly increasing costs for the medevac provider. Airport Alternative 2a is designed with the Learjet 35 in mind. Alternative 2b is designed for the Beechcraft King Air.

The Learjet 35 is a multi-role business jet that can carry eight passengers. It has a cruise speed of 480 mph. The Beechcraft King Air has two turboprop engines and can carry up to 13 passengers. It has a cruise speed of 330 mph. Each of the aircraft can be configured for use as an air ambulance.

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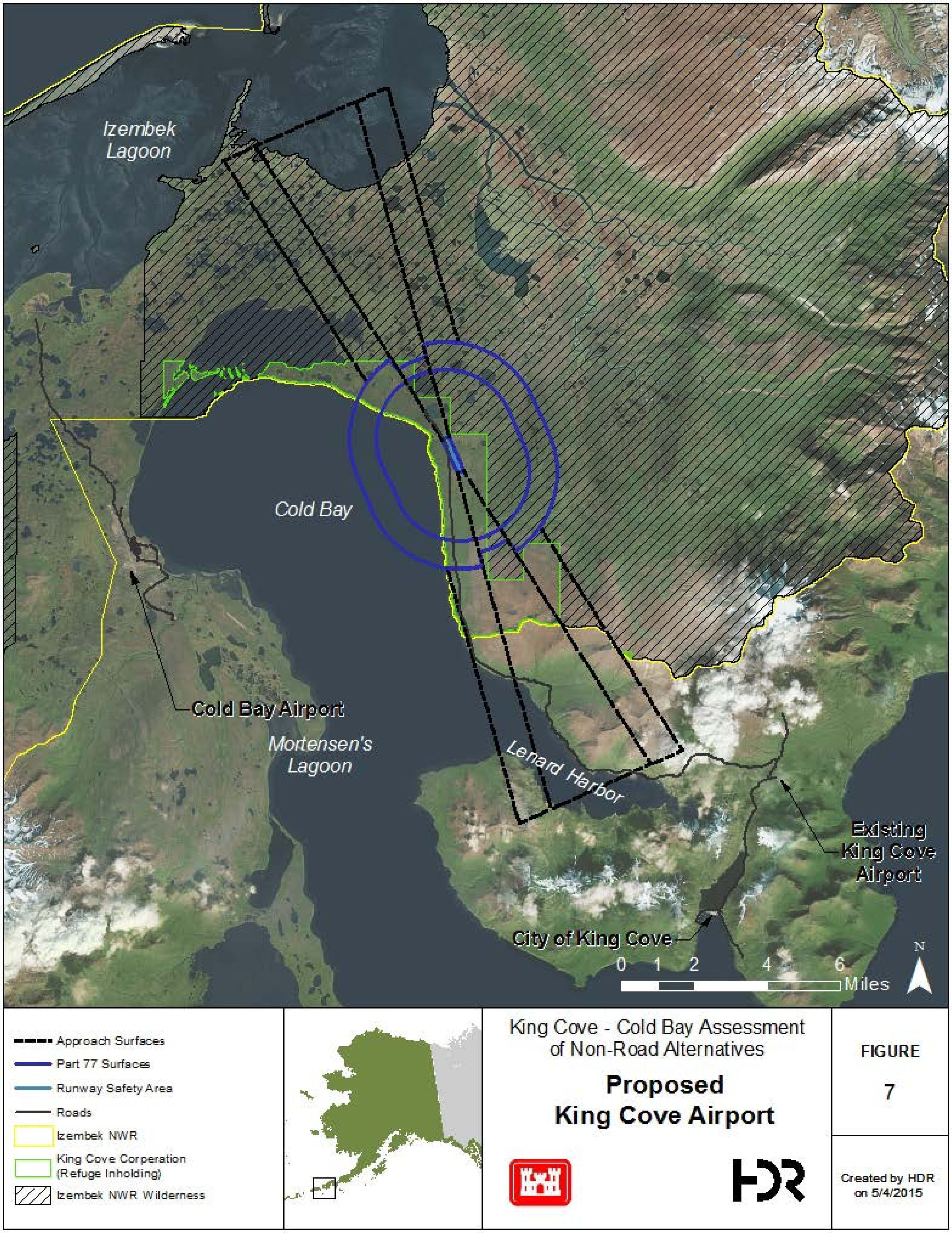

Figure 7. Proposed King Cove Airport

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The new airport would be close enough to the Cold Bay Airport that aircraft movement patterns could be coordinated between the two airports by the Cold Bay FAA Flight Service Station. Local reports are that wind and cloud conditions would still be severe at the proposed airport site, but—much like the Cold Bay Airport—there would be fewer obstructions to compound weather and visibility problems, and instrument-based flights would be more practical than at the existing King Cove Airport.

In accordance with the Statement of Work for this project, both airport alternatives include a Category 1 Instrument Landing System (ILS). However, the FAA is no longer installing ILSs; their preferred system is now RNAV (aRea NAVigation), a method of instrument flight rules (IFR) navigation based on a satellite-based Global Positioning System. Regardless, for design and estimating purposes for this project, ILS approach dimensional and clearance standards also apply to RNAV approaches.

The new airport would include a runway, an apron, and a connecting taxiway. The runway alignment is assumed to be the same as for Cold Bay Airport's primary runway, located approximately 9 miles directly west across the bay from that location. A site-specific wind study could alter this assumption or require the addition of a crosswind runway.

Power for the runway lighting system and navigation aids is assumed to be generated on-site. Snow removal for the road would be provided from King Cove. Snow Removal Equipment (SRE) dedicated for airport maintenance would be housed in an SRE Building located on the apron.

The airport site would be accessed by an existing gravel road extending 21 miles from the City of King Cove. Between King Cove and the existing airport, a distance of about 5 miles, the road is two lanes wide with a gravel surface. From the existing airport to the proposed airport site, a distance of about 16 miles, the road is a single-lane gravel road with inter-visible turnouts for passing. As described in this document, the road would not be widened. Given the low level of traffic expected on this route, one driving lane with turnouts is appropriate. It would also minimize maintenance costs.

5.2 Detailed Descriptions—Airport Alternatives

Both airport alternatives would be designed to the same FAA A/B II standard. The “Critical Aircraft” is defined by the FAA as the most demanding aircraft anticipated to operate at the airport more than 500 times per year—in this case, a Cessna 208, as defined by the DOT&PF *Alaska Transportation Plan* (2004). The Cessna 208 and Beechcraft King Air (the primary medevac aircraft serving the region) have similar runway requirements. For Alternative 2a, however, the runway is extended and paved to support occasional use by the more demanding Learjet 35. Figure 8 illustrates the standard airport layout and the relative length of the 3,500-foot runway versus the 5,000-foot runway.

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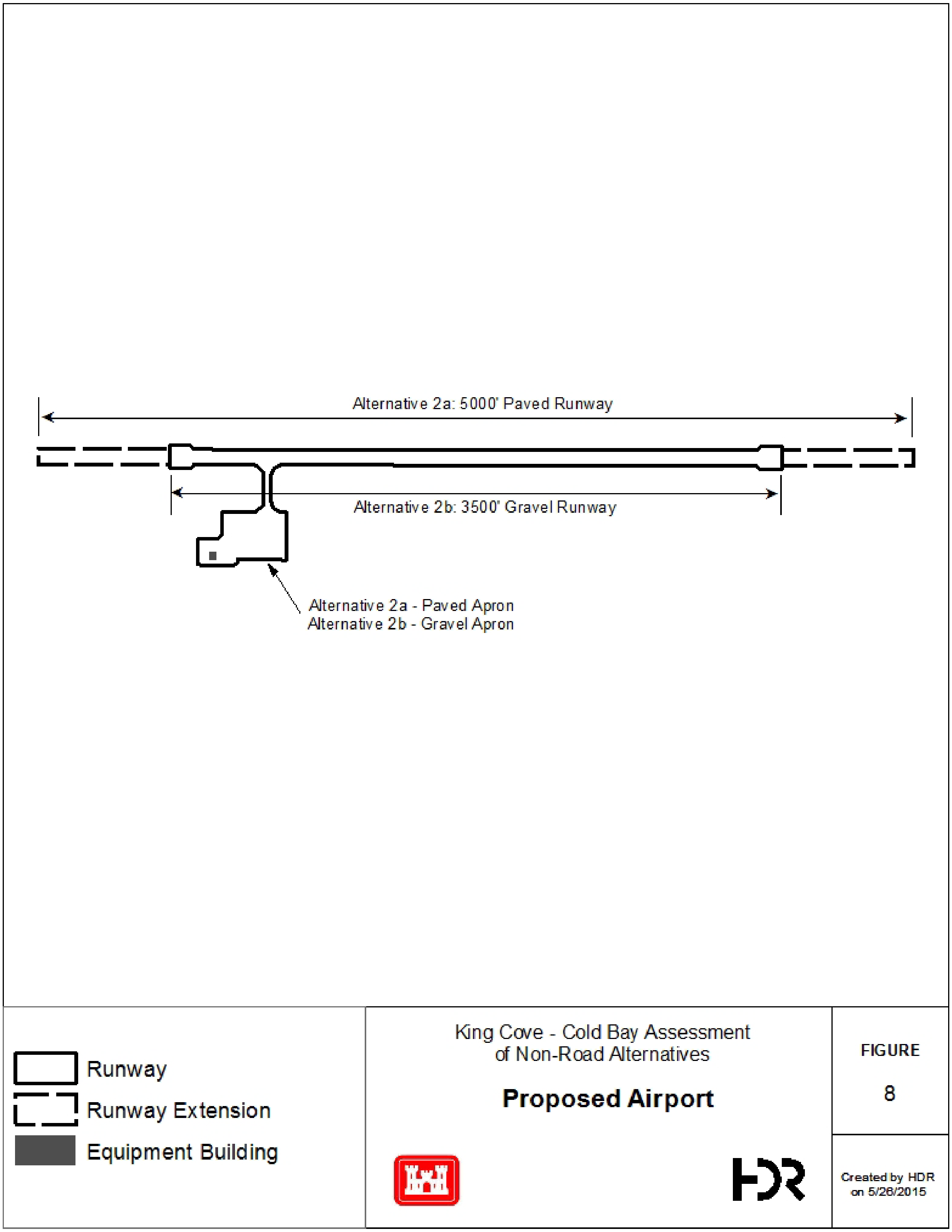

Figure 8. Airports Concept

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Either alternative would include Object Free Areas around the runway (300 feet on the sides, 500 feet at each end) and Runway Safety Areas (150 feet on the sides, and 300 feet at each end of the runway), per FAA standards. The airport would be fenced.

The following sections detail the differences between the two alternatives.

5.2.1 Alternative 2a (5,000-foot runway/Learjet 35)

Alternative 2a would provide a runway 75 feet wide and 5,000 feet long, to accommodate occasional service by the Learjet 35. The difference between the "standard" length for an A/B II airport (3,500 feet) and the desired length would have to be approved by the FAA if federal Airport Improvement Program (AIP) funds were to be used to construct the airport.

The Learjet does not operate on a gravel surface, because gravel can cause catastrophic damage to jet engines. The runway therefore would be paved. In addition, to maintain adequate friction on the runway surface to permit safe operations in winter conditions, the runway would require a higher level of maintenance than is common at gravel surface airports. At minimum, this would require a grader, a mechanical broom, a broom truck, and a sand spreader. This equipment would be stored in a heated, three-bay snow removal equipment (SRE) building, and the airport would probably be staffed by an airport maintenance staff of three in the winter, and possibly fewer in summer.

Total medevac travel time from King Cove to ANC using the Learjet 35, inclusive of traveling the road between King Cove and the new airport, is estimated to be 2.4 hours.

5.2.2 Alternative 2b (3,500-foot runway/King Air)

Alternative 2b would provide a runway 75 feet wide and approximately 3,500 feet long. The runway surface would be gravel. This runway length, width, and surfacing are very similar to conditions at the existing King Cove Airport and are standard for the aircraft typically serving community airports in the region from the Unalaska Airport regional hub. The Beechcraft King Air is an appropriate aircraft to operate at the small gravel-surfaced community airports typical of the Aleutian Region. Airport-dedicated snow removal equipment typical for unpaved remote airports—a bulldozer, a grader, or both—would be sufficient for surface maintenance. Maintenance equipment would be stored in a heated, single-bay SRE building. Maintenance staff for the access road would share airport maintenance duties, but additional staff would be required.

The runway length proposed for this alternative (3,500 feet) is slightly longer than the 3,300-foot runway proposed for King Cove by the *Southwest Alaska Transportation Plan Revised* (DOT&PF 2004), but matches the runway length of the existing King Cove Airport.

Total travel time from King Cove to ANC using the King Air, inclusive of traveling the road between King Cove and the new airport, is estimated to be 3 hours.

5.2.3 Comparison of Airport Options

Table 4 provides a comparative summary of the relative pros and cons of the two airport alternatives. This is meant to summarize the material above and include relative information on costs presented later in this document, and is not necessarily a complete list of criteria that should be used for alternative selection. Rather, it is a tool to present a snapshot of some relative advantages and disadvantages.

Table 4. Summary Comparison of Airport Alternatives

Alt	Description	Medevac Travel Time	Operations and Maintenance Cost	Appropriate for Critical Aircraft	Sum
2a	5,000-ft Runway/Learjet 35	1	-1	-1	-1
2b	3,500-ft. Runway/Beechcraft King Air	-1	1	1	1

1=Favorable; 0=Neutral; -1=Unfavorable

5.3 Construction and 75-Year Life-Cycle Cost

Capital costs used in this document for construction of a new airport are based on recent construction of the Akutan Airport, on Akun Island. The lump sum total for the airport is the basis for figures used here, with adjustments for runway length and surface type, with allowance for inflation.

The capital costs would be higher for Alternative 1a because it would have a longer runway, it would be paved, and the runway would require a larger building to house SRE. The paved runway for jet service would require more maintenance at higher cost. Both would require maintenance of an additional 16 miles of road to reach the airport. Table 5 shows capital costs and O&M costs. This document presents the full costs of the alternatives. If the existing King Cove Airport were to be closed upon completion of the new airport, which is likely, the existing operating and maintenance costs accruing to the DOT&PF operating budget for the existing airport would be replaced by the costs of the new airport.

Table 5 reports capital costs in 2015 dollars and assumes that all airport alternatives would be built in 1 year. O&M costs shown are the costs projected for the first year of operations, in 2015 dollars. The O&M costs were bundled with the capital costs and applied over 75 years, accounting for inflation, and then brought back to 2015 dollars using a discount rate to provide a net present value (cost) of each alternative. Note that this does not include provisions for periodic replacement of snow removal equipment, the navigation system, or recurring tasks such as repaving (Alternative 2a only) the runway .

Table 5. Costs of the Airport Alternatives

Description	Alt 2a	Alt 2b
Capital Cost	$84 M	$47 M
Annual Operations and Maintenance Cost	$674,700	$223,300
75-Year Life-Cycle Cost (Net Present Value)	$97.0 M	$49.3 M

Notes:
All costs are in 2015 dollars. M = million.
Capital costs include a complete airport. Assumes no road construction necessary.
O&M costs include airport O&M and road O&M for the road segment dedicated to airport use.
The 75-year total cost is escalated to account for inflation over time and brought back to 2015 dollars.
This table presents the full costs of the alternative. Potential savings to the DOT&PF operating budget resulting from closure of the existing King Cove Airport are not included.

5.4 Risks

Methods for assessing risk for all marine, airport, and helicopter alternatives are explained in Section 2. Risk assessment tables for all of the alternatives appear in Appendix A. Multiple types of risks were identified and ranked using a matrix (shown in Appendix A). This qualitative assessment resulted in an average risk score. For the airport alternatives, the average risk scores were:

- Alternative 2a (5,000-foot runway): 2.4—medium-serious
- Alternative 2b (3,500-foot runway): 2.5—medium-serious

The risks identified in the assessment tables for each of the two airport alternatives are nearly identical. Those considered to be of the greatest concern are discussed below.

The risks of night operations and air travel in general for the King Cove-Cold Bay area, as well as for the Aleutian Island region, are significant. Various sources describe the Aleutian Islands as the windiest and rainiest region in the United States. The mountainous terrain can cause dangerous turbulence, increased wind speeds due to venturi effects, and accumulation of clouds. These factors, together with the remoteness of both communities, place a premium on the appropriate implementation and use of technology, pilot training for good decision-making, and timely weather data collection and reporting, particularly when night operations compound the regional weather effects.

The road between King Cove and the identified airport site passes through three possible avalanche areas, based upon a preliminary examination of aerial photography. Two of these areas are located along the road to the existing King Cove Airport. The third is located about 5 miles west of the existing airport. Further information on the frequency of avalanches should be collected, but anecdotal accounts indicate that avalanches are not annual occurrences. In addition to representing a risk to travelers on the road, an avalanche would effectively close the new airport until the avalanche debris could be cleared from the road.

Animal behaviors are a concern for the safe operation of the airport, due mainly to the potential for conflicts with animals on the runway and birds in the runway approach airspace. Fencing would mitigate the danger from animals but not guarantee removal of all danger. Snow drifts, failure to close gates, and poor maintenance can facilitate animal passage over or through fences. Avoiding the creation of additional water bodies through the use of best management practices during construction and the revegetation of disturbed terrain near the airport would help reduce the concentration of birds near the airport.

The ability to secure construction funding would be critical to the success of either alternative. The most likely source of funding would be a grant from the FAA Airport Improvement Program (AIP). Acceptance of an AIP grant carries with it many obligations, including the ability to ensure the long-term support of the facility, which would include the maintenance of any associated single-purpose airport access road. In Alaska, DOT&PF is most often the owner/operator of rural public airports. In assuming responsibility for the cost of the proposed airport, DOT&PF could minimize the impact to their maintenance budget by closing the existing King Cove Airport. However, DOT&PF also would assume the cost of maintaining approximately 16 miles of roadway past the existing airport that they are not currently maintaining. Given recent reductions to the state operating budget, this could be problematic. In theory, these same ownership and maintenance responsibilities could be assumed by the AEB or the City of King Cove, but the cost and administrative burdens may be beyond the abilities of either entity to support.

5.5 Dependability

Weather is the chief determinant of dependability of access in the Aleutian Islands region. How weather affects the safety and operability of airports within the region is highly site-specific. On-site weather data were not collected for the proposed airport site, but data collected at Cold Bay Airport were evaluated as a reasonable proxy. It should be noted, however, that the topography differs at the two sites. About 5 miles to the southeast of the proposed airport site is a ridge (elevations less than 3,000 feet) off Mount Dutton. For the Cold Bay Airport, Mount Frosty is somewhat higher (6,300 feet) and lies about 9 miles to the southwest. Winds coming from the southeast at the proposed airport site likely would generate more turbulence than might be expected at Cold Bay Airport from that direction. The mountains may also tend to affect the accumulation or departure of cloud cover differently.

Cold Bay Airport has an ILS but, according to information compiled by the Medallion Foundation,[3] is not able to support safe operations 100 percent of the time.

Guidance provided by the Medallion Foundation also indicates that, at wind speeds above 35 knots (40 MPH), commercial pilots should consider not operating at Cold Bay Airport. Wind conditions are expected to be similar at the proposed site. An examination of monthly average wind speeds at the airport (see Appendix B) shows that higher wind speeds occur most often in the winter—October through March. There is not a strong seasonal trend in wind direction on an annual basis at Cold Bay (Weatherspark.com 2015). For this document, a wind speed of 40 knots (46 MPH) was used as a cutoff. Appendix B shows that wind speeds of 40 knots (46 MPH) are exceeded about

[3] The Medallion Foundation is an Alaska-based non-profit organization that promotes aviation safety. Medallion guidance, compiled from information submitted by its member commercial air carriers, identifies thresholds for safe wind speeds at Alaska's commercial airports, beyond which aircraft operations are not advised.

0.128 percent of the time on an annual basis. Note that the data set for June is probably an anomaly, possibly an issue with the data collection equipment.

Finally, the snow events and avalanche-prone areas on the 21-mile access road may reduce dependability an additional 5 percent, but only in the winter.

Wind data used for all marine, airport, and helicopter alternatives appear in Appendix B. Table 6 indicates dependability of Alternatives 2a and 2b by month based on wind speed.

Table 6. Alternatives 2a and 2b, Dependability by Month (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
94.9	94.6	94.6	95.0	95.0	94.9	95.0	95.0	95.0	94.7	95.0	94.8	94.9

Notes: Based on 2012-2013 wind measurements at Cold Bay Airport. Dependability is based primarily on winds each month at greater than 40 knots (46 MPH). Data source: National Climatic Data Center.

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6 Helicopter Alternative

6.1 Introduction to Helicopter Concept and Common Design Features

The helicopter concept is modeled on the helicopter service AEB currently employs between the community of Akutan and the community's airport on Akun Island. This service would feature the following elements:

- A leased helicopter (Bell 212 or similar on floats) and crew. Minimum on-station crew would consist of one pilot and one mechanic.
- A lighted heliport facility with a pad of 100 feet by 100 feet.
- A hangar of 40 feet by 80 feet for sheltering the helicopter when not in use, providing space for performing helicopter maintenance, and storing spare parts and fuel. The hangar would accommodate a B 212 helicopter with the main rotor blades folded.
- Road access from King Cove.

This document examines four possible alternative locations on the King Cove side of the bay:

- Alternative 3a: Northeast Heliport (located on the northeast shore of Cold Bay)
- Alternative 3b: Lenard Harbor Heliport (located at the north shore of Lenard Harbor)
- Alternative 3c: Peninsula Heliport (located on the peninsula at the western end of Lenard Harbor)
- Alternative 3d: King Cove Heliport (located at the City of King Cove)

The features above would be common to all locations. See Figure 9 for heliport locations.

The Cold Bay Airport does not have a designated heliport, but it is assumed the helicopter would follow normal landing procedures and hover-taxi to and from an existing aircraft parking apron. It is assumed the helicopter and crew would be located on the King Cove side of the bay; however, see "Other Considerations" at the end of Section 6.

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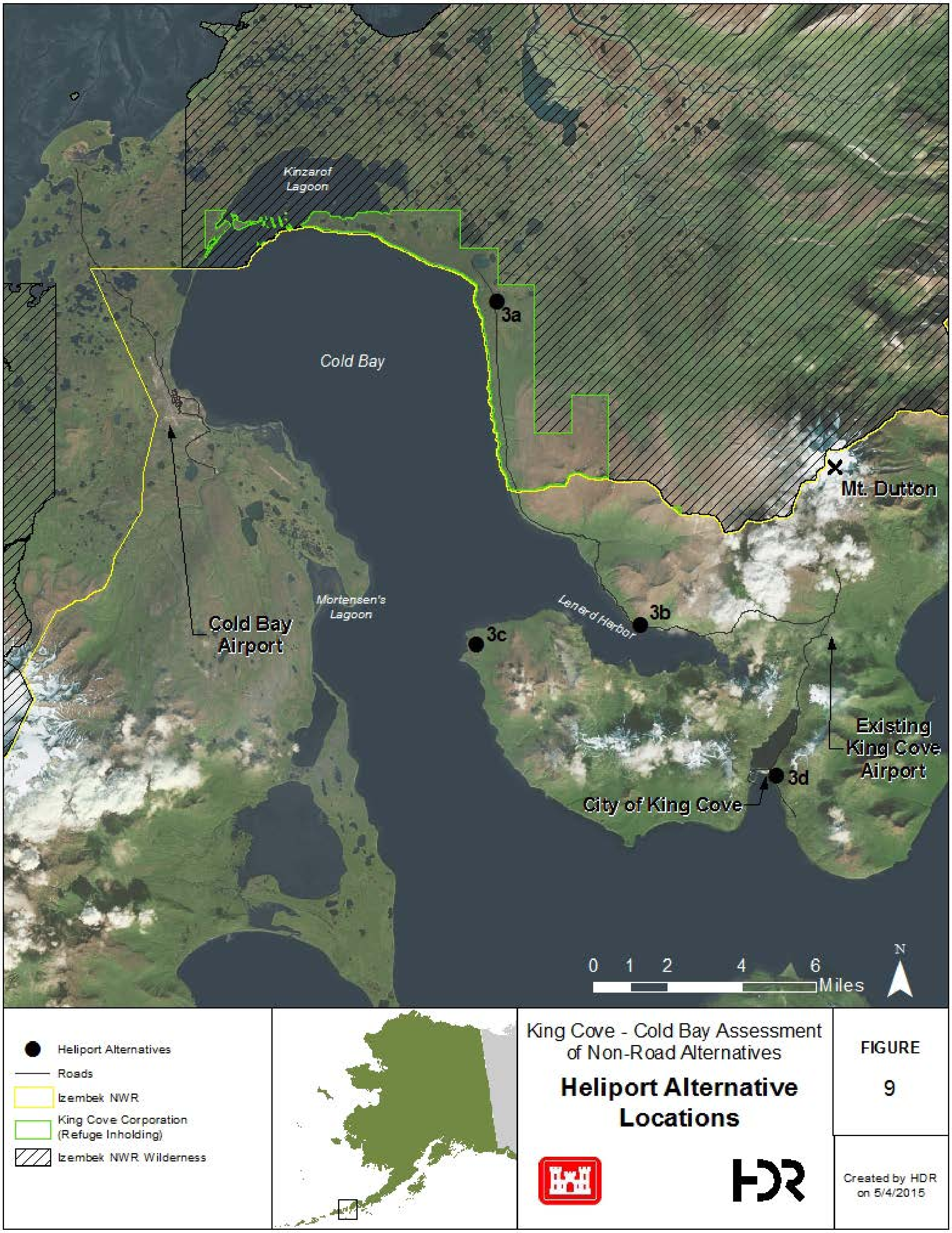

Figure 9. Heliport Alternative Locations

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6.2 Detailed Descriptions—Helicopter Alternatives

The new heliport would be designed in accordance with FAA Advisory Circular No. 150/5390-2C, *Heliport Design*, with lighting and navigation aids appropriate for operation in Visual Flight Rules (VFR) conditions. Figure 10 illustrates the basic layout. The dimensions of the heliport would be based on a Design Helicopter; i.e., the most demanding helicopter anticipated to use the facility. In this case, the Design Helicopter would be the U.S. Coast Guard (USCG) HH-60 (currently based in Kodiak). Although the Bell 212 (or similar) helicopter would provide routine service between King Cove and Cold Bay, it is anticipated that the USCG HH-60 would operate occasionally at King Cove in conjunction with search and rescue missions or if the Bell 212 (or similar) was out of service. The hangar to support helicopter service would be sized to accommodate the Bell 212, because there should be no need to shelter the USCG helicopter in King Cove.

The following sections describe the four alternative sites and outline the advantages and disadvantages of each.

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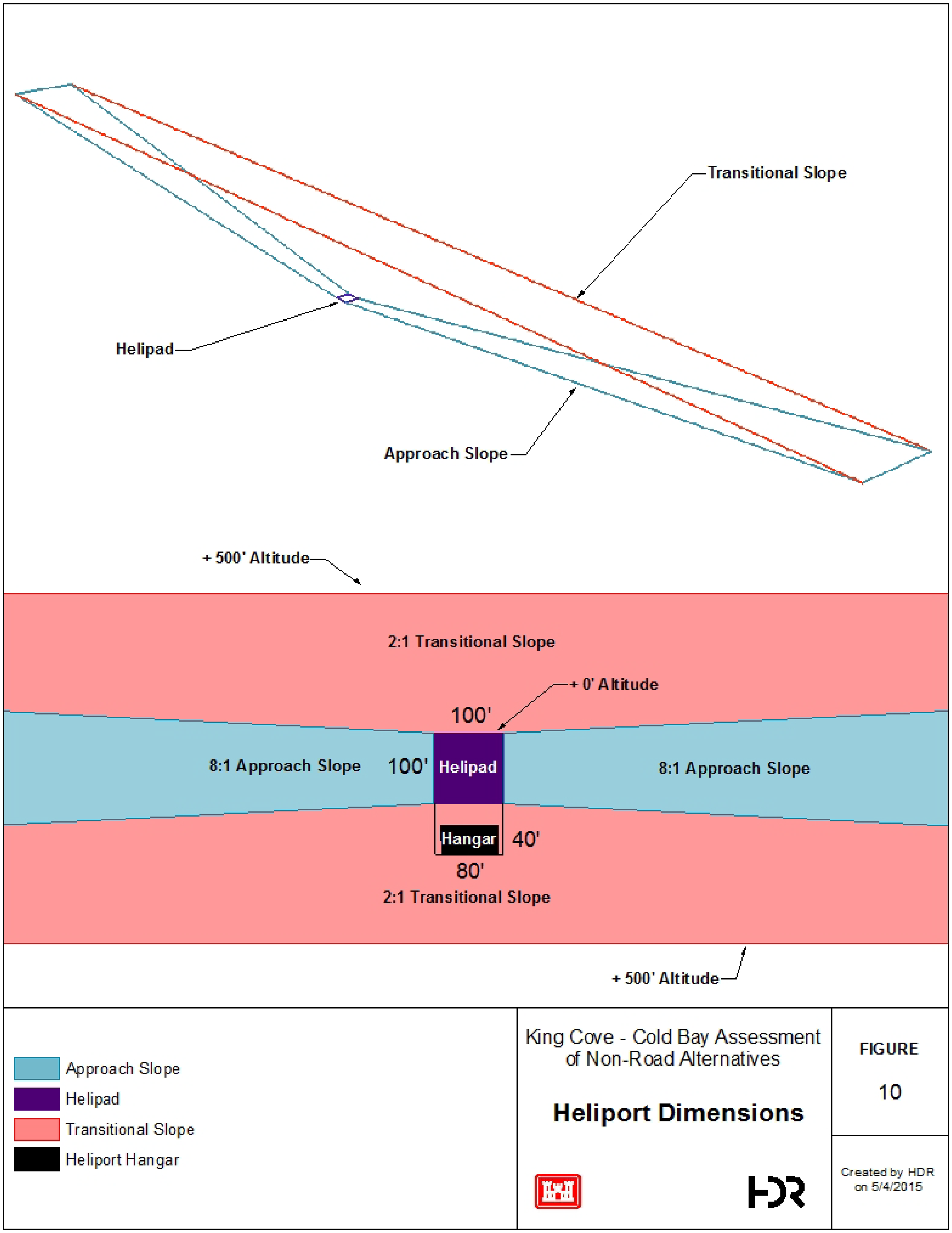

Figure 10. Heliport Dimensions

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6.2.1 Alternative 3a (Northeast Heliport)

This alternative provides a heliport at the existing (abandoned) hovercraft ramp on the northeast shore of Cold Bay. Passengers and crew would access the heliport via the existing 21-mile road from King Cove. Electricity for lighting and navigation aids is assumed to be generated on site.

This alternative may be able to incorporate the existing concrete hovercraft ramp into the design of the heliport, which could reduce construction costs. The cost estimate in this document does not reflect this potential cost reduction. A detailed verification of the usability of the existing concrete ramp for use in this alternative was beyond the scope of this assessment. However, this activity should be considered if this alternative is carried forward to a feasibility study. The approaches to this location are unobstructed. This site is accessible by an existing road.

Potential disadvantages of this site include its distance from King Cove. Access to this site requires maintenance of 16 miles of road beyond the existing King Cove Airport that are not currently maintained. The heliport owner would be required to ensure maintenance of the road if federal funds were used to construct the heliport.

Medevac travel time from King Cove to ANC from this location would require 3.1 hours, the longest time required for any heliport alternative. Appendix C provides a complete overview of medevac travel time for the marine, airport, and helicopter alternatives.

6.2.2 Alternative 3b (Lenard Harbor Heliport)

This alternative provides a heliport about 6 miles west of the existing King Cove Airport at an existing materials site near the head of Lenard Harbor. This is the heliport site identified in the *King Cove Access Project FEIS* (2003). Passengers and crew would access the heliport via an 11-mile road from King Cove, about half of which is currently maintained. Electricity for lighting and navigation aids is assumed to be generated on site.

This alternative would incorporate a cleared/filled area produced during construction of the existing road, possibly reducing construction costs. This site is accessible via the existing road.

Potential disadvantages of his site include a constrained location. The approaches to this location are partially obstructed. It is in terrain that could channel winds and trap clouds. Turbulence is likely to occur at this location whenever the prevailing north wind cascades over the mountainous terrain to the north. Access to this site would require the airport owner to ensure maintenance of about 6 additional miles of road if federal funds were used to construct the heliport.

Medevac travel time from King Cove to ANC from this location would require 2.6 hours. Appendix C provides a complete overview of medevac travel time for the marine, airport, and helicopter alternatives.

6.2.3 Alternative 3c (Peninsula Heliport)

This alternative provides a heliport on the west end of a peninsula directly east of Mortensen's Lagoon. Passengers and crew would access the heliport via a 22.5-mile drive from King Cove. Approximately 14 miles of the road currently exists. An additional 8.5 miles of new road would be constructed through mountainous terrain. Electricity for lighting and navigation aids is assumed to be generated on site.

The approaches to this location are unobstructed. It is also free of terrain that could channel winds and trap clouds.

One disadvantage of this alternative is that access to the site would require construction of 8.5 miles of new road, which also would need to be maintained. The airport owner would be required to ensure maintenance of the road if federal funds were used to construct the heliport.

Medevac travel time from King Cove to ANC from this location would require 2.7 hours. Appendix C provides a complete overview of medevac travel time for the marine, airport, and helicopter alternatives.

6.2.4 Alternative 3d (King Cove Heliport)

This alternative provides a heliport in or adjacent to the community of King Cove. A site selection study would be necessary to determine the most appropriate location for the heliport. Passengers and crew would access the heliport by a relatively short access road of undetermined length.

Access to this location primarily would be via existing roads. Minimal road maintenance would be required to ensure access. Electricity is presumed available nearby.

Disadvantages of this site relate primarily to terrain. Approaches to this location are not unobstructed. It is located in terrain that could channel winds and trap clouds.

Medevac travel time from King Cove to ANC from this location would require 2.1 to 2.2 hours, depending upon whether the helicopter took a straight line route over the mountains or followed the coast west and then north to Cold Bay Airport. This is the least time required by any alternative, because there would be no road travel component. Appendix C provides a complete overview of medevac travel time for the marine, airport, and helicopter alternatives.

6.2.5 Comparison of Heliport Options

Table 7 provides a comparative summary of the relative pros and cons of the four heliport alternatives. This is meant to summarize the material above and include relative information on costs presented later in this document, but is not necessarily a complete list of criteria that should be used for selection of heliport locations. Rather, it is a tool to present a quick snapshot of some relative advantages and disadvantages.

Table 7. Summary Comparison of Heliport Alternatives

Alt.	Location	Use Existing Infra-structure	Un-obstructed Airspace	Weather Conditions	Use Existing Road	Travel Time for Medevac	M&O Cost	Available Electricity	Capital Cost	Sum
3a	Northeast	1	1	1	1	-1	-1	-1	1	2
3b	Lenard Harbor	1	-1	-1	1	0	0	-1	1	0
3c	Peninsula	-1	1	1	-1	-1	-1	-1	-1	-4
3d	King Cove	0	-1	-1	1	1	1	1	1	3

1=Favorable; 0=Neutral; -1=Unfavorable

6.3 Construction Cost and 75-Year Life-Cycle Cost

The construction cost at each alternative location, with hangar, would be approximately the same, at $2.5 million ($1.5 million for the heliport and $1 million for the hangar). There may be small savings for Alternatives 3a and 3b, because they would use existing developments (former hovercraft terminal and former gravel extraction area).

Construction of the heliport would cost about $150 per square foot. Construction of the hangar is estimated at $300 per square foot.

The cost of Alternative 3c (Peninsula Heliport) would include a substantial additional expense, the construction of approximately 8.5 miles of single-lane roadway with turnouts at $3,000,000 per mile, or $25 million.

Table 8 summarizes the costs of the heliport alternatives. The table reports capital costs in 2015 dollars and uses the assumption that any of the heliport alternatives would be built in 1 year. O&M costs shown are the costs projected for the first year of operations, in 2015 dollars. The O&M costs were bundled with the capital costs and applied over 75 years, accounting for inflation, and then brought back to 2015 dollars using a discount rate to provide a net present value (cost) of each alternative. Note that this does not include provisions for periodic maintenance tasks such as replacement of the hangar or navigation system or repaving the heliport.

Table 8. Costs of the Heliport Alternatives (millions)

Description	Alt 3a	Alt 3b	Alt 3c	Alt 3d
Capital Cost	$2.8	$2.8	$28.3	$2.8
Annual Operations and Maintenance Cost	$2.34	$2.25	$2.28	$2.19
75-Year Life-Cycle Cost (Net Present Value)	$78.3	$75.3	$99.1	$73.5

Notes:
All costs are in 2015 dollars.
Capital costs include a complete heliport. Assumes no road construction necessary except under Alternative 3c; road construction accounts for the cost difference for Alternative 3c. Assumes electricity is generated on site.
O&M costs include heliport O&M (at 5% of heliport capital cost each year) and road O&M for the road segment dedicated to airport use.
The 75-year total cost is escalated to account for inflation over time and brought back to 2015 dollars.
This table presents the full costs of the alternative. It does not account for cost reductions that might be possible by using partially developed sites under Alternatives 3a and 3b.

Annual heliport operating and maintenance costs are based primarily on the assumption that the heliport owner would contract with a helicopter company for the helicopter, its pilot, and its mechanic at about $2 million per year. The cost of maintaining the access roads to Alternatives 3a, 3b, and 3c are assumed to be a separate cost (not part of the helicopter contract) at about $8,700 per lane mile per year.

6.4 Risks

Methods for assessing risk for all marine, airport, and helicopter alternatives are explained in Section 2. Risk assessment tables for all of the alternatives appear in Appendix A. Multiple types of risks were identified and ranked using a matrix (shown in Appendix A). This qualitative assessment resulted in an average risk level for each alternative. For the heliport alternatives, the average risk scores were:

- Alternative 3a (Northeast Heliport): 2.6—medium-serious
- Alternative 3b (Lenard Harbor Heliport): 2.5—medium-serious
- Alternative 3c (Peninsula Heliport): 2.6—medium-serious
- Alternative 3d (King Cove Heliport): 2.3—medium (+)

The risks identified in the assessment tables for each of the four heliport alternatives are nearly identical. Those considered to be of the greatest concern are discussed below.

As with the airport alternatives, the risks of night operations and air travel in general for the King Cove-Cold Bay area, as well as for the Aleutian Island region, are significant. Various sources describe the Aleutian Islands as the windiest and rainiest region in the United States. The mountainous terrain can cause dangerous turbulence, increased wind speeds due to venturi effects, and accumulation of clouds. These factors, together with the remoteness of both communities, place a premium on the appropriate implementation and use of technology, pilot training for good decision-making, and timely weather data collection and reporting.

The road between the City of King Cove and the heliport sites for Alternatives 3a and 3b passes through three possible avalanche areas, based upon a preliminary examination of aerial photography. Two of these areas are located along the road to the existing King Cove Airport. A possible third area is located about 5 miles west of the existing airport. Further information on the frequency of avalanches should be collected, but anecdotal accounts indicate that avalanches may not be annual occurrences. In addition to representing a risk to travelers on the road, an avalanche would effectively close the heliports until the debris could be cleared from the road. In addition to the two avalanche areas on the road to the existing King Cove Airport, about 8 miles of the unconstructed portion of the road needed for access to Alternative 3c would be susceptible to avalanches. Alternative 3d would be in or immediately adjacent to the community of King Cove and would be free of road risk and avalanche danger.

Animal behaviors are a concern for the safe operation of the heliports mainly due to the potential for conflicts with birds in the approach and departure airspace. Avoiding the creation of additional water bodies through the use of best management practices during construction and the revegetation of disturbed terrain near the heliport would help reduce the concentration of birds near the heliport. In the case of Alternative 3d, care should be taken to locate the heliport in King Cove at least 10,000 feet from landfills, sewer lagoons, or waste from fish processing facilities (FAA AC 150/5200-33B).

Securing construction funding would be critical to the success of any alternative. The most likely source of funding for the heliport would be a grant from the FAA AIP. Eligible grant recipients would include DOT&PF, AEB, or the City of King Cove. Acceptance of an AIP grant carries with it many obligations, such as ensuring the long-term support of the facility, which would include the maintenance of any associated single-purpose heliport access roads. For Alternatives 3a, 3b, and 3c, this would include the cost of maintaining approximately 16, 6, and 9 miles, respectively, of roadway beyond the existing airport. Given recent reductions to the state operating budget, this could be problematic.

Although the distances from the heliports to Cold Bay Airport vary, the duration of the helicopter flight would be relatively brief. The time required for a passenger to travel from King Cove to Cold Bay Airport and on to Anchorage is determined in large part by the amount of road travel required. At an assumed speed of 20 miles per hour, the trip by road from King Cove to Alternative 3a would take about 1 hour. Road travel to Alternatives 3b and 3c would require traveling 30 and 40 minutes, respectively. Because Alternative 3d is in or very near the community of King Cove (exact location to be determined), road travel would be almost eliminated, and the length of time required to reach Anchorage would be the lowest of any alternative. The elimination of the road segment, including the time needed to drive it and the potential risk of avalanche, ice, or snow on it, is the primary reason for the slightly lower average risk determined for Alternative 3d when compared to other alternatives.

6.5 Dependability

As with the airport alternatives, weather is the chief determinant of dependability of helicopter access in the Aleutian Islands region. How weather affects the safety and operability of heliports within the region is highly site-specific. Because King Cove Airport does not have automated weather data collection equipment, weather data for Cold Bay Airport were used as a proxy for this project. As with the airport alternatives, wind speeds are an important consideration in determining dependability. Unlike the airport alternatives, however, the heliport alternatives and the leased helicopter service are assumed to operate under VFR only, as is the case with the existing helicopter contract AEB holds for access to the Akutan/Akun Island airport. It would not incorporate navigation aids to allow the helicopters to function in low- or "no"-visibility conditions. Cloud cover increases and visibility decreases in the Aleutian region in summer. Poor visibility is expected to have an adverse effect on dependability in both the winter (10 percent) and the summer (15 percent) at each of the alternative heliport sites. Further investigation may determine that appropriate electronic navigation aids are available and compatible with helicopters offered as part of a leased helicopter service.

Conditions at the Alternative 3a site are anticipated to be somewhat similar to those at Cold Bay, except that topography south and southeast of the new site may contribute to turbulence and wind gusts. Snow events and avalanche-prone areas on the 21-mile access road may reduce dependability an additional 5 percent, but only in winter. Average dependability of access via the Alternative 3a heliport throughout the year is expected to be about 82.6 percent, varying from a high of 85 percent in the summer to a low of about 79 percent in some of the winter months. These percentages are based on wind data, adjusted for summer cloud cover and winter avalanche or snow events.

The topography adjacent to heliport sites 3b, 3c, and 3d is mountainous, unlike the terrain near Cold Bay Airport. Wind in these locations is likely to be accelerated by venturi effects and generate considerably more turbulence than might be expected at Cold Bay Airport. The mountains may also affect the accumulation or departure of cloud cover differently. The chief executive officer for PenAir has been quoted as saying that, on an annual basis, up to 30 percent of scheduled PenAir flights have been cancelled due to weather considerations. PenAir provided the Medallion Foundation with guidance to help identify wind regimes that represent hazardous conditions at King Cove Airport. Given that Alternatives 3b and 3c have similar settings and are reached by traveling access roads of significant length, the dependability assessments for each are similar. The annual average dependability is estimated to be about 67.5 percent varying from a high of 75 percent in the summer to a low of about 60 percent in some of the winter months. Dependability for Alternative 3d is somewhat better, because the access road to the heliport is assumed to be very short. Estimates are based on the PenAir assessment of 70 percent, minus summer clouds and winter avalanche or snow events as appropriate. Dependability and wind data for all marine, airport, and helicopter alternatives appear in Appendix B.

Table 9 shows dependability of the heliport alternatives, by month.

Table 9. Heliport Alternatives, Dependability by Month (%)

Alt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
3a	79.6	79.2	79.2	85	85	79.8	85	85	85	79.4	85	84.5	82.6
3b	60	60	60	75	75	75	75	75	75	60	60	60	67.5
3c	60	60	60	75	75	75	75	75	75	60	60	60	67.5
3d	65	65	65	75	75	75	75	75	75	65	65	65	70

6.6 Other Considerations

While this document generally assumes the new hangar, the helicopter, and the crew would be based on the King Cove side of the bay, it would be possible to locate them at the Cold Bay Airport. The location of the hangar would not affect the time required to medevac a patient to Anchorage unless the heliport and hangar were co-located in King Cove. For the other heliport locations, travel by the patient from King Cove to the heliport and the helicopter's flight from the hangar to the heliport would occur at about the same time. The following sections present brief consideration of the pros and cons of the hangar location.

6.6.1 Helicopter Hangar on the King Cove Side of the Bay

This alternative does not require the helicopter to cross the open water of Cold Bay from Cold Bay Airport to pick up passengers/patients departing King Cove. The helicopter flight and maintenance crew would likely lodge in King Cove, regardless of whether the heliport were in King Cove or at one of the remote sites. This leads to the pros and cons of this option:

Pro: If the both the King Cove heliport and the hangar were located in King Cove, this alternative would achieve the lowest overall travel time required for medevac and would somewhat facilitate logistical considerations for the helicopter flight and maintenance crew, who would lodge in King Cove.

Con: If the hangar were located at one of the more remote sites on the King Cove side of the bay (i.e., not in King Cove), the helicopter flight and maintenance crew would need to travel to the heliport for flight preparations and helicopter maintenance, which would be more time-consuming overall and could delay medevac flights slightly.

6.6.2 Helicopter Hangar at Cold Bay Airport

Pro: If an existing hangar facility at Cold Bay Airport were available for the helicopter, capital costs could be reduced.

Con: Medevac flights would have to transit to King Cove before picking up a patient, increasing response time. If the King Cove heliport were located at one of the more remote sites, this disadvantage would be negated—the helicopter could easily cross the waterbody of Cold Bay in the time required for the patient to reach one of the remote heliport sites—but the response time still would be greater than if the hangar were in King Cove.

Table 10 summarizes the positive and negative aspects of the hangar locations of the heliport alternatives.

Table 10. Pros and Cons of Hangar Locations

Alt		Flying Time for Medevac	Facilitates Crew Logistics	Capital Costs	Sum
Located on King Cove Side of the Bay					
3a	Northeast Heliport	0	-1	-1	-2
3b	Lenard Harbor	0	-1	-1	-2
3c	Peninsula Heliport	0	-1	-1	-2
3d	King Cove Heliport	1	1	-1	1
Located at Cold Bay Airport					
	Cold Bay Airport	-1	1	1	1

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King Cove-Cold Bay Assessment of Non-Road Alternatives

Appendix A

Risk Matrix and Risk Assessment Tables

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Risk Assessment Matrix

	Severity			
Likelihood	Negligible IV	Marginal III	Critical II	Catastrophic I
Frequent A				
Probable B				*High 4*
Occasional C			*Serious 3*	
Remote D		*Medium 2*		
Improbable E	*Low 1*			

Severity Scale Definitions

Catastrophic	Results in fatalities and/or loss of the system.
Critical	Severe injury and/or major system damage.
Marginal	Minor injury and/or minor system damage.
Negligible	Less that minor injury and/or less than minor system damage.

Likelihood Scale Definitions

Frequent	Individual	Likely to occur often.
	Fleet	Continuously experienced.
Probable	Individual	Will occur several times.
	Fleet	Will occur often.
Occasional	Individual	Likely to occur sometime.
	Fleet	Will occur several times.
Remote	Individual	Unlikely to occur, but possible.
	Fleet	Unlikely but can reasonably be expected to occur.
Improbable	Individual	So unlikely, it can be assumed it will not occur.
	Fleet	Unlikely to occur, but possible.

Source:

U.S. Forest Service and Bureau of Land Management. April 2010.
Aviation Risk Management Workbook.

Qualitative Risk Assessment Alternative 1a - Northeast Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing / damaged or power loss to navaids and dock lights	Emergency response plan; use of electronic chart plotting systems and GPS with hazards identified	Remote	Marginal	Medium	2	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training, implement crew management procedures and relief crew members	Occasional	Critical	Serious	3	Costs and availability of relief crew members questionable for this region.
3	Weather - Ferry travel	Life-Safety, Operations	High winds or extreme wave conditions that could blow the vessel off course or capsize the vessel	Restrict operations based on weather conditions	Remote	Catastrophic	Serious	3	Assume ferry can operate 99% of the time based on weather limitations.
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and the ferry terminal	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Sea Ice	Operations		Requires Ice Class A0 vessel to safely navigate Lenard Harbor	Occasional	Negligible	Low	1	

Qualitative Risk Assessment Alternative 1a - Northeast Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Long-Term Operational Funding	Financial	Annual maintenance and operations expenses could exceed available funding	Annual ferry operating costs can be partially offset by passenger fares with scheduled ferry service, as well as usage fees for medevac	Probable	Catastrophic	High	4	Based on assumption that AEB would be responsible for subsidies needed and on recent AEB experience with hovercraft and helicopter.
7	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting for marine structures could take up to a year depending on permit requirements and regulatory hurdles.
8	Vessel Maintenance	Operations	Dry dock required every 2 years, 40-day planned downtime; no vessel redundancy for unplanned maintenance	Contract a backup vessel and plan dry dock and maintenance during mild weather seasons with no sea ice risk	Occasional	Negligible	Low	1	
9	Faunal Response to Construction and Operations	Environmental	Disruption and displacement of wildlife during construction and ferry operations	Marine mammal monitoring during construction; construction mitigation methods to reduce environmental impact such as bubble curtains for pile driving	Probable	Marginal	Serious	3	Presence of certain marine species present in construction area during in-water work period could cause construction delays. Ferry service could disrupt certain migratory patterns.

Qualitative Risk Assessment
Alternative 1a - Northeast Ferry

					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
10	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Ferry terminals at each end of route likely to have security fencing; use of ferry terminals by unauthorized vessels is low	Remote	Negligible	Low	1	
11	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
12	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies en route	Frequent	Marginal	Serious	3	
13	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Marginal	Medium	2	Could lead to unplanned maintenance and additional vessel downtime.
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment Alternative 1b - Lenard Harbor Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing / damaged or power loss to navaids and dock lights	Emergency response plan, use of electronic chart-plotting systems and GPS with hazards identified	Remote	Marginal	Medium	2	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training, implement crew management procedures and relief crew members	Occasional	Critical	Serious	3	Costs and availability of relief crew members questionable for this region.
3	Weather - Ferry travel	Life-Safety, Operations	High winds or extreme wave conditions that could blow the vessel off course or capsize the vessel	Restrict operations based on weather conditions	Remote	Catastrophic	Serious	3	Assume ferry can operate 99% of the time based on weather limitations.
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and the ferry terminal	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Sea Ice	Operations	Lenard Harbor historically known for icing over	Requires Ice Class A0 vessel to safely navigate Lenard Harbor	Occasional	Negligible	Low	1	Less chance of encountering sea ice with the avoidance of Lenard Harbor and terminals located sufficiently offshore to avoid most ice near shoreline.

Qualitative Risk Assessment Alternative 1b - Lenard Harbor Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Long-Term Operational Funding	Financial	Annual maintenance and operations expenses could exceed available funding	Annual ferry operating costs can be partially offset by passenger fares with scheduled ferry service, as well as usage fees for medevac	Probable	Catastrophic	High	4	Based on assumption that AEB would be responsible for subsidies needed and on recent AEB experience with hovercraft and helicopter.
7	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting for marine structures could take up to a year depending on permit requirements and regulatory hurdles.
8	Vessel Maintenance	Operations	Dry dock required every 2 years, 40-day planned downtime; no vessel redundancy for unplanned maintenance	Contract a backup vessel and plan dry dock and maintenance during mild weather seasons with no sea ice risk	Occasional	Negligible	Low	1	
9	Faunal Response to Construction and Operations	Environmental	Disruption and displacement of wildlife during construction and ferry operations	Marine mammal monitoring during construction; construction mitigation methods to reduce environmental impact such as bubble curtains for pile driving	Probable	Marginal	Serious	3	Presence of certain marine species present in construction area during in-water work period could cause construction delays. Ferry service could disrupt certain migratory patterns.
10	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Ferry terminals at each end of route likely to have security fencing; use of ferry terminals by unauthorized vessels is low	Remote	Negligible	Low	1	

Qualitative Risk Assessment Alternative 1b - Lenard Harbor Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
11	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
12	Total Travel Time Required (King Cove to Anchorage hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Frequent	Marginal	Serious	3	
13	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Marginal	Medium	2	Could lead to unplanned maintenance and additional vessel downtime.
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment Alternative 1c: Direct Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops	Life-Safety, Operations	Missing / damaged or power loss to navaids and dock lights	Emergency response plan; use of electronic chart plotting systems and GPS with hazards identified	Remote	Marginal	Medium	2	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training; implement crew management procedures and relief crew members	Occasional	Critical	Serious	3	Costs and availability of relief crew members questionable for this region.
3	Weather - Ferry travel	Life-Safety, Operations	High winds or extreme wave conditions that could blow the vessel off course or capsize the vessel	Restrict operations based on weather conditions	Occasional	Catastrophic	High	4	Assume ferry can operate 98% of the time based on weather limitations. More susceptible to rough seas between King Cove and Cold Bay.
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous within King Cove	Staffing, equipment, and operational funding for road maintenance	Occasional	Negligible	Low	1	This applies only to road between ferry landings and airport. Much shorter distances and likelihood of other on-land transportation alternatives for these areas.
5	Sea Ice	Operations	Shore ice may be present	Requires Ice Class A0 vessel to safely navigate Lenard Harbor	Occasional	Negligible	Low	1	Less chance of encountering sea ice with the avoidance of Lenard Harbor and terminals located sufficiently offshore to avoid most ice near shoreline.

Qualitative Risk Assessment Alternative 1c: Direct Ferry									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Long-Term Operational Funding	Financial	Annual maintenance and operations expenses could exceed available funding	Annual ferry operating costs can be partially offset by passenger fares with scheduled ferry service, as well as usage fees for medevac	Probable	Catastrophic	High	4	Based on assumption that AEB would be responsible for subsidies needed and on recent AEB experience with hovercraft and helicopter.
7	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting for marine structures could take up to a year depending on permit requirements and regulatory hurdles.
8	Vessel Maintenance	Operations	Dry dock required every 2 years, 40-day planned downtime. No vessel redundancy for unplanned maintenance	Contract a backup vessel and plan dry dock and maintenance during mild weather seasons with no sea ice risk	Occasional	Negligible	Low	1	
9	Faunal Response to Construction and Operations	Environmental	Disruption and displacement of wildlife during construction and ferry operations	Marine mammal monitoring during construction; construction mitigation methods to reduce environmental impact such as bubble curtains for pile driving	Probable	Marginal	Serious	3	Presence of certain marine species present in construction area during in-water work period could cause construction delays. Ferry service could disrupt certain migratory patterns.
10	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Ferry terminals at each end of route likely to have security fencing; use of ferry terminals by unauthorized vessels is low	Remote	Negligible	Low	1	

Qualitative Risk Assessment
Alternative 1c: Direct Ferry

					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
11	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
12	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Frequent	Critical	High	4	Total medevac transit time over 5 hours, highest travel time of all alternatives.
13	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Marginal	Medium	2	Could lead to unplanned maintenance and additional vessel downtime.
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment Alternative 2a - 5,000-foot Runway									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged navaids and lighting; loss of electrical power	Emergency response plan, use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training; implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; Just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds; close redundant facility (existing KC Airport)	Remote	Critical	Medium	2	

Qualitative Risk Assessment
Alternative 2a - 5,000-foot Runway

					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting could take up to 3 years depending on permit requirements and regulatory hurdles.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasion al	Negligible	Low	1	
8	Faunal Response to Construction and Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Critical	Serious	3	
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Frequent	Marginal	Occaisional	2	Alt 2a delivers medevac patient to Anchorage about 40 minutes quicker than Alt 2b.
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Likely a State-owned facility.
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment Alternative 2b - 3,500-foot Runway										
					Post-mitigation					
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged navaids and lighting; loss of electrical power	Emergency response plan, use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training, implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds; close redundant facility (existing KC Airport)	Remote	Critical	Medium	2	

Qualitative Risk Assessment Alternative 2b - 3,500-foot Runway									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting could take up to 3 years depending on permit requirements and regulatory hurdles.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasional	Negligible	Low	1	
8	Faunal Response to Construction and Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Critical	Serious	3	
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Frequent	Critical	Serious	3	Alt 2a delivers medevac patient to Anchorage about 40 minutes quicker than Alt 2b.

Qualitative Risk Assessment Alternative 2b - 3,500-foot Runway									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Likely a State-owned facility.
				Average Risk Score				2.5	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

	Qualitative Risk Assessment Alternative 3a - Northeast Heliport				Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged nave aids and lighting; loss of electrical power	Emergency response plan; use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training[implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds	Remote	Critical	Medium	2	

Qualitative Risk Assessment Alternative 3a - Northeast Heliport									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting could take a year depending on permit requirements and regulatory hurdles.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasional	Negligible	Low	1	
8	Faunal Response to Construction & Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Negligible	Low	1	Heliport site is already disturbed (hovercraft ramp). Uses existing access road.
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Frequent	Critical	Serious	3	Longest total travel time (road + helicopter) to Cold Bay Airport required of all heliport alternatives.

Qualitative Risk Assessment
Alternative 3a - Northeast Heliport

					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Heliport could be State, AEB, or city owned/operated.
13	Helicopter Contractor Performance	Operations	Lapses in staffing availability, training, and certification; absent or poorly maintained equipment and supplies	Contract oversight and periodic inspections	Remote	Catastrophic	Serious	3	
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment
Alternative 3b - Lenard Harbor Heliport

					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged navaids and lighting; loss of electrical power	Emergency response plan, use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training; implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Occasional	Critical	Serious	3	Assume road is passable 95% of the time, with 5% downtime due to avalanches or heavy snow.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds	Remote	Critical	Medium	2	

Qualitative Risk Assessment Alternative 3b - Lenard Harbor Heliport									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting could take a year depending on permit requirements and regulatory hurdles.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasional	Negligible	Low	1	
8	Faunal Response to Construction and Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Negligible	Low	1	Heliport site is already disturbed (material site). Uses existing access road.
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	

Qualitative Risk Assessment Alternative 3b - Lenard Harbor Heliport									
					Post-mitigation				
	Risk	Categories *	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Probable	Negligible	Medium	2	Third longest total travel time (road + helicopter) to Cold Bay Airport of all heliport alternatives.
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Heliport could be State, AEB, or city owned/operated.
13	Helicopter Contractor Performance	Operations	Lapses in staffing availability, training, and certification; absent or poorly maintained equipment and supplies	Contract oversight and periodic inspections	Remote	Catastrophic	Serious	3	
				Average Risk Score				2.3	

* Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment Alternative 3c - Peninsula Heliport									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged navaids and lighting; loss of electrical power	Emergency response plan, use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training; implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Probable	Critical	High	4	Unconstructed portion of road corridor has considerable avalanche potential.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds	Remote	Critical	Medium	2	

Qualitative Risk Assessment Alternative 3c - Peninsula Heliport									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Probable	Negligible	Medium	2	Permitting could take a year depending on permit requirements and regulatory hurdles.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasional	Negligible	Low	1	
8	Faunal Response to Construction and Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Negligible	Low	1	Site is most environmentally sensitive of all heliport alternatives. Greenfield site. Requires construction of 8.5 miles of new access road.
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	

Qualitative Risk Assessment Alternative 3c - Peninsula Heliport									
				Post-mitigation					
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Probable	Negligible	Medium	2	Second longest total travel time (road + helicopter) to Cold Bay Airport of all heliport alternatives.
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Heliport could be State, AEB, or city owned/operated.
13	Helicopter Contractor Performance	Operations	Lapses in staffing availability, training, and certification; absent or poorly maintained equipment and supplies	Contract oversight and periodic inspections	Remote	Catastrophic	Serious	3	
				Average Risk Score				2.4	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

Qualitative Risk Assessment
Alternative 3d - King Cove Heliport

					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
1	Night Ops - Environmental risks	Life-Safety, Operations	Missing/damaged navaids and lighting; loss of electrical power	Emergency response plan; use of GPS / Capstone navigation systems	Occasional	Catastrophic	High	4	
2	Night Ops - Physiological hazards	Life-Safety, Operations	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Education and training; implement crew management procedures and relief crew members	Occasional	Catastrophic	High	4	
3	Weather - Air travel	Life-Safety, Operations	Flight operations in conditions beyond recommended wind speeds or VFR operations in IFR conditions	Preflight planning; just say NO (accept fact that mission cannot be completed); instrument flight and landing systems	Remote	Catastrophic	Serious	3	
4	Weather - Road travel	Life-Safety, Operations	Heavy snow and avalanches could make the road impassable or extremely hazardous between King Cove and Lenard Harbor	Staffing, equipment, and operational funding for road maintenance	Remote	Marginal	Medium	2	Heliport located in community at site TBD; avalanche danger negligible unless heliport located at existing airport.
5	Long-Term Operational Funding	Financial	State or local project sponsor could default on capital grant obligations	User fees; dedicated funds	Remote	Critical	Medium	2	

Qualitative Risk Assessment Alternative 3d - King Cove Heliport									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
6	Standard Permitting Process Required	Development/Permitting	Standard permitting process required	Keep in mind BMPs and construction techniques / design approaches with least amount of environmental impact	Remote	Negligible	Low	1	NEPA documentation likely would be Categorical Exclusion.
7	Long-Term Management Response	Regulatory	Refuge may need to update current plan		Occasional	Negligible	Low	1	
8	Faunal Response to Construction and Operations	Environmental	Animals on runway or in airspace; changes in nesting/feeding behaviors	Fencing; restrictions on aircraft operations; revegetation	Occasional	Negligible	Low	1	Heliport site is already disturbed - in community core area. Uses existing access road.
9	Uncontrolled Use by Non-Medical Evac	Operations	Uncontrolled use by non-medical evac	Patrols by airport maintenance staff; pilot reporting	Remote	Negligible	Low	1	
10	Capital Funding	Financial	Lack of project sponsor; competing federal, State, or local priorities	In-kind contributions of surface and sub-surface holdings from stakeholders	Remote	Catastrophic	Serious	3	
11	Total Travel Time Required (King Cove to Anchorage Hospital)	Life-Safety, Operations	Time-sensitive medical conditions	Efficient transfer between modes; use of best medical technologies	Probable	Negligible	Medium	2	Shortest total travel time (road + helicopter) to Cold Bay Airport of all heliport alternatives.

Qualitative Risk Assessment Alternative 3d - King Cove Heliport									
					Post-mitigation				
	Risk	Categories*	Hazards	Mitigation	Likelihood	Severity	Outcome	Score	Comments
12	Liability	Other	Lapses in facility maintenance; delays in reporting conditions	Sufficient operational funding for staffing and equipment	Remote	Negligible	Low	1	Heliport could be State, AEB, or city owned/operated.
13	Helicopter Contractor Performance	Operations	Lapses in staffing availability, training, and certification; absent or poorly maintained equipment and supplies	Contract oversight and periodic inspections	Remote	Catastrophic	Serious	3	
				Average Risk Score				2.2	

*Life-Safety, Life-Cycle, Development, Regulatory, Permitting, Environmental, Operations, Financial, Other

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King Cove-Cold Bay Assessment of Non-Road Alternatives

Appendix B

Wind Data

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Cold Bay Hazardous Wind

2012	January	February	March	April	May	June	July	August	September	October	November	December
Perfect Number of Readings	744	696	744	720	744	720	744	744	720	744	720	744
Actual Number of Readings	735	687	743	720	743	720	743	743	718	743	717	741
Number of Non-Recorded Data Points	9	9	1	0	1	0	1	1	2	1	3	3
> 40 knots any direction	0.136%	0.908%	0.135%	0.000%	0.000%	0.000%	0.000%	0.000%	0.139%	0.404%	0.000%	0.405%
> 60 knots any direction	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

2013	January	February	March	April	May	June	July	August	September	October	November	December
Perfect Number of Readings	744	672	744	720	744	720	744	744	720	744	720	744
Actual Number of Readings	742	667	741	718	728	707	733	732	717	744	717	743
Number of Non-Recorded Data Points	2	5	3	2	16	13	11	12	3	0	3	1
> 40 knots any direction	0.000%	0.000%	0.675%	0.000%	0.138%	0.424%	0.000%	0.000%	0.000%	0.403%	0.000%	0.135%
> 60 knots any direction	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

2014	January	February	March	April	May	June	July	August	September	October	November	December
Perfect Number of Readings	744	672	744	720	744	720	744	744	720	744	720	744
Actual Number of Readings	741	664	733	719	741	713	735	742	718	737	710	740
Number of Non-Recorded Data Points	3	8	11	1	3	7	9	2	2	7	10	4
> 40 knots any direction	0.135%	0.155%	0.273%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.141%	0.000%
> 60 knots any direction	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

Combined Monthly Average 2012 - 2014	January	February	March	April	May	June	July	August	September	October	November	December	Average
> 40 knots any direction	*0.090%*	*0.354%*	*0.361%*	*0.000%*	*0.046%*	*0.141%*	*0.000%*	*0.000%*	*0.046%*	*0.269%*	*0.047%*	*0.180%*	*0.128%*
> 60 knots any direction	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*

Note: Table reflects hourly readings recorded by Automated Weather Observing System equipment at Cold Bay Airport.

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King Cove-Cold Bay Assessment of Non-Road Alternatives

Appendix C

Medevac Elapsed-Time Tables

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Estimated Medevac Travel Times, City of King Cove to Ted Stevens Anchorage International Airport (ANC)

		Distance (miles)	Speed (mph)	Time Required (hours)*	
Alternative 1a: Northeast Ferry					
	King Cove to NE Boat Landing	21	20	1.1	
	NE Boat Landing to CB Dock	6	11.5	0.5	Assumes 10-knot average cruising speed per Glosten report in EIS appendix
	CB Dock to Cold Bay Airport	1	20	0.1	
	Cold Bay Airport to ANC (King Air)	630	330	1.9	
Total Time Required				3.5	
Alternative 1b: Lenard Harbor Ferry					
	King Cove to Lenard Harbor Boat Landing	11	20	0.6	
	Lenard Harbor Boat Landing to CB Dock	14	11.5	1.2	Assumes 10-knot average cruising speed per Glosten report in EIS appendix
	CB Dock to Cold Bay Airport	1	20	0.1	
	Cold Bay Airport to ANC (King Air)	630	330	1.9	
Total Time Required				3.7	
Alternative 1c: Direct Ferry					
	King Cove to KC Boat Landing	1	20	0.1	
	KC Boat Landing to CB Dock	27	9	3.0	Assumes 8-knot average cruising speed based on half of trip at 6 knots in open water
	CB Dock to Cold Bay Airport	1	20	0.1	
	Cold Bay Airport to ANC (King Air)	630	330	1.9	
Total Time Required				5.0	
Alternative 2a: 5,000-foot Runway					
	King Cove to New Airport	21	20	1.1	
	New Airport to ANC	630	480	1.3	
Total Time Required				2.4	

		Distance (miles)	Speed (mph)	Time Required (hours)*
Alternative 2b: 3,500-foot Runway				
	King Cove to New Airport	21	20	1.1
	New Airport to ANC	630	330	1.9
Total Time Required				3.0
Alternative 3a: Northeast Heliport				
	King Cove to Heliport	21	20	1.1
	Heliport to Cold Bay Airport	9	80	0.1
	Cold Bay Airport to ANC (King Air)	630	330	1.9
Total Time Required				3.1
Alternative 3b: Lenard Harbor Heliport				
	King Cove to Heliport	11	20	0.6
	Heliport to Cold Bay Airport	14	80	0.2
	Cold Bay Airport to ANC (King Air)	630	330	1.9
Total Time Required				2.6
Alternative 3c: Peninsula Heliport				
	King Cove to Heliport	14	20	0.7
	Heliport to Cold Bay Airport	10.5	80	0.1
	Cold Bay Airport to ANC (King Air)	630	330	1.9
Total Time Required				2.7
Alternative 3d: King Cove Heliport - Direct Flight Path				
	King Cove to Heliport	0	20	0.0
	Heliport to Cold Bay Airport	19	80	0.2
	Cold Bay Airport to ANC (King Air)	630	330	1.9
Total Time Required				2.1

	Distance (miles)	Speed (mph)	Time Required (hours)*
Alternative 3d: King Cove Heliport - Coastal Flight Path			
King Cove to Heliport	0	20	0.0
Heliport to Cold Bay Airport	23	80	0.3
Cold Bay Airport to ANC (King Air)	630	330	1.9
Total Time Required			2.2

*Some totals may not be exact, due to rounding.

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