



U.S. Department of the Interior
Bureau of Land Management

Willow Master Development Plan

Environmental Impact Statement

SUPPLEMENT TO THE DRAFT

Volume 2: Appendix A

March 2020

Prepared by:

U.S. Department of the Interior
Bureau of Land Management

In Cooperation with:

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Department of Transportation
Native Village of Nuiqsut
Inupiat Community of the Arctic Slope
City of Nuiqsut
North Slope Borough
State of Alaska

**Estimated Total Costs Associated with
Developing and Producing this EIS:
\$5,005,000**



Willow Master Development Plan Supplement to the Draft Environmental Impact Statement

Appendix A Figures

March 2020

Estimated Total Costs Associated with Developing and Producing this EIS: \$5,005,000

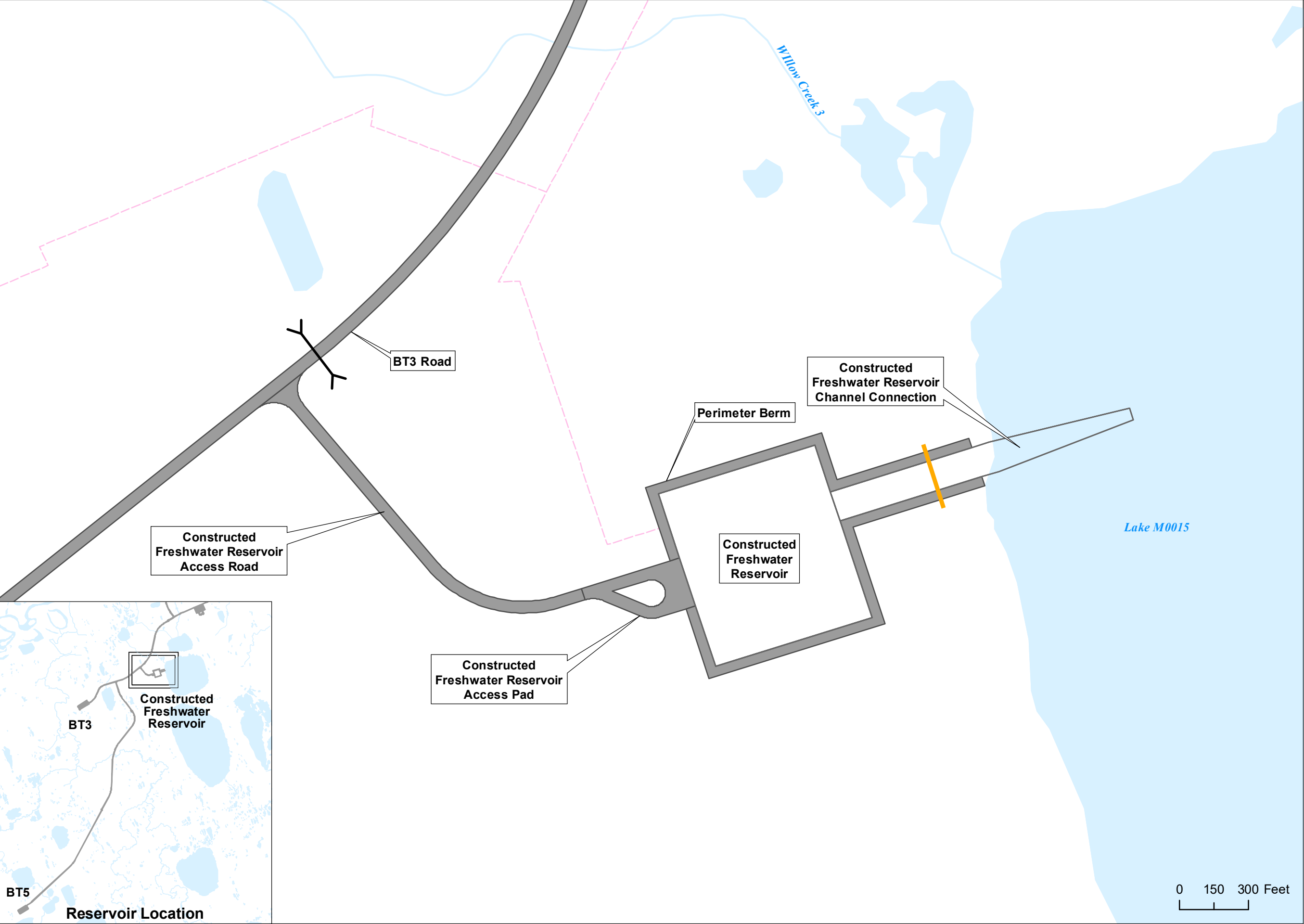
The dollar figure represented here is an approximate cost to date.
Previously published costs were estimates for the full EIS process.

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Willow Proposed Development Features

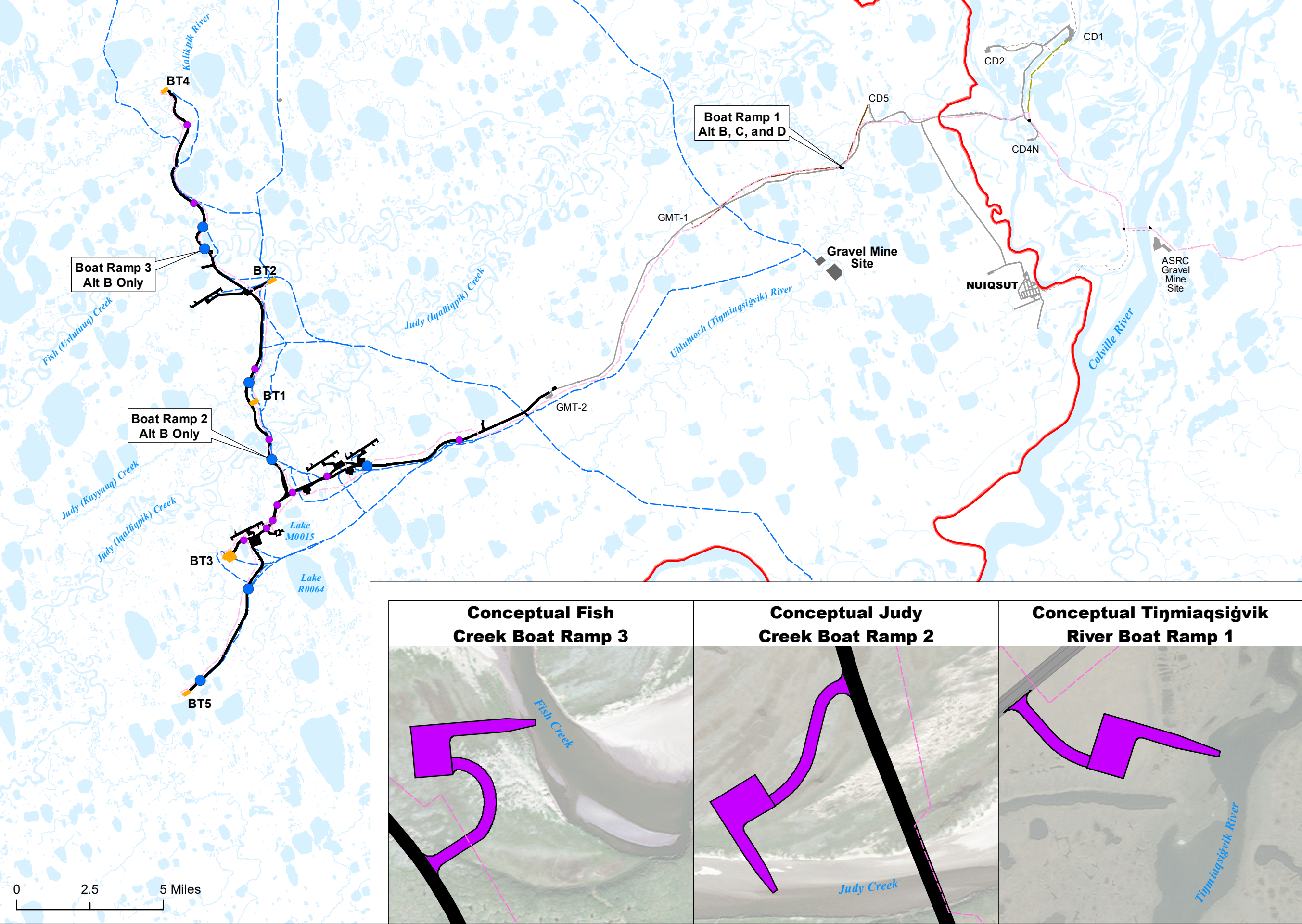
- Culvert Battery
- Weir
- New Pipeline New VSM
- Gravel Footprint

Note:
Alternative B is shown as a reference.
The freshwater reservoir will be the same for all alternatives.

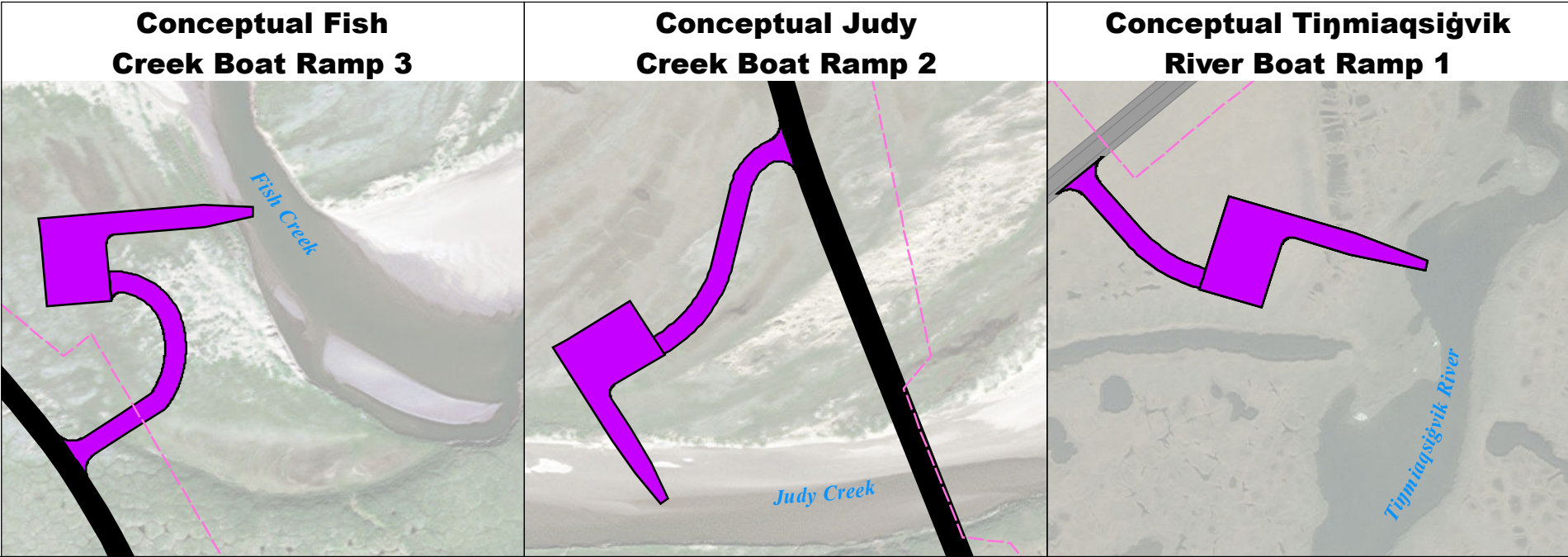
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Figure 2.2.1



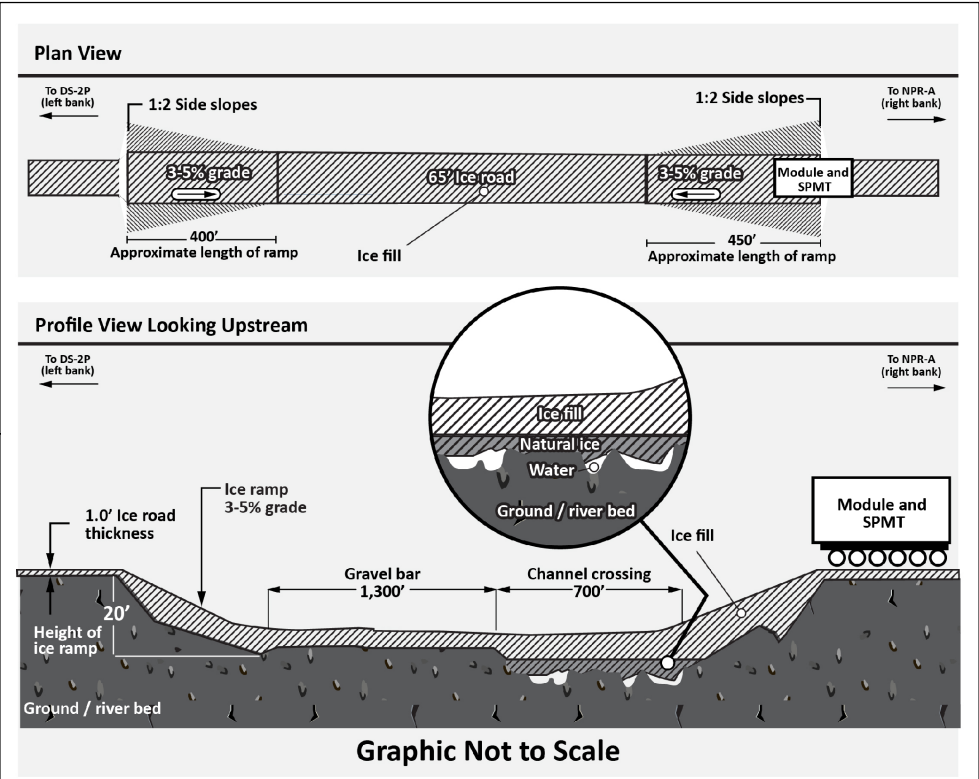
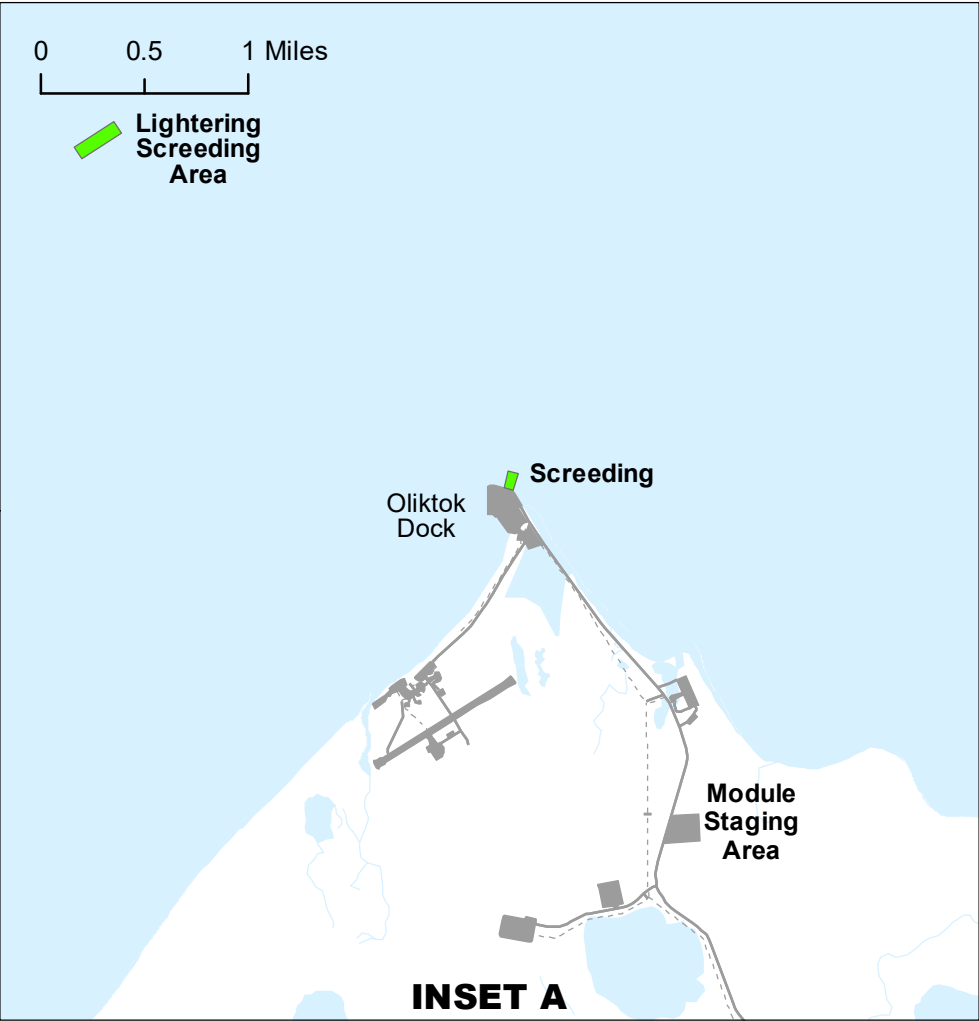
- Willow Proposed Development Features**
- Culvert Battery
 - Bridge
 - New Pipeline Existing VSM
 - New Pipeline New VSM
 - Ice Road
 - Drill Site
 - Gravel Footprint
 - Boat Ramp
- Other Infrastructure**
- Existing Road
 - Existing Pipeline
 - Existing Infrastructure
- Land Designation**
- National Petroleum Reserve in Alaska



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Figure 2.2.2



DETAIL A - Colville River Ice Bridge

Willow Proposed Development Features

- Drill Site (Not to Scale)
- Gravel Mine Site
- Screeding

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Best Management Practice Areas

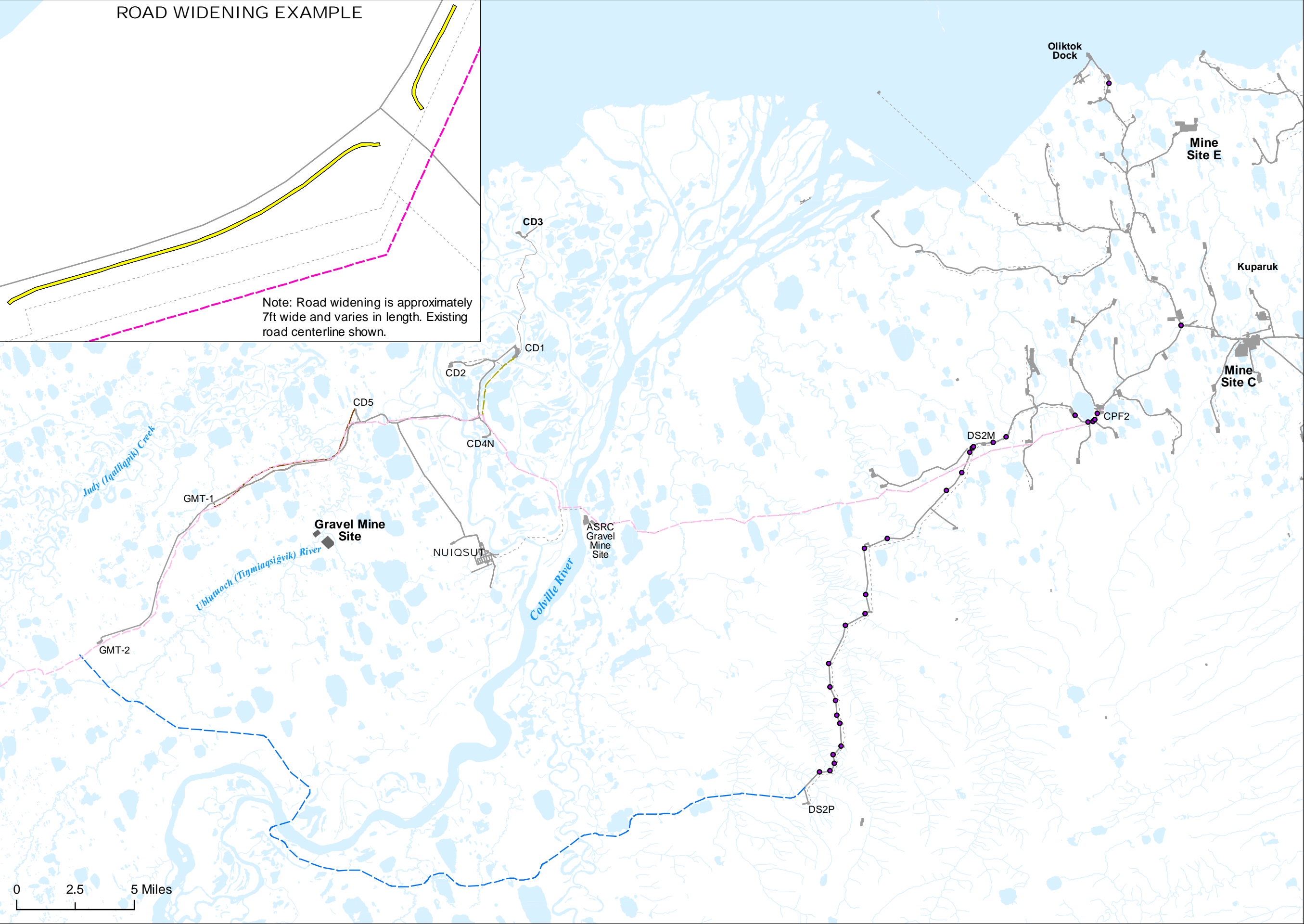
- K-1 River Buffers
- K-5 Teshekpuk Lake
- Caribou Habitat Area

Oil & Gas

- Unavailable to Leasing
- Unavailable no Leasing and no new non-subsistence infrastructure

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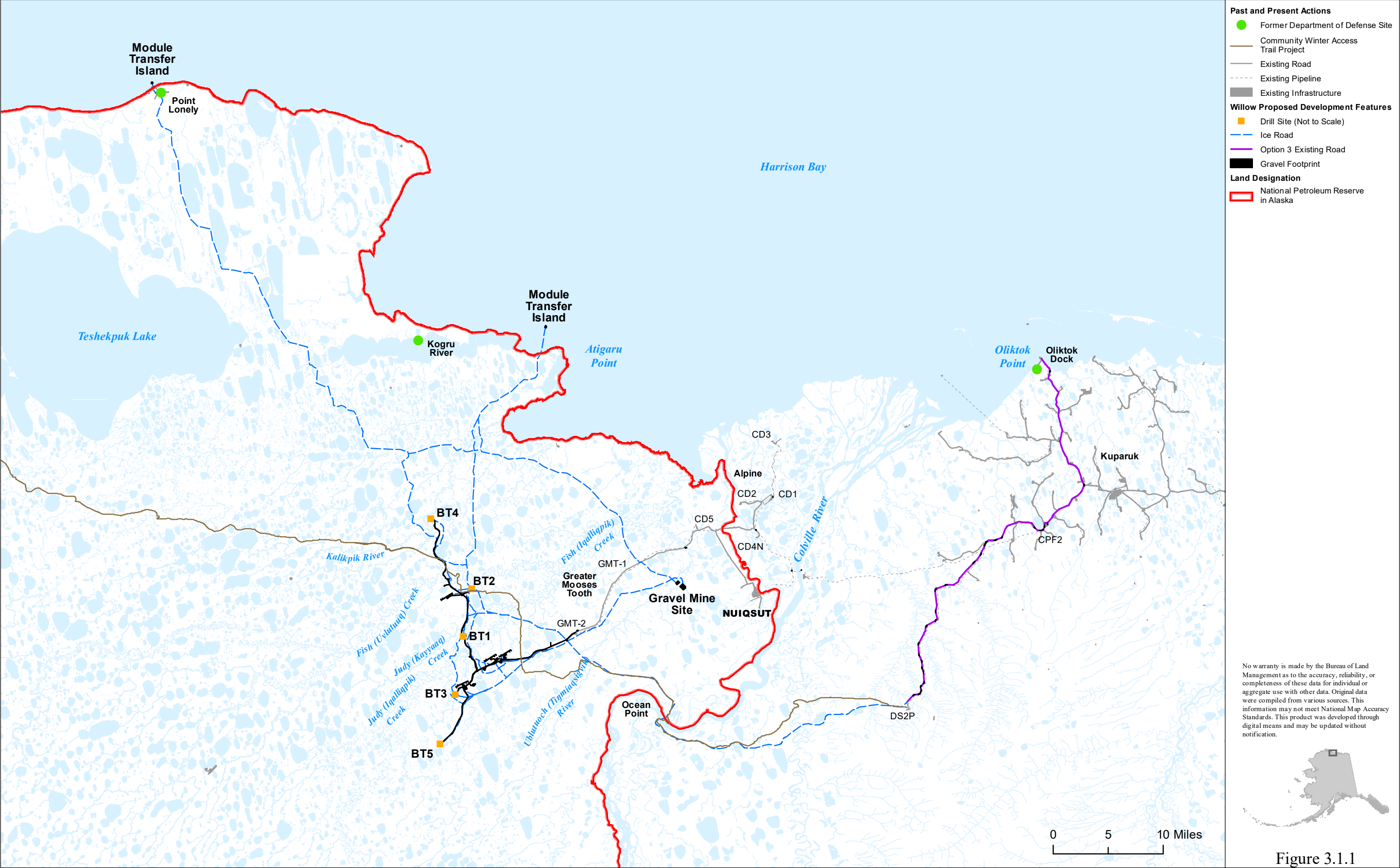
Figure 2.3.1

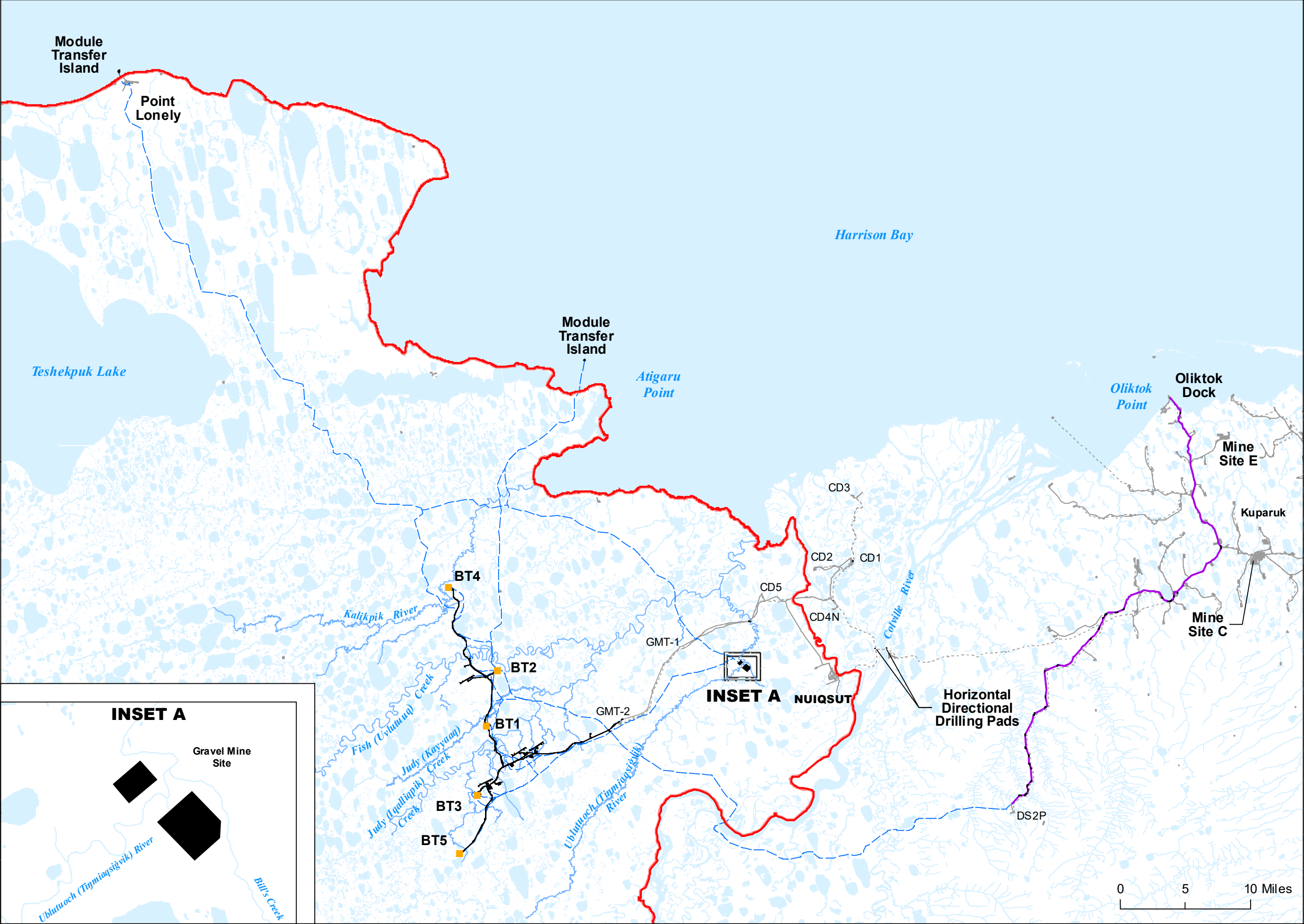


- Willow Proposed Development Features**
- Option 3 Road Widening Locations
 - New Pipeline Existing VSM
 - New Pipeline New VSM
 - Option 3 Ice Road
 - Option 3 Road Widening
- Other Infrastructure**
- Existing Road
 - Existing Pipeline
 - Existing Infrastructure



Figure 2.3.2





Willow Proposed Development Features

- Drill Site (Not to Scale)
- Ice Road
- Option 3 Existing Road
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Note:
The analysis area is the area within 328 feet (100 meters) of proposed ground disturbances and ice infrastructure.

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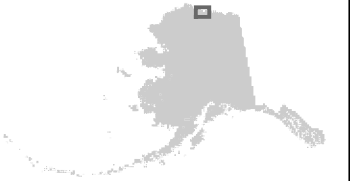
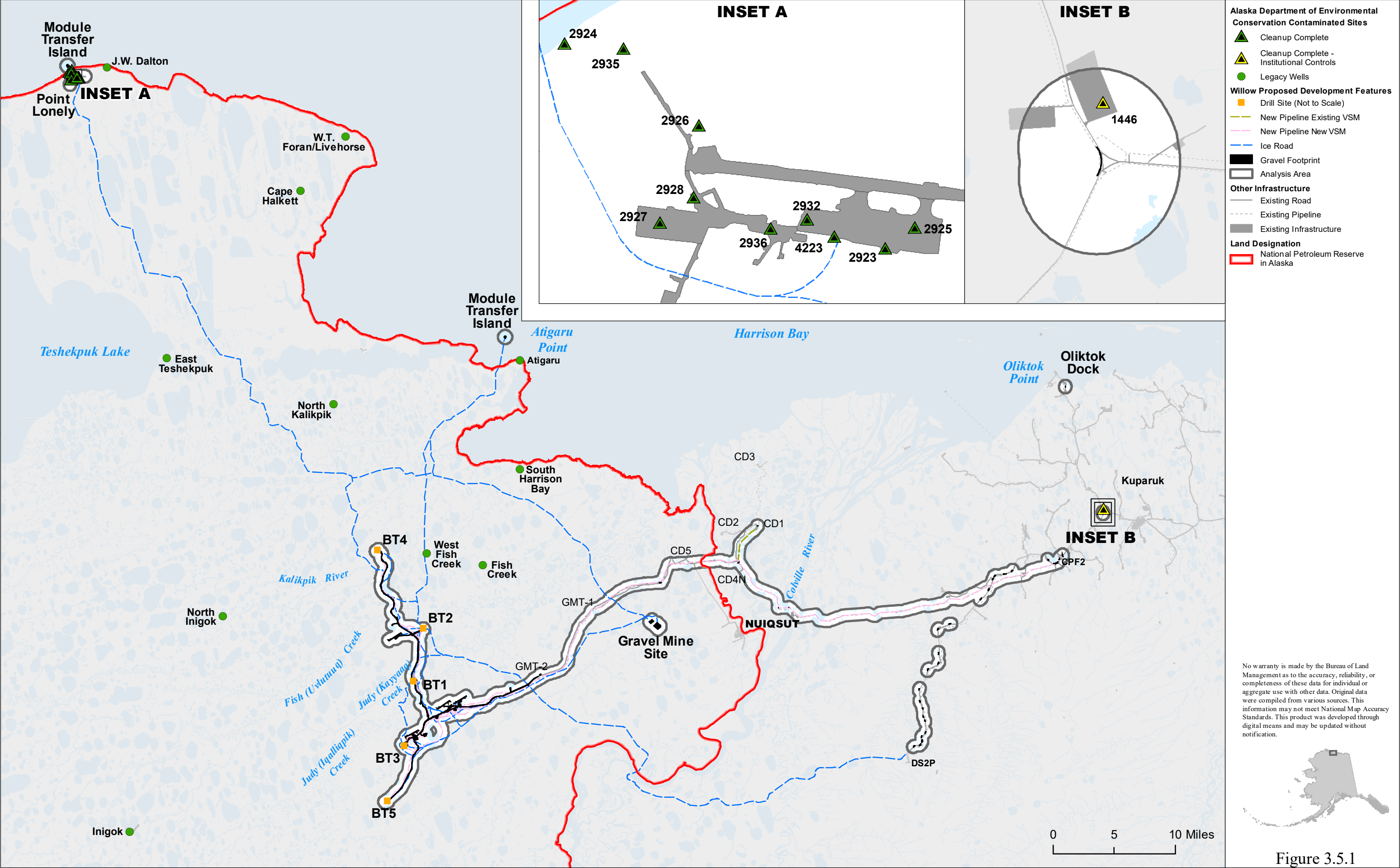
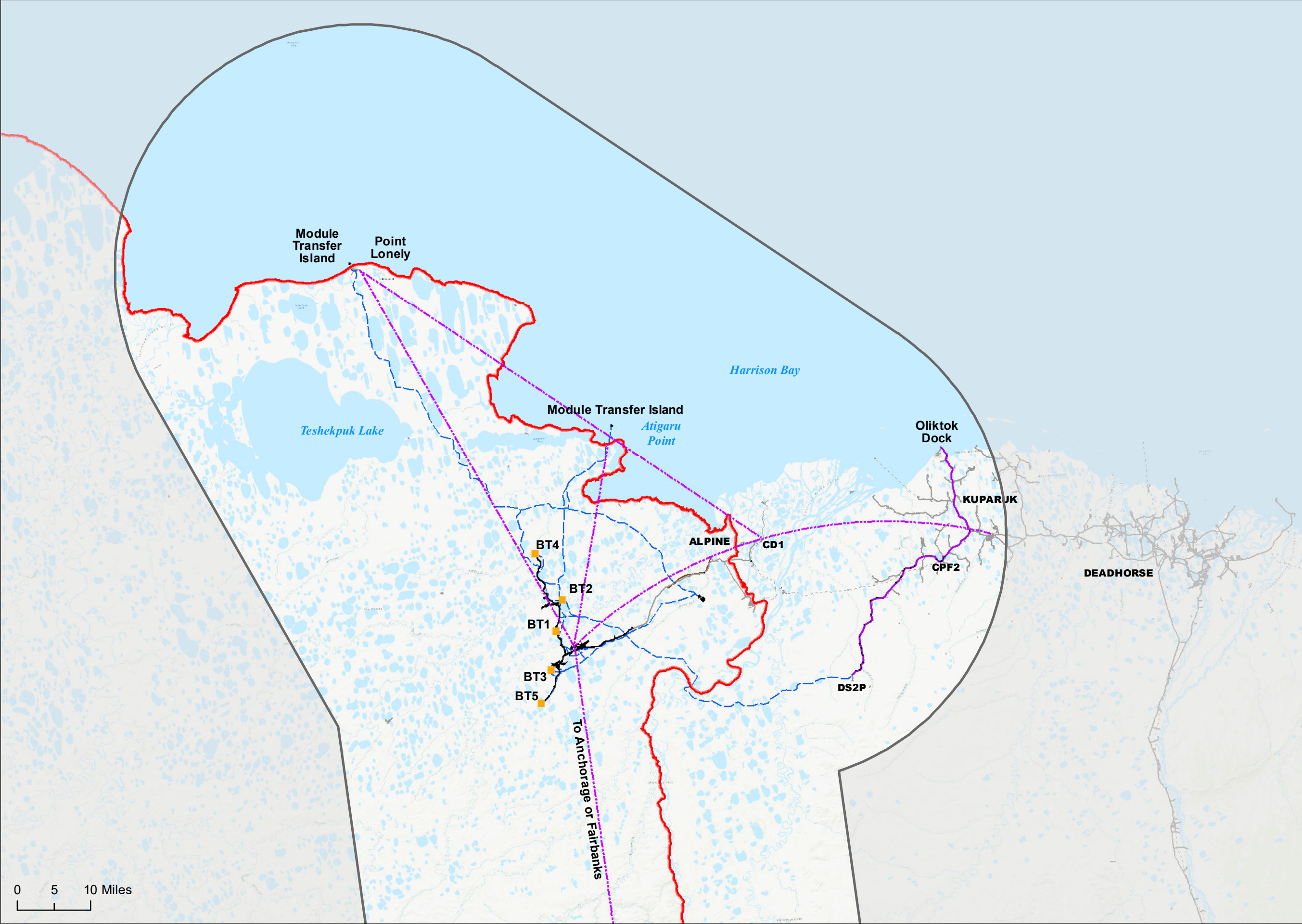


Figure 3.4.1





- Flights**
- Estimated Flight Path
- Willow Proposed Development Features**
- Drill Site (Not to Scale)
 - Ice Road
 - Option 3 Existing Road
 - Gravel Footprint
 - Attenuation Zone (Analysis Area)
- Other Infrastructure**
- Existing Road
 - Existing Pipeline
 - Existing Infrastructure
- Land Designation**
- National Petroleum Reserve in Alaska

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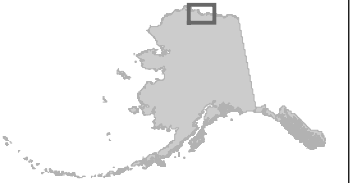
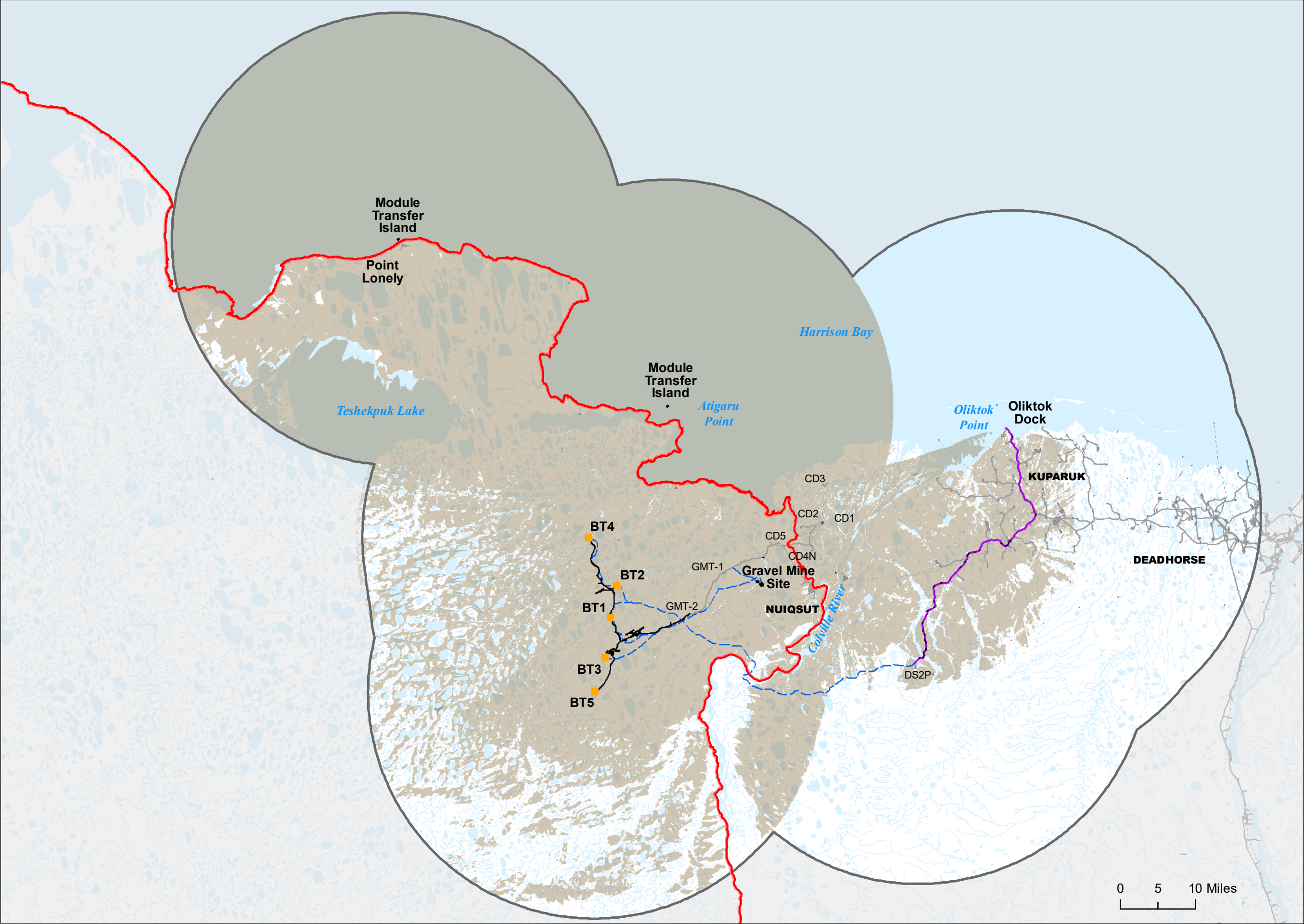


Figure 3.6.1

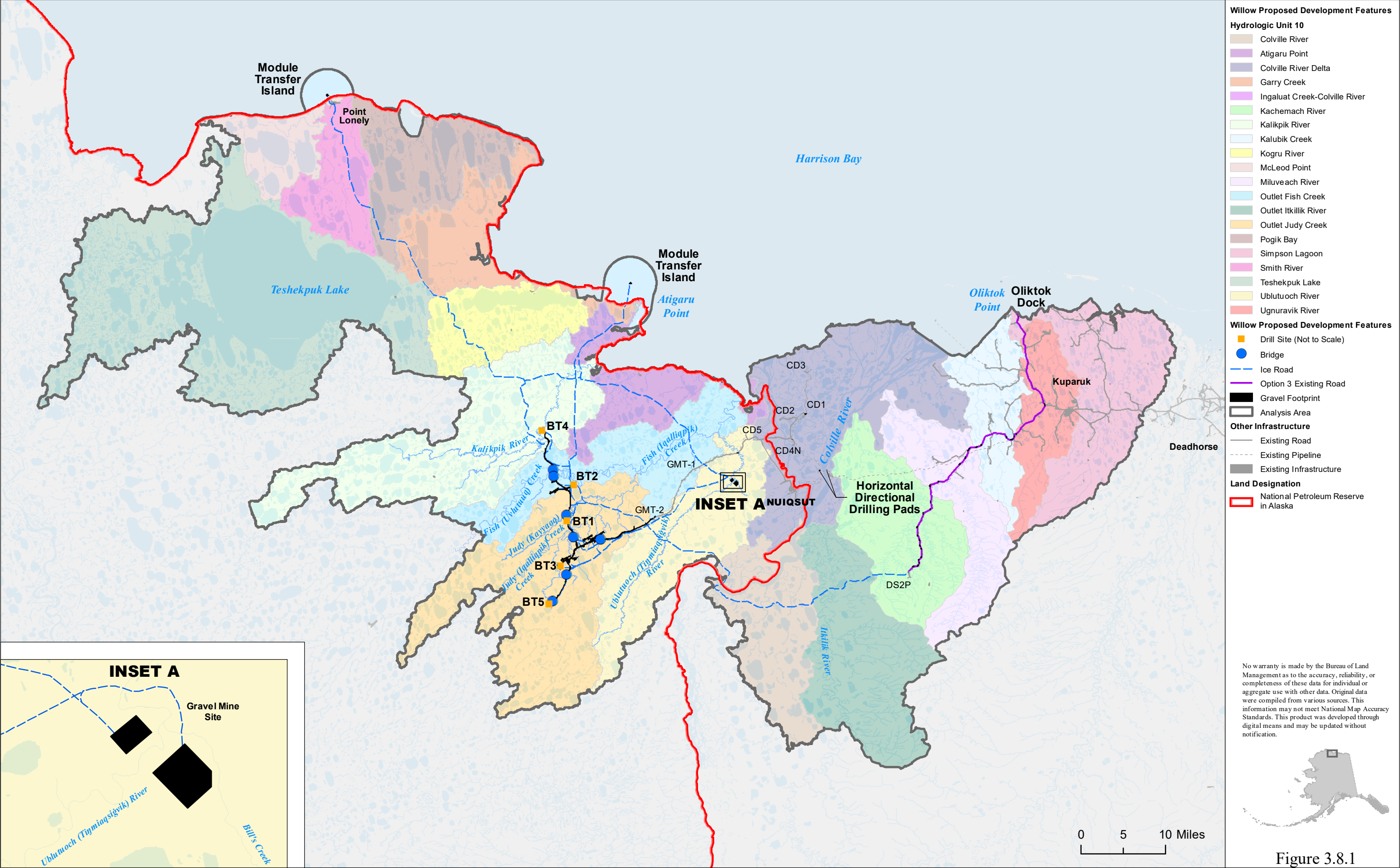


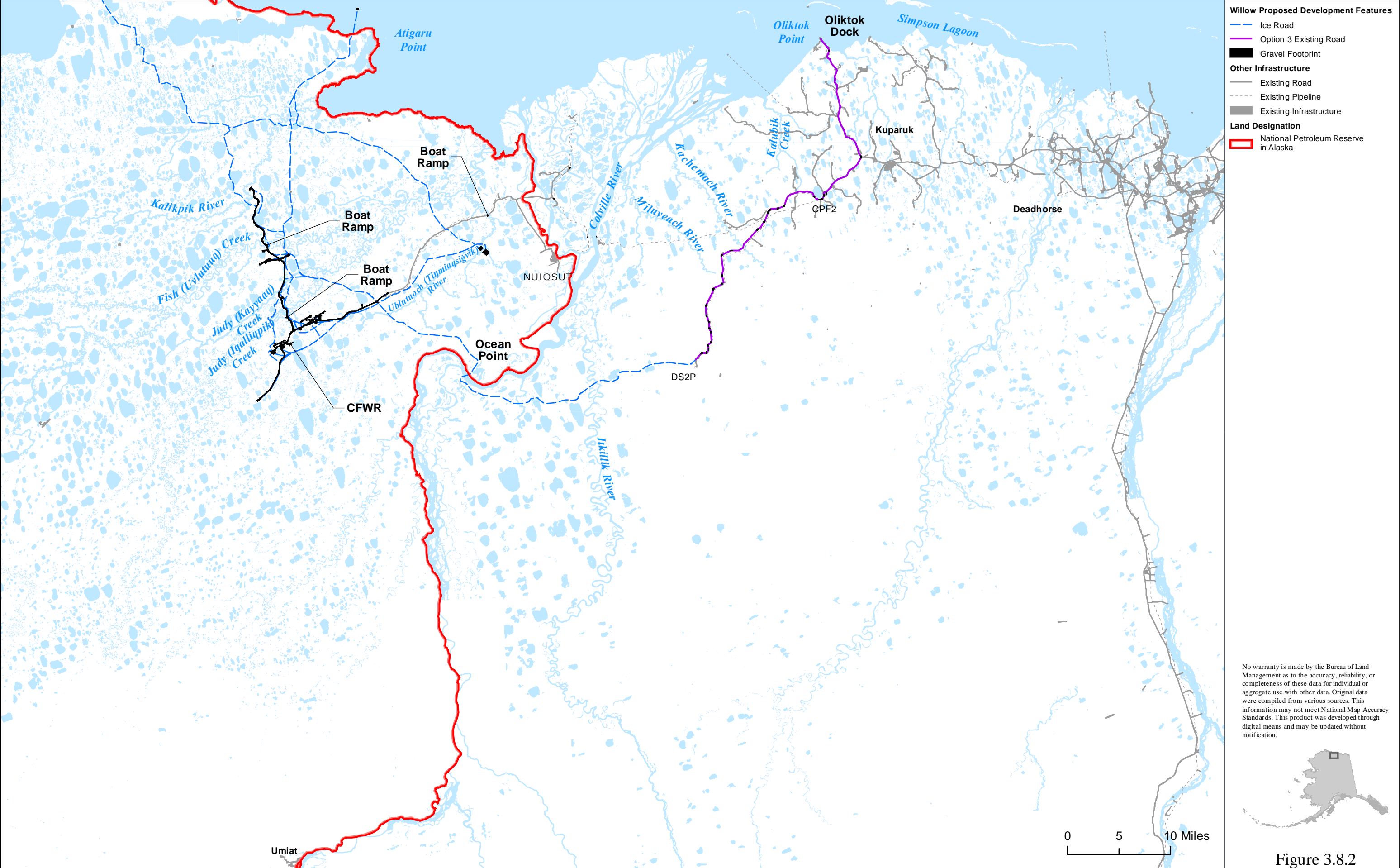
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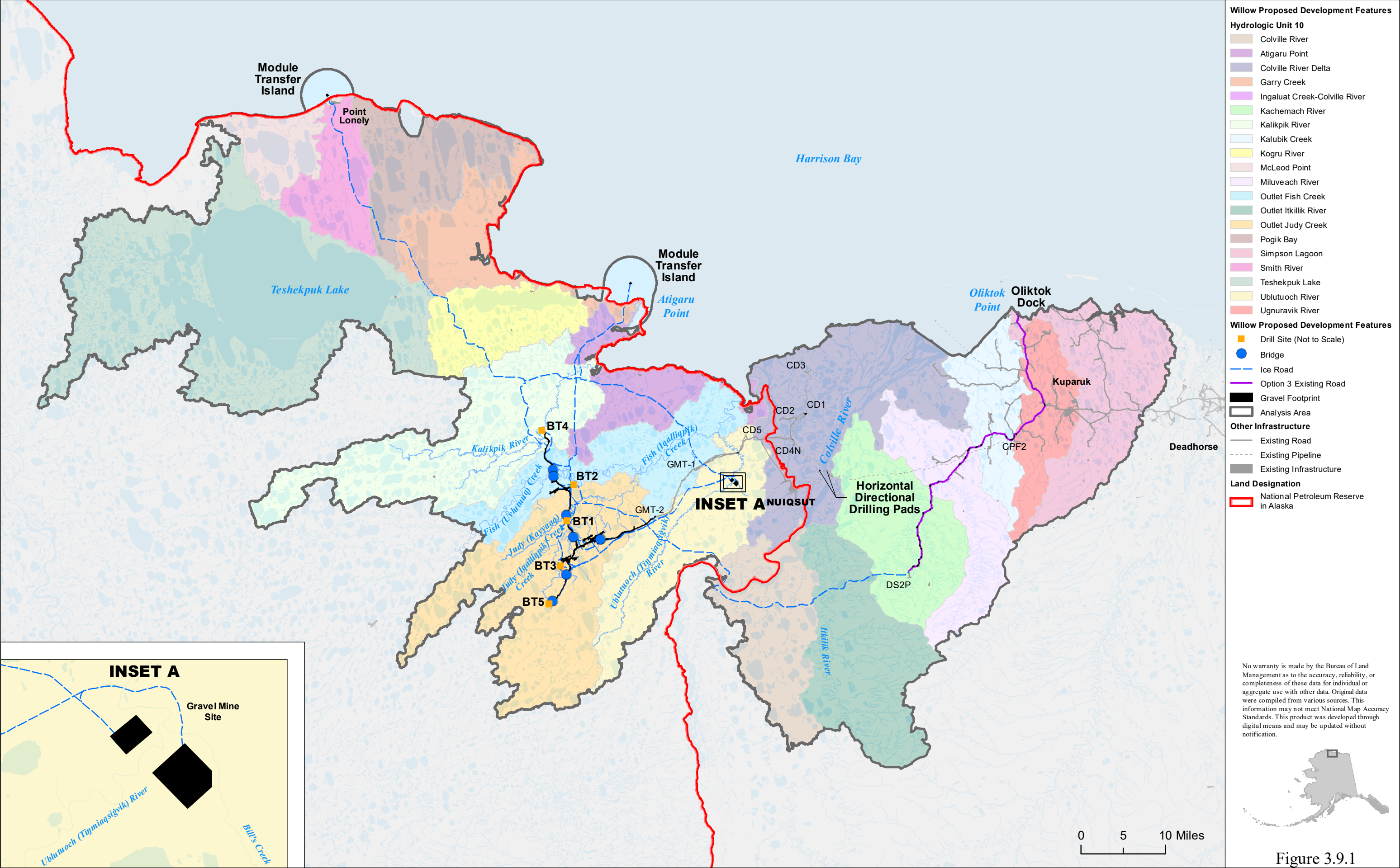


0 5 10 Miles

Figure 3.7.1







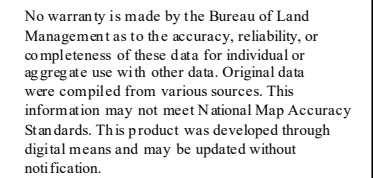
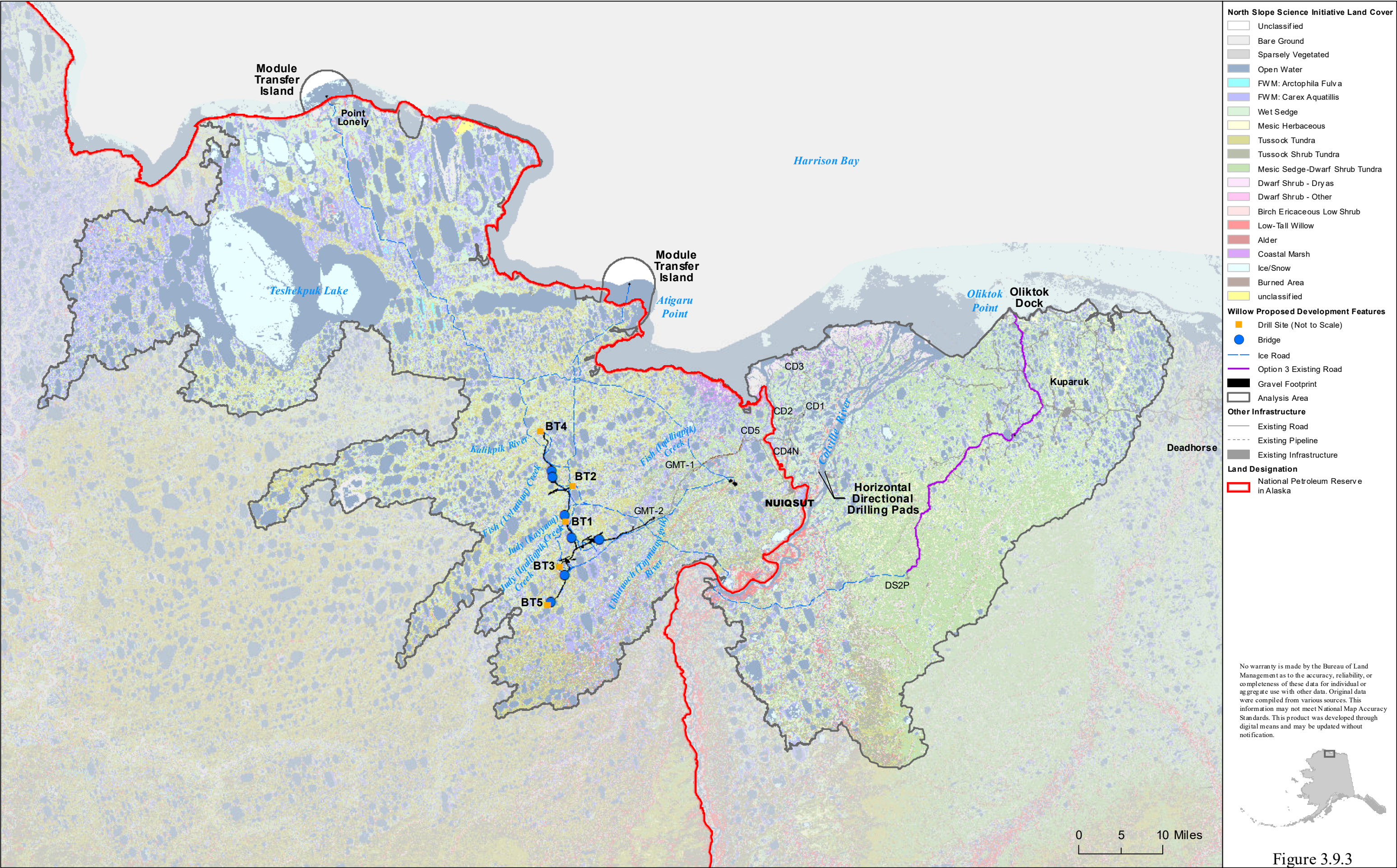


Figure 3.9.2



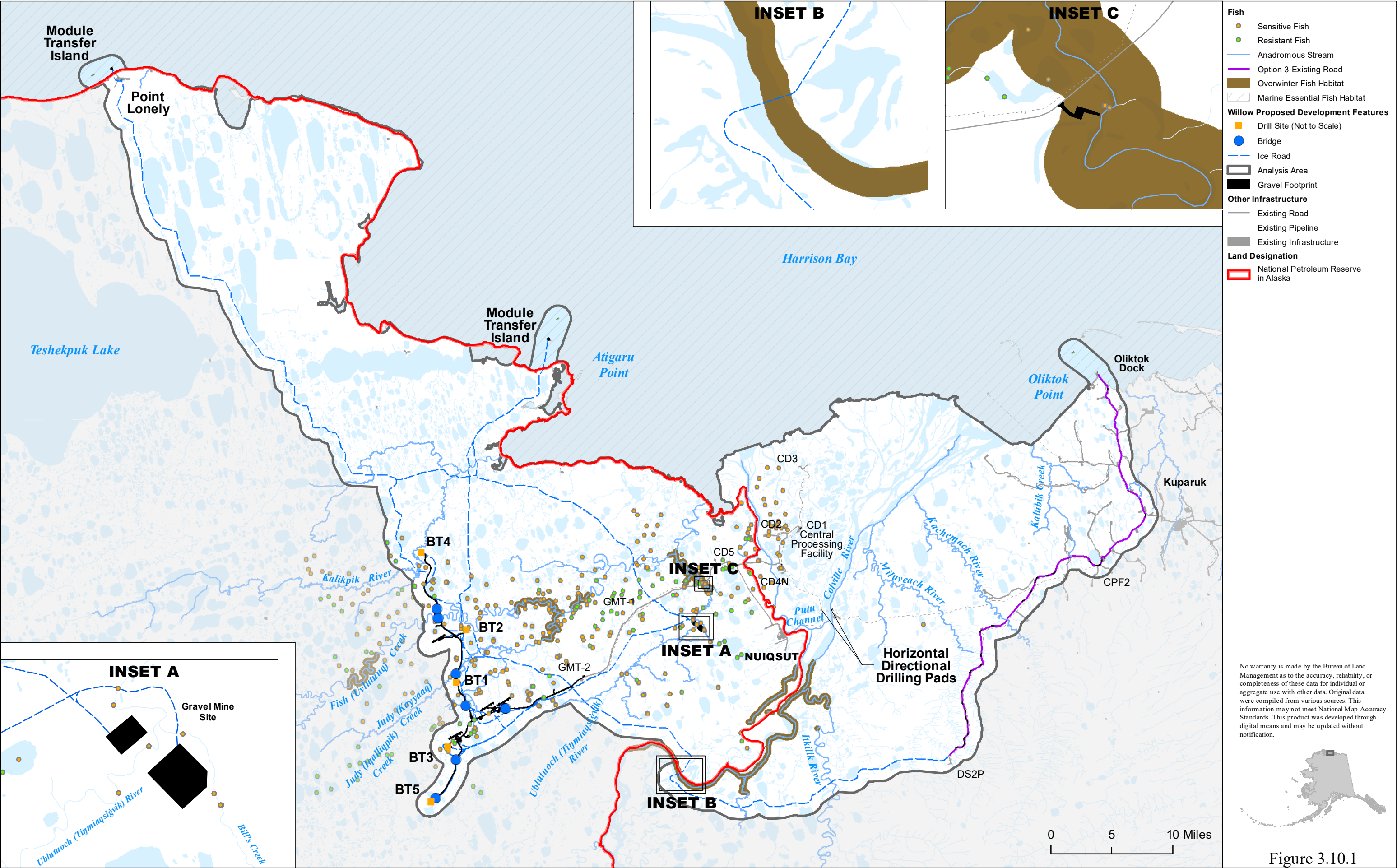
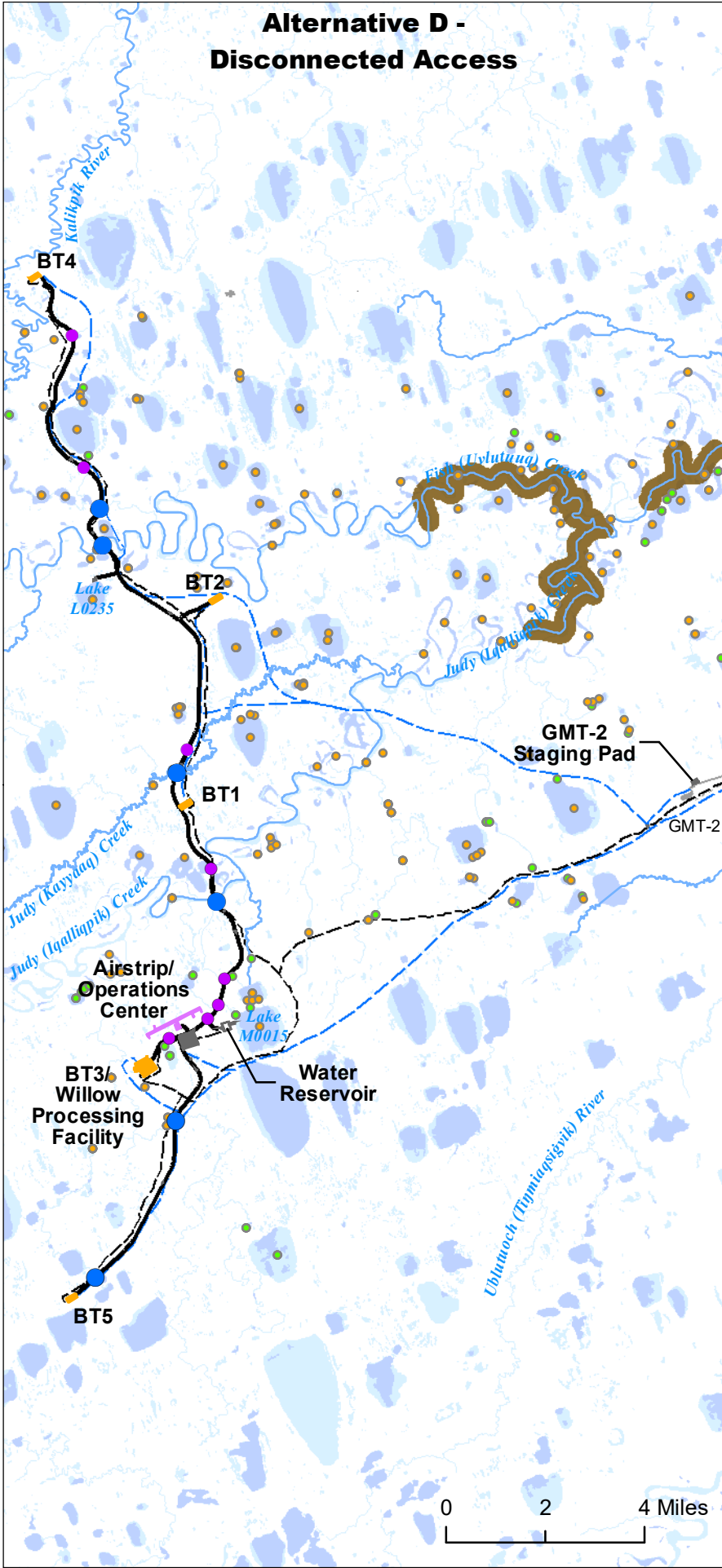
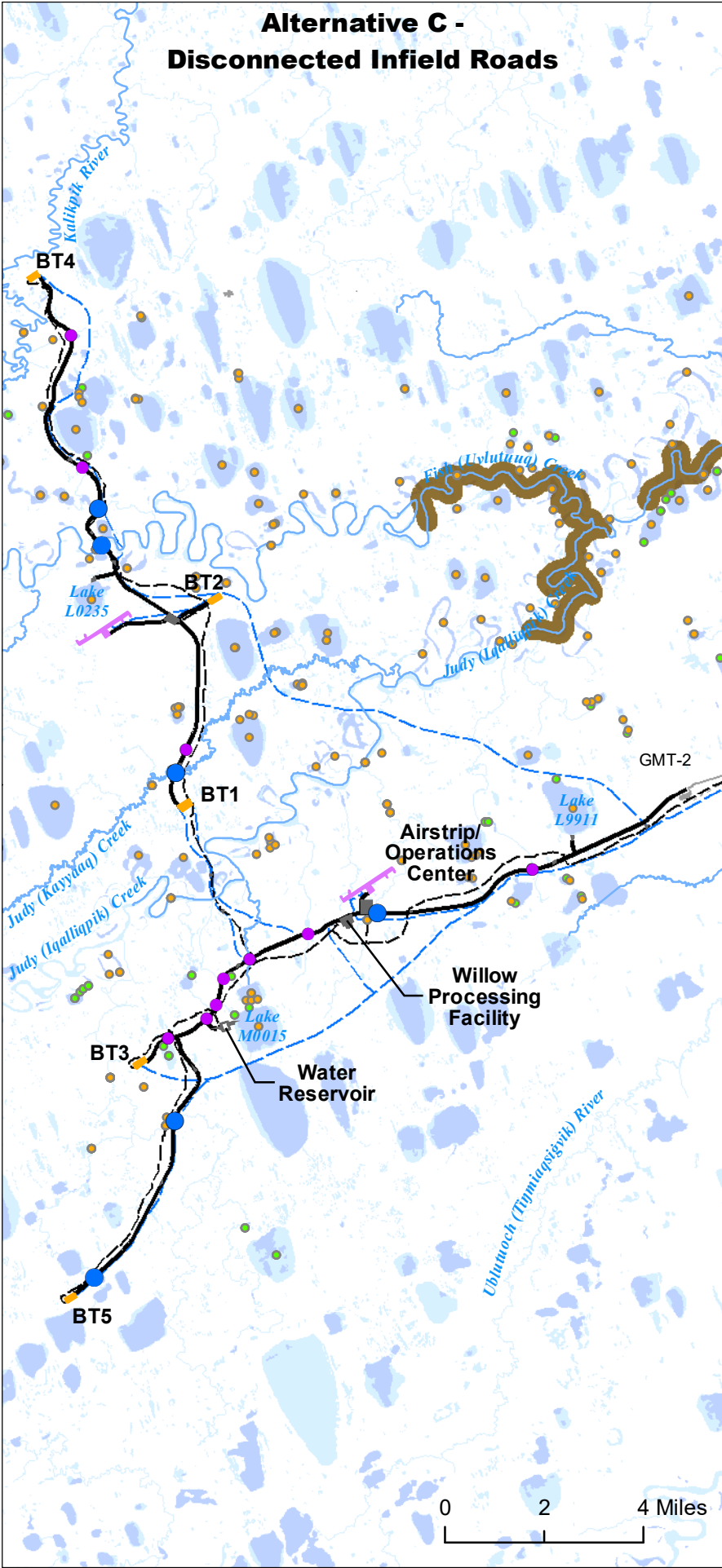
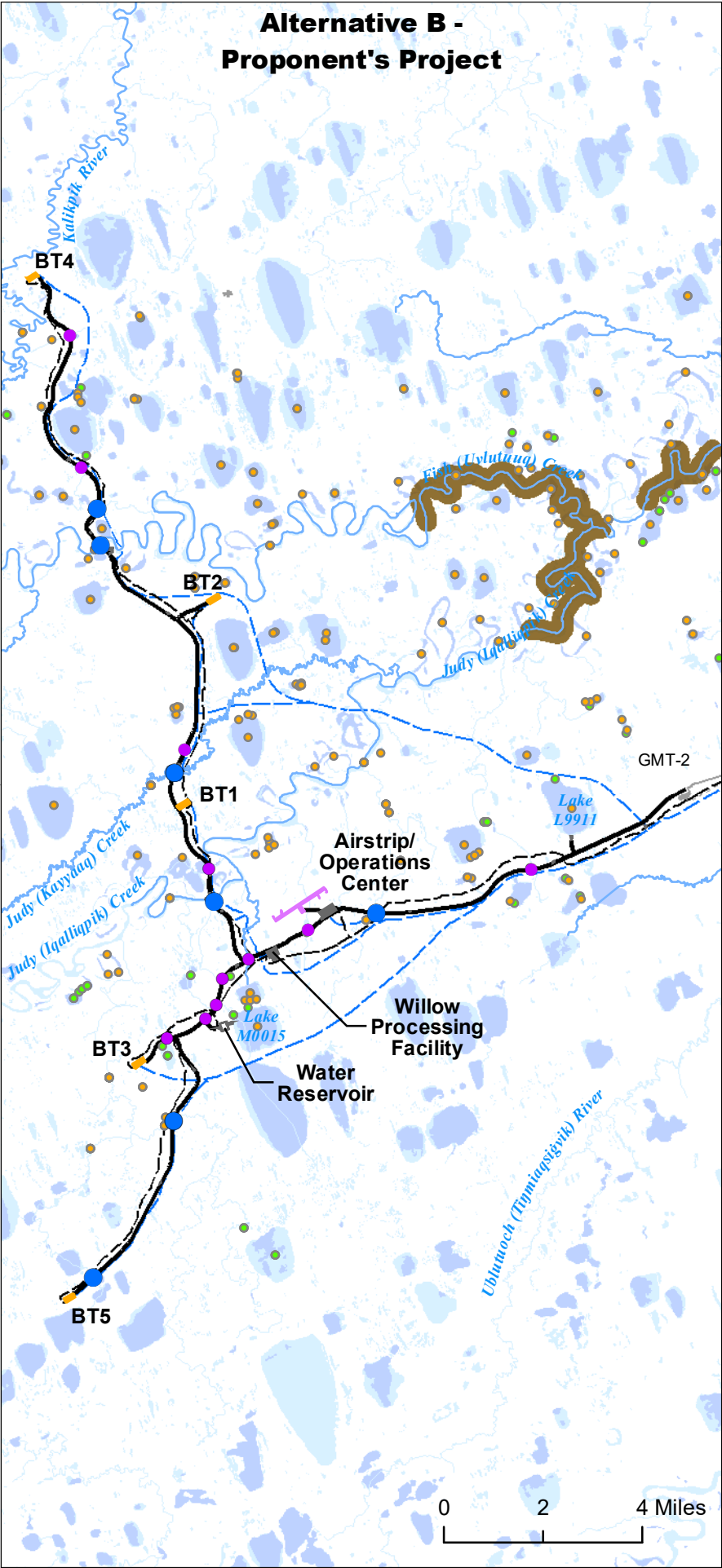


Figure 3.10.1



Fish

- Sensitive Fish
- Resistant Fish

Anadromous Stream

- Anadromous Stream

Overwinter Fish Habitat

- Overwinter Fish Habitat

North Slope Science Initiative

- Winter Liquid Water Availability

Willow Proposed Development Features

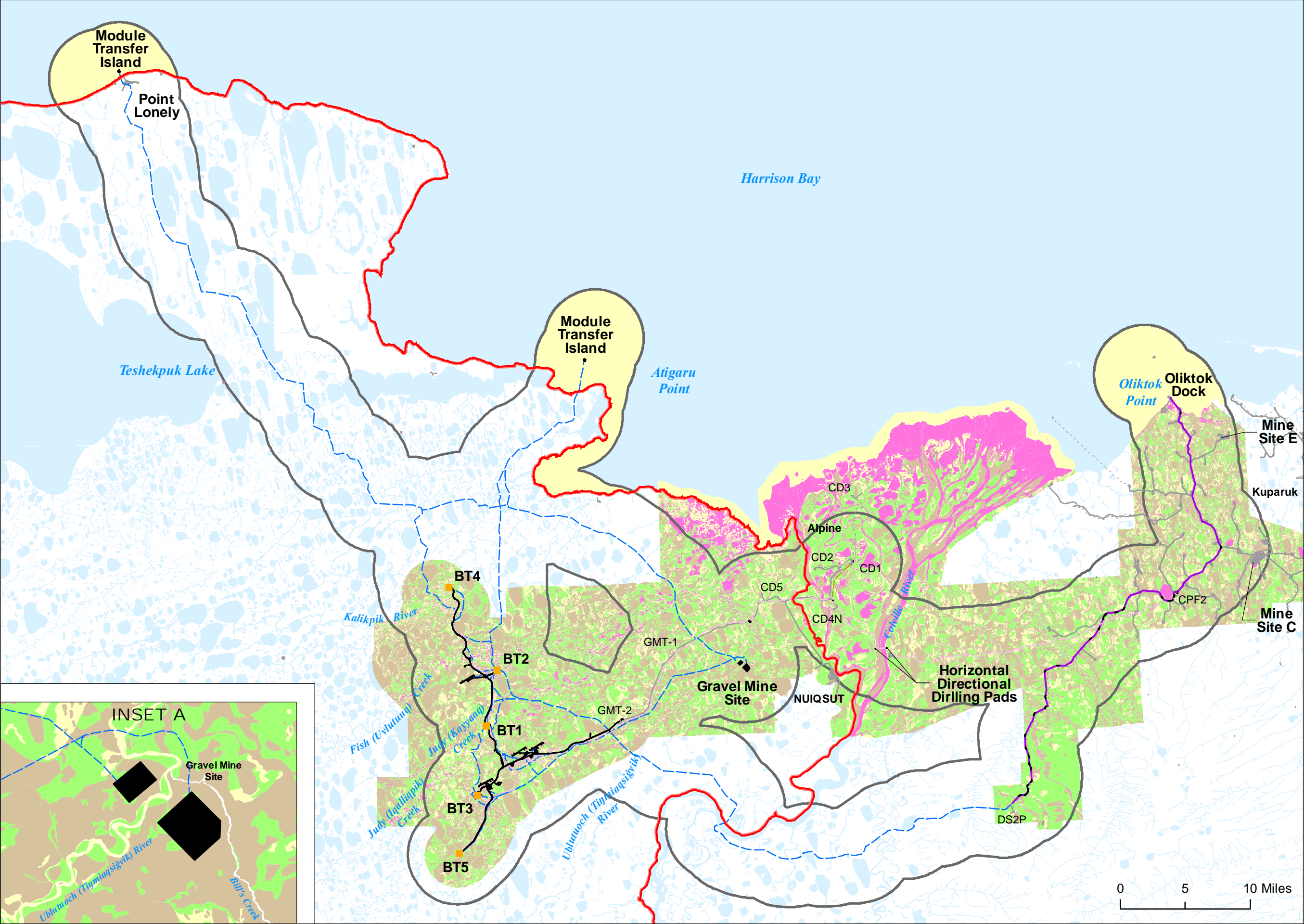
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Dilling Site Pad
- Gravel Pad

Other Infrastructure

- Existing Road
- Existing Infrastructure

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Figure 3.10.2



Bird Habitat

No. of Species Using

- 1-10
- 11 - 20
- 21 - 30
- >30

Willow Proposed Development Features

- Drill Site (Not to Scale)
- Ice Road
- New Pipeline Existing VSM
- New Pipeline New VSM
- Option 3 Existing Road
- Gravel Footprint
- Analysis Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

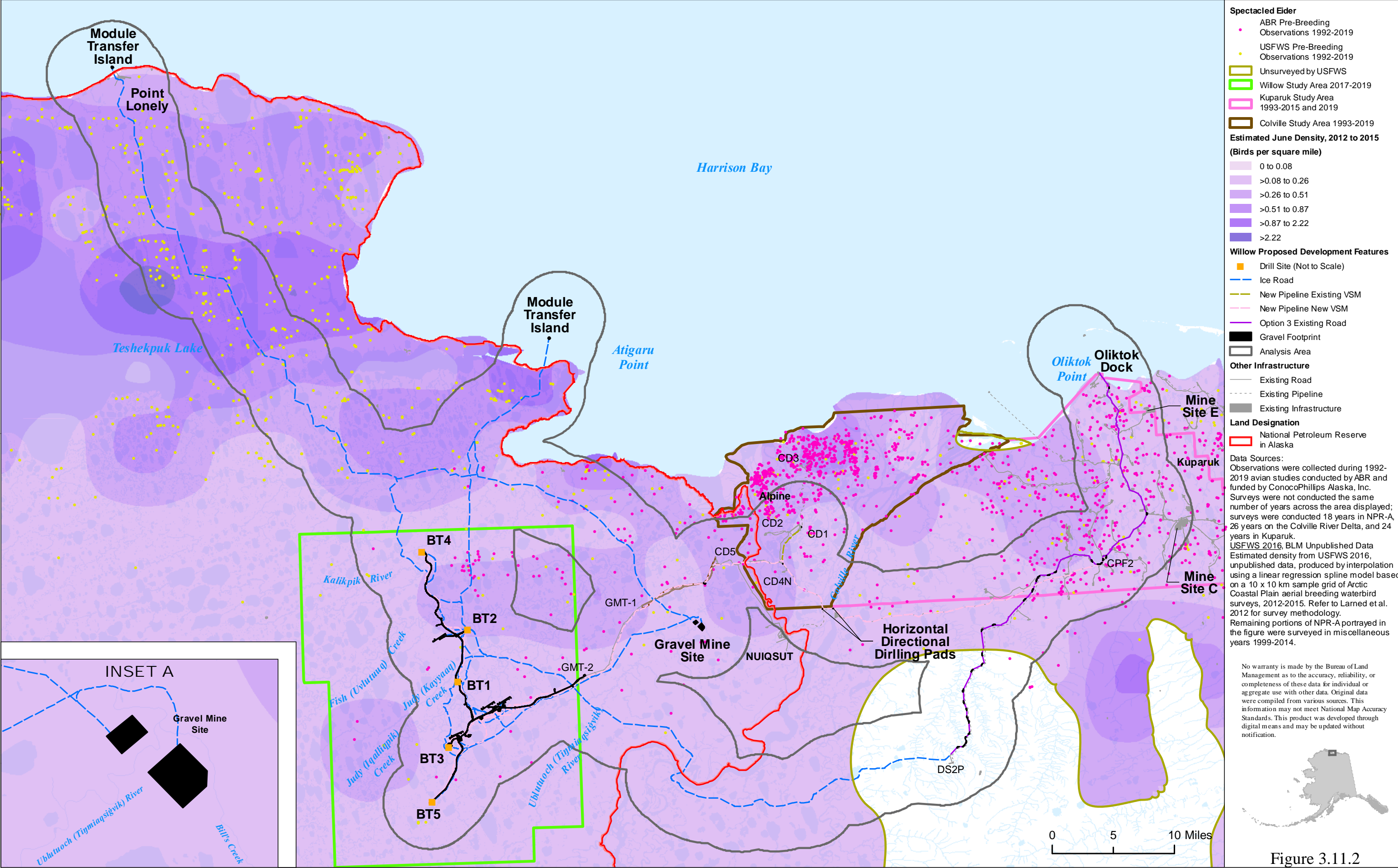
Land Designation

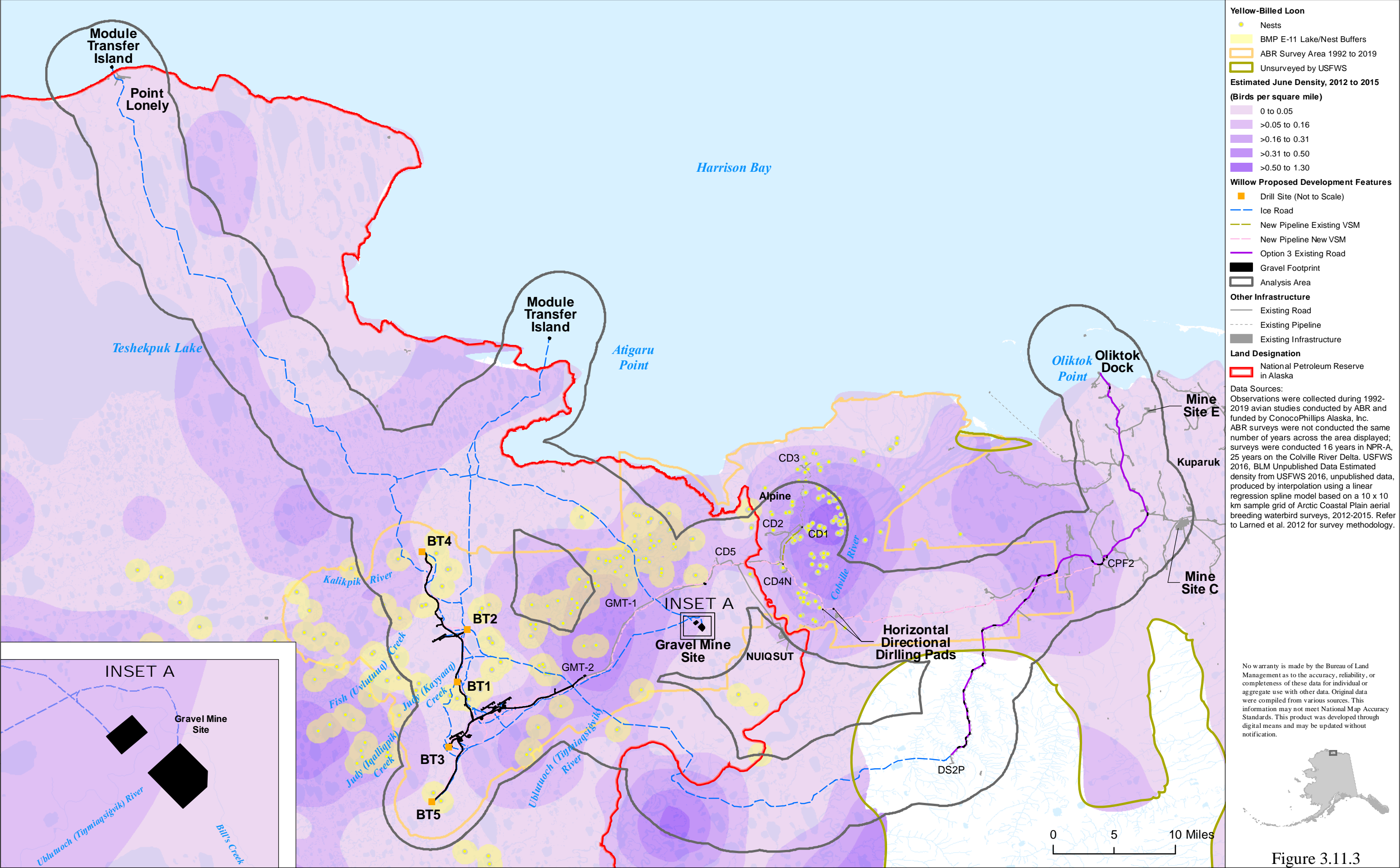
- National Petroleum Reserve in Alaska

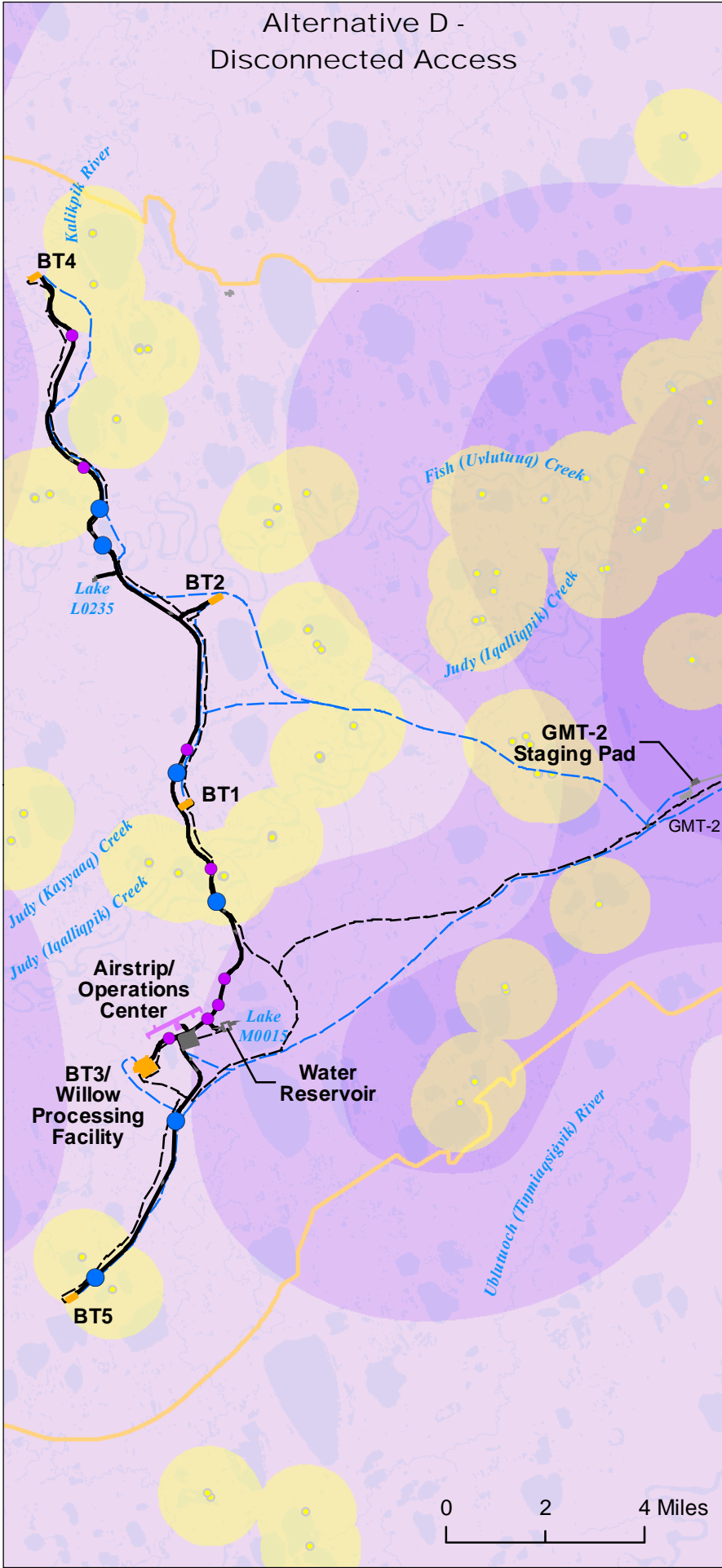
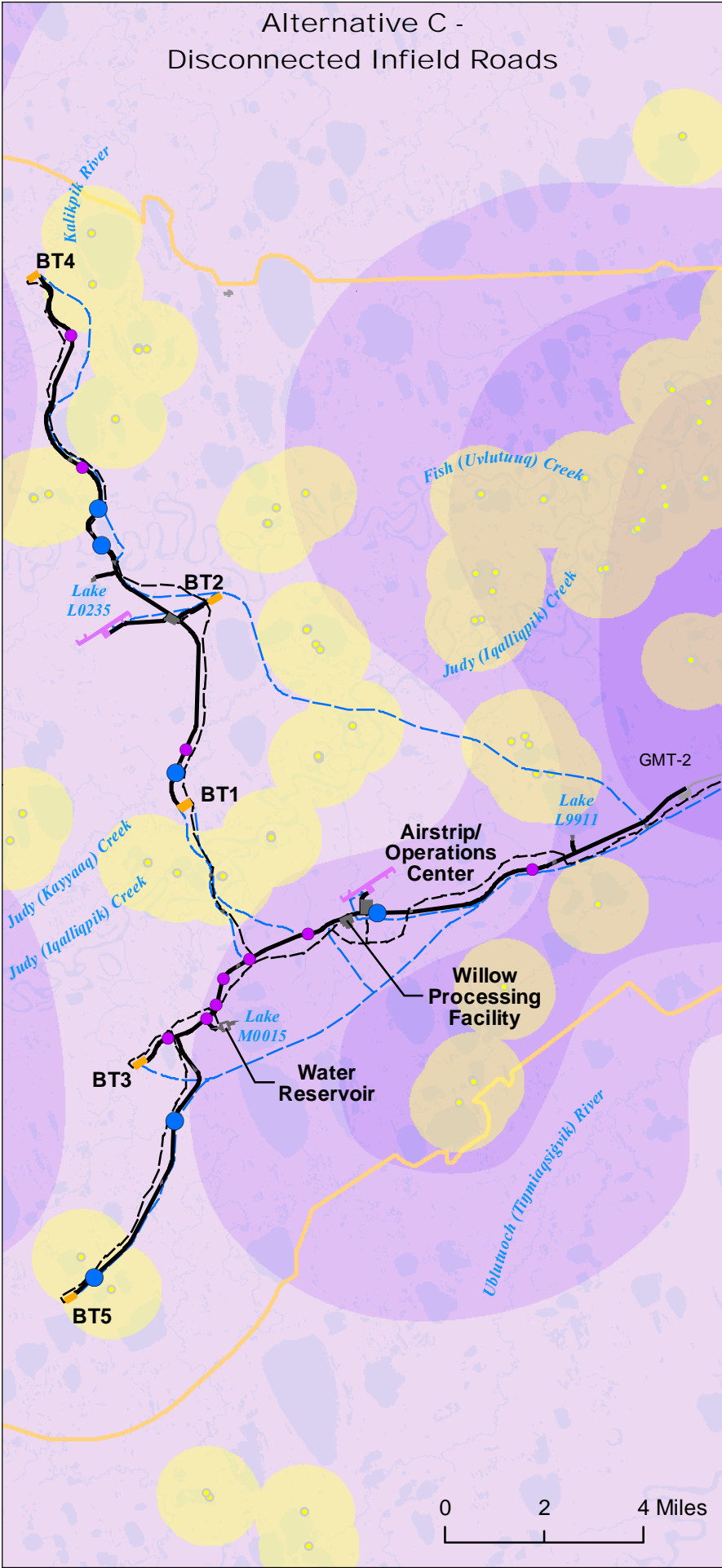
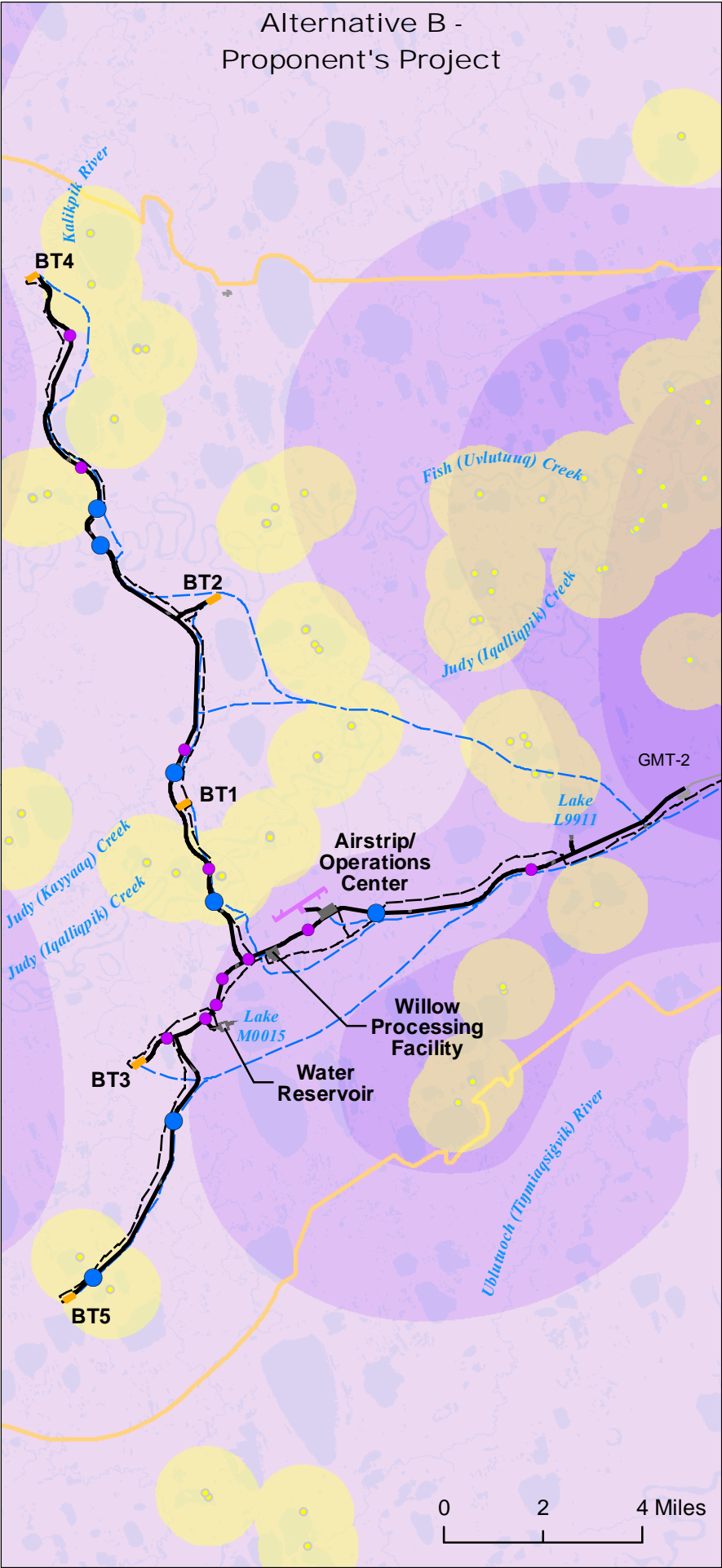
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Figure 3.11.1







Yellow-Billed Loon

- Nests
- Lake/Nest Buffer
- ABR Survey Area 1992 to 2019

Estimated June Density, 2012 to 2015
(Birds per square mile)

- 0 to 0.05
- >0.05 to 0.16
- >0.16 to 0.31
- >0.31 to 0.50
- >0.50 to 1.30

Willow Proposed Development Features

- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Dilling Site Pad
- Gravel Pad

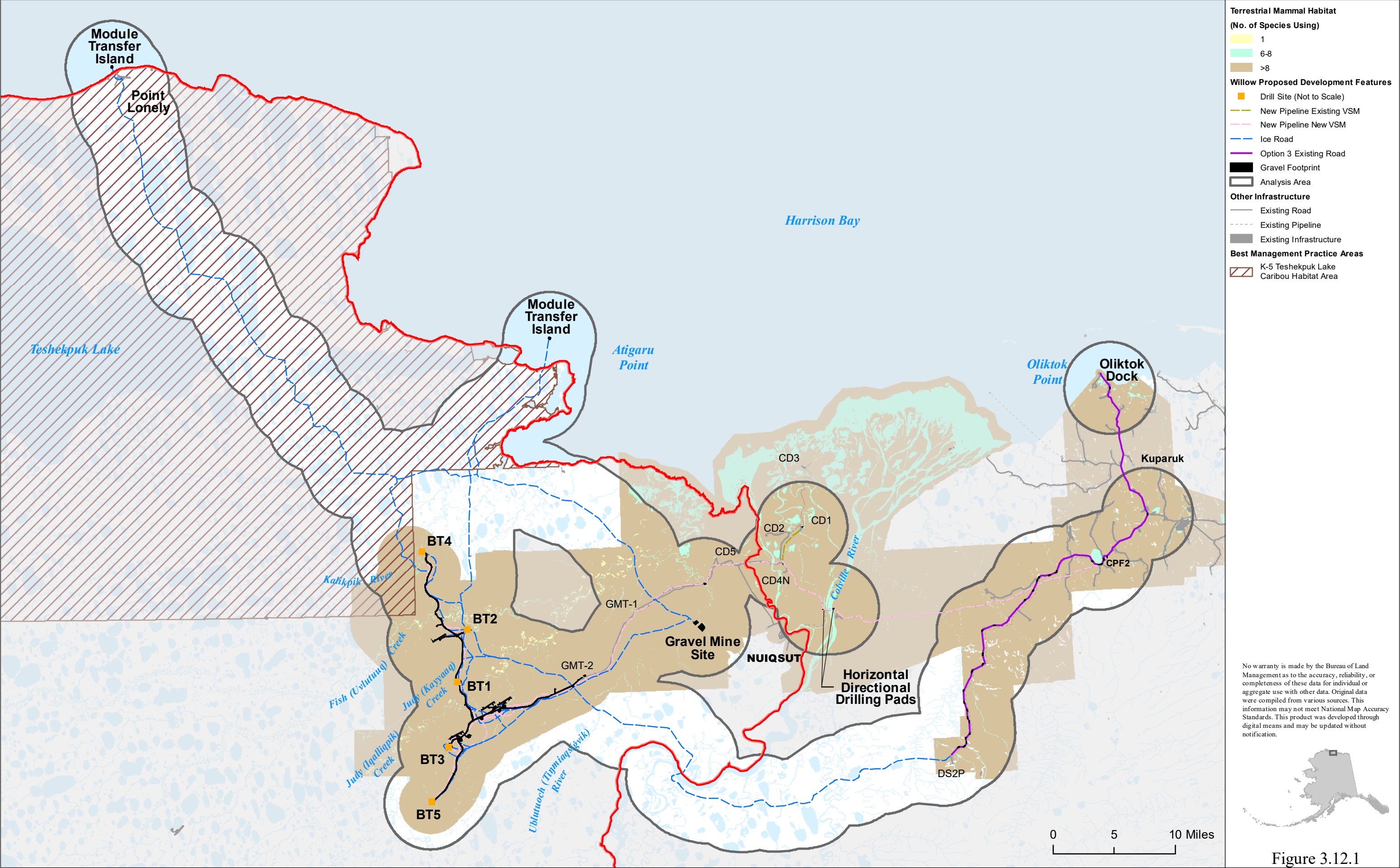
Other Infrastructure

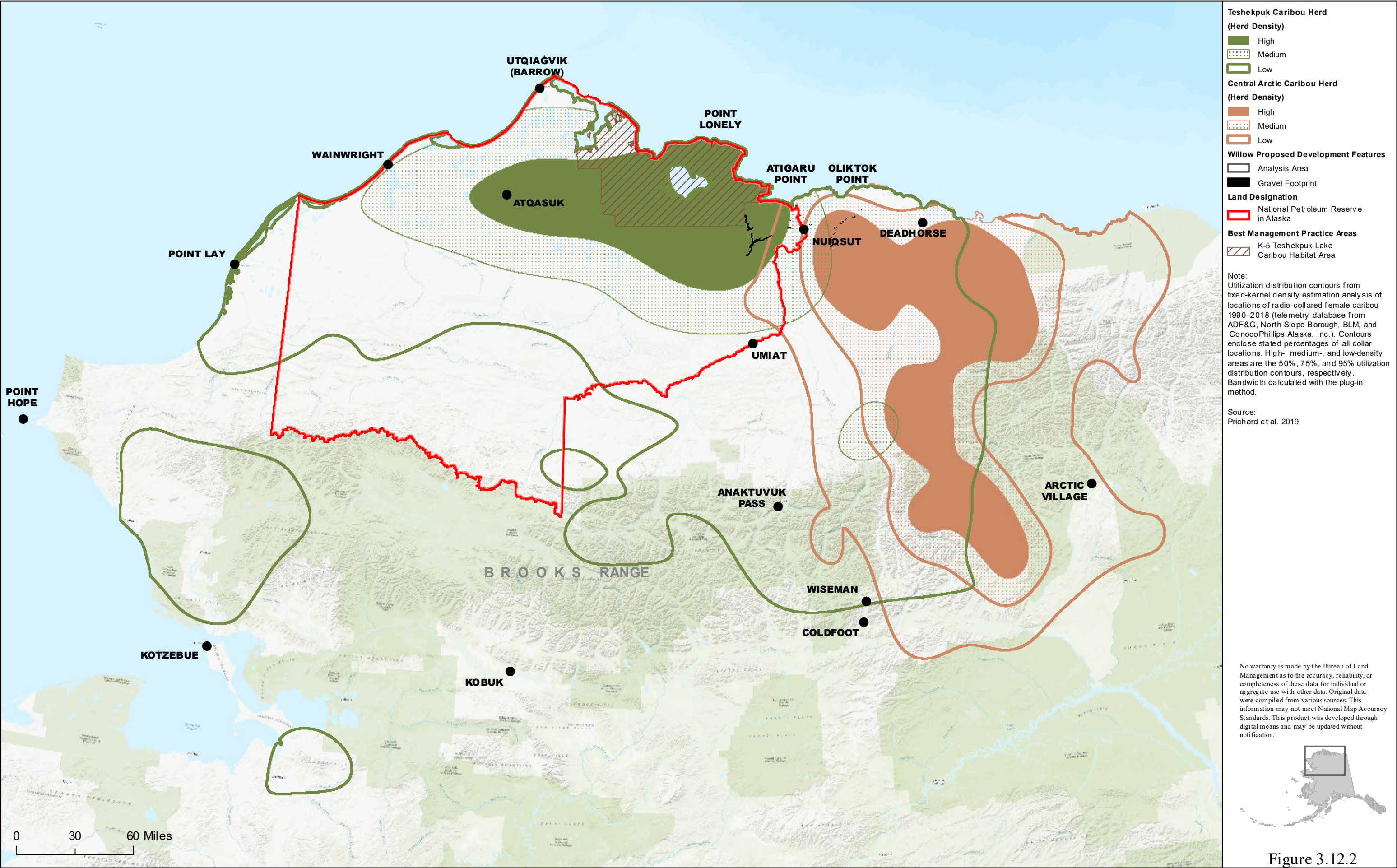
- Existing Road
- Existing Pipeline
- Existing Infrastructure

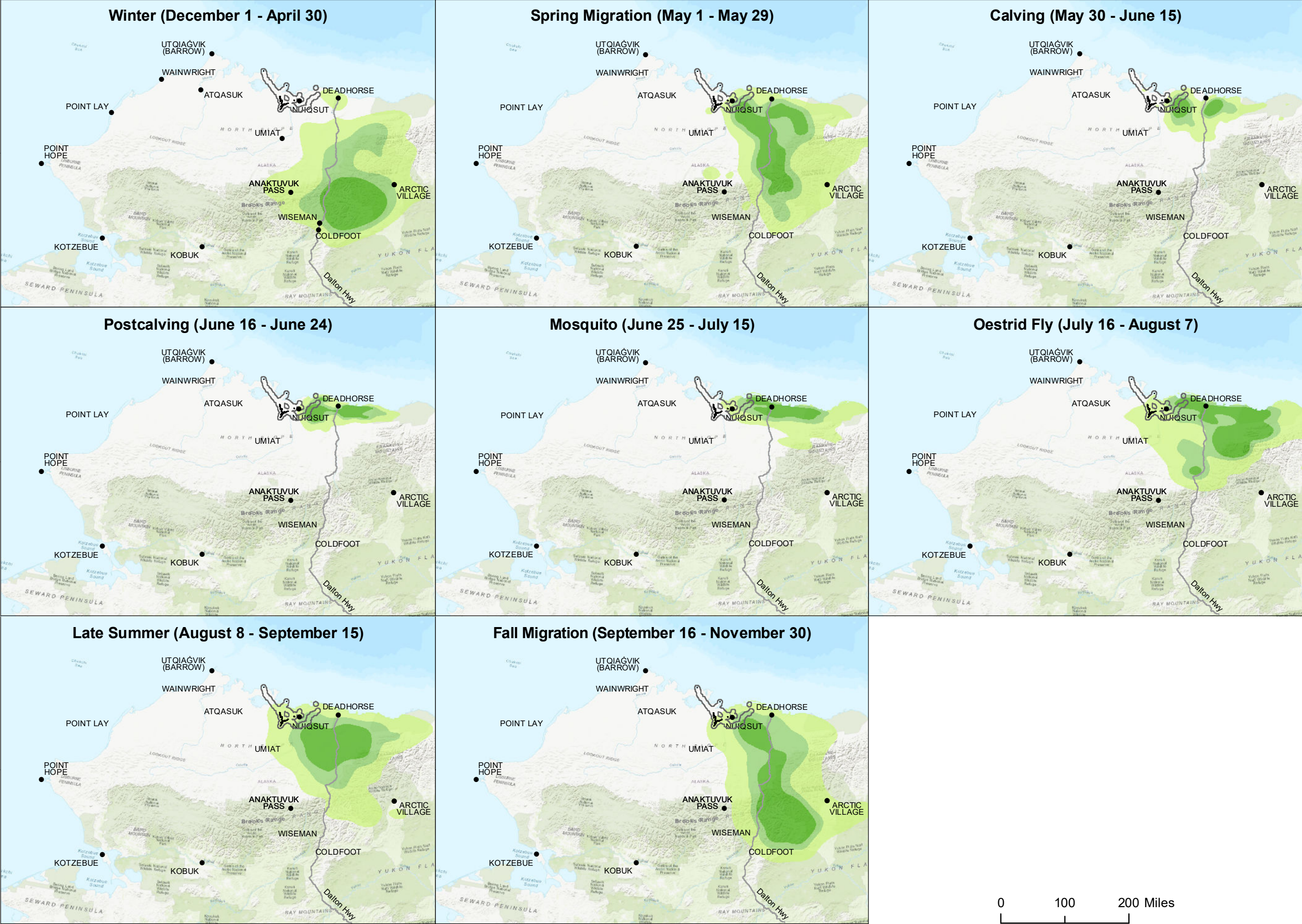
Data Sources:
Observations were collected during 2001-2010, 2014, 2017-2019 2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. ABR surveys were not conducted the same number of years across the area displayed; surveys were conducted 16 years in NPR-A, 25 years on the Colville River Delta. USFWS 2013, BLM Unpublished Data. Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned et al. 2012 for survey methodology.

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Figure 3.11.4







Central Arctic Herd
(Female Density)

High
Medium
Low

Willow Proposed Development Features

Analysis Area
Gravel Footprint

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
Prichard et al. 2019

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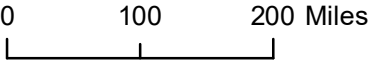
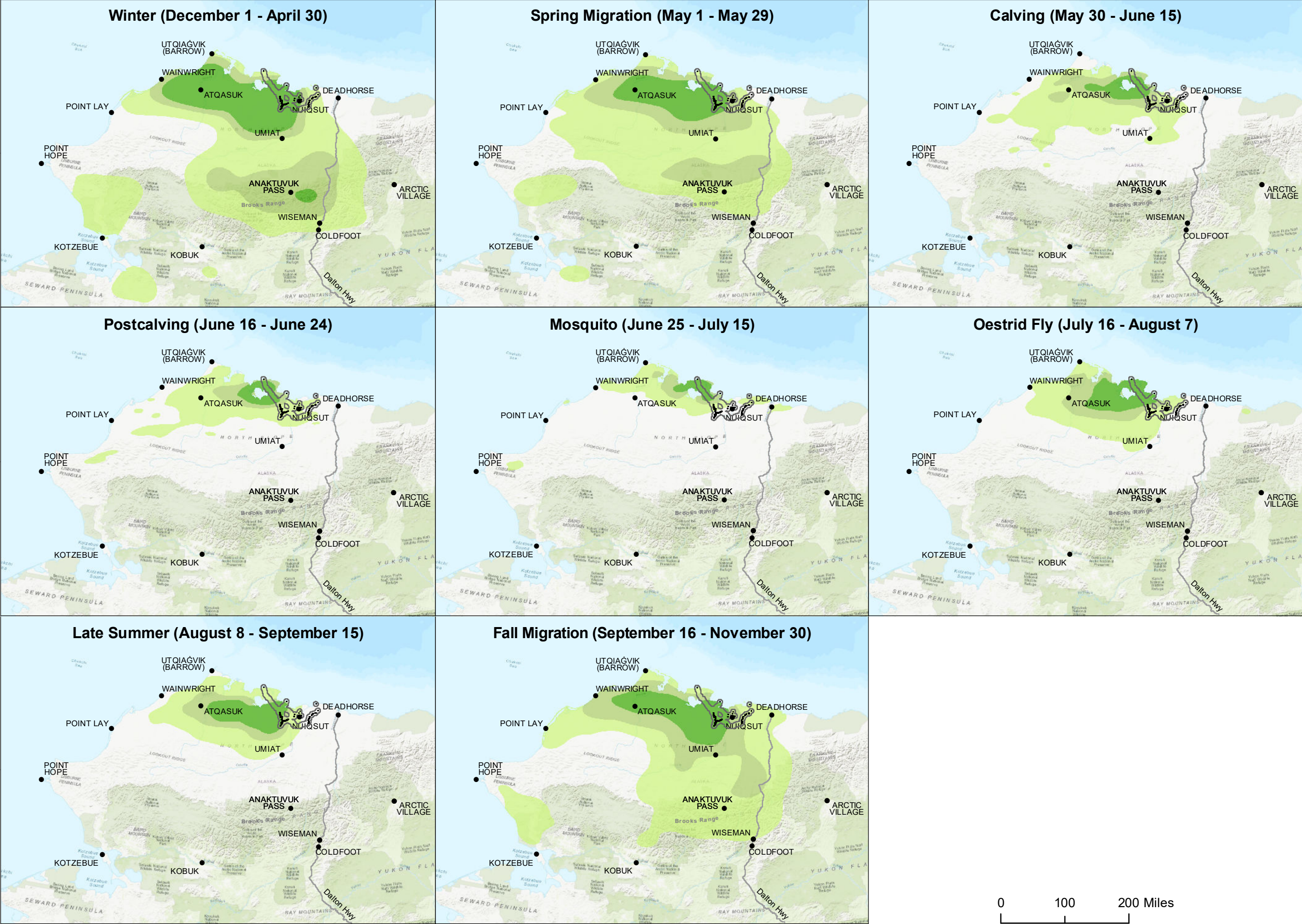


Figure 3.12.3



Teshekpuk Caribou Herd
(Female Density)

- High
- Medium
- Low

Willow Proposed Development Features

- Analysis Area
- Gravel Footprint

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
Prichard et al. 2019

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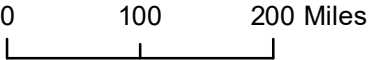
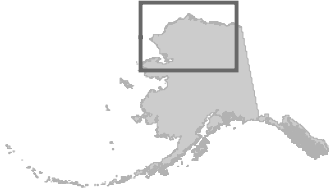
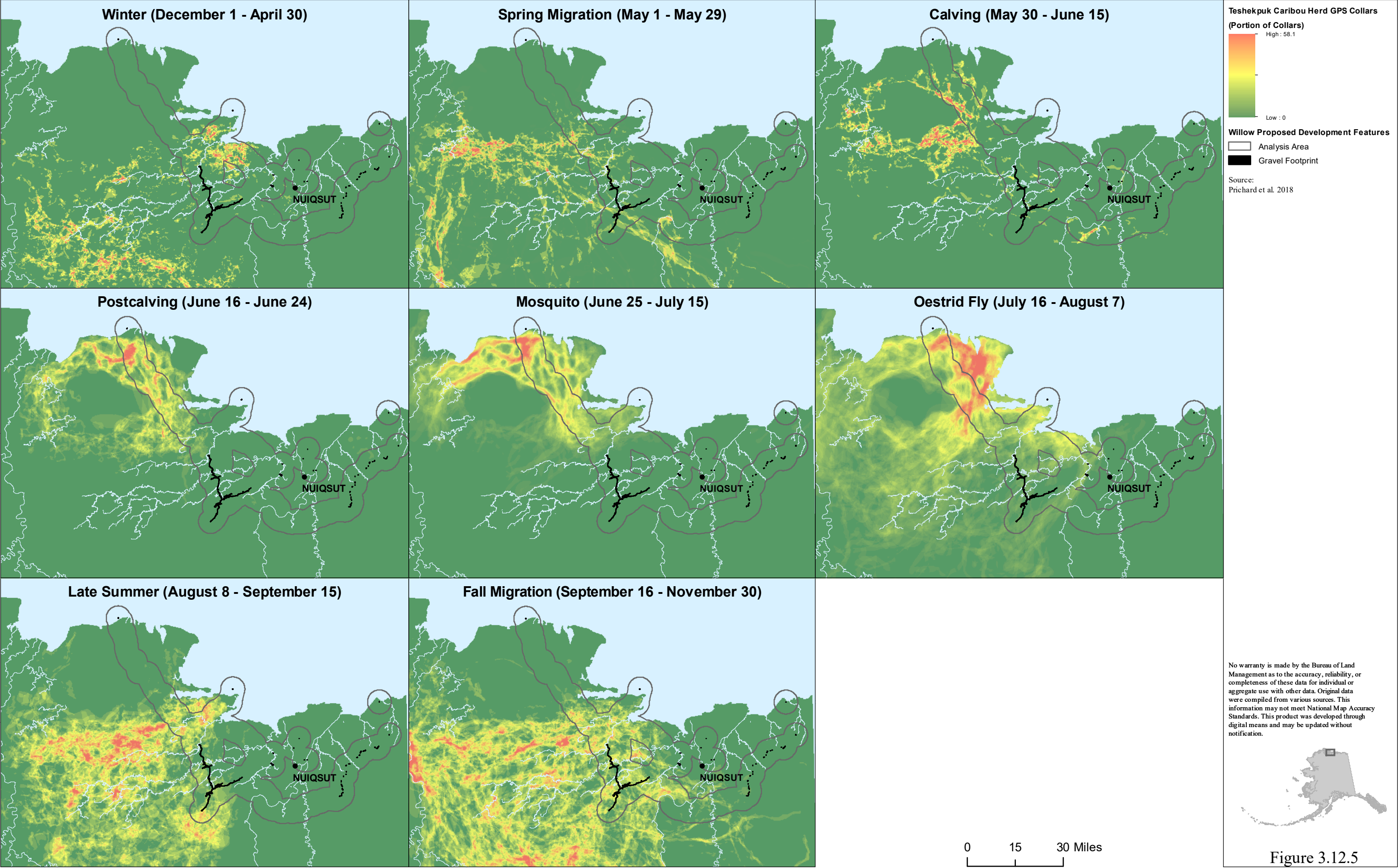


Figure 3.12.4



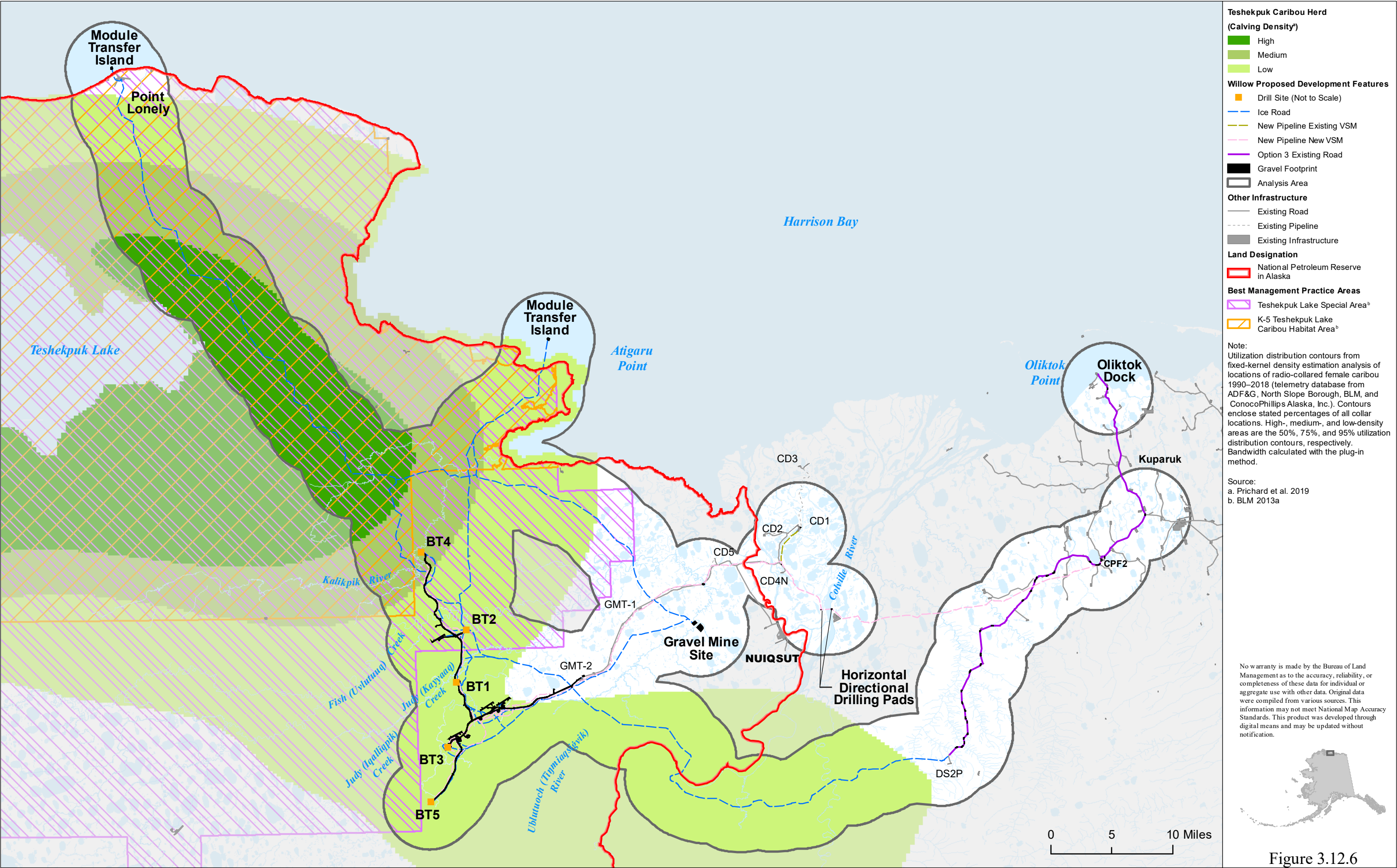
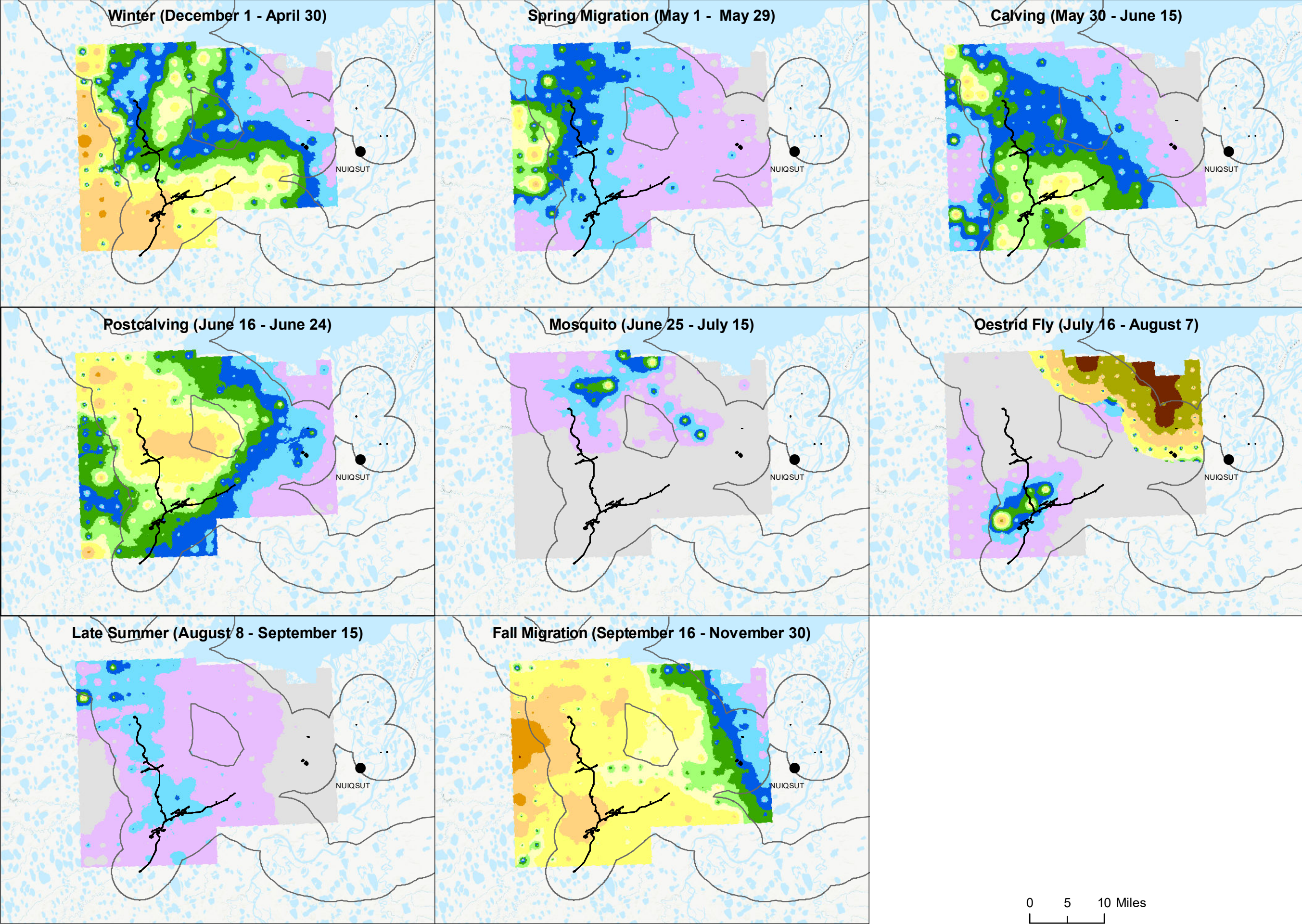


Figure 3.12.6



Mean Caribou Density
(caribou per square kilometer)

0.0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1
1.0 - 2.0
2.0 - 5.0
5.0 - 100.0

Willow Proposed Development Features

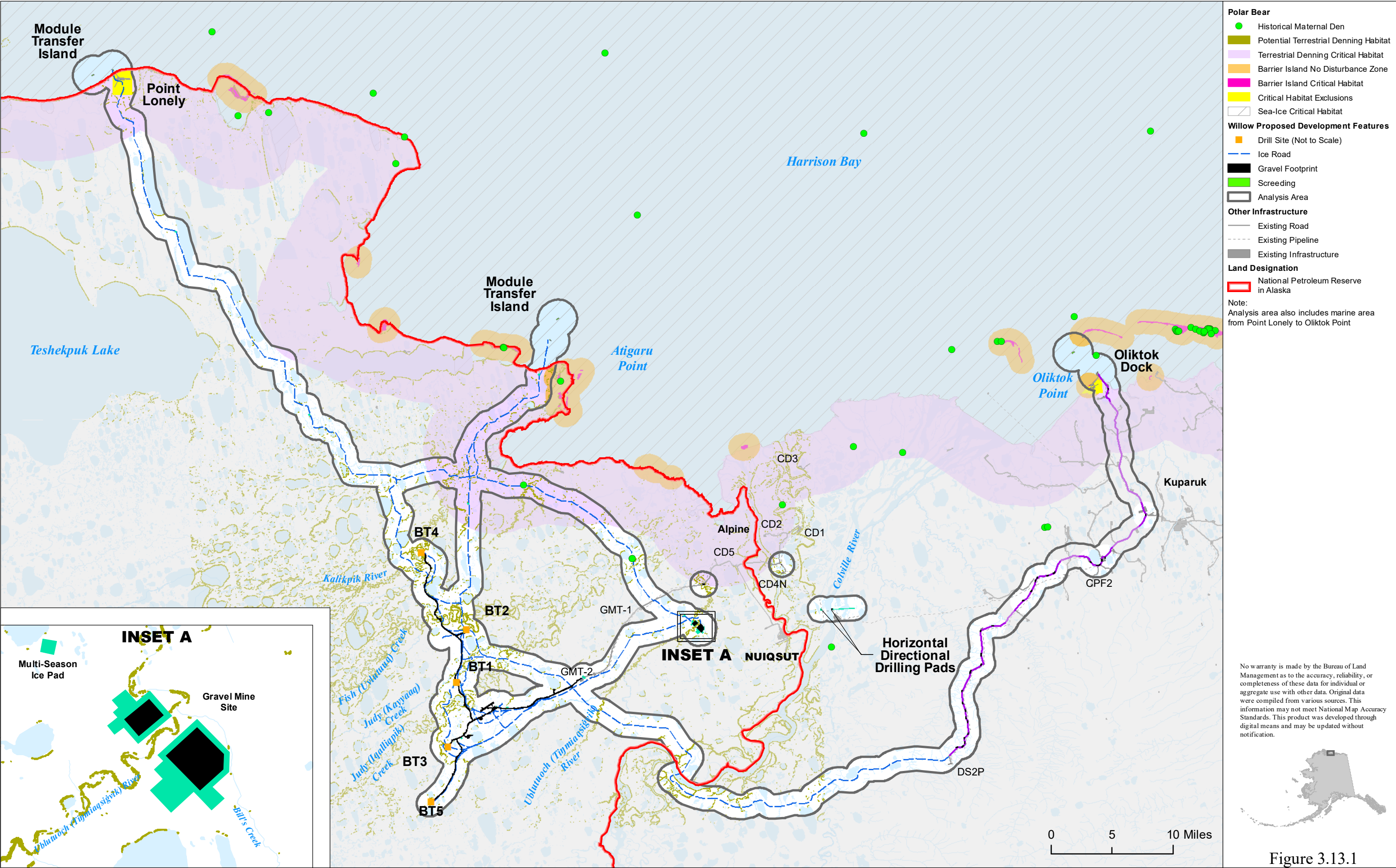
Analysis Area
Gravel Footprint

Source:
Prichard et al. 2018

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0 5 10 Miles

Figure 3.12.7



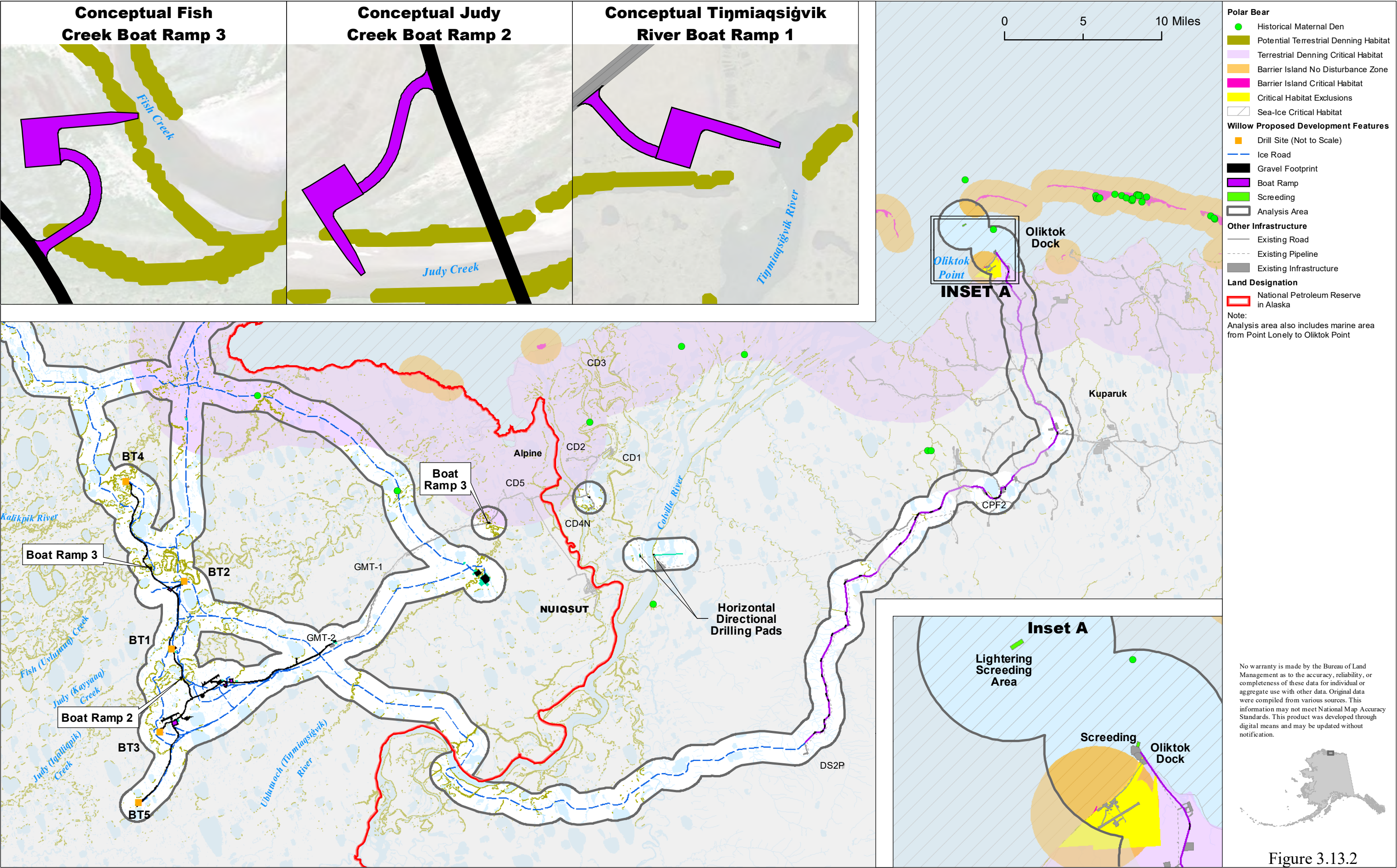
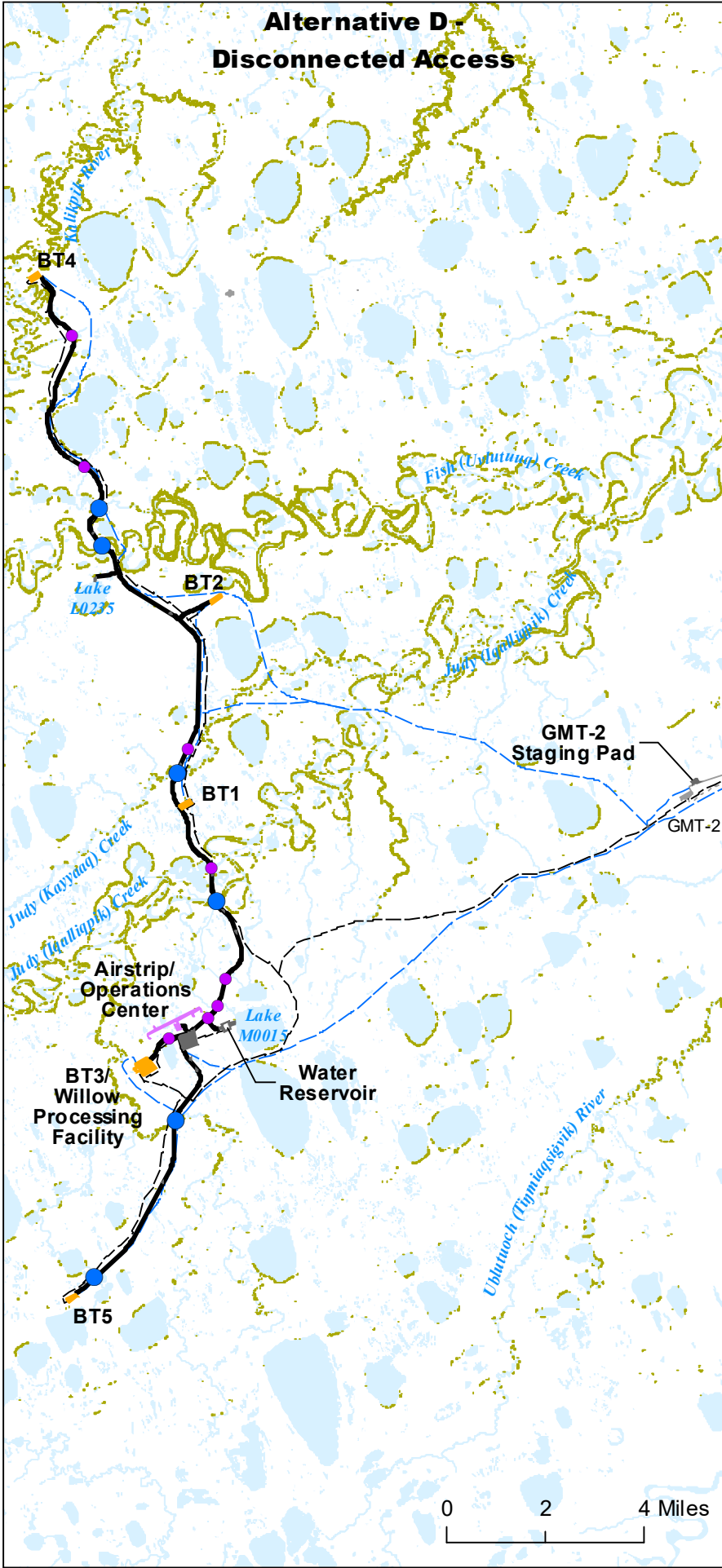
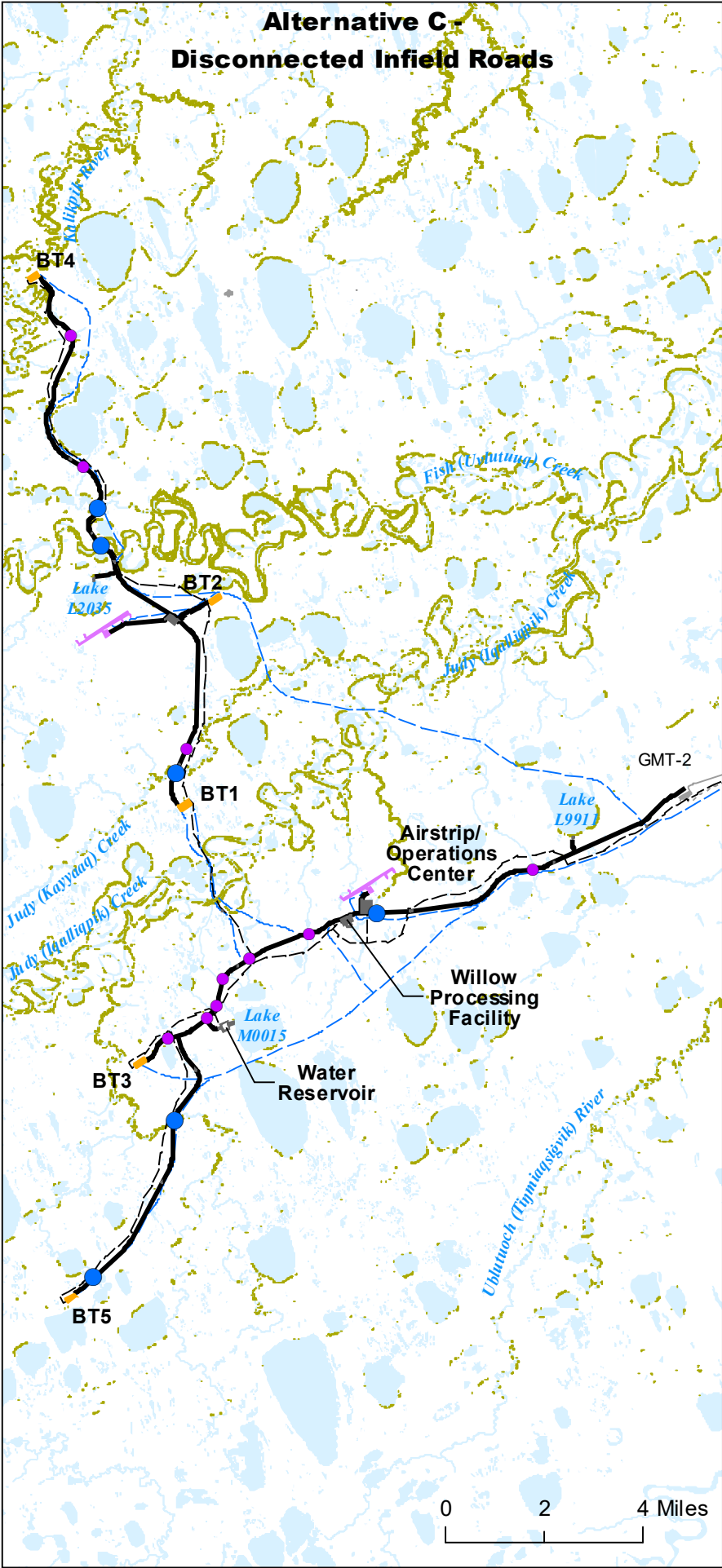
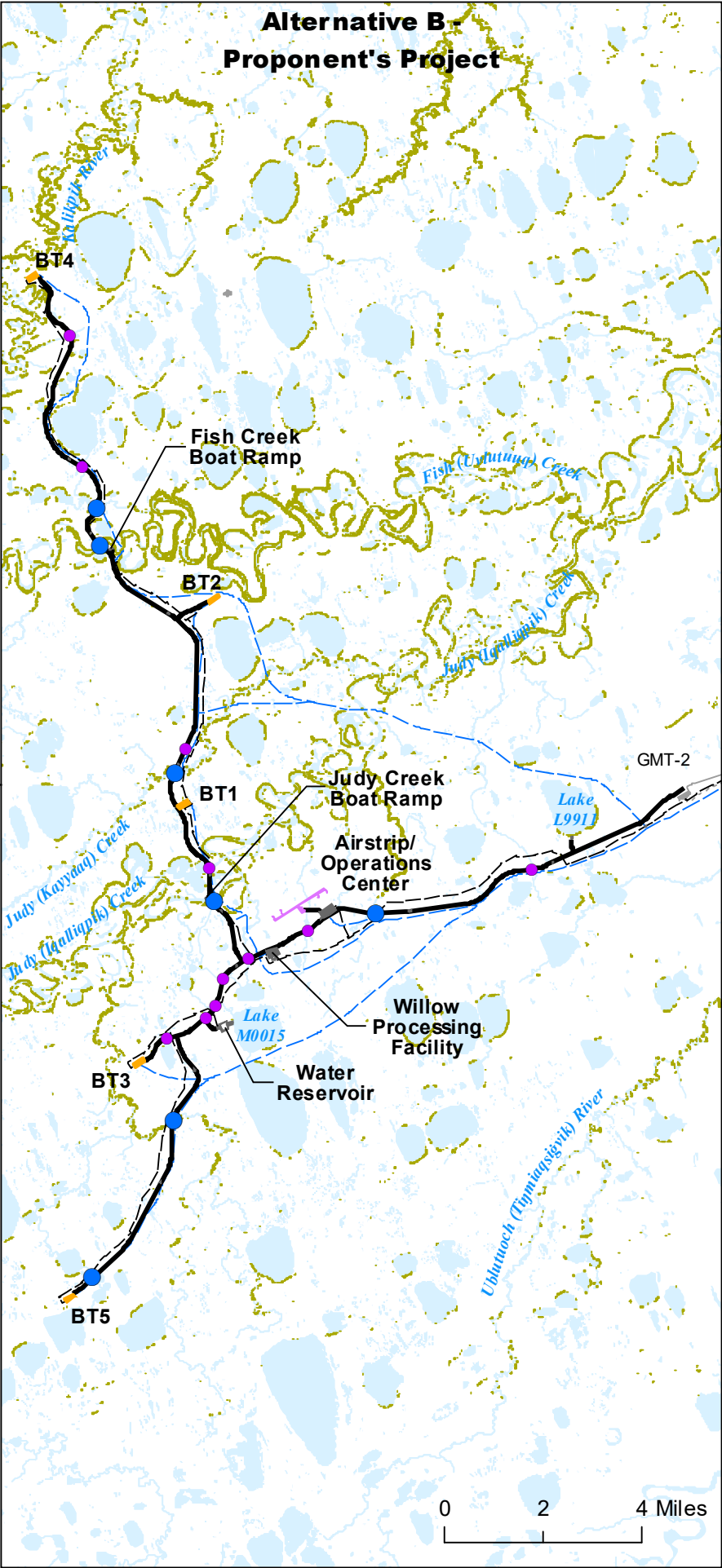


Figure 3.13.2



Polar Bear

- Potential Terrestrial Denning Habitat

Willow Proposed Development Features

- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Dill Site
- Gravel Pad

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Sources:
Observations were collected during 1992-2018 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 17 years in NPR-A, 25 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2013, BLM Unpublished Data
Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned et al. 2012 for survey methodology.

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Figure 3.13.3

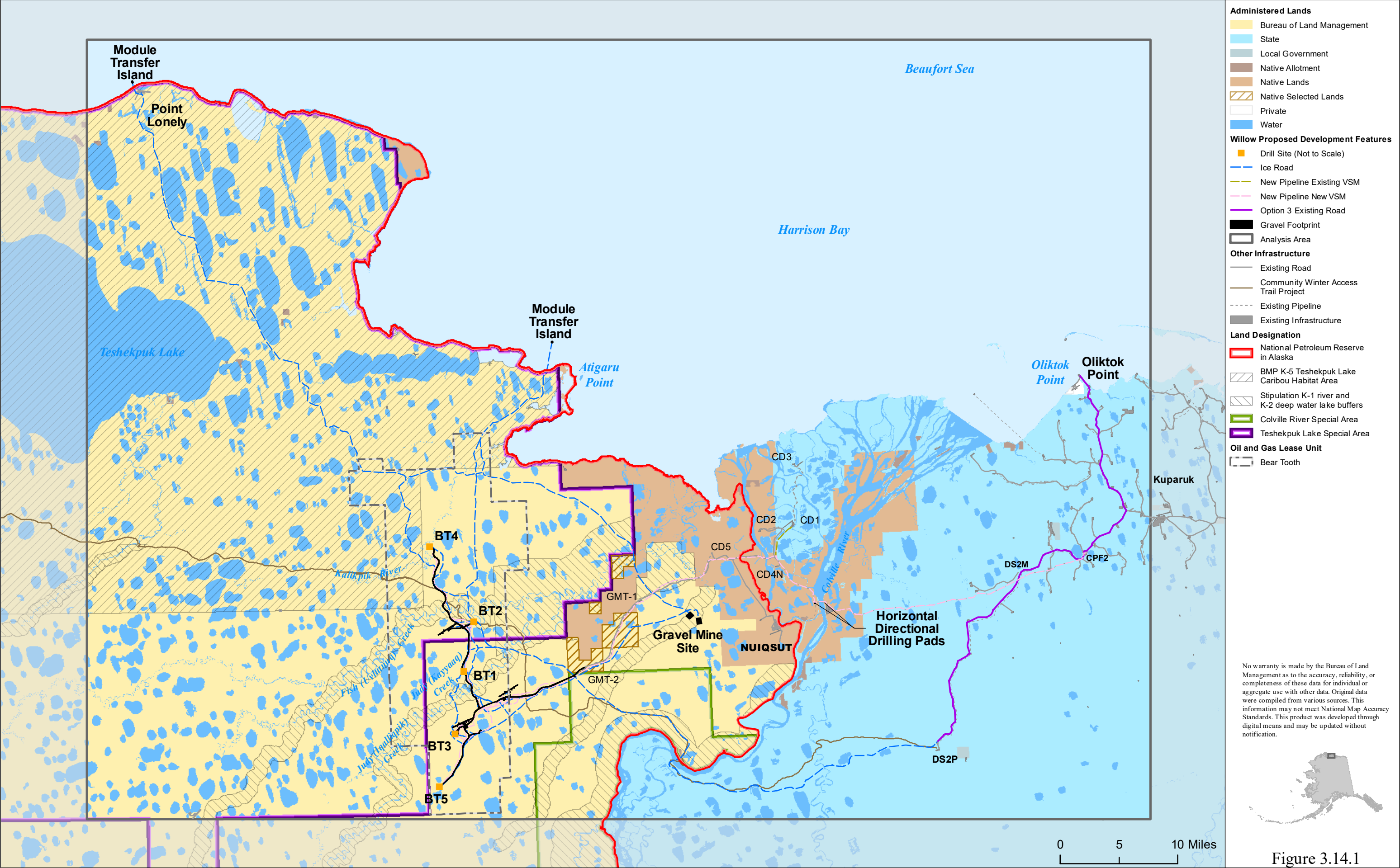
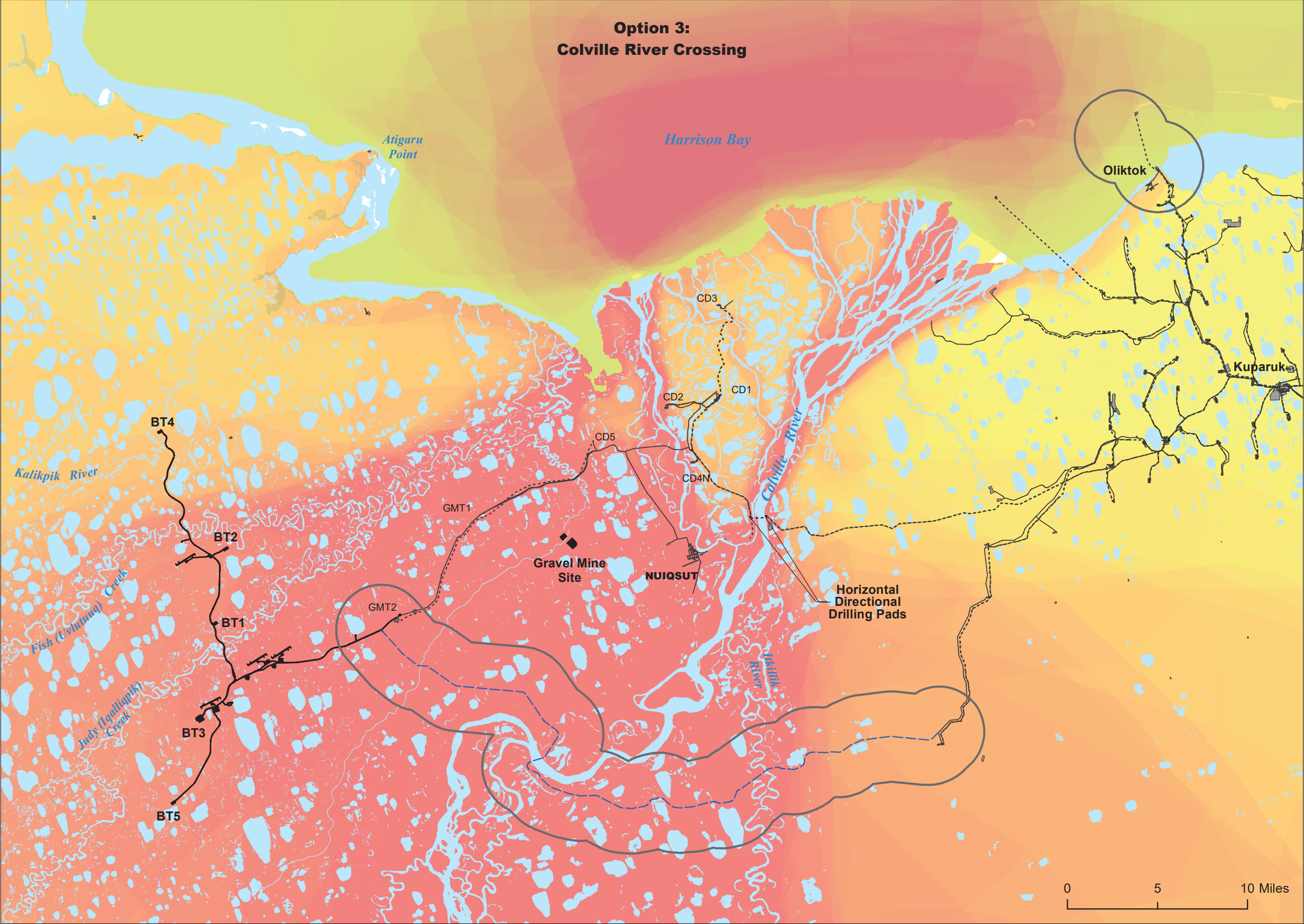


Figure 3.14.1



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low All Resources, 1995-2006 ^a

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

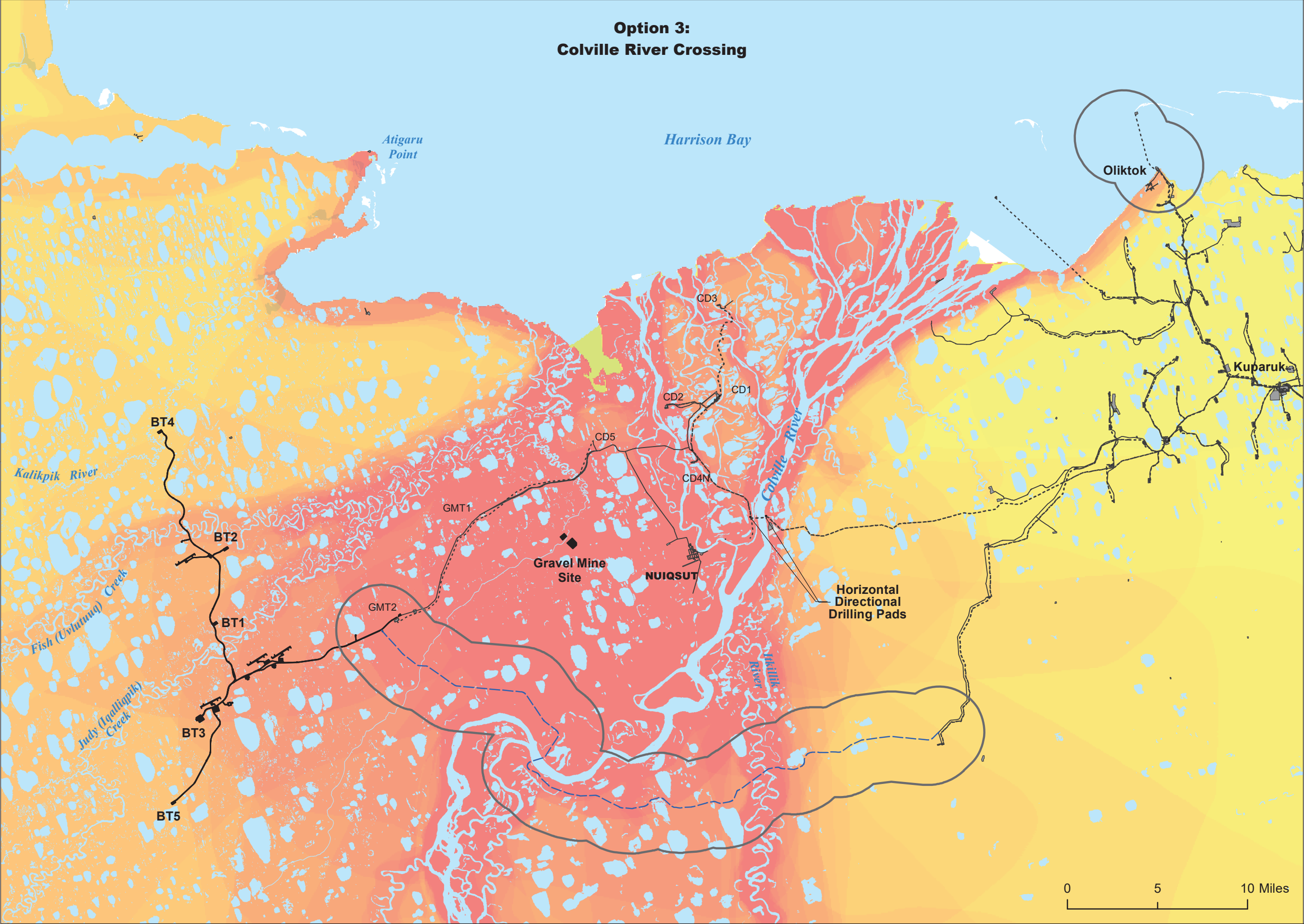
Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.1



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low Caribou, 1995-2006^a

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

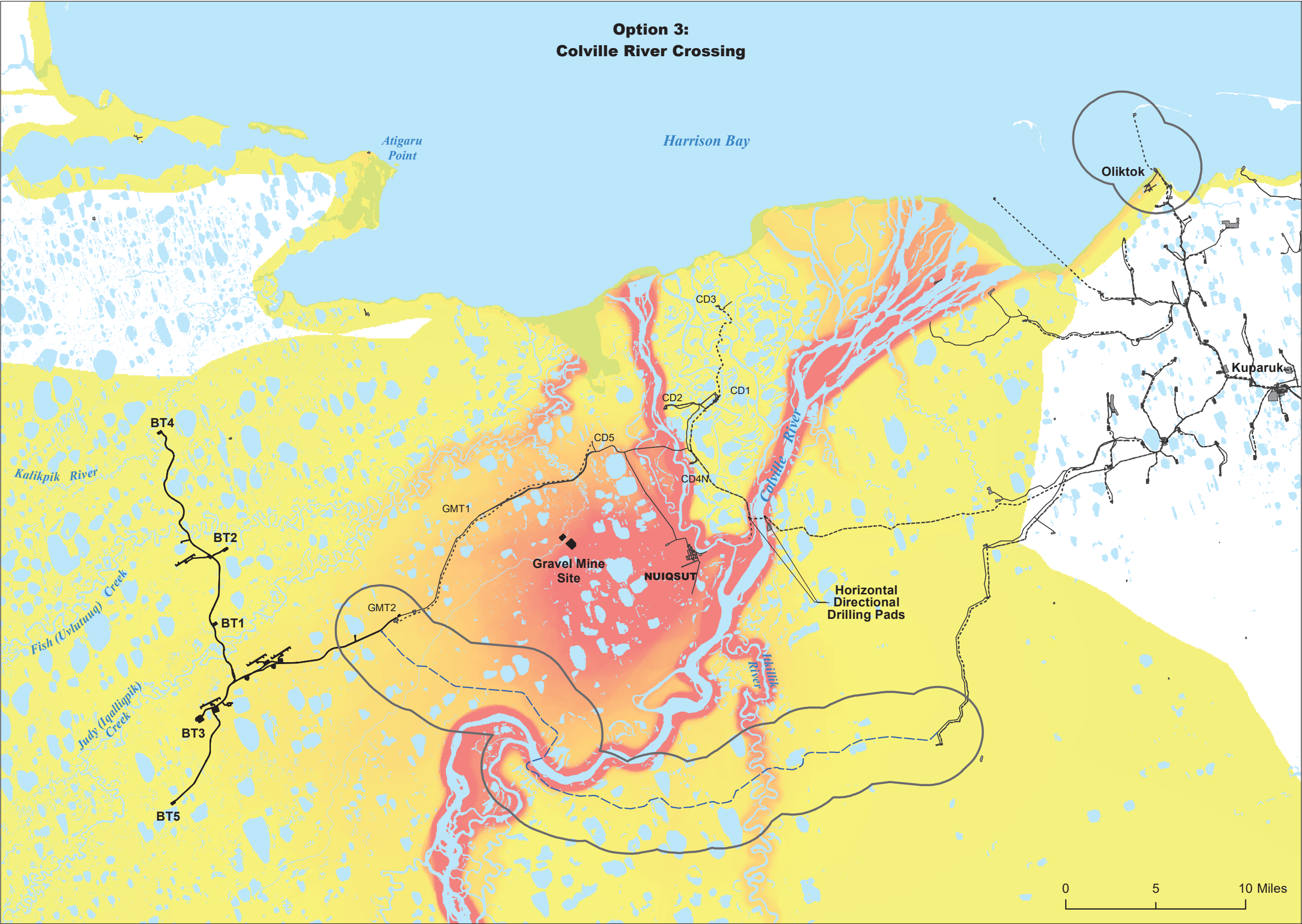
Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.2



Willow Proposed Development Features

Subsistence Data

- Overlapping Subsistence Use Areas Caribou, January 2008 through October 2016^a
- High
- Low

Module Transport Analysis Area

Ice Road

Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

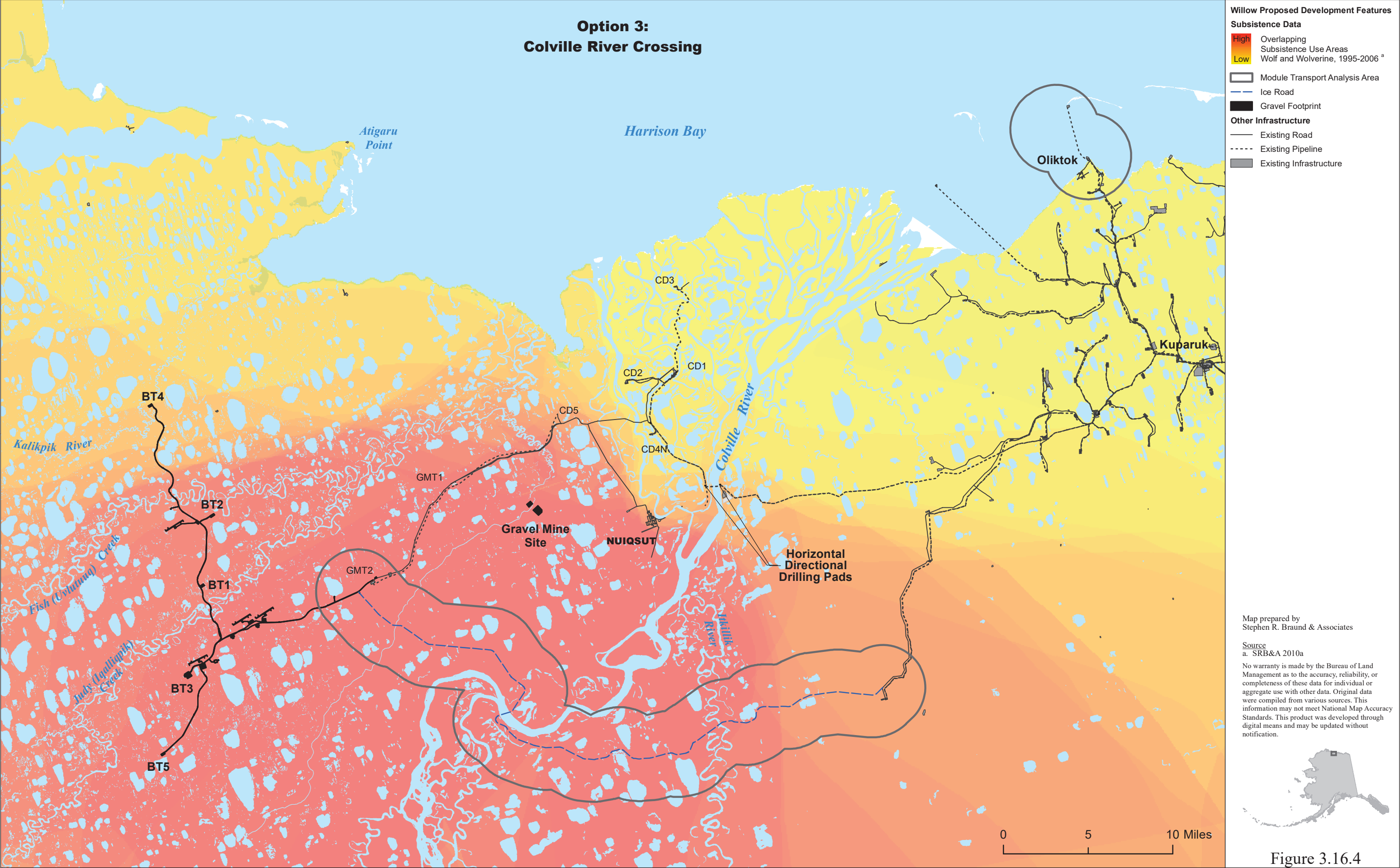
Source
a. SRB&A 2018

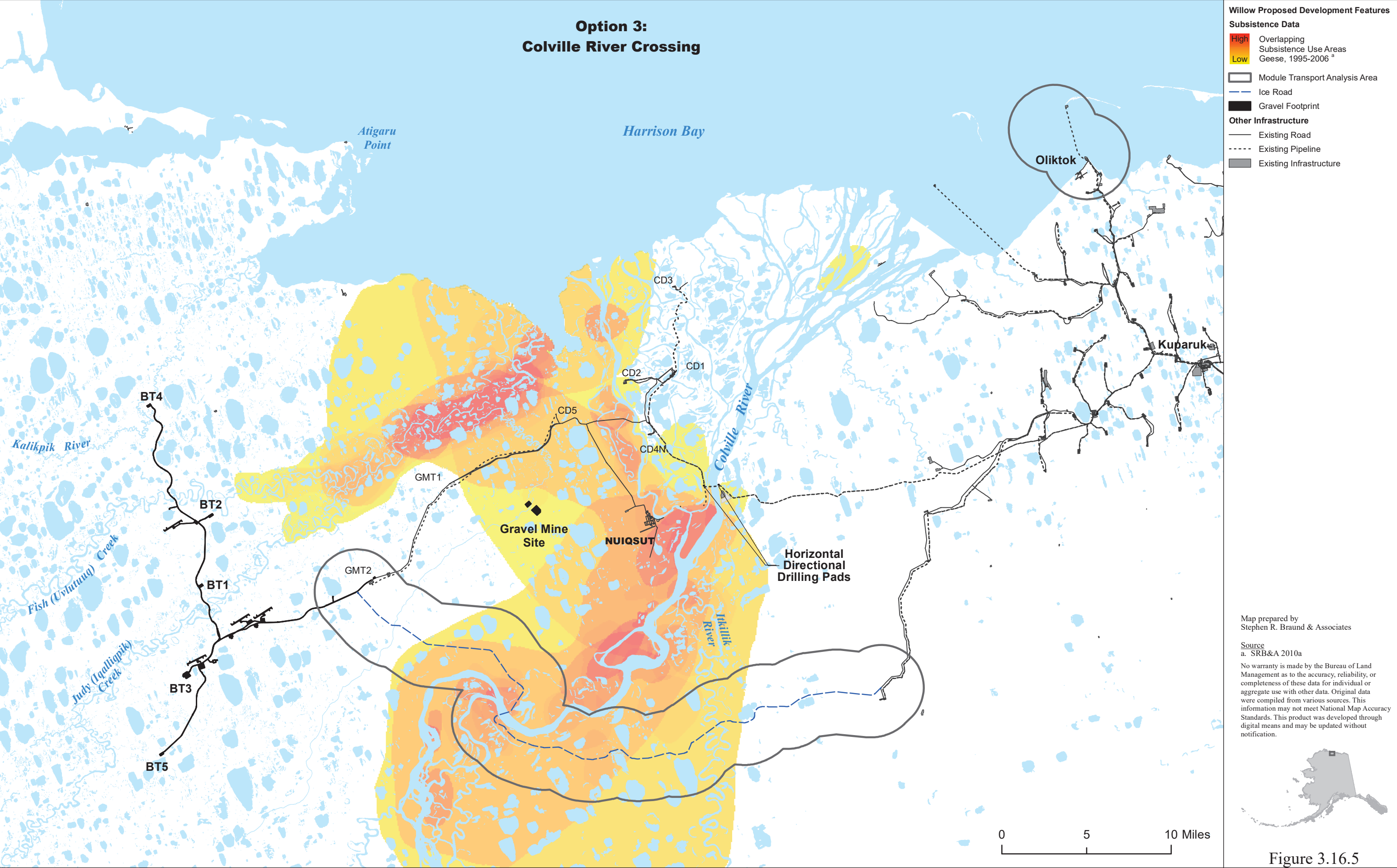
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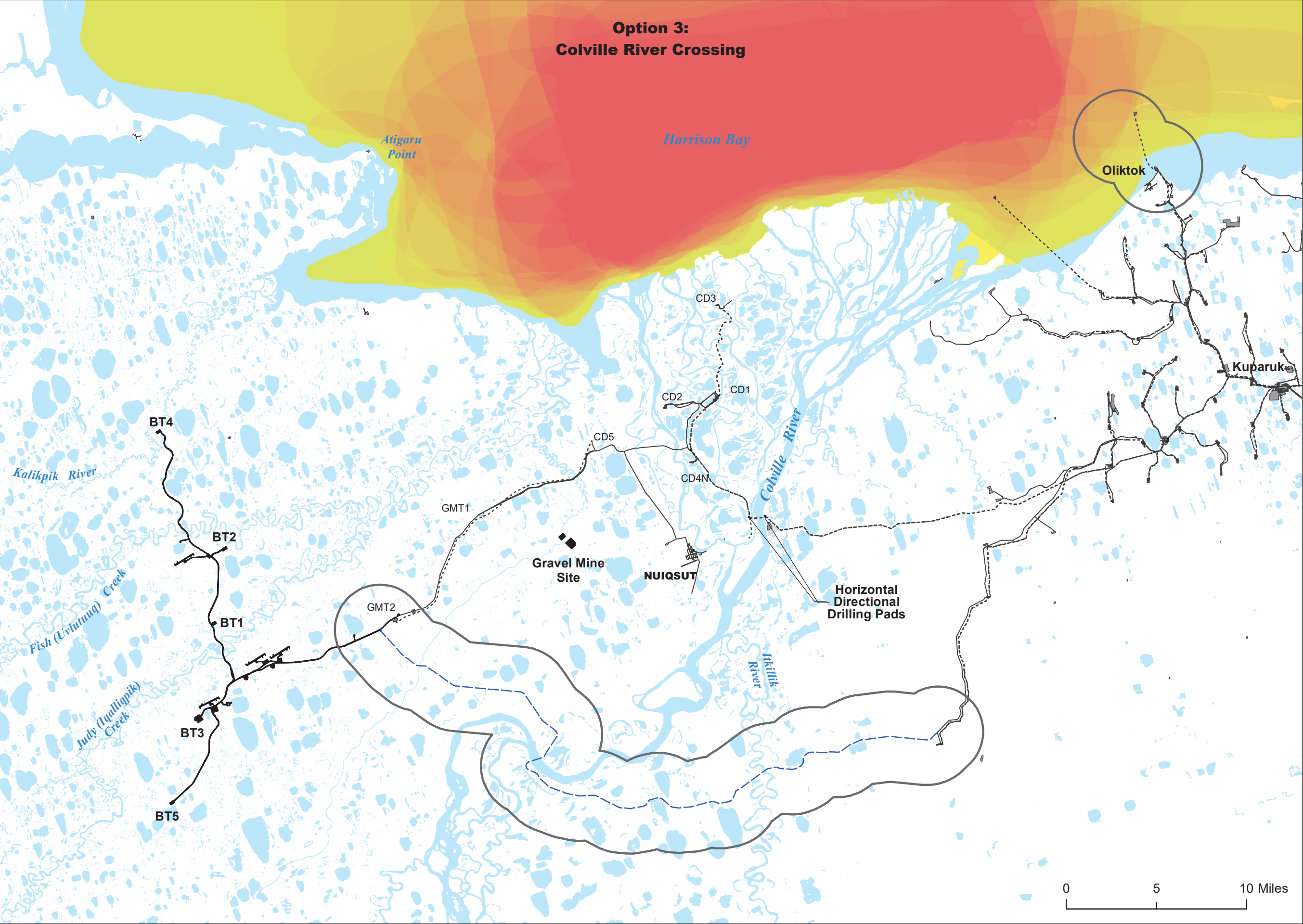


0 5 10 Miles

Figure 3.16.3







Willow Proposed Development Features

Subsistence Data

High Overlapping Subsistence Use Areas Seal, 1995-2006 ^a

Low

Module Transport Analysis Area

Ice Road

Gravel Footprint

Other Infrastructure

Existing Road

Existing Pipeline

Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

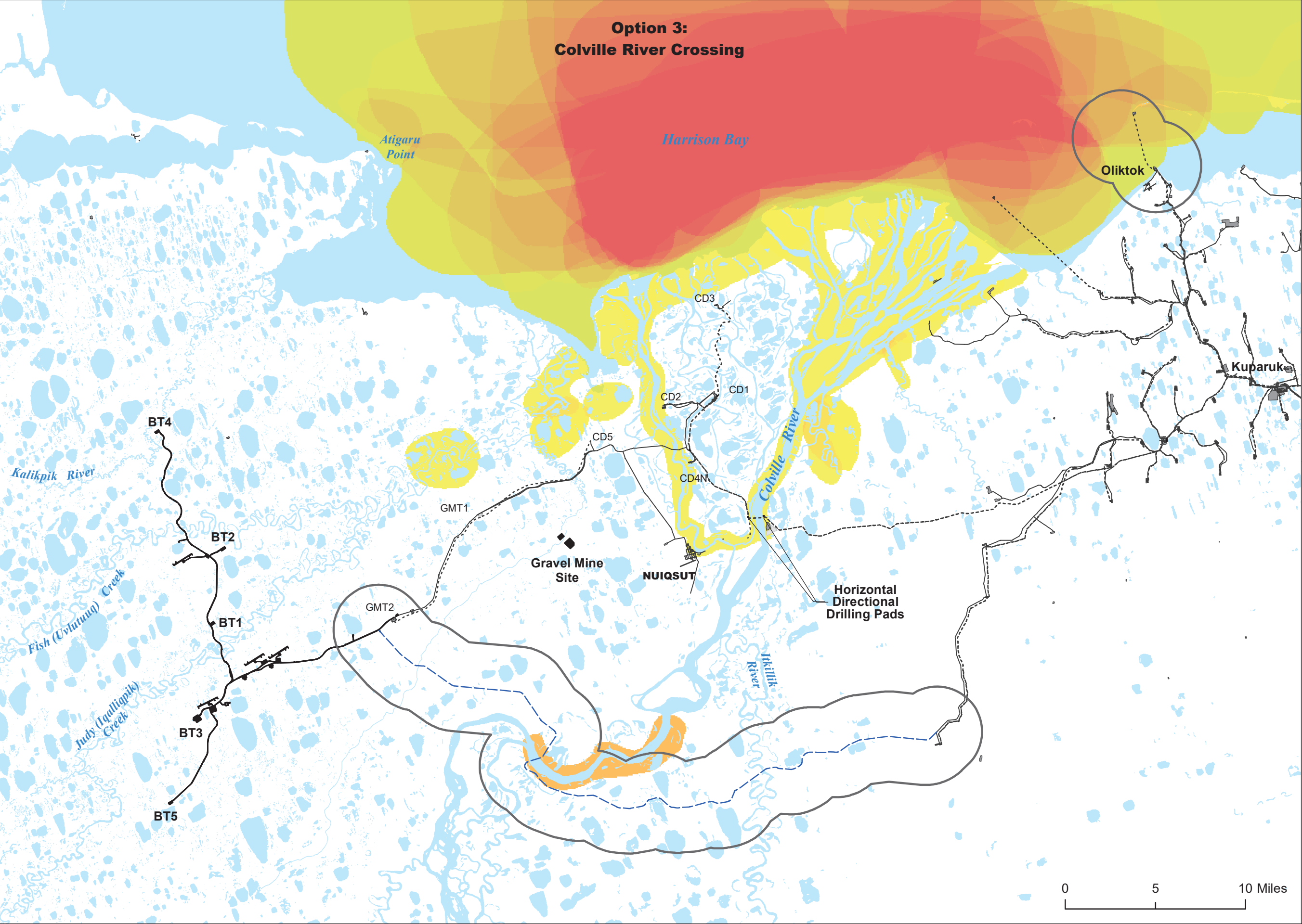
Source
a. SRB&A 2010a

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0 5 10 Miles

Figure 3.16.6



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas Eider, 1995-2006^a
- Low

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

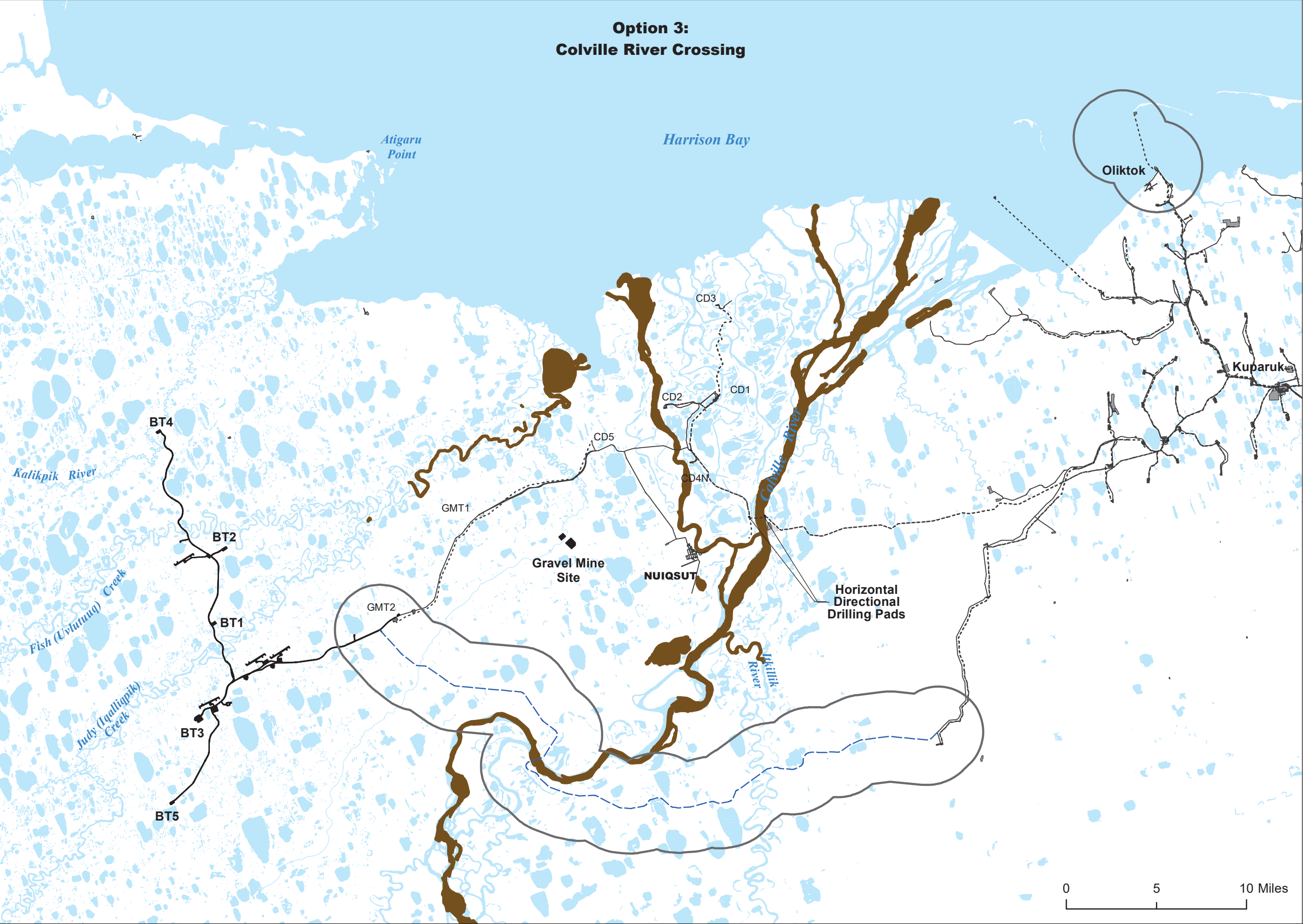
Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.7



- Willow Proposed Development Features**
- Fish, 1995-2006 ^a
 - Module Transport Analysis Area
 - Ice Road
 - Gravel Footprint
- Other Infrastructure**
- Existing Road
 - Existing Pipeline
 - Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

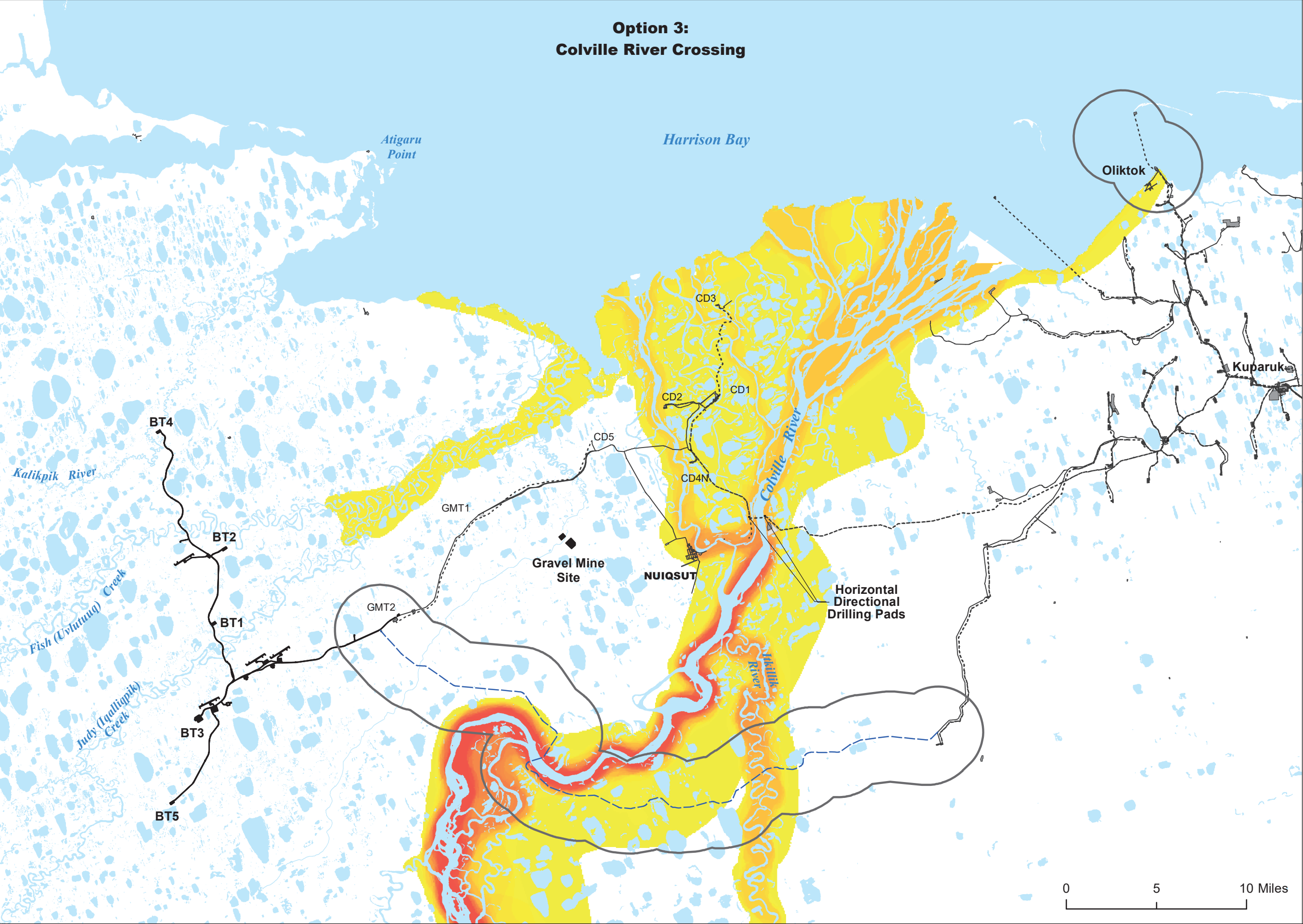
Source
a. SRB&A 2010a

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0 5 10 Miles

Figure 3.16.8



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low Moose, 1995-2006^a

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

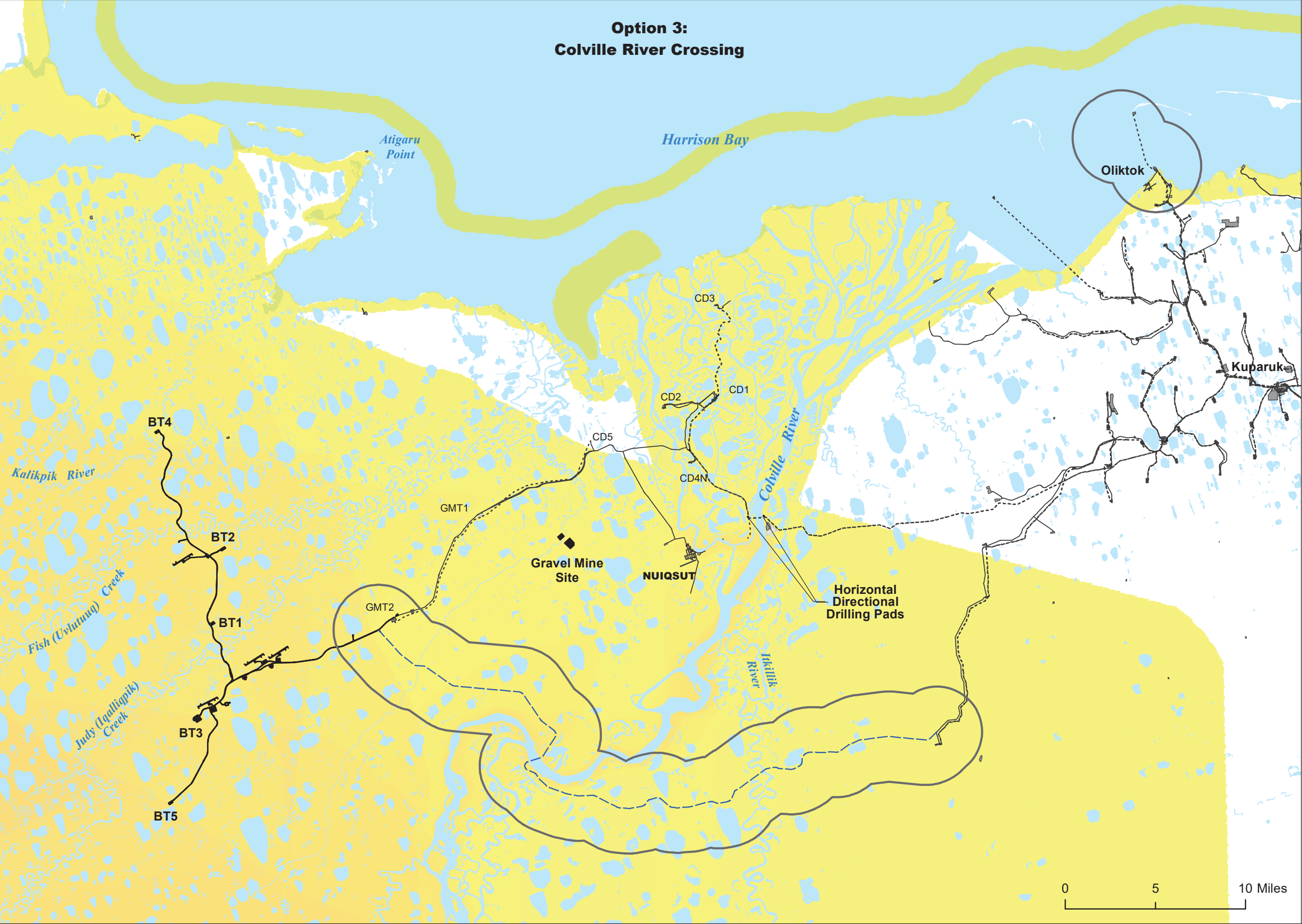
Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.9



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low All Resources, 1997-2006 ^a

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

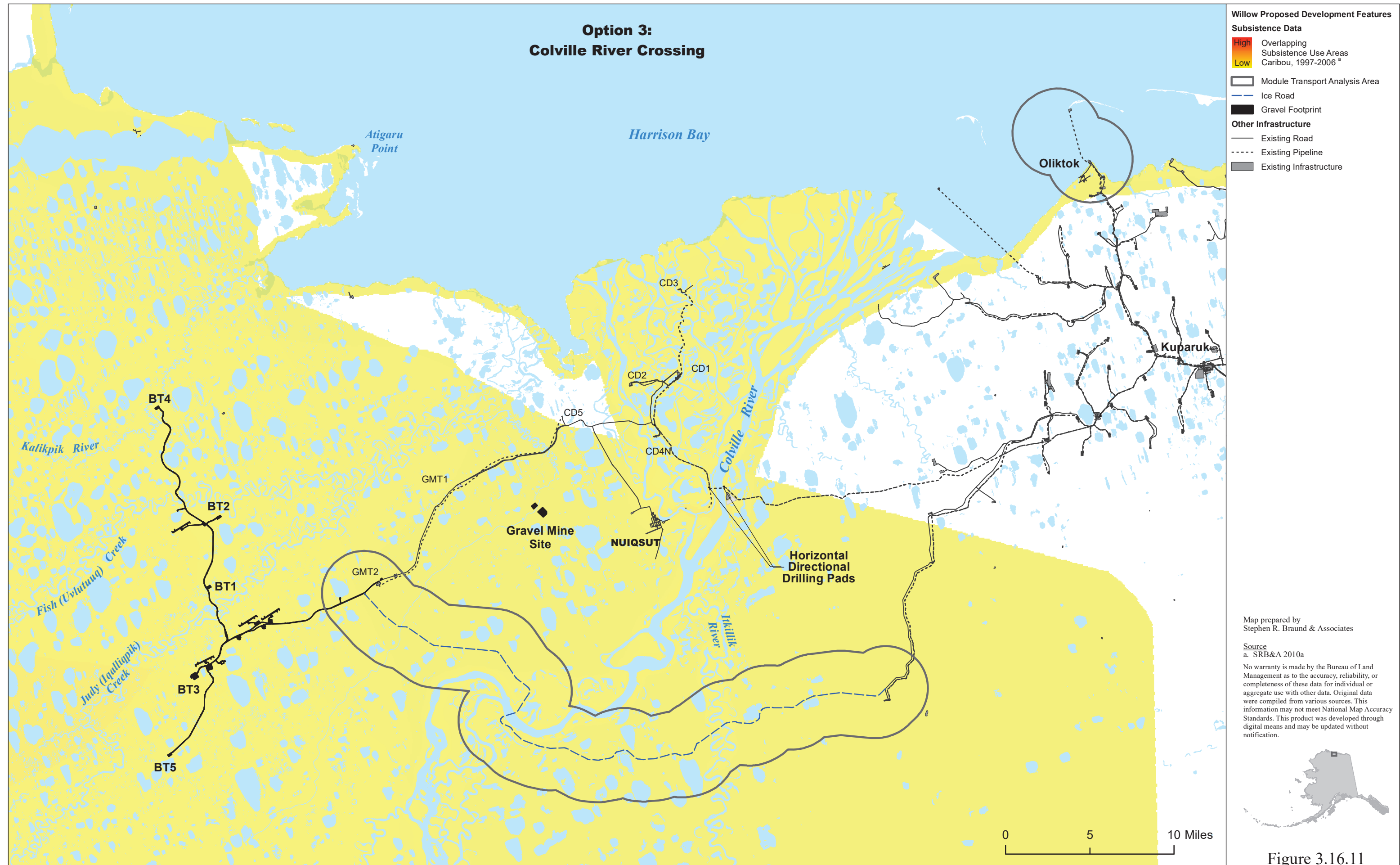
Source
a. SRB&A 2010a

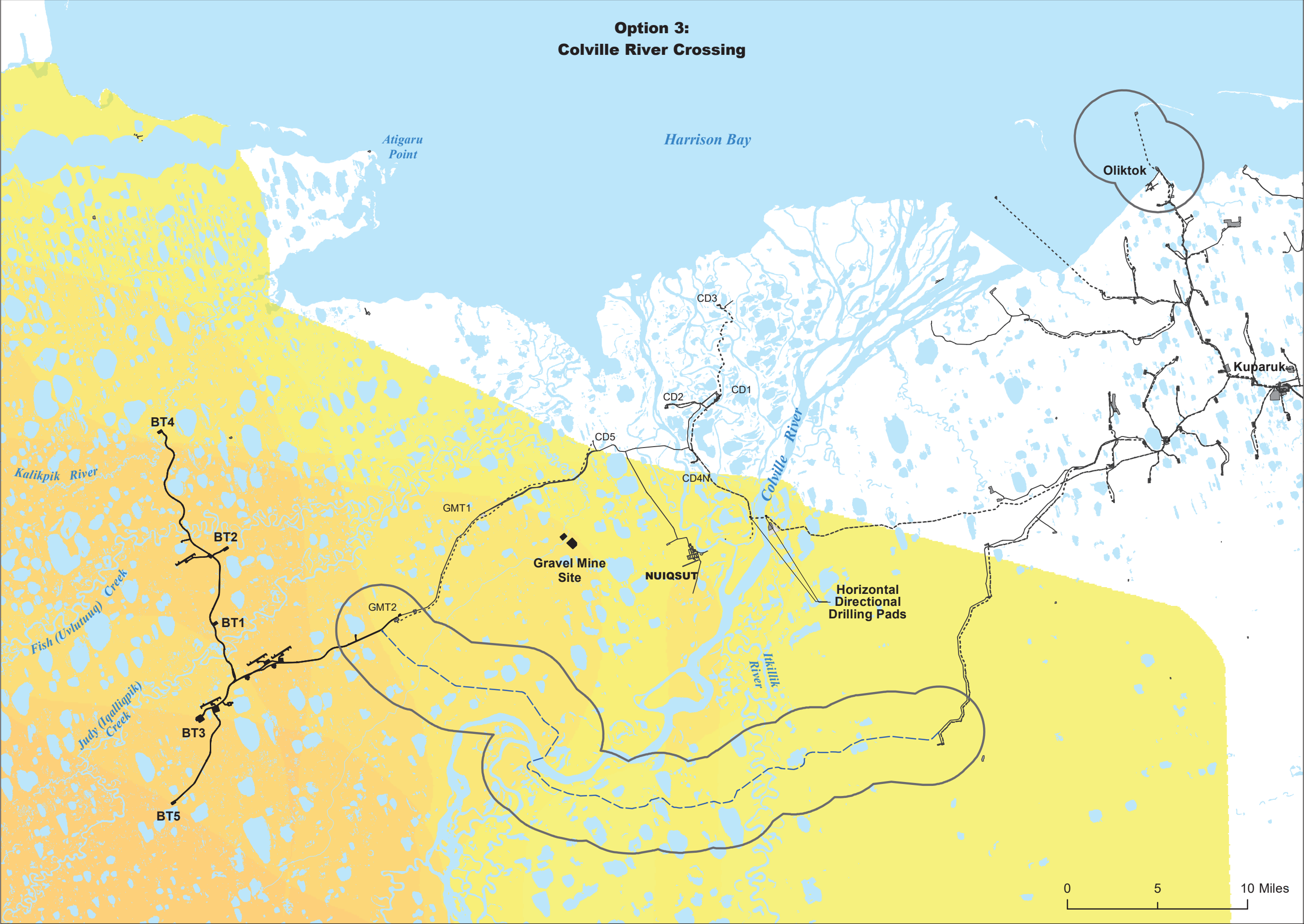
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0 5 10 Miles

Figure 3.16.10





Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low Wolf and Wolverine, 1997-2006 ^a

Other Infrastructure

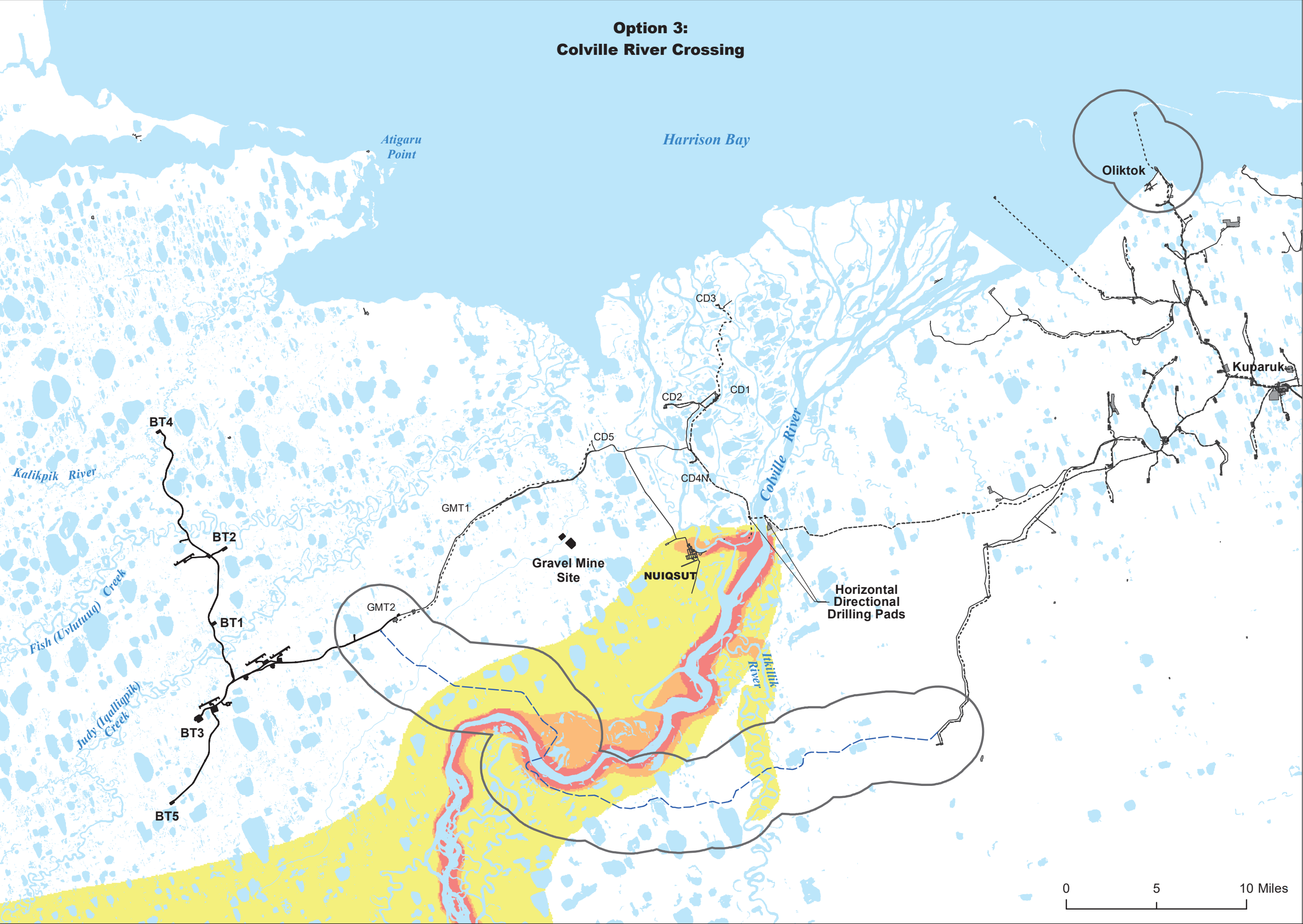
- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.12



Willow Proposed Development Features

Subsistence Data

- High Overlapping Subsistence Use Areas
- Low Moose, 1997-2006^a

Other Infrastructure

- Module Transport Analysis Area
- Ice Road
- Gravel Footprint
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

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Figure 3.16.13

