Kivalina Airport Relocation Feasibility Study

February 2024

Inventory, Forecast, Issues, Facility Requirements

NFAPT00742/3-02-0152-006-2022

Prepared for:

State of Alaska
Department of Transportation & Public Facilities, Northern Region
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EXECUTIVE SUMMARY

The Northern Region of the Alaska Department of Transportation and Public Facilities (DOT&PF) and the Federal Aviation Administration (FAA) is conducting an airport relocation feasibility study for the Kivalina Airport (KVL) in support of a larger community relocation plan. This is the Inventory, Forecast, Issues, and Facility Requirements chapter.

KVL is a public DOT&PF owned Commercial Service – Non-Primary, Community Off-road Airport. KVL has a single, gravel, 3,000-foot-long, 60-foot-wide runway. KVL operates with regularly scheduled passenger service from Bering Air and Ryan Air, primarily flying Cessna C208B/Grand Caravans, Cessna 208 Caravans, and Piper PA-31 Navajos.

The existing and future Aircraft Approach Category and Airplane Design Group for KVL is A-II (Small) and the designated critical aircraft is the Cessna C208B Grand Caravan.

Issues with the current facility include:

1. Runway erosion
2. Storm surge creating runway hazards
3. Crosswinds on runway
4. Runway incursions
5. Too small of apron and/or apron congestion
6. Trail use along the runway penetrating the Part 77 protected airspace
7. Landfill at the end of the runway

The current facility was also compared with the airport design standards in Advisory Circular 150/5300-13B for the critical aircraft, which is an A-II Small Aircraft. This standard is an increase from the existing A-I design at the airport. The design would require an increase in Runway Design Code to A-II-5000, and larger runway protection areas.

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LIST OF ACRONYMS

AAC	Aircraft Approach Category
AC	Advisory Circular
ADG	Airplane Design Group
AIP	Airport Improvement Program
ALP	Airport Layout Plan
ARC	Airport Reference Code
ASOS	Automated Surface Observation System
CTAF	Common Traffic Advisory Frequency
DOT&PF	Department of Transportation and Public Facilities
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
GA	General Aviation
IFR	instrument flight rules
K-Hill	Kisimigiuktuk Hill
KVL	Kivalina Airport
MGW	Main Gear Width
MHz	mega-hertz
MSL	mean sea level
OFZ	Obstacle Free Zone
RDC	Runway Design Code
ROFA	runway object free area
ROFZ	runway object free zone
RPZ	Runway Protection Zone
RSA	runway safety area
RVR	Runway Visibility Range
SREB	Snow Removal Equipment Building
TDG	Taxiway Design Groups
TOFA	taxiway object free area
TSA	taxiway safety area
TSS	threshold siting surfaces
VFR	visual flight rules

1 INTRODUCTION

The Northern Region of the Alaska Department of Transportation and Public Facilities (DOT&PF) and the Federal Aviation Administration (FAA) is conducting an airport relocation feasibility study for the Kivalina Airport (KVL) (Figure 1-1, 1-2, 1-3, 1-4) in support of a larger community relocation plan. This is the Inventory, Forecast, Issues, and Facility Requirements chapter.

The City of Kivalina is located on the southeast tip of a barrier island located between the Chukchi Sea (Arctic Ocean) and Kivalina Lagoon. Historically the area was a seasonally used hunting camp. A school was constructed at the current site, which led to the transition from a seasonal establishment to the current permanent community. Due to severe storms and rising sea levels, Kivalina hopes to relocate to a site off the barrier island to higher ground near Kisimigiuktuk Hill (K-Hill). To accomplish the relocation, the community is actively developing a community relocation plan.

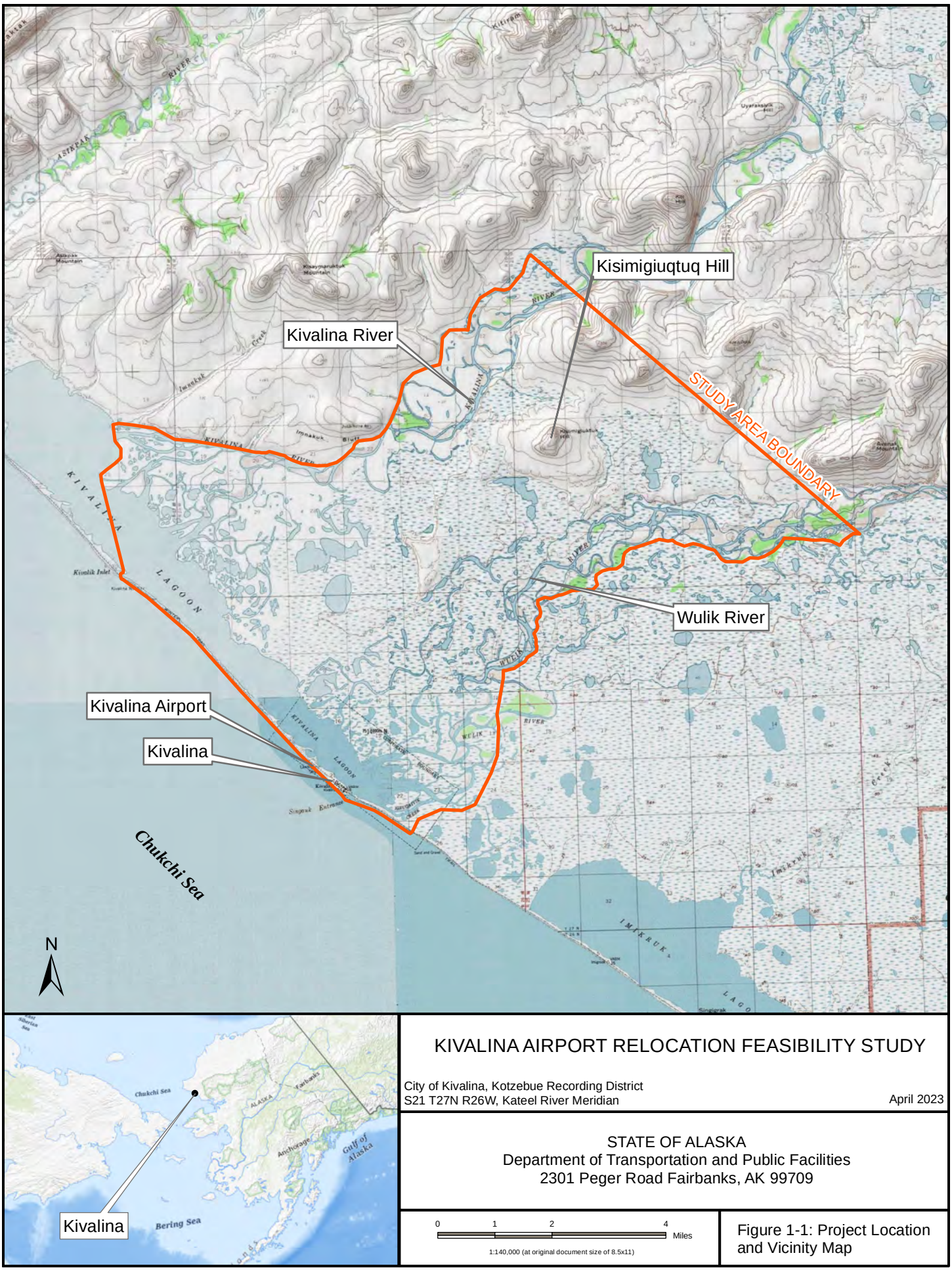
Kivalina was identified by a Government Accountability Office report as one of 31 environmentally threatened communities in Alaska. Articles in the local newspaper (Arctic Sounder) provides the documentation of the history of storm damage in Kivalina (Table 1-1).

Table 1-1 Kivalina Storms (as documented by the Arctic Sounder)

Month/Year of Storm	Description
Fall 2012	Students miss five weeks of school after fall storm cut of water supply to the school
November 2013	First big storm of season Concerns about having to relocate the landfill again after latest storm, storm washing out road to dump, water getting dangerously close to the airport
October 2015	Storm causes erosion close to Airport Efforts to place sandbags on shore by airport failed the next day
January 2017	Series of storms causes power outages and damage
November 2017	November storm flooding the beach in Kivalina
November 2018	Storm went through Kivalina, eroding the airstrip Volunteers bolster Kivalina landing strip against fall storm
January 2020	Holiday storm wreaks havoc in Kivalina Dislodged roofs and broken stoves after 65 mph winds over two days Cold snap on Jan 28, many residents without heat
December 2021	Weekend winds push ice cover, cause power outages – storm brings strong gusts to Northwest Arctic communities Part of Kivalina loses power for at least two days amid frigid weather
September 2022	Major Pacific storm: Water rose in Kivalina but no serious impacts
October 2022	High winds peeled back roofing in Kivalina buildings, destroyed homes, shattered glass
November 2022	New Kivalina school opens its doors to students – Classes begin in new building after storm delays opening. Storm caused school cancellations for two days

An evacuation road from the Kivalina barrier island, across the Kivalina Lagoon, was recently constructed in 2020 and now provides a safe means for the community to escape to K-Hill during storm surges. Additionally, the evacuation road connects the village with the new school site at K-Hill, opened in Fall 2023.

To coordinate with the community's relocation planning efforts, the critical need exists to begin the process of studying the feasibility of maintaining the current airport on the barrier island or constructing a new airport site on the mainland. This relocation feasibility study is the first of three phases of airport analysis: relocation feasibility, site selection, and design. Depending on the outcome of the relocation feasibility study the project may proceed with a site selection study and an Airport Layout Plan (ALP) update in subsequent phases, pending FAA approval.



KIVALINA AIRPORT RELOCATION FEASIBILITY STUDY

City of Kivalina, Kotzebue Recording District
S21 T27N R26W, Kateel River Meridian

April 2023

STATE OF ALASKA
Department of Transportation and Public Facilities
2301 Peger Road Fairbanks, AK 99709

0 1 2 4 Miles

1:140,000 (at original document size of 8.5x11)

Figure 1-1: Project Location and Vicinity Map

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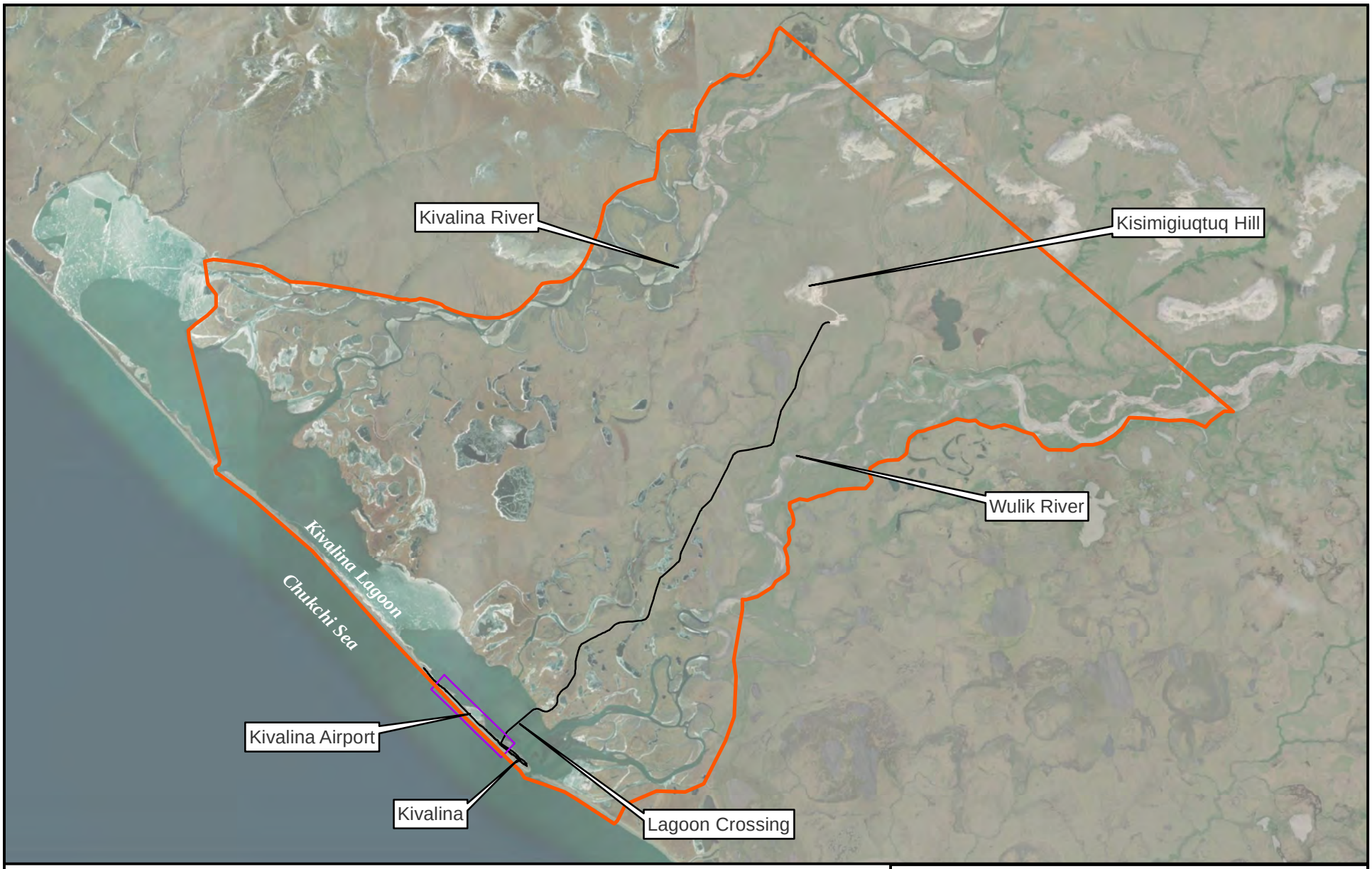

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0 1 2 Miles

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Study Area Boundary
Airport Boundary
Road

Notes:
1. Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

KIVALINA AIRPORT RELOCATION
FEASIBILITY STUDY

STATE OF ALASKA
Department of Transportation and Public Facilities
2301 Peger Road Fairbanks, AK 99709

May 2023

Figure 1-2: Study Area

N

0 0.25 0.5 Miles

1:15,000 (At original document size)

Study Area Boundary
Airport Boundary
Road

Notes:
1. Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

KIVALINA AIRPORT RELOCATION
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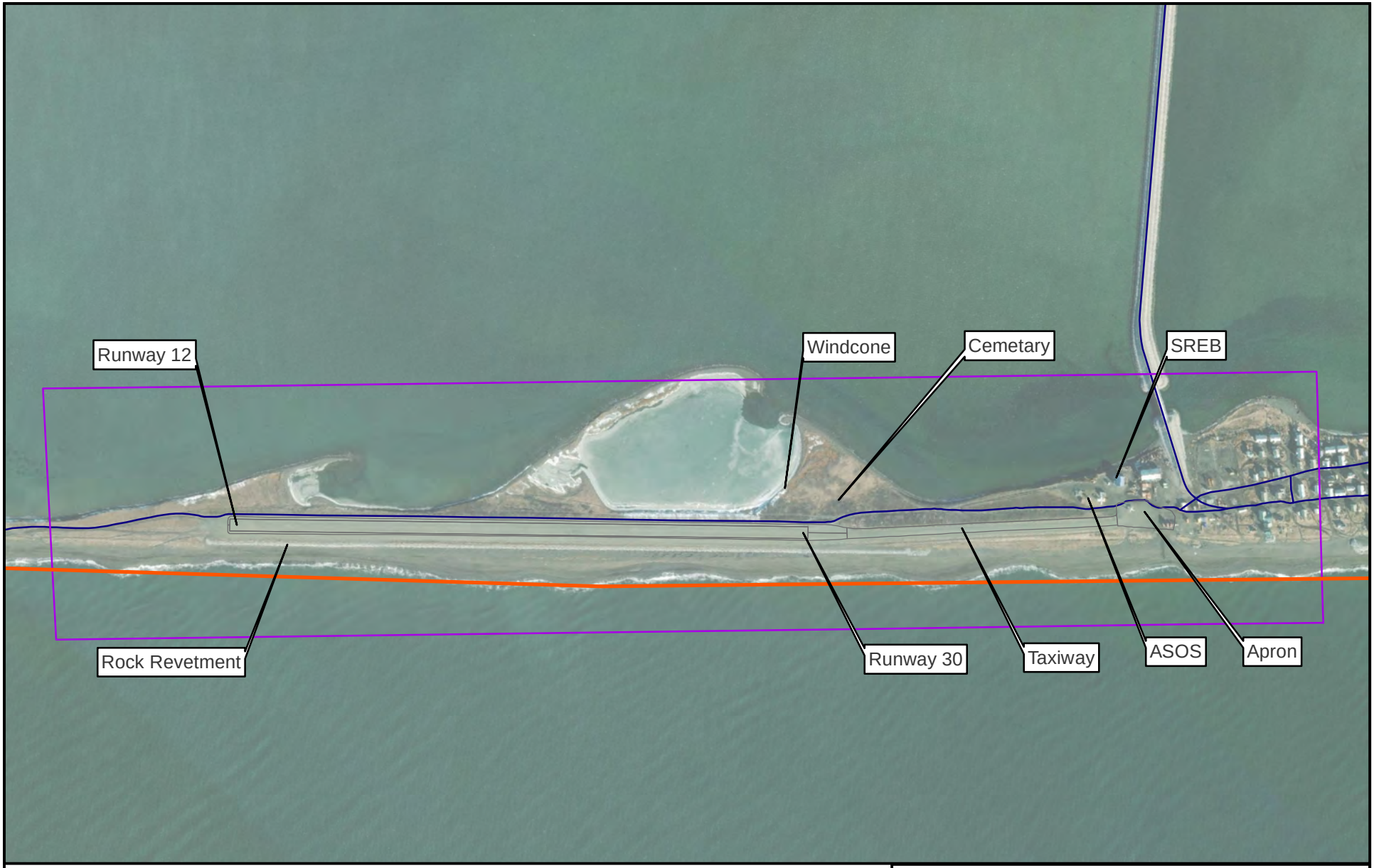
2301 Peger Road Fairbanks, AK 99709

May 2023

Figure 1-3: Kivalina



N

0 0.1 0.2 Miles

1:8,500 (At original document size)

Study Area Boundary
Airport Boundary
Road

Notes:
1. Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

KIVALINA AIRPORT RELOCATION
FEASIBILITY STUDY

STATE OF ALASKA
Department of Transportation and Public Facilities
2301 Peger Road Fairbanks, AK 99709

May 2023

Figure 1-4: Kivalina Airport (KVL)

2 INVENTORY

KVL is a public DOT&PF owned Commercial Service – Non-Primary, Community Off-road Airport. It is not a Federal Aviation Regulation (FAR), Part 139 certificated airport and only serves FAR Part 135, air taxi operations. KVL operates with regularly scheduled passenger service from Bering Air and Ryan Air, primarily flying Cessna C208B/Grand Caravans, Cessna 208 Caravans, and Piper PA-31 Navajos.

KVL has a single, gravel, 3,000-foot-long, 60-foot-wide runway, with medium intensity runway edge lights. The gravel is seasonally soft, and is aligned on a narrow barrier island, offshore from the mainland. The runway is subject to maritime storm erosion and wave action depositing debris on the runway.

2.1 Background

Kivalina is located on the 5-mile barrier island. Historically, that island has hosted the community and airport. No mainland infrastructure existed in the area. KVL is the only year-round access to other communities (i.e., Kotzebue) and emergency medical care.

The FAA funded the acquisition of land and construction of the current airport at KVL in 1985 via the Airport Improvement Program (AIP). This history of AIP grant funded projects are summarized in Table 2-1.

Table 2-1 Airport Improvement Program (AIP) at KVL

Year	Grant Number	Description	Grant Agreement Date	Grant Close Date	Grant
2018	3-02-0200-122-2018	Rehabilitate Runway 12/30 Various SPM - Kivalina (Resurface and Apply Dust Palliative to RWY 7/25, and, incidentally, Safety Areas, TWY, and Apron)	9/18/2018		$180,075
2018	3-02-0152-005-2018	Acquire Easement For Approaches Acquire Easement for Runway 30 RPZ	8/22/2018	4/25/2022	$100,000
2018	3-02-0152-005-2018	Improve Airport Erosion Control Construct Airport Erosion Protection	8/22/2018	4/25/2022	$11,018,429
2013	3-02-0200-094-2013	Acquire Snow Removal Equipment Acquire SRE (Loader)	9/19/2013	3/12/2018	$394,457
2011	3-02-0200-079-2011	Rehabilitate Runway 12/30 Various Surface Preservation	9/16/2011	6/6/2017	$199,092
2010	3-02-0000-015-2010	Conduct aeronautical survey for WAAS approach Aeronautical Survey	9/22/2010	11/3/2016	$231,340
2001	3-02-0152-004-2001	Rehabilitate Runway 12/30	9/12/2001	8/23/2004	$2,174,845
1998	3-02-0152-003-1998	Conduct Airport Master Plan Study (Wind Study Only)	8/19/1998	9/12/2002	$38,271
1994	3-02-0152-002-1994	Acquire Snow Removal Equipment	8/26/1994	9/11/2000	$98,825
1994	3-02-0152-002-1994	Improve Snow Removal Equipment Building	8/26/1994	9/11/2000	$456,168
1985	3-02-0152-001-1985	Install Runway Lighting	9/3/1985	3/11/1991	$221,341
1985	3-02-0152-001-1985	Construct Runway 11/29	9/3/1985	3/11/1991	$2,314,377
1985	3-02-0152-001-1985	Acquire Land for Development	9/3/1985	3/11/1991	$9,375

When accepting FAA grants to complete these improvements, the airport owner agreed to maintain compliance with FAA grant assurances from the date of acceptance of a grant for airport development (such as runway rehabilitation) for the life of the development. The length of those grant assurances is typically 20 years.

Outside of airport development, Kivalina has been undergoing a community relocation project. In 2020 the Kivalina Access Road was officially opened, providing a causeway across the lagoon, and a road to K-Hill.

In 2022, Kivalina students began attending the new school built at K-Hill. As of 2023, residents still live in Kivalina, and students are bused to K-Hill every day.

2.1.1 Past Planning Efforts

Kivalina has a rich history of planning for improvements to their community. The most recent plan is expected to be published in 2023, focusing on relocation of Kivalina to K-Hill. One major project coming out of that planning effort is the construction of a new solid waste facility along the road to K-Hill.

In 2006 the US Army Corps of Engineers published a Relocation Planning Project Master Plan (USACE 2006). This plan looked at 6 alternative locations on the mainland to relocate Kivalina. These alternatives included airport relocations on the mainland. None of the 6 alternatives included the school location that was eventually constructed (at K-Hill).

The 2016 – 2026 Kivalina Comprehensive Community Development Plan (NWAB Undated) emphasized that the top community capital priorities were erosion control and supporting the road to K-Hill.

A wind study was published in a 2017 report, from wind measurements taken on top of K-Hill, to inform the potential for wind power (V3 Energy 2017). This study found a mean annual wind speed of 7.94 meters/second at a height of 32 meters above K-Hill. The wind direction instruments were not calibrated, and so there is no wind direction data.

2.1.2 Role in National Aviation System

KVL is listed as a community off road airport in the Alaska Aviation System Plan. It is a non-primary, commercial service in the National Plan of Integrated Airport Systems. It does not receive Essential Air Service. It is owned by the DOT&PF. It is not regularly staffed, and maintenance is completed by a contracted provider. There is a 2-Bay Snow Removal Equipment Building (SREB), no passenger facilities, and no Airport Rescue Firefighting facility.

2.2 Airfield/Airspace

The current Airport Layout Plan (ALP) for KVL was updated in 2021 with project as-built information, according to FAA Advisory Circular (AC) 150/5300-13A, Airport Design, Change 1. The current edition of the Airport Design AC is now FAA AC 150/5300-13B, issued March 31, 2022. Future airport development will follow the latest edition of this AC.

2.2.1 Runways

Per the 2021 ALP, KVL is categorized as an Airport Reference Code (ARC) A-I airport with an ultimate ARC of B-I. An A-I ARC indicates the airport typically serves aircraft with approach speeds of less than 91 knots and have a wingspan less than 49 feet or a tail height of less than 20 feet. The B-I classification is for aircraft with approach speeds between 91 knots and less than 121 knots.

KVL has a single, gravel runway 3,000 feet long and 60 feet wide (Figure 2-1). It is classified as utility runway, typically accommodating aircraft of 12,500 pounds or less. The runway lies within 10 degrees magnetic alignment of 120/300 degrees and is designated RW 12/30. Aircraft approaching from the northwest are said to be using RW 12 and RW 30 from the southeast. Visibility minimum for the runway is not lower than 1 statute mile.

The runway has an effective gradient of 0.057 percent, with only a 1.7-foot elevation difference between the runway endpoints. The airport elevation of 18.41 feet above mean sea level (MSL) is based on a runway high point near the RW 30 threshold. The gravel is rated as good but is seasonally soft.

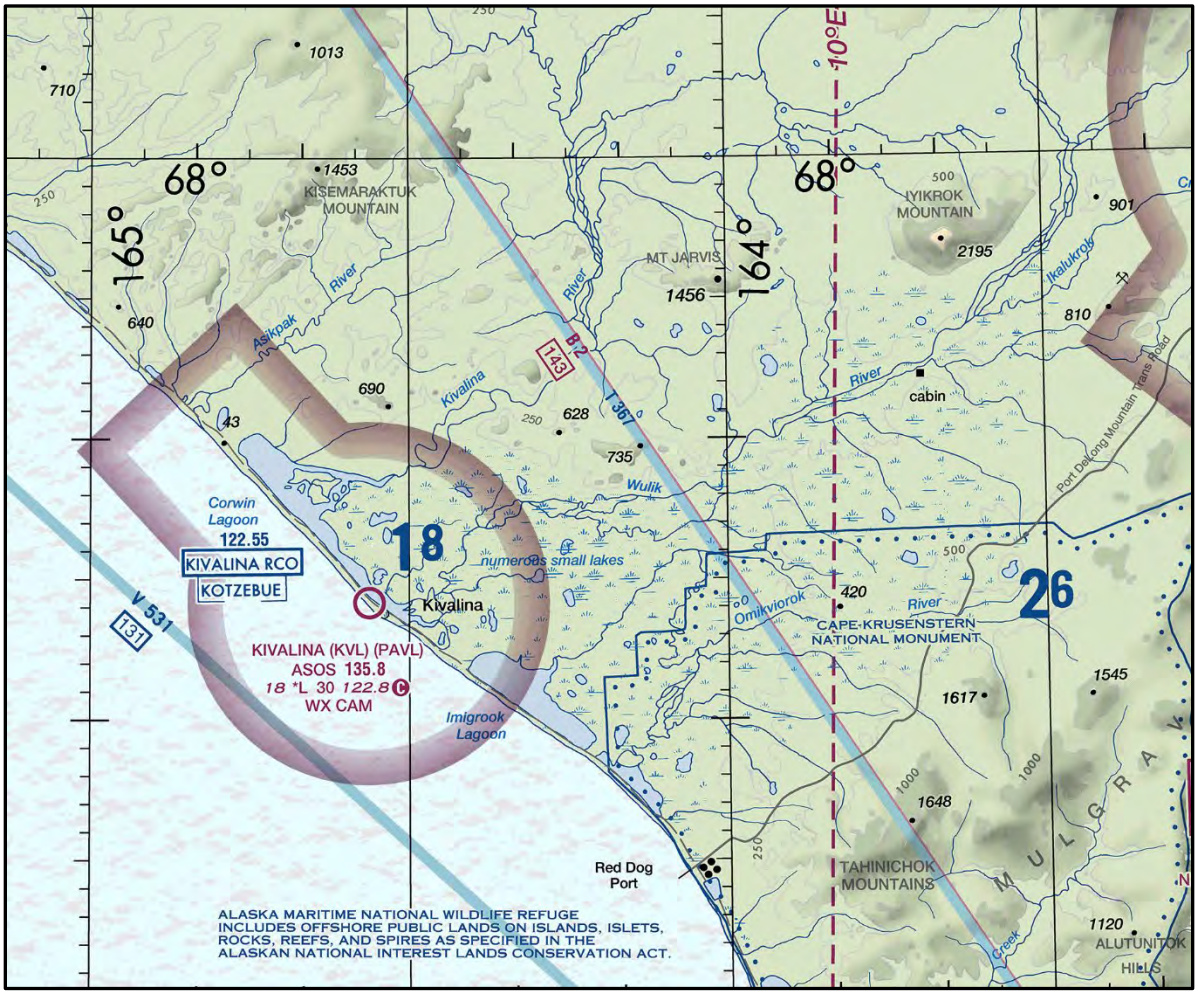
The current runway provides 79.8% wind coverage for a 10.5-knot crosswind component, and 85.9% coverage for a 13-knot crosswind component. FAA standards require 95% wind coverage by runways for the required crosswind component. Wind coverage is discussed further in Section 2.2.10.

There are two non-standard conditions shown on the ALP:

- Landfill separation of 1,800’, which lays north aligned with the RW 12 threshold.
- Inboard Runway 12 threshold lights.

Rock revetments line the runway’s Chukchi Sea beach, to protect against storm wave erosion.

Figure 2-1 KVL Sectional



*The school site, Kisimigiuktuk Hill (K-Hill), is roughly halfway between the coastline and Mt. Jarvis.

2.2.2 Taxiways

The airport has one taxiway. The taxiway is 1,600 feet long and 45 feet wide. The taxiway is long because it overlays the old, previous, runway and extends to the airport SREB and apron.

The taxiway also aligns with the RW 30 threshold which can lead to possible conflicts between aircraft landing on RW 30 and aircraft taxiing to the runway. This configuration is unavoidable due to the terrain restrictions of the barrier island.

2.2.3 Aprons

KVL has one apron, that is designated as 290 feet x 130 feet. This provides the primary passenger and cargo loading area. It also is adjacent to fuel tanks, Automated Surface Observation System (ASOS), SREB, and storage.

2.2.4 Safety Area, Object Free Area, and Object Free Zone

The runway safety area (RSA) is a graded area surrounding the runway serving a function like that of a highway shoulder. Under dry conditions, the RSA must be capable of supporting the occasional passage of aircraft, thereby reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. It also provides accessibility for emergency equipment during such incidents. FAA standards require the RSA be cleared, graded, and drained. After the 2021 ALP was updated, the FAA issued updated design guidance (FAA 150/5300-13B *Airport Design*). Under 150/5300-13B, for a Runway Design Code (RDC) of A-I-5000, the RSA is to extend 240 feet beyond the runway threshold and be 120 feet wide (FAA 2022).

The runway object free area (ROFA) provides a clear area around the runway to protect aircraft during landing and takeoff. The ROFA should be clear of all aboveground objects protruding above the RSA edge elevation. Objects required for air navigation or aircraft maneuvering may be in the ROFA, provided they are constructed on frangible (breakable) mounted supports. The ROFA extends 240 feet beyond each runway threshold (but never longer than the existing RSA) and is 400 feet wide.

The runway object-free zone (ROFZ) is designed to provide protection to aircraft landing and takeoff. The ROFZ is a volume of airspace centered on the runway centerline, with elevations matching the nearest point on the runway at any point. The ROFZ extends 200 feet beyond each runway threshold and is 250 feet wide. While compliant with the approved 2021 ALP, the ROFZ width does not meet current FAA standards.

2.2.5 Lightings, Marking, and Signing

The runway and taxiway are lighted with white and blue, medium intensity lights respectively. They outline the edges of these movement areas during periods of darkness or low visibility. The runway also has runway end threshold lights.

2.2.6 Navigational Aids

The Kotzebue Flight Service Station (Kotzebue FSS) provides service to aircraft operating within the Kivalina area using the Kivalina Remote Communications Outlet (RCO, 122.55). Pilots communicate with other pilots and advise their intentions on the Common Traffic Advisory Frequency (CTAF) frequency 122.8 mega-hertz (MHz). The ASOS reports are broadcast on frequency 135.8 MHz

KVL is served by the Anchorage Center Air Route Traffic Control Center. The controllers are primarily concerned with aircraft operating under instrument flight rules (IFR) at an altitude over 18,000 feet but Anchorage Center can provide approach vectors into KVL for IFR traffic prior to approving a frequency change to the CTAF.

2.2.7 Visual Approach Aids

Runway end threshold lights and medium intensity runway lights are present along the runway. This system provides rapid and positive identification of the runway during periods of reduced visibility. Lights are pilot activated by the CTAF.

2.2.8 Instrument Approach Procedures

KVL has an area navigation global positioning system (RNAV GPS) non-precision instrument approach procedure for both RW12 and RW30. Both are straight-in approaches. Pilots flying the instrument approach to RW12 must see the runway when they reach a minimum altitude of 340 feet or 1 statute-mile visibility. Pilots flying the instrument approach to RW30 have minimums of 380 feet and 1 statute-mile visibility.

Figure 2-2 Instrument Approach RNAV RWY 12

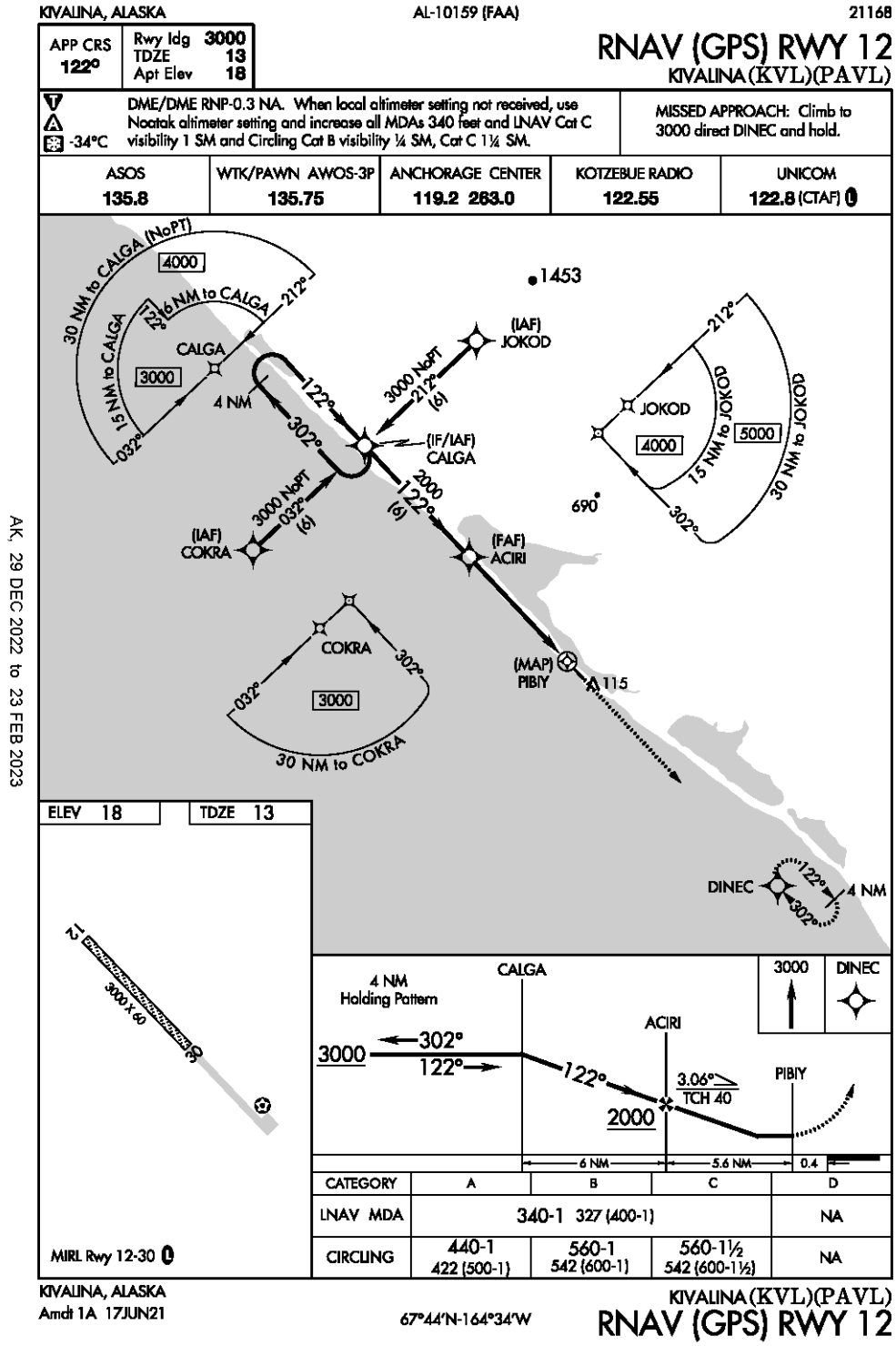
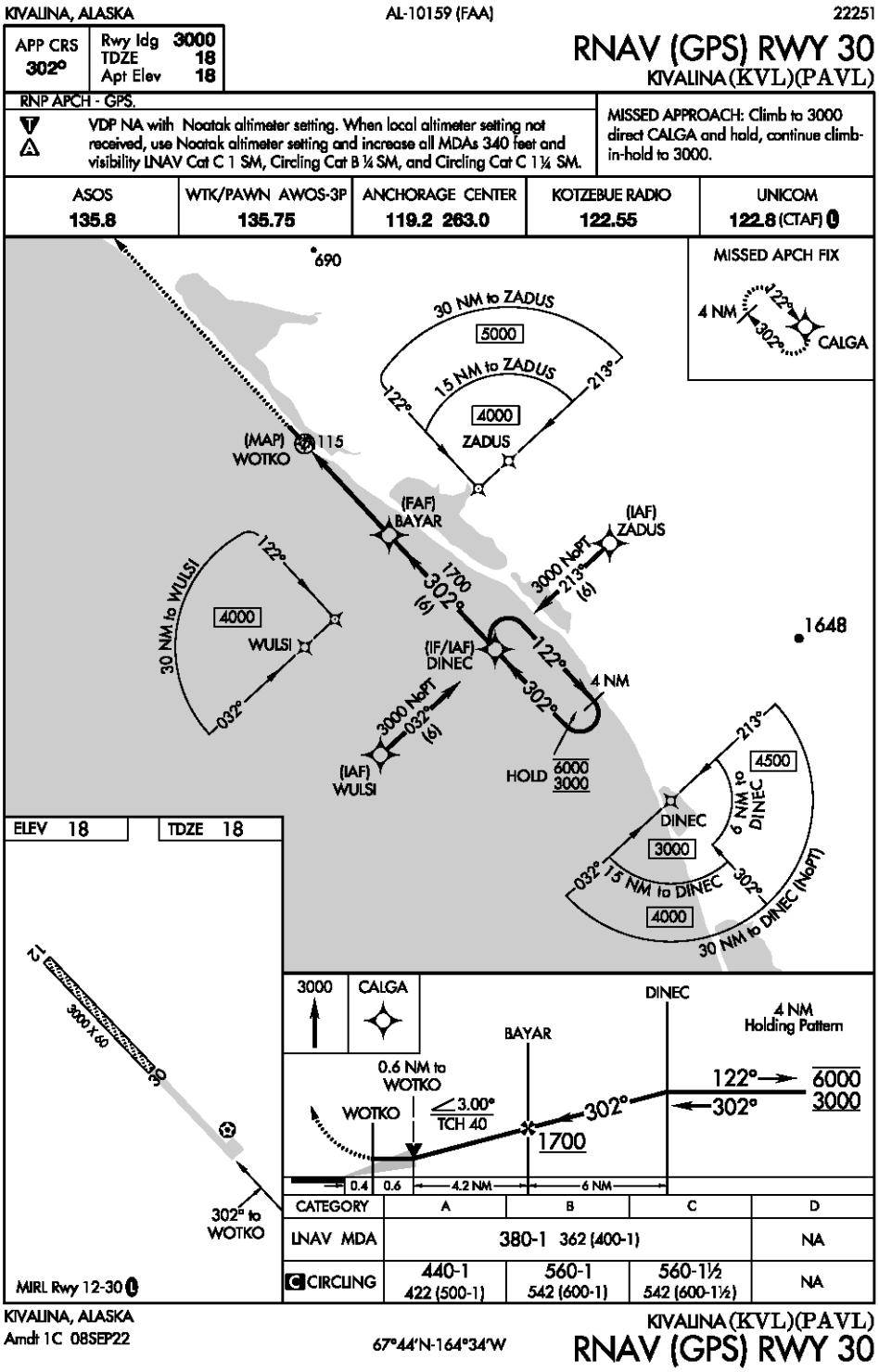


Figure 2-3 Instrument Approach RNAV RWY30



2.2.9 Airspace and Air Traffic Management

The Part 77 surfaces are as follows:

- Primary Surface: The primary surface is longitudinally centered on the runway, and identical to the elevation of the nearest corresponding point on the runway centerline. At KVL it is 500 feet wide and 3,400 feet long.
    - The primary surface is penetrated by the terrain by 2 feet.
    - A trail along the runway leading to the landfill and trails to the north of the airport penetrates the primary surface by 10 feet based a 10-foot vehicle clearance height per the requirements of FAR Part 77.17, Obstruction Standards.
- Horizontal Surface: The horizontal surface is a horizontal plane 150 feet above the established airport elevation (for KVL, it is at 168.41 feet). The perimeter of which is established by swinging a 5,000-foot radius arc from the center of each end of the primary surface and connecting each arc with lines tangent to those arcs.
- Conical Surface: The conical surface is a surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 horizontal to 1 vertical for a horizontal distance of 4,000 feet.
- Approach Surface: The approach surface is longitudinally centered on the extended runway centerline and extends outward and upward from each end of the primary surface. The approach surface slopes are 20:1 for both runways, and measure 500 feet x 2,000 feet x 5,000 feet.
    - The trail along the runway penetrates the approach surface by 9 feet based on a 10-foot vehicle clearance height where the approach surface meets the primary surface.
- Transitional Surface: The transitional surfaces extend outward and upward at right angles to the runway centerline and the extended runway centerline at a slope of 7 horizontal to 1 vertical from the sides of the primary and approach surfaces to the horizontal surface.

Figure 2-4 East and Northeast (right) Views from Kivalina (FAA, 2023)

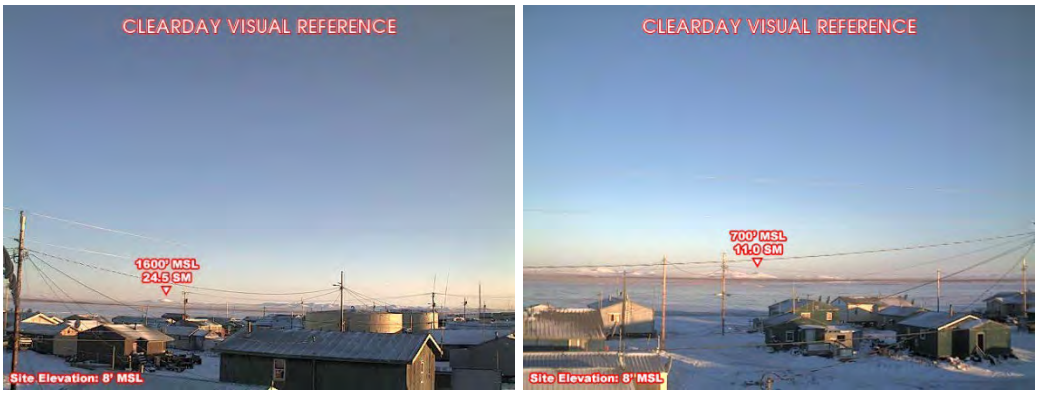
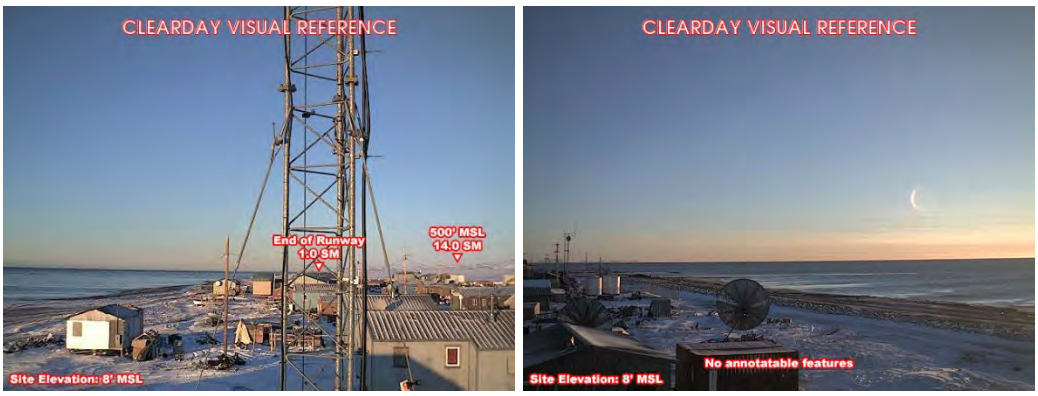


Figure 2-5 Northwest and Southeast (right) Views from Kivalina (FAA, 2023)



2.2.10 Weather

KVL is equipped with an ASOS and an internet accessible webcam system (Figure 2-4, 2-5). The ASOS measures precipitation in addition to visibility, cloud, and ceiling data (Table 2-1). A lighted windsock is present adjacent to the RW30 threshold, outside of the OFA.

Severe storms impact the runway. Wind pushed water can erode and flood the runway. Ice and rock debris can also be pushed up the shoreline and onto the runway. These can close the runway, particularly during bad weather events which require excavation.

Wind data collected at KVL from 2004 to 2013 indicate that the current runway provides 79.8% wind coverage for 10.5-knot crosswind, and 85.9% coverage for 13-knot crosswinds (Figure 2-6). Winds are generally out of the southeast but during strong winter storms, the winds are seen to come from the northeast.

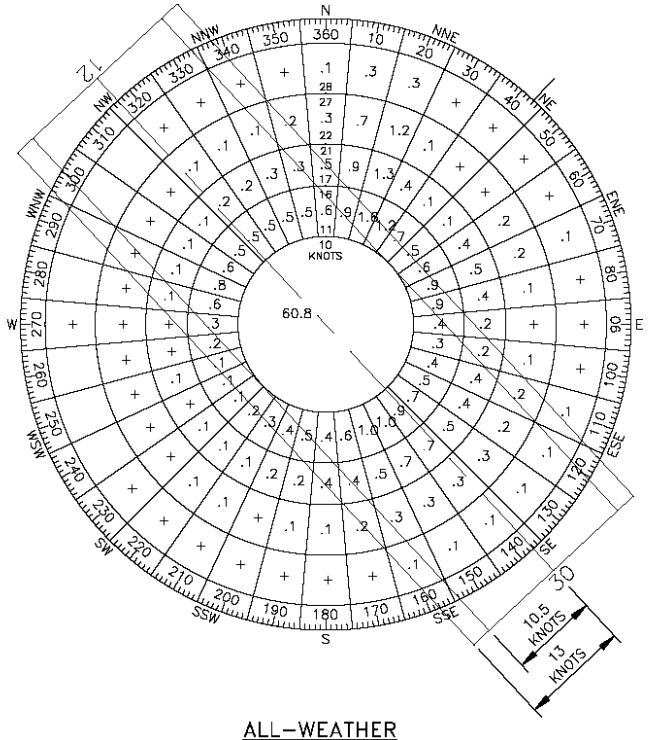
Table 2-2 KVL Weather Summaries

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precip. (inches)	0.28	0.44	0.18	0.56	0.57	0.79	1.41	2.33	1.52	0.93	0.51	0.17	9.69
Mean Max Temp (°F)	6.6	9.7	9.4	23.6	38.2	50	56.3	54.5	46.2	30.5	17.3	10	29.4
Mean Min Temp (°F)	-9	-7.1	-7.6	6	25.9	37.8	45.5	43.7	35.1	20.6	5.5	-4.1	16
Mean Avg Temp (°F)	-1.2	1.3	0.9	14.8	32.1	43.9	50.9	49.1	40.6	25.6	11.4	2.9	22.7
% of time under Non-VFR conditions	25%	26%	27%	22%	28%	25%	36%	32%	22%	21%	24%	25%	26%

* Non-VFR conditions summarized from KVL visibility and ceiling observations at the airport between 2003 and 2023

Source: ASOS-AWOS-METAR Data Download, https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS and https://xmacis.rcc-acis.org/.

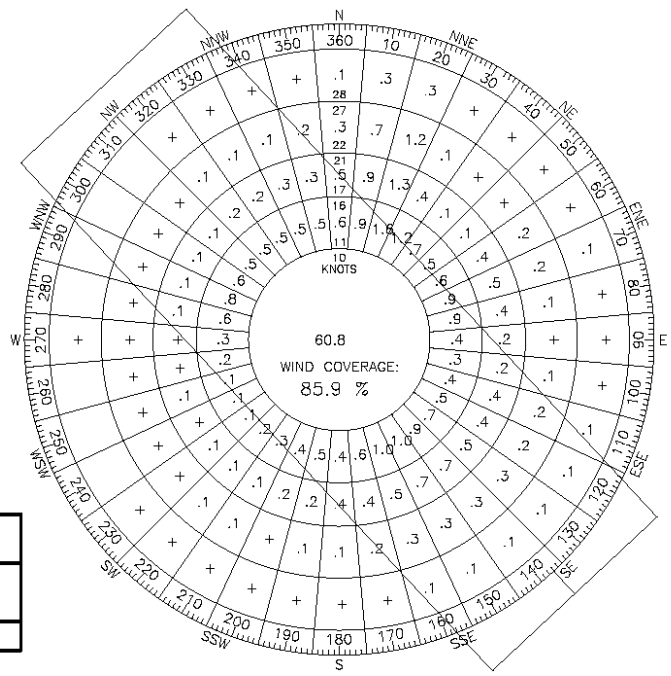
Figure 2-6 Wind Rose



ALL–WEATHER

WIND DATA		
RUNWAY	10.5 kt (A–I)	13 kt (B–II)
12/30	79.82%	85.90%

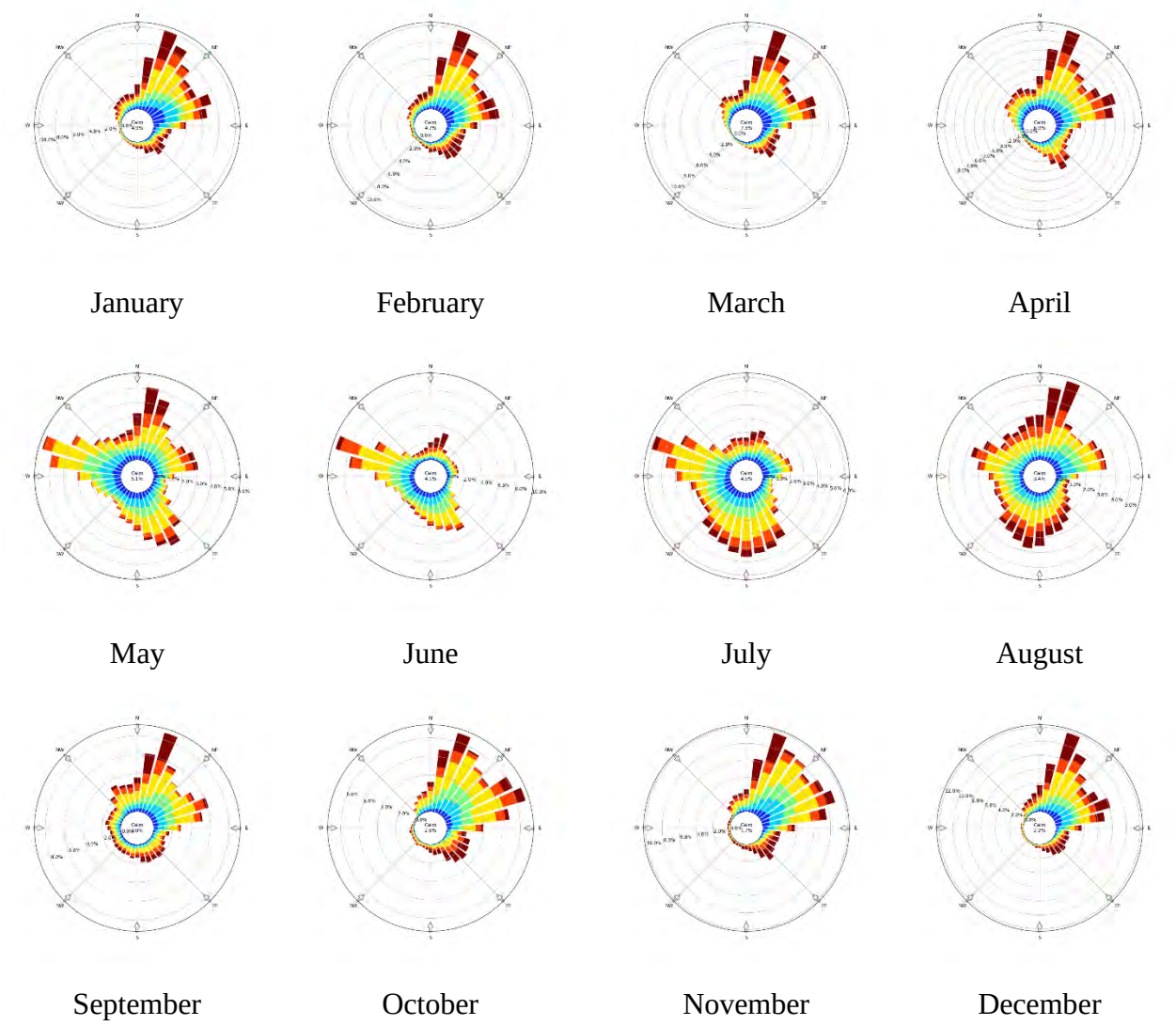
SOURCE: NATIONAL WEATHER SERVICE/MESOWEST
STATION NAME: PAVL
PERIOD 11/2004 TO 7/2013
SAMPLED IN MILES PER HOUR



INSTRUMENT METEOROLOGICAL CONDITION

*From 2021 Airport Layout Plan for Kivalina Airport (KVL)

Figure 2-7 Seasonality of Wind at KVL



*Note the seasonality of wind, with summer and winter prevailing winds

(Observations between August 1, 1998 and August 10, 2023, accessed from https://www.mesonet.agron.iastate.edu/sites/windrose.phtml?station=PAVL&network=AK_ASOS)

2.3 Facilities

There are no passenger or cargo facilities at KVL. Cargo is unloaded, and placed on the ground, or into residents' vehicles.

There are no General Aviation (GA) facilities at KVL.

2.3.1 Fuel Storage

Aviation fuel is not available for purchase at KVL. Fuel storage on the airport has been limited to heating oil for the SREB and fuel for snow removal equipment at the airport.

The community has constructed a fuel storage tank fuel farm on airport property to receive fuel deliveries for the village energy and heating needs. The Alaska Village Electrical Cooperative manages fuel deliveries for Kivalina and stated in March 2023 that barges are primarily used to transport fuel into Kivalina, although airplanes may be used in an emergency.

2.3.2 Chemical Materials

Chemical materials, other than standard vehicle maintenance lubricants, are not stored at the airport.

2.4 Maintenance and Operations

Airport maintenance facilities are necessary to house airport equipment and provide the contracted airport maintenance staff a space to store the equipment. The airport has a 2-Bay SREB.

The staff must occasionally remove sea ice and rocks from the runway, that is deposited by large wave/wind action from the Chukchi Sea.

2.5 Access, Circulation, and Parking

The old runway is used as the current taxiway from the apron to the current runway. Community members arrive at the apron and meet each flight, offloading and loading each airplane by hand.

No parking is present on the airport.

A trail runs along the runway, providing community residents access to the portion of the island located on the far (northern) side of the runway, including the community landfill.

The airport is not fenced. Runway incursions remain an issue, as the runway can be used as a 'highway' for individuals traveling up the island. Fencing poses a maintenance challenge because the storms push debris that would damage a fence. Fence gating is also an issue, as gates would need to be left open to allow residents access to the aircraft.

2.6 Utilities

KVL is connected to the city's power grid, which provides the electricity for the airport.

No other utilities are present on the airport.

2.7 Land Use

Aeronautical land is land that involves, makes possible, or supports the operation of aircraft or contributes to or is required for the safety of such operations. Figure 2-8 depicts the airport property at Kivalina. As is common in rural Alaska, the airport property hosts community infrastructure and users that are non-aeronautical and are not formal leaseholders.

Land acquisition and retention should consider planning for the future of aeronautical use. Land use planning can use buffer zones to minimize negative externalities (e.g., noise) to the local community. Land use planning can also help plan the location of non-compatible land uses, such as landfills.

2.7.1 Kivalina Land Use

Some infrastructure of the community of Kivalina is located along the southeastern portion of the airport property. This portion of the airport also hosts the airport maintenance area, apron, and road/causeway to the mainland. The main body of the Kivalina community lies directly under the approach/departure path of the runway.

The northeastern portion of the airport property is ultimately bound by the waters of the lagoon. This area also hosts a cemetery, and the primary trails to access the northern portion of the island, including the town landfill.

The southwestern portion of the airport property is dominated by the shoreline with the ocean. A rock revetment has been constructed to help protect the runway from coastal erosion.

The northwestern portion of the airport property is undeveloped. Kivalina's community landfill is located directly along the approach/departure path of the runway (1,800 feet from the threshold). The landfill is off airport property.

2.7.2 Northwest Arctic Borough Zoning

The Northwest Arctic Borough has land use zoning, which assists in planning for activities in the borough. The Kivalina Airport is in the Village District.

The Subsistence Conservation district currently encompass the mainland portion of Kivalina. The Subsistence Conversation district generally discourages infrastructure development. Waivers are often granted for community supported infrastructure development, such as road and airport construction. Conversations with the Northwest Arctic Borough in March 2023 indicated zoning is being changed, to incorporate the new road to K-Hill and school. These conversations indicated that the relocation of an airport would also be a welcome change, and incorporated into the new zoning changes.

2.7.3 FAA Grant Obligations

By accepting FAA funds for KVL, grant obligations attached to the funds require the State of Alaska to operate and maintain KVL. FAA grant obligations expire in 2033, meaning that KVL must continue to be maintained through that period.

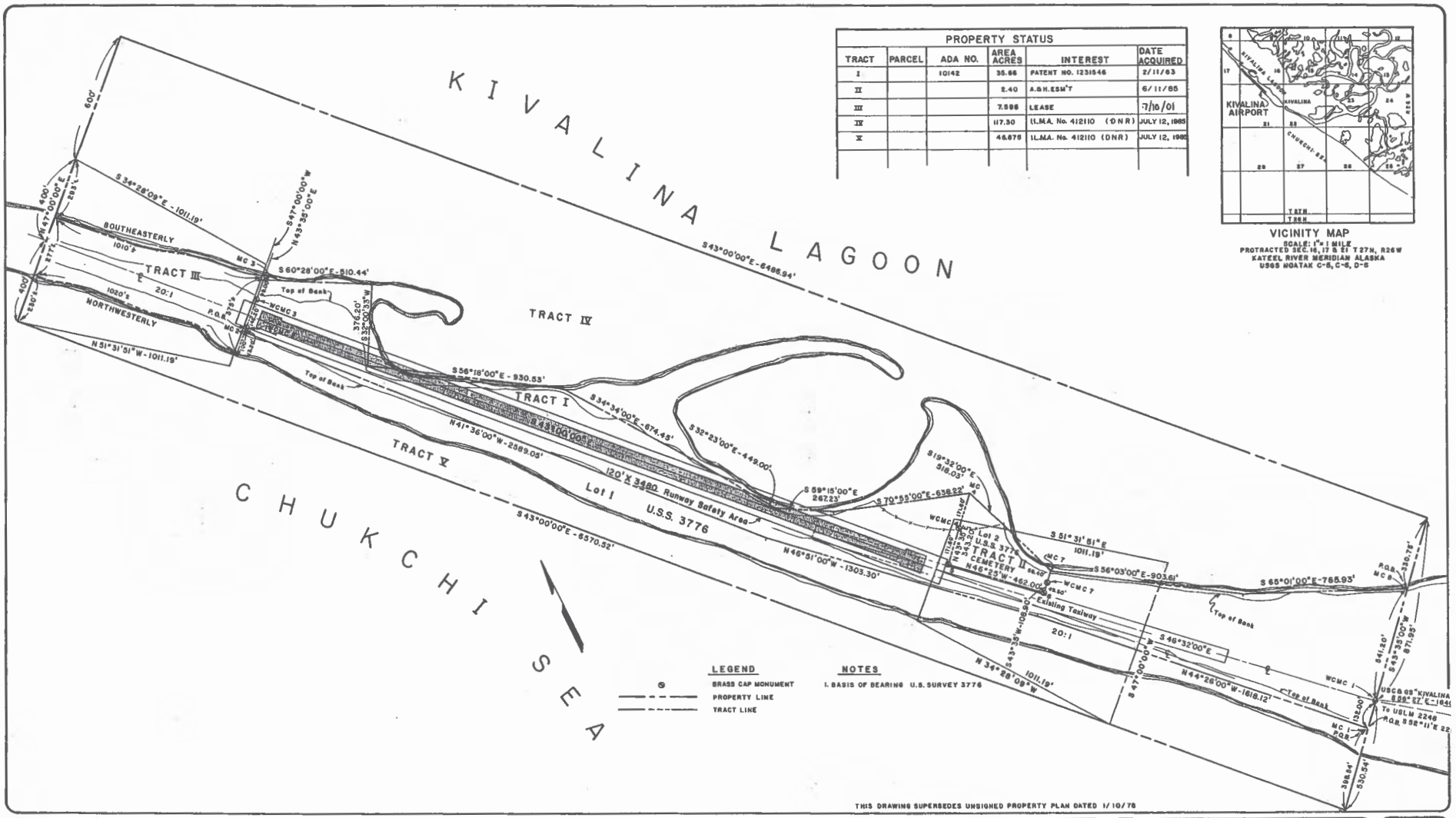
2.7.4 Lease Lots

The airport publishes a Property Plan (Figure 2-8) and a Land Occupancy Plan (Figure 2-9, 2-10). The Property Plan depicts that the runway is owned in patent by the State of Alaska. The approach to RW12 is leased, and there is an avigation easement for cemetery near the end of RW30, allowing the airspace over the cemetery to be used for air navigation, but the land may continue to serve as the community's cemetery. The cemetery's land is owned by the City of Kivalina through quit claim. The lagoon and marine waters are on an interagency land management agreement to DOT&PF from Department of Natural Resources.

The Land Occupancy plan depicts the leaseholders, all of which are located near the apron (Table 2-2).

Table 2-3 Land Occupancy

Lease Holder	Property	Term End
City of Kivalina	72290	01/01/2025
Alaska Village Electric Cooperative	Utility	Indefinite
FAA	72175	09/30/2031
City of Kivalina	72519	09/01/2043



PROPERTY STATUS

TRACT	PARCEL	ADA NO.	AREA ACRES	INTEREST	DATE ACQUIRED
I		10142	35.66	PATENT NO. 1231546	2/11/63
II			2.40	A.S.H.ESM'T	6/11/85
III			7.598	LEASE	7/10/01
IV			117.30	I.L.M.A. No. 412110 (DNR)	JULY 12, 1985
V			48.679	I.L.M.A. No. 412110 (DNR)	JULY 12, 1985

BY	DATE	REVISIONS
RHA	11/26/91	Updated Property Status Block
LLL	3-2-94	UPDATED PROPERTY STATUS BLOCK
LL	7/12/85	UPDATED PROPERTY STATUS

DESIGN
DRAWN LL
CHECKED

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
NORTHERN REGION – DESIGN AND CONSTRUCTION – AVIATION
APPROVED Daniel D. Urback DATE 9-19-85
DANIEL D. URBACK, P.E. CHIEF AVIATION DESIGN GROUP

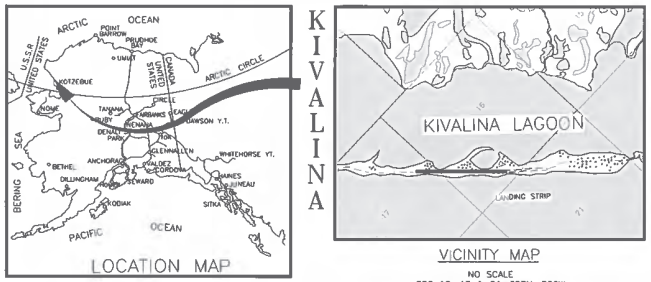
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
NORTHERN REGION – DESIGN AND CONSTRUCTION
APPROVED Harold A. Cameron DATE 9/26/85
HAROLD A. CAMERON CHIEF RIGHT OF WAY AGENT

KIVALINA AIRPORT PROPERTY PLAN

SCALE: 1" = 200'

SHEET 1 OF 1

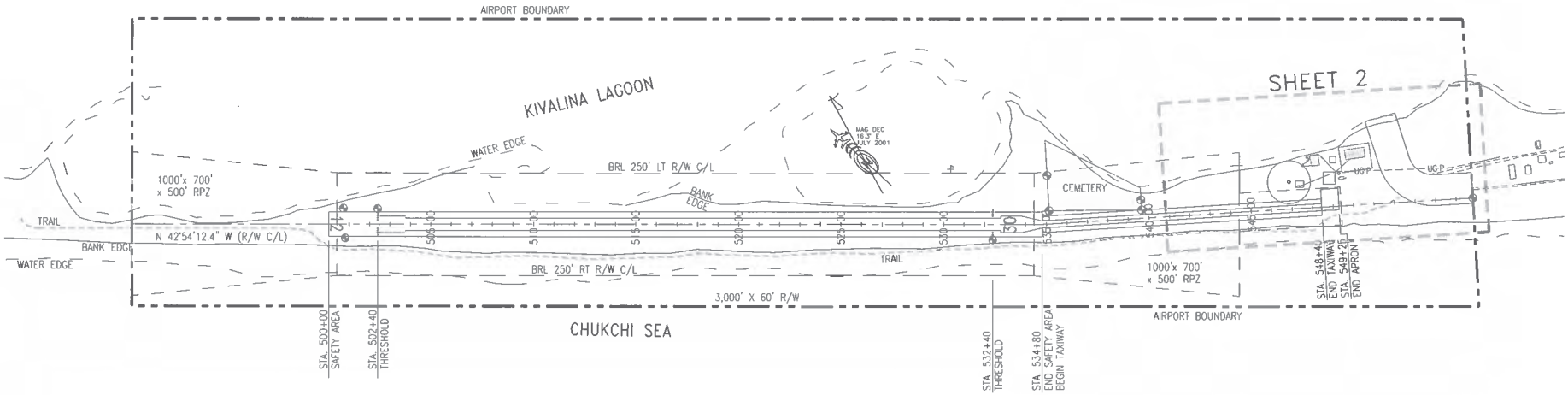
Figure 2-8 Property Plan



KIVALINA

VICINITY MAP

NO SCALE
SEC 16, 17 & 21, T27N, R26W
KATEEL RIVER MERIDIAN
USGS NOATAK C-5, C-6, D-6



LEGEND

EXISTING	△ = ANTENNA OR TOWER
ULTIMATE	ASOS = AUTOMATED SURFACE OBSERVATION SYSTEM
BRL — BUILDING RESTRICTION LINE	C/L = CENTERLINE
UG-P — UNDERGROUND POWER	EEE = ELECTRICAL EQUIPMENT ENCLOSURE
UG-CC — UNDERGROUND CONTROL CABLE	LT = LEFT
WATER LINE	ROW = RIGHT OF WAY
BUILDINGS	RPZ = RUNWAY PROTECTION ZONE
ABOVEGROUND FUEL TANKS	RT = RIGHT
PRIMARY MONUMENT	R/W = RUNWAY
SECONDARY MONUMENT	SREB = SNOW REMOVAL EQUIPMENT BUILDING
AVIGATION & HAZARD EASEMENT	STA. = STATION
	T/W = TAXIWAY
	XFMR = TRANSFORMER

LAND OCCUPANCY

BLK	LOT	ADA NO.	AREA (SQ FT)	OCCUPANT	BEGIN DATE	EXP. DATE

This Land Occupancy Drawing (LO) was compiled from the Airport Layout Plan dated and approved by FAA on 08/29/2001, and the Property Plan dated 04/22/1985 and updated 08/23/2001

The locations and elevations of all utilities shown are approximate only; locations have not been field verified. Additional utilities that are not shown on this LO may also exist.

The natural meanders of the ordinary high tide line of the Kivolina Lagoon and the Chukchi Sea form the true boundary line of the property, as applicable.

FEET
250 0 125 250 500

BY	DATE	CHANGE
KC	07/27/18	UPDATE LO

REVISIONS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
AVIATION LEASING

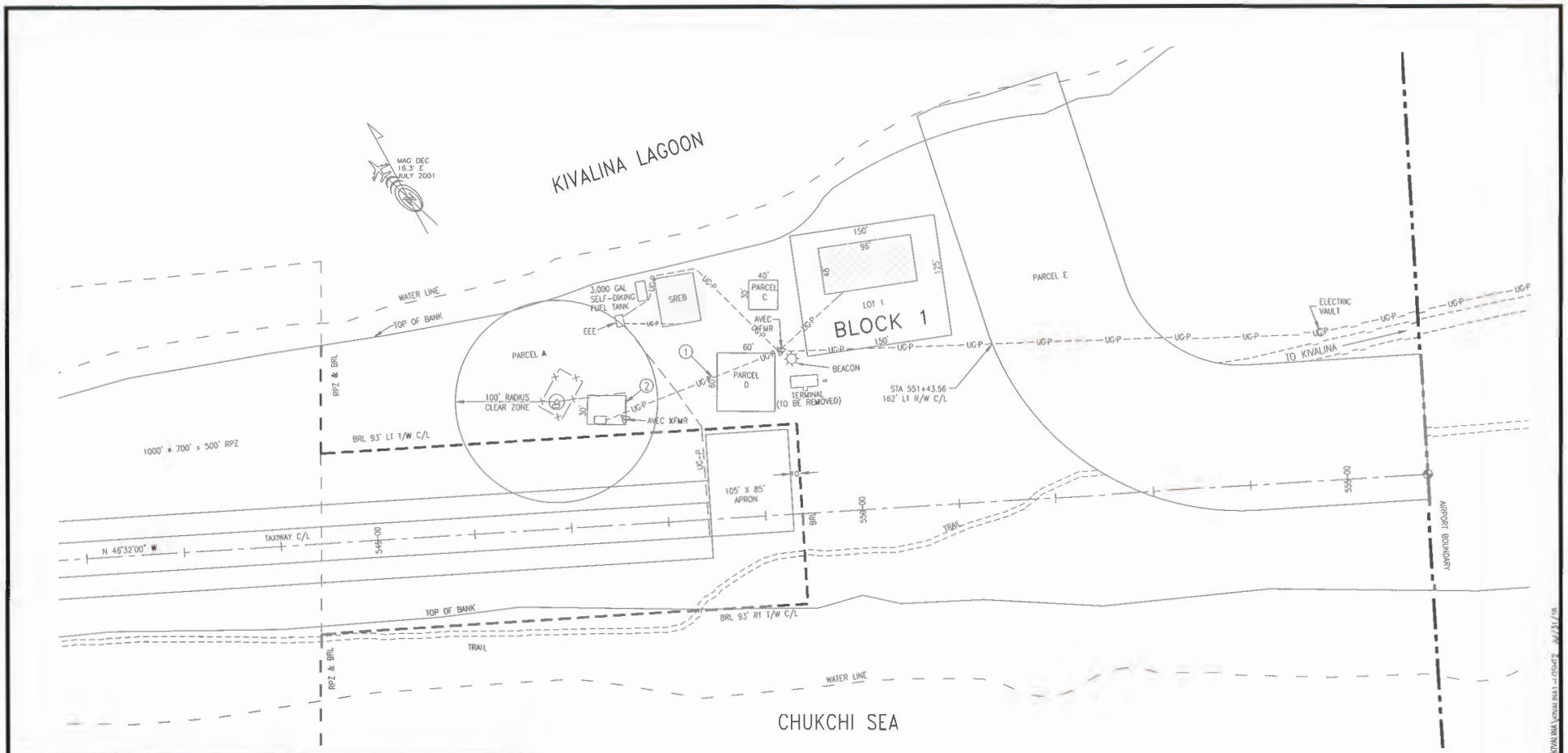
KIVALINA AIRPORT
LAND OCCUPANCY

APPROVED Pamela A. Lewis
PAMELA A. LEWIS
CHIEF, AVIATION LEASING
DATE 12/13/2002

SCALE 1"=250'
DWN KC, RP
DATE 12/02/02
SHEET 1 OF 2

R:\ALP_&_LO\LO\NR_LO\KIVALINA\KIVALINA1-LOSHT1 Jul/31/18

Figure 2-9 Land Occupancy Plan Sheet 1



LAND OCCUPANCY

BLK	LOT	ADA NO.	AREA (SQ FT)	OCCUPANT	BEGIN DATE	EXP. DATE
1	1	72290	18,750	CITY OF KIVALINA	01/01/2015	01/01/2025
ITEM	1	UTILITY		AVEC-PERMIT 93-020	05/10/1993	INDEFINITE
	2	UTILITY		AVEC-PERMIT 94-025	04/29/1994	INDEFINITE
PARCEL	A	72175	31,415	FAA - MOA - RCO & ASOS WITH CLEAR ZONE	06/08/2011	05/30/2031
	C	~~72218~~	900	~~BLM CADASTRAL~~	~~06/15/2014~~	~~06/14/2014~~
	D	~~72218~~	3,600	~~BLM CADASTRAL~~	~~06/15/2014~~	~~06/14/2014~~
	E	72519	100,623.6	CITY OF KIVALINA	09/01/2018	09/01/2043

The locations and elevations of all utilities shown are approximate only; locations have not been field verified. Additional utilities that are not shown on this LO may also exist.

SCALE IN FEET

BY	DATE	CHANGE
KC	07/27/18	UPDATE LO

REVISIONS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
AVIATION LEASING

KIVALINA AIRPORT
LAND OCCUPANCY

APPROVED Pamela A. Lewis
PAMELA A. LEWIS, CHIEF, AVIATION LEASING
DATE: 12/13/2002

SCALE 1"=50'
DWN JB
DATE 12/02/02
SHEET 2 OF 2

Figure 2-10 Land Occupancy Plan Sheet 2

3 FORECAST AND AVIATION ACTIVITY

3.1 Commercial Activity

Commercial flights operate as a hub and spoke system, from the primary hub of Kotzebue. Two air carriers, Bering Air and Ryan Air, provide most of the service (Table 3-1). In early 2020, Hageland Aviation (Ravn Alaska) ended providing service to the community as the parent company went bankrupt.

The Kivalina airport serves the local residents, with little industrial activity. Figure 3-1 and Table 3-2 shows that the number of passengers enplaned at Kivalina. A major decrease in aviation activity occurred because of COVID-19 pandemic restrictions (2020 - 2021), with aviation activity beginning to pick back up in 2022.

Kivalina is situated on an island in the Chukchi Sea. Aviation provides the only year-round connection to other communities and regional infrastructure, such as medical, groceries, and retail. While seasonal barge service provides limited bulk freight transport during ice-free months, the airport remains an important source of imported freight and mail. Table 3-3 and 3-4 demonstrate the majority of freight and mail enters the community, as opposed to leaving.

Additionally, some fuel began being delivered to the community by air by Everts in 2019. Fuel is primarily imported by barge but can be flown in an emergency.

Table 3-1 Operations of Major Air Carriers Providing Service to Kivalina, 2011–2022

Air Carrier	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bering Air Inc.	1,619	1,710	1,526	1,608	1,540	1,598	1,634	1,656	1,661	1,730	2,174	2,254
Hageland Aviation Service (Ravn Alaska)	1,339	1,424	1,356	1,356	1,416	1,508	1324	1,347	1,512	196	0	0
Ryan Air (Arctic Transportation)	214	274	226	242	252	238	236	254	266	285	322	346
Frontier Flying Service	2	0	1	0	0	0	0	0	0	0	0	0
Everts	0	0	0	0	0	0	0	0	12	4	2	0
Era Aviation	2	4	4	0	1	0	0	0	0	0	0	0
Wright Air Service	0	0	0	0	0	0	0	0	0	0	4	0
Alaska Central Express	0	0	0	0	0	0	0	0	0	0	8	0

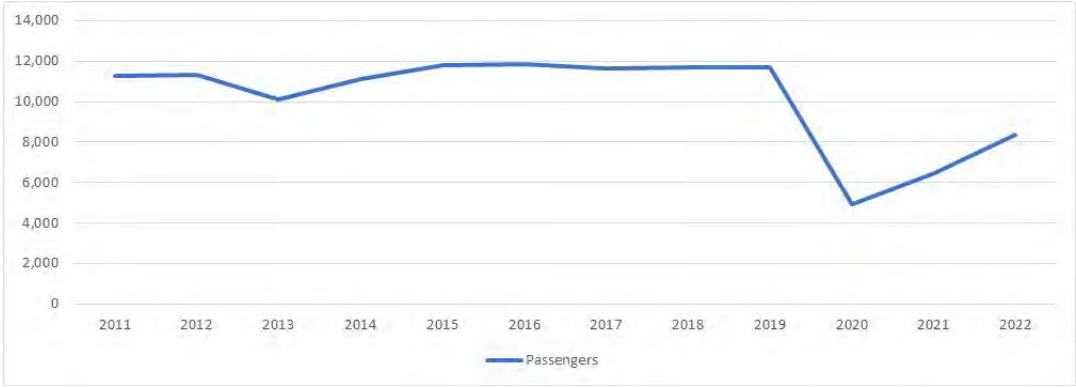
Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

Table 3-2 Passengers at Kivalina, 2011- 2022

Year	Passengers (Destination)	Passengers (Origin)	Total Passengers (Enplaned)
2011	5,595	5,679	11,274
2012	5,589	5,759	11,348
2013	5,025	5,107	10,132
2014	5,479	5,647	11,126
2015	5,861	5,958	11,819
2016	5,910	5,922	11,832
2017	5,772	5,842	11,614
2018	5,835	5,867	11,702
2019	5,838	5,840	11,678
2020	2,444	2,474	4,918
2021	3,231	3,243	6,474
2022	4,198	4,163	8,361

Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

Figure 3-1 Enplaned Passengers at Kivalina Airport, 2011–2021



Source: USBTS (2023).

Table 3-3 Freight (lbs) at Kivalina, 2011- 2022

Year	Freight (Leaving)	Freight (Incoming)	Freight (Total)
2011	69,356	219,117	288,473
2012	84,570	322,824	407,394
2013	68,370	204,765	273,135
2014	80,105	221,393	301,498
2015	88,149	251,133	339,282
2016	90,218	288,624	378,842
2017	78,566	289,388	367,954
2018	99,641	288,869	388,510
2019	92,334	411,454	503,788
2020	82,791	426,502	509,293
2021	93,975	453,056	547,031
2022	52,298	463,542	515,840

Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

Table 3-4 Mail (lbs) at Kivalina, 2011- 2022

Year	Mail (Leaving)	Mail (Incoming)	Mail (Total)
2011	232,181	1,044,654	1,276,835
2012	233,408	1,053,764	1,287,172
2013	188,440	1,026,240	1,214,680
2014	155,907	1,015,302	1,171,209
2015	149,996	1,006,540	1,156,536
2016	173,985	1,071,387	1,245,372
2017	154,909	1,024,144	1,179,053
2018	148,790	1,047,036	1,195,826
2019	117,057	1,140,404	1,257,461
2020	86,889	1,295,530	1,382,419
2021	85,415	1,328,776	1,414,191
2022	44,073	1,330,138	1,374,211

Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

3.2 Airport Operations

Airport operations are dominated by the regular commercial air-taxi service provided by Bering Air and Ryan Air. The number of commercial flights by aircraft, and aircraft design requirements are presented in Table 3-5 and 3-6. Three aircraft: Cessna 208 Caravan, Cessna C208B/Grand Caravan, and Piper PA-31 (Navajo) make up the bulk of the fleet mix for Kivalina. The Cessna Caravan and Grand Caravan are Aircraft Approach Category (AAC) A and Airplane Design Group (ADG) II (Small). The Piper PA-21 (Navajo) is a B-I aircraft, but operations are dropping off.

Everts appears to have delivered fuel by air tanker into Kivalina (12x in 2019, 4x in 2020, 2x in 2021). These deliveries do not cross the threshold of 500 flights; but provides an essential service to the community.

There are no GA based aircraft at Kivalina. No GA aircraft were seen during the site inspections, none are registered in the FAA Aircraft Owners Database, and none are reported on the 5010 database.

There are also no known military aircraft operations at Kivalina.

Table 3-5 Aircraft Operations at Kivalina, 2011–2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cessna 208 Caravan	2039	2278	1952	2084	1707	1021	959	1067	1163	170	100	6
Cessna C208B/Grand Caravan					432	1384	1466	1510	1509	1602	1761	2138
Piper PA-31 (Navajo)/T-1020	695	812	906	868	797	685	517	404	511	124	154	28
Casa/Nurtanio C212 Aviocar	208	250	188	212	222	234	250	274	244	315	338	428
Cessna C206/207/209/210 Stationair	224	68	54	42	42	14	2					
Beech 200 Super Kingair	2		4		6	2		2	14		1	
Pilatus PC-12						4			10	4	5	
De Havilland DHC8-100 Dash-8	2	4	4		1							

Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

Table 3-6 Aircraft Design Requirements at Kivalina

Aircraft	AAC	ADG	Small?	TDG	Wingspan	Length	Main Gear Width (MGW)	Cockpit to Main Gear	MTOW
Cessna 208 Caravan	A	II	Small	1A	52.08	37.58	11.67	11.67	8000
Cessna C208B/Grand Caravan	A	II	Small	1A	52.08	41.58	7.17 - 11.67	13.33	8807
Piper PA-31 (Navajo)/T-1020	B	I	Small	2	40.67	32.63 / 34.63	15	5.8	6500 / 7000
Casa/Nurtanio C212 Aviocar	A	II		1A	62.3	53.0	11.2	15 to17	16976
Cessna C206/207/209/210 Stationair	A	I	Small	1A	36.0 - 36.75	27.33 - 28.25	8.08		3600 - 4100
Cessna 406 Caravan II	B	II		1A	49.5	39.0	14.5	12.5	9850
Beech 200 Super Kingair	B	II		2	54.5	43.75	17.17	15	12500
Pilatus PC-12	A	II	Small	1A	53.33	47.25	14.83	11.42	10450
De Havilland DHC8-100 Dash-8	B	III		3	85	73	28.12	26.08	36300

Source: U.S. Bureau of Transportation Statistics (USBTS) (2023)

3.2.1 Airport Operations Forecast

Since Kivalina is primarily a residential community, the population trends are likely the best indicator of airport operations. The State of Alaska Department of Labor and Workforce Development provides historic population counts for the State of Alaska, Northwest Arctic Borough, and Kivalina (Table 3-7 and Figure 3-2). The department also provides projections of future population for the Northwest Arctic Borough. The percentage of population change projected for the borough was extrapolated to the City of Kivalina, to provide an estimate for future population (Table 3-7).

Since 2011, the population at Kivalina has fluctuated from 387 to 455 (Table 3-7). This represents a population fluctuation of +/- 17%. Overall, the population is expected to moderately decrease, from the current population of 445 individuals to 431 individuals.

Aircraft operations saw little variability prior to COVID-19 (Table 3-8). With the onset of COVID-19, operations dropped from 3,451 to 2,215. More recently the number of operations has begun to rise back to historical levels, with 2,600 in 2022. Excluding the drop due to COVID-19, the historic number of operations has varied between 3,170 and 3,451. This represents a fluctuation of +/- 9%.

KVL enplanements steadily increased from 2011 to 2019; with a peak in 2019 of 9,566. With the onset of COVID-19, enplanements dropped to 3,826 in 2020, and climbed to 8,361 in 2022.

3.2.1.1 Population Based Forecast

The population-based forecast applied the projected percentage changes in population to operations and enplanements. This forecast provides a projected range of operations between 2,489 and 2,523 between 2025 – 2045 (Table 3-8). It also provides a projected range of enplanements between 4,354 and 4,404 between 2025 – 2045 (Table 3-9).

3.2.1.2 FAA Forecast

The FAA publishes a forecast of aviation activity for U.S. airports called the Terminal Area Forecast (TAF) (Table 3-8). These estimates forecast a flat 5,000 total operations for every year at Kivalina.

Most accurate TAF data comes from towered airports where operations are tallied daily. Because KVL is non-towered and rural, operation and enplanement data from operators to FAA is completely voluntary, and thus is typically inaccurate.

Table 3-7 Population Estimates: Historic (2011 – 2023) and Estimated (2025 – 2045)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2025	2030	2035	2040	2045
Northwest Arctic Borough	7,691	7,804	7,944	7,975	8,103	8,212	8,170	8,123	8,115	7,793	7,594	7,353	7,464	7,632	7,569	7,509	7,461	7,436
Kotzebue	3,236	3,235	3,198	3,145	3,250	3,262	3,110	3,055	3,047	3,102	3,011	2,933	2,953	3045	3,020	2,996	2,977	2,967
Kivalina	387	407	410	422	426	445	434	459	446	444	445	426	429	443	439	435	433	431

Source: Department of Labor and Workforce Development (2024)

Figure 3-2 Kivalina Population: Historic (2011 – 2023) and Estimated (2025 – 2045)

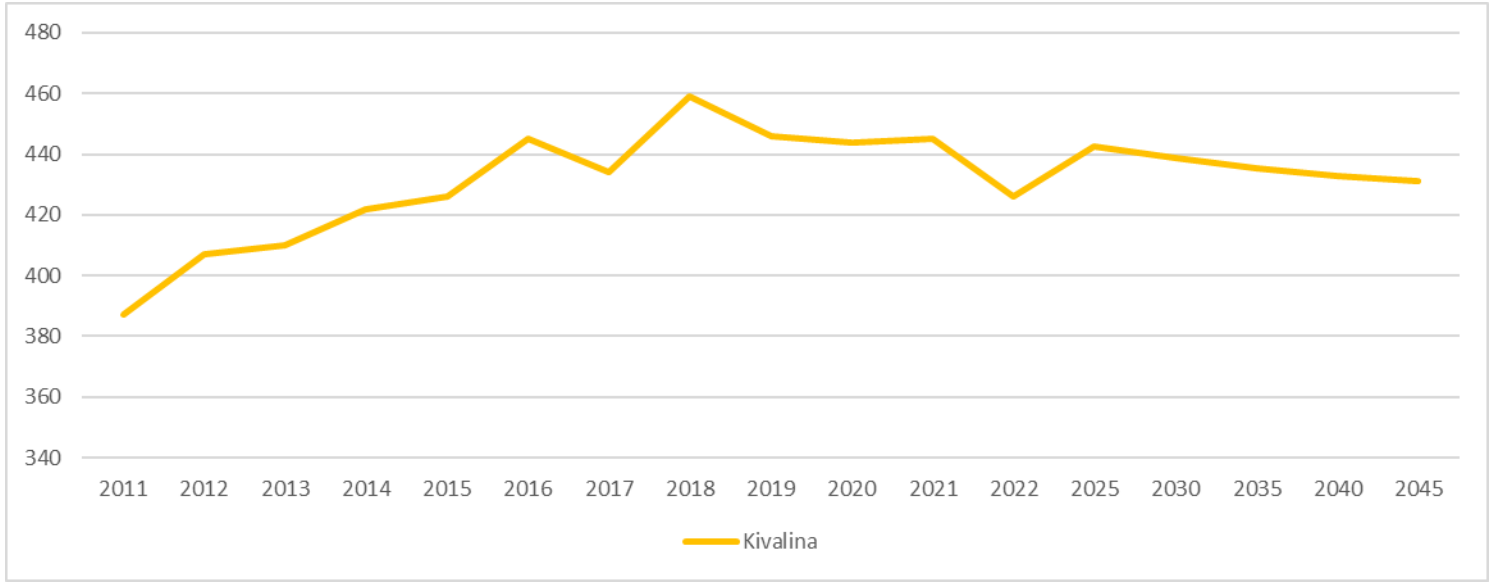


Table 3-8 Kivalina Operations: Historic and Forecast

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030	2035	2040	2045
Historic	3,176	3,412	3,113	3,206	3,209	3,344	3,194	3,257	3,451	2,215	2,359	2,600					
Forecast:																	
Population Based													2,659	2,637	2,616	2,599	2,590
TAF													5,000	5,000	5,000	5,000	5,000

Source: Historic numbers from the Bureau of Transportation Statistics (USBTS) (2023). TAF forecast from FAA (2023).

Table 3-9 Kivalina Enplanements: Historic and Forecast

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030	2035	2040	2045
Historic	11,274	11,348	10,132	11,126	11,819	11,832	11,614	11,702	11,678	4,918	6,474	8,361					
Forecast:																	
Population Based													8,549	8,479	8,411	8,358	8,330
TAF													1,773	1,808	1,843	1,878	1,913

Source: Historic numbers from the Bureau of Transportation Statistics (USBTS) (2023). TAF forecast from FAA (2023).

3.2.1.3 Kivalina's Vision for Growth

During public involvement, Kivalina expressed the desire to see analysis in this report for their vision of growth in their community. Kivalina desires to see higher growth than evident in the population-based forecast. Kivalina expects growth in aviation activity to match the growth they expect to see from the relocation planned in their 2023 Kivalina Community Master Plan. The 2023 Kivalina Community Master Plan estimates there are currently 90 homes in Kivalina and anticipates the community relocation would grow the community to 130 homes. While this is a growth in homes, rather than population, Kivalina residents desired to see a population growth analysis of if the population also increased as the same rate as housing. Kivalina residents contend that with the increase in housing, the population will grow at a similar rate, because people will move back to the community. Kivalina residents would like to ensure that even if this growth happens, the airport will have the capacity to serve this larger population. Growth at this level would correlate to a 45% increase in population.

With a 45% increase in population, the residents would increase from 445 people (in 2021) to 643 people. Concerning the airport, a 45% increase in operations would be from 2,510 (in 2021) to 3,625; and a 45% increase in enplanements would be from 4,382 (in 2021) to 6,330. To accommodate for even more growth, a 45% increase in operations from pre-Covid use would be from 3,451 (in 2019) to 5,003.

Any of these levels of activity can be accommodated by the current airport, and any airport sized to the population-based forecast and FAA forecast. All these levels of growth would be expected to use the same types of airplanes and runway.

For example, Alaska Airlines service at Kotzebue uses larger aircraft, because that airport sees ~50,000-70,000 enplanements a year. Until Kivalina reaches that level of demand, it is unlikely that Alaska Airlines, or similar air carriers, will provide that level of service to Kivalina. As discussed in the following Facilities Requirements chapter, the single runway and apron can accommodate all the potential growth at Kivalina.

3.3 Critical Aircraft

Critical aircraft are the most demanding aircraft types, or grouping of aircraft with similar characteristics, that make regular use of the airport. Per FAA AC 150/5000-17, *Critical Aircraft and Regular Use Determination*, regular use is defined as at least 500 annual operations, including both itinerant and local operations but excluding touch-and-go operations. The critical aircraft determines the applicable design standards for facilities on the airport.

The AAC/ADG categorizes aircraft by aircraft design requirements, specifically approach speed and wingspan. Between 2011 and 2021, only three aircraft had more than 500 annual operations, the Cessna 208 Caravan, Cessna C208B Grand Caravan, and Piper PA-31 Navajo (Table 3-5). The Caravan and Navajo have recently seen a drop in use, in favor of the Grand Caravan. The AAC/ADG for the Caravan and Grand Caravan is A-II (Small).

It is useful to note that Ryan Air, one of the two air carriers serving Kivalina, primarily flies the Casa C212 Aviocar, with 338 operations in 2021. This is below the 500 operations threshold but is an important cargo carrier for Kivalina. This aircraft is also an A-II.

Medivac flights are provided by the King Air, a B-II aircraft. This is also below the 500 operations but is an important service to the community.

Table 3-10 Aircraft Approach Category (AAC) and Airplane Design Group (ADG)

AAC	Approach Speed (knots)	ADG	Wingspan (feet)	Tail Height (feet)
A	less than 91	I	To 48	To 20
B	91-120	II	49-78	20-30
C	121-140	III	79-117	30-45
D	141-165	IV	118-170	45-60
E	166 or more	V	171-213	60-66
		VI	214-262	66-80

Source: USBTS (2023)

No change in forecasted operations is expected to change the critical aircraft regularly using the airport in the short, medium, or long term. A change in the number of based aircraft is not expected.

Based on current aeronautical use, forecast, and consultation with FAA, the existing and future AAC/ADG for Kivalina airport is A-II (Small) and the designated critical aircraft is the Cessna C208B Grand Caravan.

Design should also allow for the occasional use of KVL by large aircraft, including cargo, medivac, and fuel tankers that deliver essential service to the community. These aircraft do not meet the minimum of 500 operations per year but should be able to use the runway and taxiway.

4 ISSUES

Interviews were conducted with the two primary air carriers (Ryan Air and Bering Air) in March 2023. Those interviews related the following challenges at Kivalina:

- Runway incursions by pedestrians, snowmachines, and vehicles are extremely common, as are near misses from those incursions. Pilots observe that the runway is preferred to be used as a 'highway,' rather than the trails alongside the runway. Pilots relate that this seems worse than other communities in the region because of how close the runway is to Kivalina.
- Crosswinds greater than 15 miles per hour are the primary reason for canceled flights
    - Prevailing winds during storms are out of the northeast, and crosswind to the runway
- Proximity of the landfill is a major hazard, primarily because of the number of birds, which frequently impede aircraft operations.
- Storage and congestion on the apron impedes operations. The apron is used for construction staging, barge staging, storing materials, and half hazard storage of debris (i.e. pallets). These uses restrict the usable spaces of the apron and impede pilots' comfort using the airport.
- The airport's coastal location means maritime fog frequently reduces visibility, when visibility is clear a short distance inland.

The following is a summary of issues identified in the inventory and through interviews:

1. Runway erosion
2. Storm surge creating runway hazards
3. Crosswinds on runway
4. Runway incursions
5. Too small of apron and/or apron congestion
6. Trail use along the runway penetrating the Part 77 protected airspace
7. Landfill at the end of the runway

5 FACILITY REQUIREMENTS

5.1 Airfield Capacity

Facility requirements, including the number of runways, are driven by the amount of activity projected to occur at an airport. KVL is forecast to have 2,616 annual operations in 2035 (See Table 3-8).

Using that forecast, the FAA provides guidance on how many flights a runway can safely handle. For an airport with a single runway, the FAA estimates that it has an hourly capacity of 98 visual flight rules (VFR)/59 instrument flight rules (IFR) flights, resulting in 230,000 operations per year (FAA 1983).

Since the projected number of annual operations for KVL is much less than runway capacity (2,616 is less than 230,000), there are no expected runway capacity or delay issues. Any proposed alternative that maintains at least one runway is expected to exceed the required runway capacity during regular operations.

5.2 Security

In addition to being an important aspect of safety, FAA funding for airport improvements is contingent upon maintaining security. The airport is not fenced, and runway incursions are a reported issue. Storm erosion causes fence maintenance issues, as can snow loading.

A fence has advantages and disadvantages. A properly maintained fence may decrease use of the runway by both wildlife and the public. A fence which is damaged by storm, snow loads, permafrost, or other factors may increase wildlife entrapment on the runway.

The runway is likely to remain ungated since the airport relies on the public having direct access to the apron for cargo and passenger service. A fence may prevent runway incursions, but the gate becomes an issue.

5.3 Design Standards

The AAC/ADG coding system relates airport design criteria to the operational and physical characteristics of aircraft that are intended to operate at an airport. For planning and design purposes, it is necessary to establish design standards that would be applicable to future development at the airport.

The AAC/ADG has two components related to an airport's design aircraft. The AAC, depicted by a letter, represents the aircraft approach category, as defined by the aircraft approach speed (Table 5-1). The ADG, depicted by a roman numeral, is the airplane design group determined by aircraft wingspan and tail

height (Table 5-2). Generally, AAC speed is related to runways and runway-related facilities, while ADG relates primarily to separation criteria involving taxiways, runways, and taxiways.

Table 5-1 AAC Classifications and Aircraft Classifications

Approach Category	Approach Speed (knots)	Typical Aircraft
A	<90	Cessna Grand Caravan
B	91-120	Beech 200 Super Kingair
C	121-140	Lockheed C-130
D	141-165	MD-11

Source: FAA AC 150/5300-13B, *Airport Design*

Table 5-2 ADG Classifications and Aircraft Classifications

Approach Category	Wingspan (feet)	Typical Aircraft
I	To 48	Piper PA-31 (Navajo)
II	49-78	Cessna Grand Caravan, Beech 200 Super Kingair
III	79-117	De Havilland Dash 8
IV	118-170	Lockheed C-130, DC-10
V	171-213	Boeing 747
VI	214-262	Lockheed C-5B

Source: FAA AC 150/5300-13B, Change 1, *Airport Design*

For KVL, the existing and future AAC/ADG for Kivalina is A-II (Small) since the designated critical aircraft is a Cessna C208B Grand Caravan. The Cessna 208 Caravan is also an A-II (Small). The other commonly used aircraft is a Piper PA-31 Navajo Chieftain/T1020, which is classified as a B-I, but no longer reaches the 500 operations threshold.

AC 150/5300-13B, *Airport Design*, defines a small aircraft as an aircraft with a maximum certificated takeoff weight of 12,500 pounds or less. The Cessna C208B Grand Caravan classifies as a small aircraft.

5.4 Runway Requirements

5.4.1 Dimensional Criteria

The runways are designed in accordance with the standards developed by the FAA using the Runway Design Code (RDC) system, which is the AAC/ADG plus a given visibility minimum as reported in Runway Visibility Range (RVR). The 2021 ALP states the visibility minimum at KVL is not lower than one statute mile or RVR 5,000, resulting in an RDC for RW 12/30 of A-I-5000. However, the RDC called

out in the 2021 ALP was determined using the Cessna 208 Caravan as the critical aircraft. Based off current operations at KVL, the critical aircraft is now the Cessna 208B Grand Caravan. This would upgrade the RDC at KVL to A-II-5000.

Table 5-3 shows the FAA design criteria for RW 12/30 comparing both RDCs of A-I-5000 and A-II-5000. The runway conforms to the A-I-5000 design, as approved in the 2021 ALP.

Table 5-3 Runway Design Standards

Airport Feature	FAA Requirements		
	Runway 12/30 (Existing)	A-I-5000 Standard	A-II-5000 (Small) Standard
Runway Length	3,000 feet	--	--
Runway Width	60 feet	60 feet	75 feet
RSA Width	120 feet	120 feet	150 feet
RSA Length (beyond runway threshold)	240 feet	240 feet	300 feet
ROFZ Width	250 feet	250 feet	250 feet
ROFZ Length (beyond runway threshold)	200 feet	200 feet	200 feet
ROFA Width	400 feet	400 feet	500 feet
ROFA Length (beyond runway threshold)	240 feet	240 feet	300 feet
RPZ Inner Width	500 feet	250 feet	250 feet
RPZ Outer Width	700 feet	450 feet	450 feet
RPZ Length	1000 feet	1000 feet	1000 feet

5.4.2 Orientation

The runway orientation is restricted by the position on a narrow island. Wind coverage for the runway is 79.8% wind coverage for 10.5 knot winds, and 85.9% coverage for 13 knot winds. For A-II aircraft, the allowable crosswind component is 13 knot winds.

For wind coverages less than 95%, development of a crosswind runway should be evaluated. When terrain does not allow and/or a crosswind runway is cost prohibitive, increasing the runway width to the next larger RDC is acceptable. The greater runway width allows for better operational tolerance to crosswinds.

Table 5-4 KVL Design Compliance

Criteria	Standard	Existing	Compliant?
RUNWAY DESIGN			
Runway Length	3,200 feet	3,000 feet	No
Runway Width	75 feet	60 feet	No
Shoulder Width	10 feet		
Crosswind Components	85.9%	95%	No
RUNWAY PROTECTION			
Runway Safety Area (RSA)			
Length beyond departure end	300 feet	240 feet	No
Length prior to threshold	300 feet	240 feet	No
Width	150 feet	120 feet	No
Runway Object Free Area (ROFA)			
Length beyond runway end	300 feet	240 feet	No
Length prior to threshold	300 feet	240 feet	No
Width	500 feet	400 feet	No
Obstacle Free Zone (OFZ)			
Length beyond runway end	200 feet	200 feet	Yes
Width	250 feet	250 feet	Yes
Approach Runway Protection Zone (RPZ)			
Length	1,000 feet	1,000 feet	Yes
Inner Width	250 feet	500 feet	Yes
Outer Width	450 feet	700 feet	Yes

5.4.3 Length

Runway length requirements are determined by analyzing the needs of the airport's existing and projected critical aircraft. The recommended length for the primary runway is determined by considering the airplane type, or family of aircraft with similar performance characteristics, that is forecast to use the runway on a regular basis in FAA AC 150/5325-4B *Runway Length Requirements for Airport Design* (FAA 2005). Departures are considered in the runway length analysis since they typically require more runway length than landings.

Runway length requirements are determined based on several variables, including the airport's mean high temperature for the hottest month of the year, July (56.3° Fahrenheit), and elevation (18.4 feet MSL). FAA recommends using figures for coverage of 95% of the fleet, because Kivalina is not near a major

metropolitan area. The recommended runway length according solely to AC 150/5325-4B for small aircraft with less than 10 passengers is 2,700 feet.

Since KVL has an instrument approach, the FAA publishes additional recommendations for runway length. For runways with instrument approaches, the runway should be long enough to meet the 3,200 feet minimum length requirements for instrument approaches from AC 150/5300-13B Table K-1. As a result, for KVL, the recommended runway length is 3,200 feet.

In addition, the manufacturers' performance calculations were referenced for the three mostly commonly used aircraft at KVL (Table 5-5). All manufacturers recommend a takeoff ground roll between 1,115 and 1,399 feet. Weight and other characteristics will affect the ground roll requirements.

Table 5-5 Runway Length Requirements at KVL

Category	Length
FAA Design Standard	3,200 feet
Manufacturer Published Takeoff Ground Role	
Cessna 208 Caravan	1,160 feet
Cessna C208B/Grand Caravan	1,399 feet
Piper PA-31 (Navajo)/T-1020	1,115 feet

5.4.4 Width

FAA AC 150/5300-13B, *Airport Design*, recommends that runways serving A-II Small Aircraft, with a visibility of not lower than 1 mile, have a width of 75 feet (FAA 2022). The existing width at KVL is 60 feet.

As noted previously, runway width also should be designed according to crosswinds. If a single runway airport does not meet the required crosswind coverage, AC 150/5300-13B, Appendix B Wind Analysis, B.2.3.2 allows a wider runway, when a crosswind is impractical or cost prohibitive:

> *For locations that justify a crosswind runway for an RDC with regular use but provision of a crosswind is impractical or cost prohibitive, it is acceptable to increase the width of*
>
> *the primary runway to the next standard width in lieu of providing a crosswind runway. The greater width allows for better operational tolerance to crosswinds. However, if the existing primary runway is already wider than what is necessary for the RDC with*

crosswind constraints, a further increase in width to the primary runway is unwarranted. Ensure that wider runways intended to mitigate crosswind coverage meet all relevant criteria, as identified in this paragraph. Example: Consider an airport with a primary B-II runway with a width of 75 feet (22.9 m) and less than 95 percent wind coverage for the B-II RDC. If it is impractical to provide a crosswind runway, it is acceptable to increase the width of the primary runway from 75 feet (22.9 m) to 100 feet (30.5 m) as an alternate means of meeting crosswind needs. However, if the RDC (with regular use) needing a crosswind is an A-I aircraft, which has a standard runway width of 60 feet (18.3 m), the existing 75-foot (22.9 m) primary runway is already sufficiently wide for crosswind purposes. No further increase in width is justified.

No orientation of a single runway can meet the crosswind criteria, and so a crosswind runway, or an increase in runway width is recommended. For KVL, an increase in runway width is recommended since a crosswind runway would be impractical and/or cost prohibitive.

There is no reported shoulder width at KVL. FAA recommends a 10-foot shoulder.

5.4.5 Airfield Safety Areas

This section presents FAA design standards for various airfield safety areas. The following airfield safety areas are reviewed in this section:

- Runway Safety Area (RSA)
- Obstacle Free Zone (OFZ)
- Runway Object Free Area (ROFA)
- Runway Protection Zone (RPZ)

Runway Safety Area. The RSA is a critical two-dimensional area surrounding the runway. The RSAs should be:

- cleared, graded, and free of potentially hazardous surface variations
- properly drained
- capable of supporting snow removal equipment, and aircraft (without causing damage to the aircraft)
- free of objects except those mounted on low-impact resistant (frangible) supports and whose location is fixed by function.

The current RSA is 240 feet wide centered on the runway centerline and extends 240 feet beyond the ends of the runway.

Current FAA standards require the RSA to be 150 feet wide and extend 300 feet beyond the ends of the runway.

Obstacle Free Zone. The OFZ is a three-dimensional volume of airspace that supports the transition of ground to airborne operations or vice versa. The OFZ clearing standards prohibit airplanes from taxiing and parking in the OFZ during operations. Also, only objects that are frangibly mounted and needed for the safe movement of aircraft operations are allowed to penetrate the OFZ.

> **Runway OFZ**. As defined by the FAA, the Runway OFZ is an area of airspace centered above the runway centerline. The Runway OFZ clearing standards prohibit taxiing, parking airplanes, and objects from penetrating the OFZ. The only objects allowed are NAVAIDs that are frangibly mounted and fixed by location.
>
> The Runway OFZ is 250 feet wide and extend 200 feet beyond each end of the runway.
>
> Current FAA standards require the Runway OFZ to be 250 feet wide and extend 200 feet beyond the end of each runway.

Runway Object Free Area. The ROFA is a two-dimensional ground area that surrounds the runway. FAA standards prohibit parked aircraft and objects from residing in the ROFA, except NAVAIDs or objects that are frangibly (low-impact resistant) mounted.

The ROFA extends 240 feet past each end of the runway and is 400 feet wide.

Current FAA standards require the ROFA to be 500 feet wide and extended 300 feet beyond each runway end.

Runway Protection Zone. The RPZ is a two-dimensional, trapezoidal surface that is centered on the extended runway centerline. The function of the RPZ is to enhance the protection of people and property on the ground, typically achieved by airport control through land acquisition. The RPZ is primarily a land-use planning tool. The RPZ begins past the end of the runway pavement that is useable for takeoffs and landings.

The RPZ is 500 feet by 700 feet by 1,000 feet long.

Current FAA standards require the RPZ for an A/B-II Small Aircraft runway to be 250 feet by 450 feet by 1,000 feet long. There is no difference in design between A/B-II Small Aircraft and A/B-II in AC 150/5300-13B except for RPZ; which is larger for A/B-II (500 feet by 700 feet by 1,000 feet long). For KVL, we recommend following the RPZ for the larger A/B-II design standard, since KVL does not exclusively serve small aircraft. This could particularly help for larger aircraft such as fuel tankers, which may use the runway.

5.5 Approach and Departure Threshold Siting Surfaces

Threshold siting surfaces (TSS) protect the use of the runway and allow pilots to follow standard approach and departure procedures. The FAA requires TSSs be clear of obstacle penetrations. The approach TSS slope for approach ends of runways with non-precision approaches only providing lateral guidance and visibility minimums ≥ ¾ statute mile is 20:1. The departure slope standard is 40:1 for all instrument operations. The specific dimensions are described in AC 150/5300-13B.

The TSSs for the 2021 ALP are:

- Approach TSS: 200 feet from threshold; 400 feet by3,800 feet by 10,000 feet at 20:1
- Departure TSS: 0 feet from threshold; 1,000 feet by 6,466 feet by10,200 feet at 40:1

Current FAA standards require the TSSs to be of a different geometry.

5.6 Runway Line of Sight

For runways without a full parallel taxiway, the design standard is any point 5 feet above the runway centerline is mutually visible with any other point 5 feet above the runway centerline. Existing runway conditions meet current line of sight design standards.

5.7 Taxiway Requirements

5.7.1 Taxiway Design Group

Previous guidance on taxiway design was based only on ADG. ADGs are based on wingspan and tail height, they do not take into consideration undercarriage dimensions. Thus, the FAA established new guidelines for determining Taxiway Design Groups (TDG). The TDG is determined using a combination of the longest Cockpit to Main Gear Distance and widest Main Gear Width (MGW) of a theoretical airplane using the taxiway. TDG establishes standards for taxiway and taxiway shoulder width, while the ADG determines taxiway safety area (TSA) and taxiway object free area (TOFA) widths.

The Cessna 208B Grand Caravan is currently the critical aircraft at KVL, which yields an ADG-II (Small) and TDG 1A determination. However, the Piper PA-31 Navajo has a wider MGW and yields a TDG 2 determination; but its use has been declining since a peak in 2013. According to FAA AC 150/5300-13B, *Airport Design*, TDG 1A airports require 25-foot-wide taxiways with 10-foot shoulders (FAA 2022). ADG-II airports require 79-foot-wide TSAs and 124-foot-wide TOFA.

KVL's taxiway is 45 feet wide, with 10-foot shoulders, while the TSA is 79 feet wide and the TOFA is 131 feet wide.

5.8 Aprons

KVL currently has a single 290 foot by 130-foot gravel surface apron approximately 1,600 feet south of the runway.

5.9 Airspace

5.9.1 FAR Part 77 Surfaces

FAR Part 77, Objects Affecting Navigable Airspace, establishes standards for determining which structures pose potential obstructions to air navigation. This is accomplished by defining specific airspace areas in the environs of an airport that cannot contain any protruding objects. These airspace areas are referred to as "imaginary surfaces." Objects affected include existing or proposed objects of natural growth, terrain, or permanent or temporary construction, including equipment that is permanent or temporary in nature.

Imaginary surfaces outlined in FAR Part 77 include:

- Primary Surface
- Transitional Surface
- Horizontal Surface
- Conical Surface
- Approach Surface

Like the RPZs, the dimensions of FAR Part 77 surfaces vary depending on the type of runway approach. Kivalina Airport's existing Part 77 surfaces for RW 12/30 are established for non-precision instrument approaches.

Although the FAA can determine which structures are obstructions to air navigation, the FAA is not authorized to regulate tall structures. Under Part 77, an aeronautical study can be undertaken by the FAA to determine whether the structure in question would be a hazard to air navigation. There is no specific regulation that permits the FAA to limit structure heights or determine which structures should be lighted or marked. In every aeronautical study determination, the FAA acknowledges that state or local officials have control over appropriate use of property beneath an airport's airspace. The airport does not enforce specific building codes for structures constructed, thus it is possible that structures could penetrate FAR Part 77 surfaces.

Definitions of key FAR Part 77 surfaces are as follows:

Primary Surface. The primary surface is a surface longitudinally centered on a runway. A runway with a hard surface has a primary surface extending 200 feet beyond each end of the runway. The width of the primary surface ranges from 250 feet to 1,000 feet depending on the existing or planned approach (visual, non-precision, or precision). At KVL, the primary surface for RW 12/30 extends 200 feet beyond each runway end and is currently 500 feet wide because it is a non-precision instrument runway with visibility minimums greater than one-statute-mile. According to the airport's most recent FAR Part 77 Airspace Drawing, completed in 2021, it is indicated at this time that there is a terrain obstruction that remains located within the primary surface.

Transitional Surface. The transitional surface extends outward and upward at right angles to the runway centerline at a slope of seven feet horizontally for each foot vertically (7:1) from the sides of the primary and approach surfaces. The transitional surfaces extend to where they intercept the horizontal surfaces at a height of 150 feet above the runway elevation. According to the airport's most recent 2021 FAR Part 77 Airspace Drawing, it is indicated at this time that there are no obstructions to the transitional surface.

Horizontal Surface. The horizontal surface is a horizontal plane located 150 feet above the established airport elevation, covering an area from the transitional surface to the conical surface. The perimeter is constructed by swinging arcs from the center of each end of the primary surface and connecting the adjacent arcs by lines tangent to those arcs. The radii of the arcs are 5,000 feet for all utility runways. According to the airport's most recent 2021 FAR Part 77 Airspace Drawing, it is indicated at this time that there are no obstructions to the horizontal surface.

Conical Surface. The conical surface extends outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet. According to the airport's most recent

2021 FAR Part 77 Airspace Drawing, it is indicated at this time that there are no obstructions to the conical surface.

Approach Surface. The approach surface is longitudinally centered on the extended runway centerline and extends outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based on the type of approach NAVAIDs. At KVL, the approach slopes for both approach ends is 20:1.

The inner edge of the approach surface is 500 feet wide, the same width as the primary surface. It expands uniformly in width to 2,000 feet for utility runways with non-precision approaches and is not affected by visibility minimums. Both approach surfaces extend for a horizontal distance of 5,000 feet. To allow for the height of vehicles on roadways, the approach surface must clear public roads by 15 feet, and private roads by 10 feet. According to the airport's most recent ALP, it is indicated at this time that the dirt road running along the east side of the runway obstructs both approach surfaces.

5.10 Passenger and Cargo Loading/Unloading

5.10.1 Airside Requirements

Current parking procedures use taxi-in, taxi-out to the apron. The taxiway is long, which requires additional maintenance (snow removal), and aligned with the RW30 threshold which would lead to possible aircraft air to ground conflicts.

Utilities are not typically provided to aircraft, and fuel is not available for purchase. Scheduled commuter flights must purchase fuel elsewhere.

5.10.2 Passenger and Cargo Facilities

There is no passenger terminal or cargo facilities at Kivalina. Passengers wait in the weather for flights, and often wait to hear the airplane landing prior to leaving home to meet the aircraft. This works when the airport is located so close to the community. If community infrastructure was located distant from the airport, the aircraft noise would not act as a signal for the community to gather at the airport. This would cause increased wait times at the airport.

Cargo handling is completed by passengers or volunteers from the community. There is no area for storing cargo.

5.10.3 Landside Requirements

There is no parking or traffic circulation provided at the airport. There is no dedicated airport access road.

5.10.4 Passenger Convenience and Access to Airport Facilities

Passenger services is inconvenient at KVL. There are no airport facilities for passengers to access. There is no shelter for passengers. Parking is not provided at the airport, and passengers are encouraged to act as cargo and baggage handlers.

5.11 General Aviation Requirements

There are no general aviation facilities at KVL. Transient airport parking can take place at the apron, although there are no tiedowns provided.

5.12 Air Cargo Requirements

Air cargo is primarily brought in on regularly scheduled passenger service. There are no air cargo facilities. The public helps load and unload air cargo.

5.13 Support Facilities

5.13.1 Airport Maintenance

The SREB is located along the apron.

5.14 Utilities

KVL is connected to the community power system. There are no other utilities provided.

5.15 Land Use

There are two important land uses to consider at KVL. There is an informal trail running along the lagoon side of the runway. The public frequently travels to the northern part of the barrier island.

There is also a cemetery near the end of the runway.

6 ENVIRONMENTAL OVERVIEW

This section is intended to provide a brief environmental overview of the major environmental constraints at the current Kivalina Airport. A more detailed environmental review will be provided in a subsequent chapter.

6.1 Wetlands

The airport is located on an island, between the Chukchi Sea and a lagoon. The deepwater habitats of the ocean and lagoon are Waters of the United States. The non-runway habitat is a mix of upland and wetland. A field verified wetland delineation is not available. The National Wetland Inventory classifies much of the non-runway habitat as Estuarine/Marine Wetland (USFWS 2023).

6.2 Biotic Resources (Fish, Wildlife, Birds, Marine Mammals, Threatened and Endangered Species)

The airport is in critical habitat for Endangered Species Act threatened polar bears. It also is within the potential range (but not critical habitat) of Endangered Species Act threatened spectacled eider and threatened Steller's eider.

The airport and surrounding environment can host large numbers of migratory birds, particularly during the spring, summer, and fall. These are attracted to the lagoon and nearshore areas. These can create a flight hazard for aircraft operations.

No reports are available of large wildlife regularly occurring on the airport. The airport's location on an island helps prevent large wildlife from accessing the runway. Polar bears would be the only species likely to walk down the shoreline, and residents report that sightings of polar bears are rare.

The waters around the airport host a variety of fish and marine mammal species. Seals may rest along the shoreline, although discussions with residents indicate the airport is not a regular haul out location for marine mammals. Current airport operations are not anticipated to significantly impact marine mammals or fish.

6.3 Floodplains and Coastal Erosion

Kivalina is not part of the Federal Emergency Management Agency floodplain mapping program.

The airport is subject to shoreline erosion and coastal storms. Coastal storms cause damage through two methods: localized flooding and high wave action depositing ice and debris on the runway. In 2018 FAA funded a rock revetment to help address these issues.

6.4 Parklands, Recreational Areas

There are no parklands or recreational areas near the airport. A trail exists adjacent to the runway, which is used by locals to access the northern part of the island, including the landfill. A cemetery exists adjacent to the runway.

6.5 Cultural Resources

The major cultural resource is the cemetery located adjacent to the runway. Given the length of time Kivalina has been occupied, other cultural resources may occur in the vicinity of the airport. There is no current inventory of cultural resources at the airport.

6.6 Noise

Aircraft approach and depart directly over the community of Kivalina. This subjects the community to increased airplane noise.

In many rural Alaskan communities, aircraft noise is not seen as a negative impact, but a welcome reminder of the connection to the larger hub communities and infrastructure.

6.7 Hazardous Materials and Storage

The Alaska Department of Environmental Conservation contaminated sites atlas reports no contaminated sites on the airport (ADEC 2023).

There is a lease for petroleum tanks on airport property, which provides the bulk fuel storage for the local utility.

There is also storage of small amounts of hazardous materials to operate the airport maintenance equipment.

6.8 Solid Waste

The community solid waste facility is located approximately 1,800 feet from the runway, directly in the path of approaching/departing aircraft. The community travels down the trails adjacent to the runway to access the landfill, which is on the other side of the airport from Kivalina.

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