



Isostatic Rebound and the Shrinking Refuge

**Challenges of Managing Marine
Protected Areas in the Changing
Landscape of Southeast Alaska**

Introduction



1. Geography and Geology

2. Ownership and Title

3. The Shrinking Refuge at a Glance

4. Management - Issues, Solutions, and Challenges



Alaska

Southeast Alaska

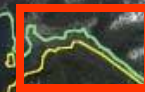
Geographic Comparison





**Glacier Bay
National Park**

**Juneau
Ice Field**



• Juneau

Lomesurier Island

Northern Southeast Alaska

Mendenhall
Glacier

This satellite map shows the Mendenhall Valley and surrounding areas. A red boundary outlines the Mendenhall Refuge, which includes Douglas Island and the Mendenhall River delta. Labels with yellow arrows point to the Mendenhall Glacier, Mendenhall Valley, Downtown Juneau, and Douglas Island. A north arrow is in the top right corner.

Mendenhall Valley

Mendenhall Refuge

Downtown
Juneau

Douglas Island

Mendenhall Refuge Values



- **Habitat**

- Beach Rye, Sedge, and mudflats
- Birds- Migratory and Resident
- Fish- Salmon, Herring, Dolly Varden
- Marine Mammals- Seals, Humpback Whales

- **Human Use**

- Hunting and Fishing
- Wildlife and nature viewing
- Boating and Navigation
- Education and Research

Mendenhall Refuge Geology



- The Ice Age
- The Little Ice Age
- Isostatic Rebound
- Glacial recession
- Rate of Uplift

The Ice Age

- **Wisconsin Ice Age- 20,000 BP**
 - Sheet of ice, 5000 feet thick
 - Global warming
 - Sea level rise
- **Mendenhall Bay- 10,000- 3,000 BP**
 - Water body, 1000 feet deep
 - Erosion and Glacial Sediment (~500' deep)
 - Land Rise (~500' rise)
 - Creates the Mendenhall Wetland

The Little Ice Age

A photograph of a snowy mountain landscape. In the foreground, there is a wide, flat expanse of snow with a small, irregularly shaped frozen pond. In the middle ground, a large glacier flows through a valley, flanked by steep, snow-covered mountains. The sky is a mix of blue and white, with some clouds. The overall scene is cold and desolate.

- 1250 AD - 1770 AD
 - Cooling Period
 - Advancing Glaciers
 - Earth Crust Depressed
- 1770 AD- Present
 - Warming Period
 - Isostatic Rebound

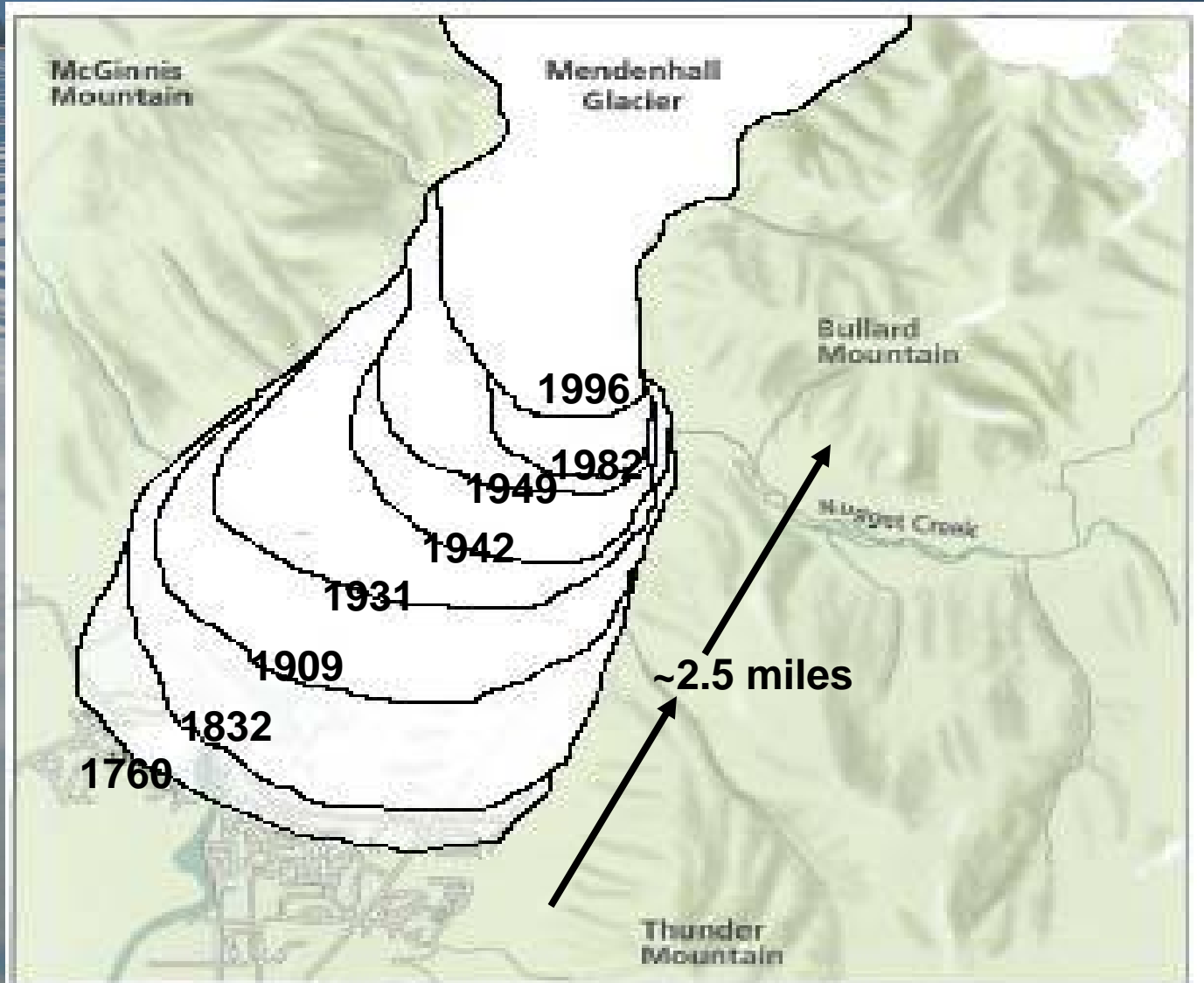
Isostatic Rebound



First, visualize a floating barge full of 200 tons of ice--

--Then, imagine how the hull would rise as the ice melts overboard and disappears.

Glacial Retreat



Hocker (2003)

Rate of Uplift

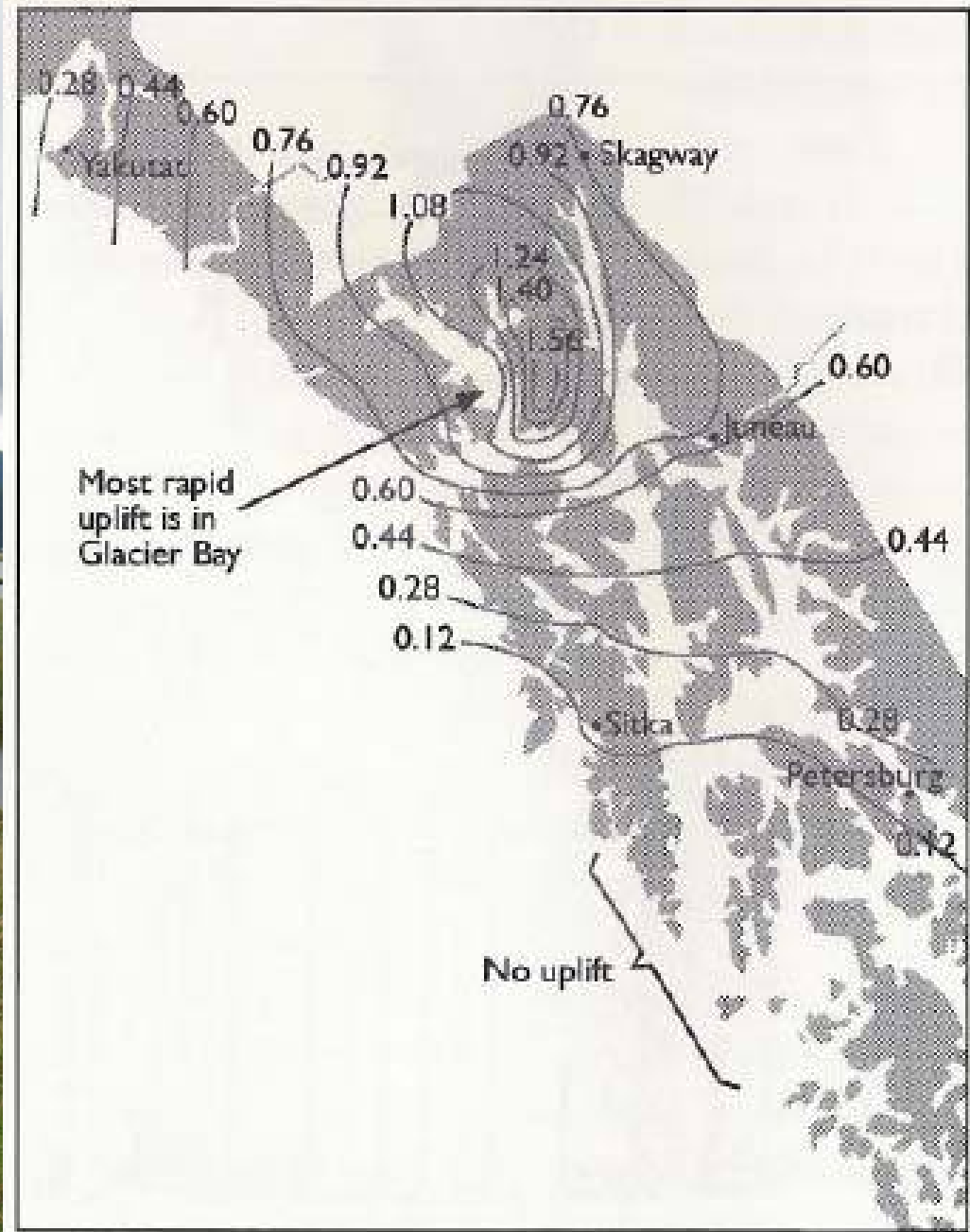
(Contours are in inches per year)

**Mendenhall
Refuge Uplift
rate is:**

~0.6 inches/year

~1/2 foot/decade

~5 feet/century



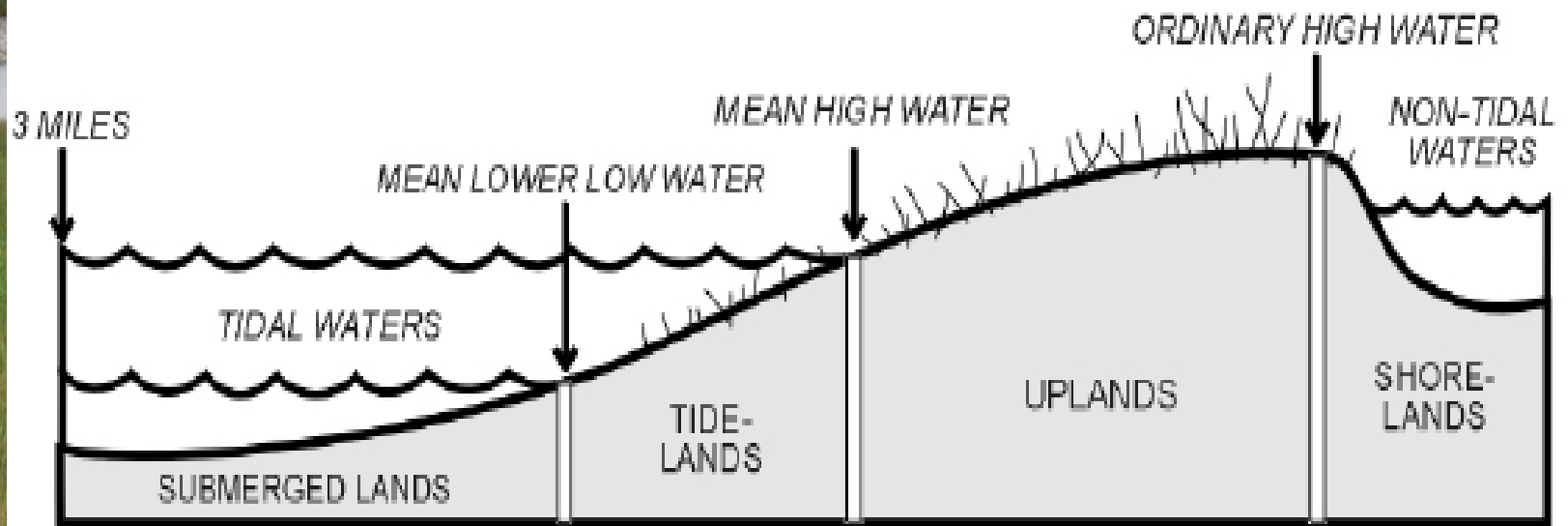
O'clair, Armstrong, Carstensen (1992)

Ownership & Title

- Land Ownership
- Riparian Rights
- Accretion
- Clouded Title
- Survey Methods
- Quiet Title Action

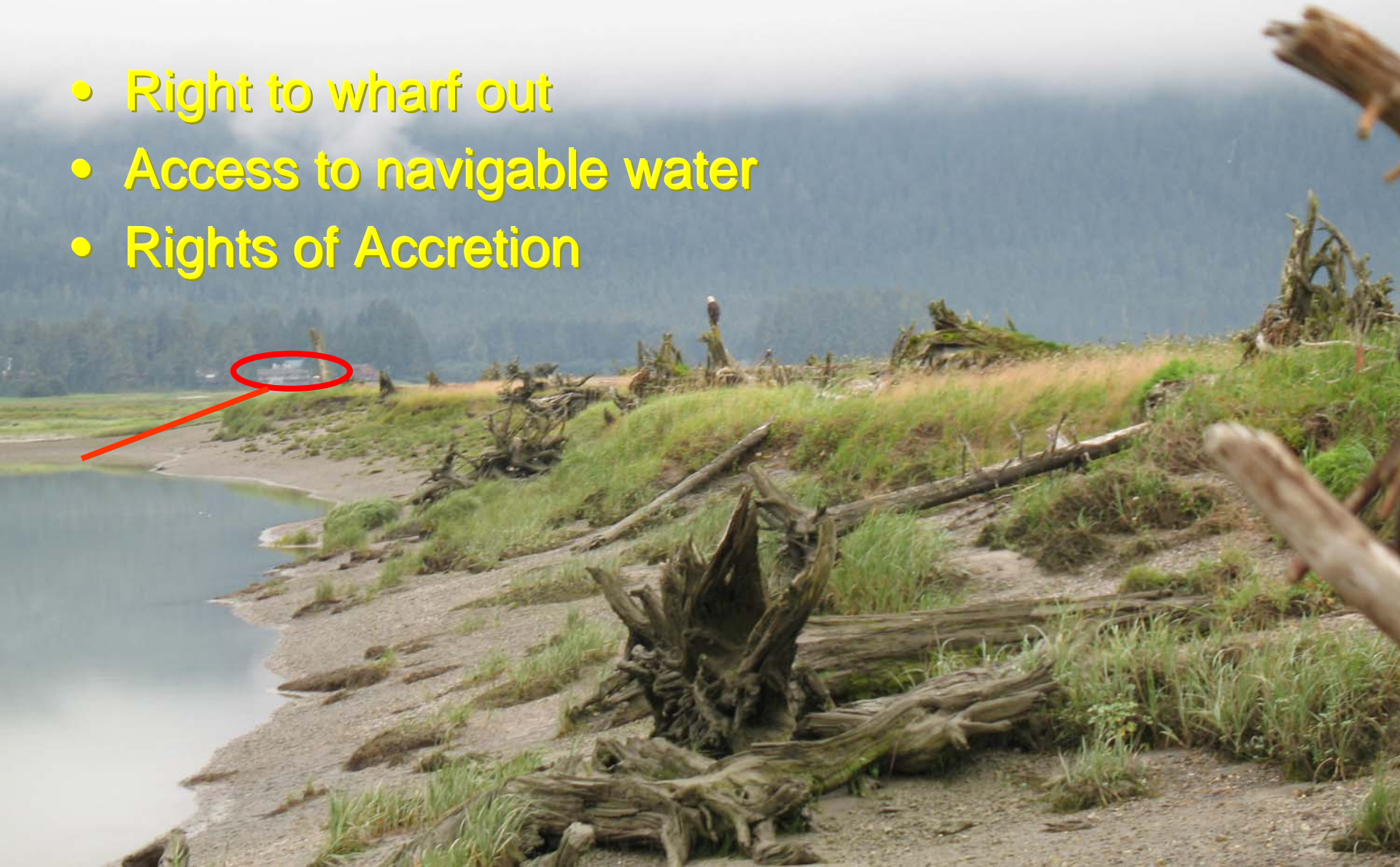


Land Ownership



Riparian Rights of Ownership

- Right to wharf out
- Access to navigable water
- Rights of Accretion

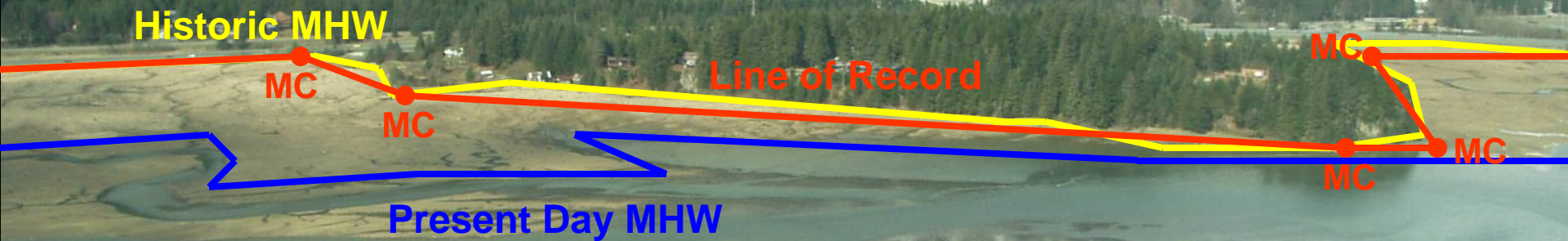


Accretion

Types of Accretion

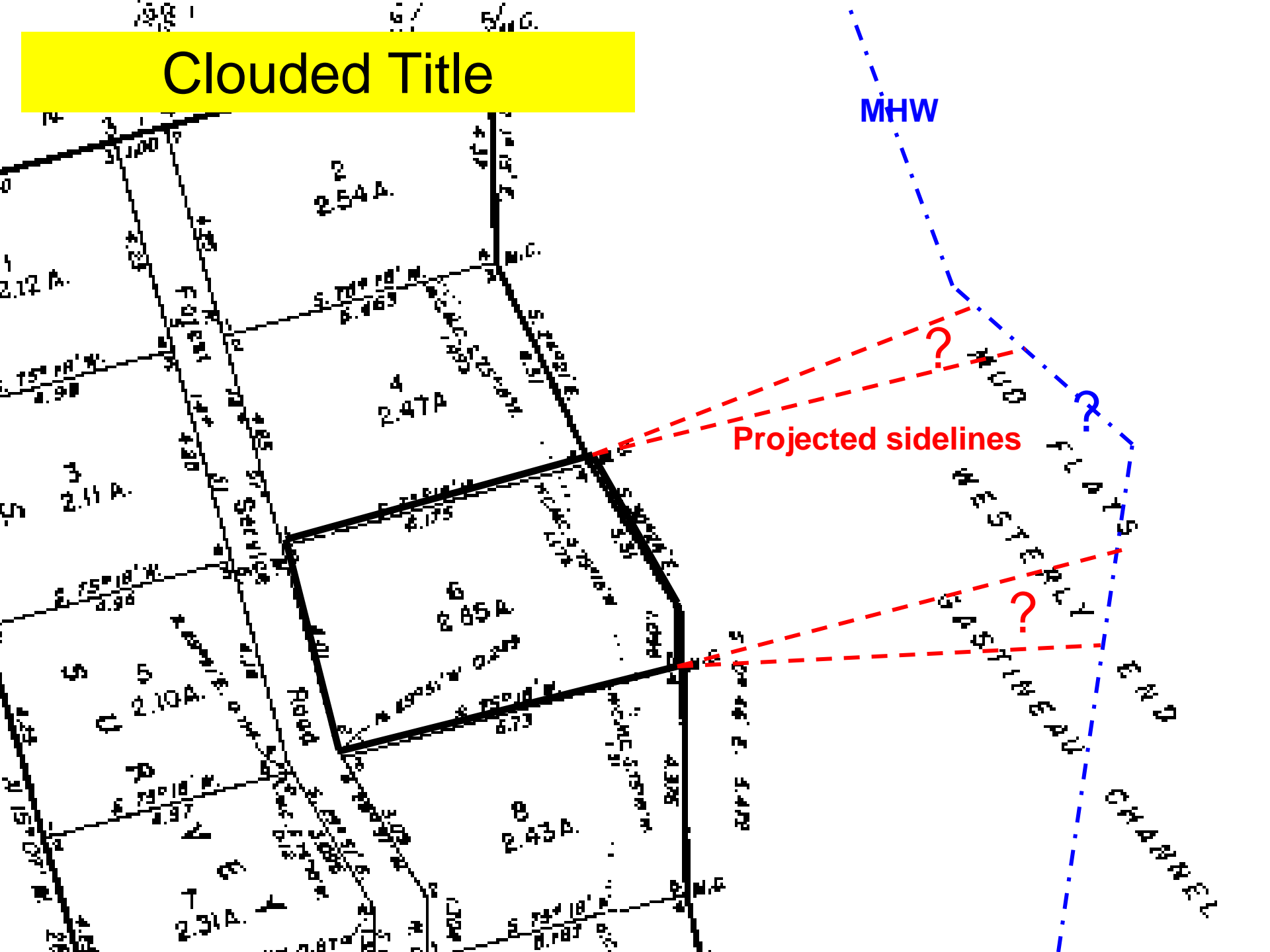
- Accretion- gradual addition of land
- Reliction- gradual recession of water
- Isostatic Rebound- gradual uplift of land

Land Ownership



- Riparian Boundaries are Ambulatory
- Meander Corners establish Survey Boundary
- Title is based on the Line of Record
- Actual Mean High Water line may differ

Clouded Title



Quiet Title Action

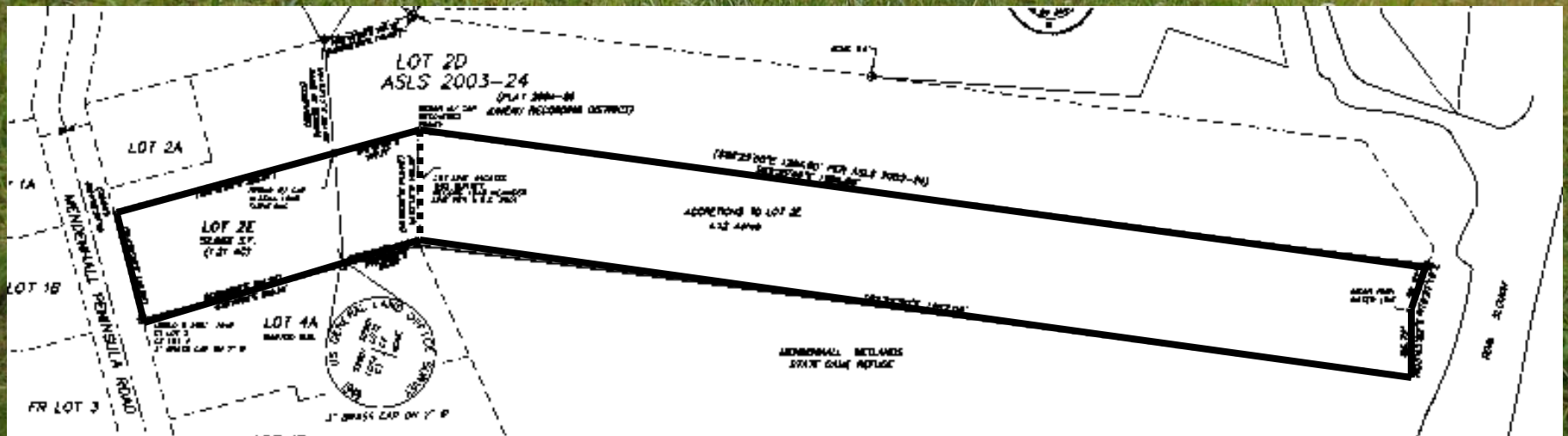
Goal is to provide an equitable apportionment

- State of Alaska asserts ownership of lands up to MHW or the record line whichever is higher.
- To gain clear title upland owners must undertake a Quiet Title Action in court

Quiet Title Action

- 1. Complaint for Quiet Title**
- 2. Summons to Defendants**
- 3. Stipulation for Entry of Judgment**
- 4. Final Judgment**
- 5. Issuance of Clerk's Deed**

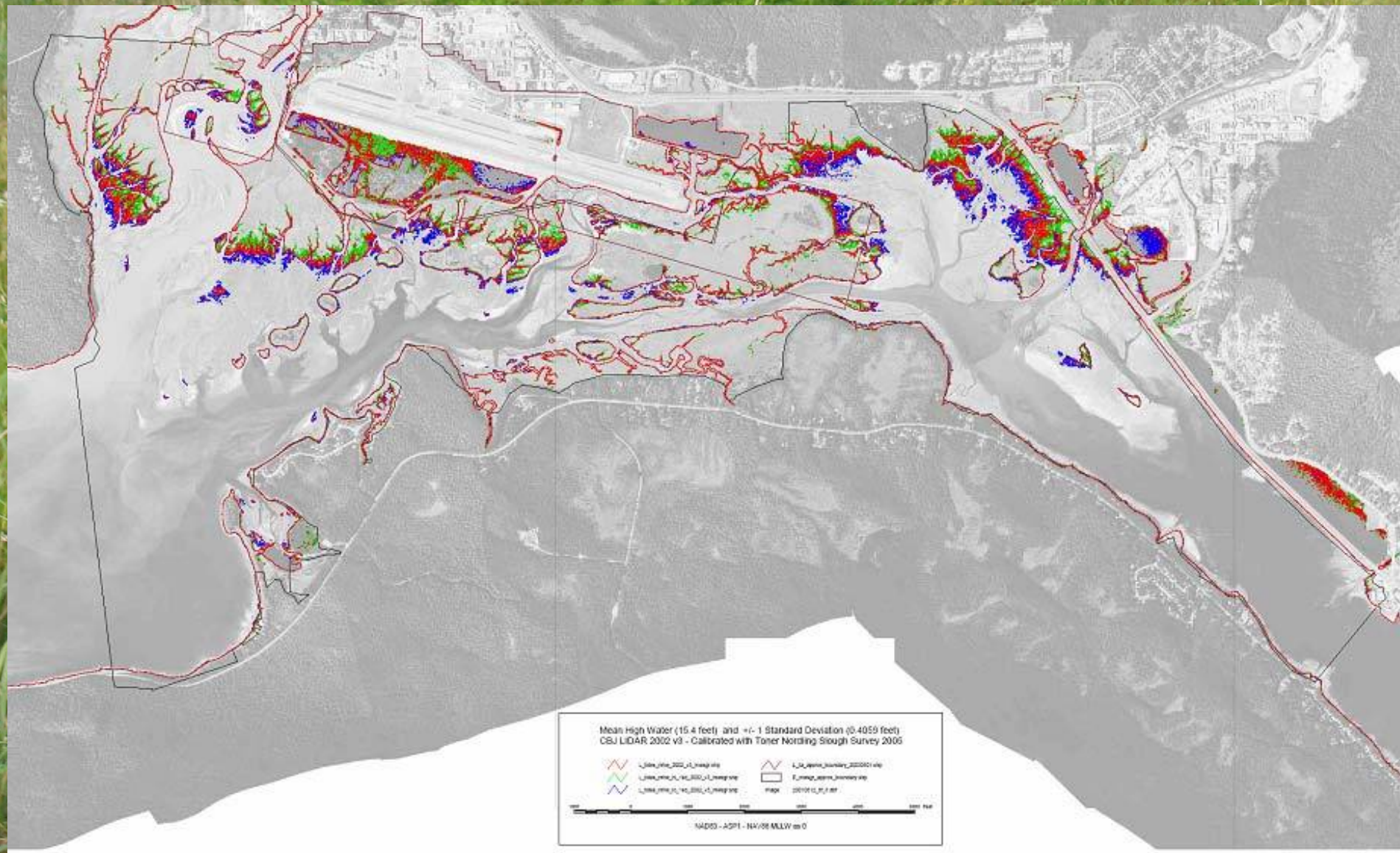
Quiet Title



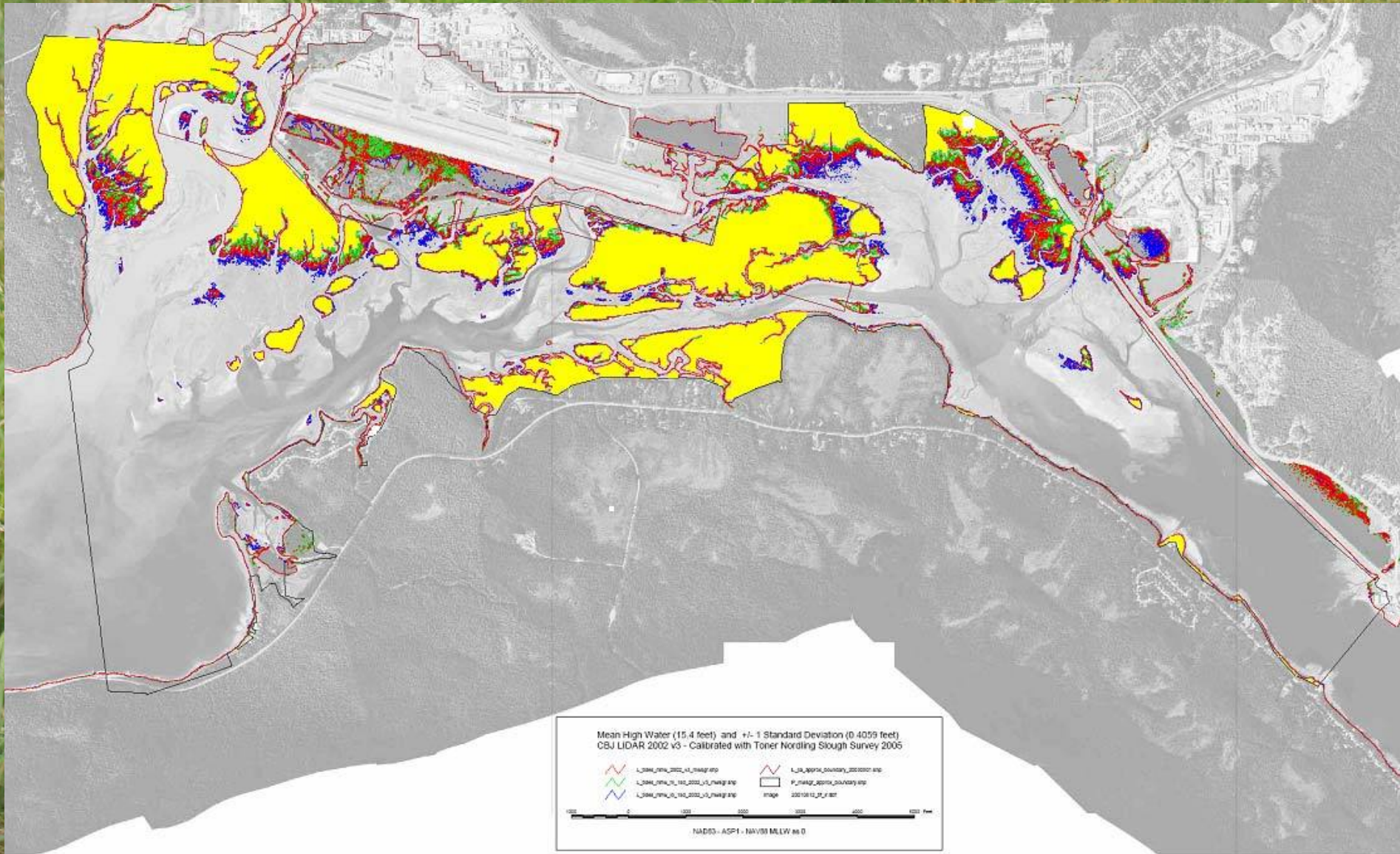
The Shrinking Refuge at a Glance

- LIDAR Imagery
 - MHW, Accretion & Clouded title
- Oblique Aerial Photography

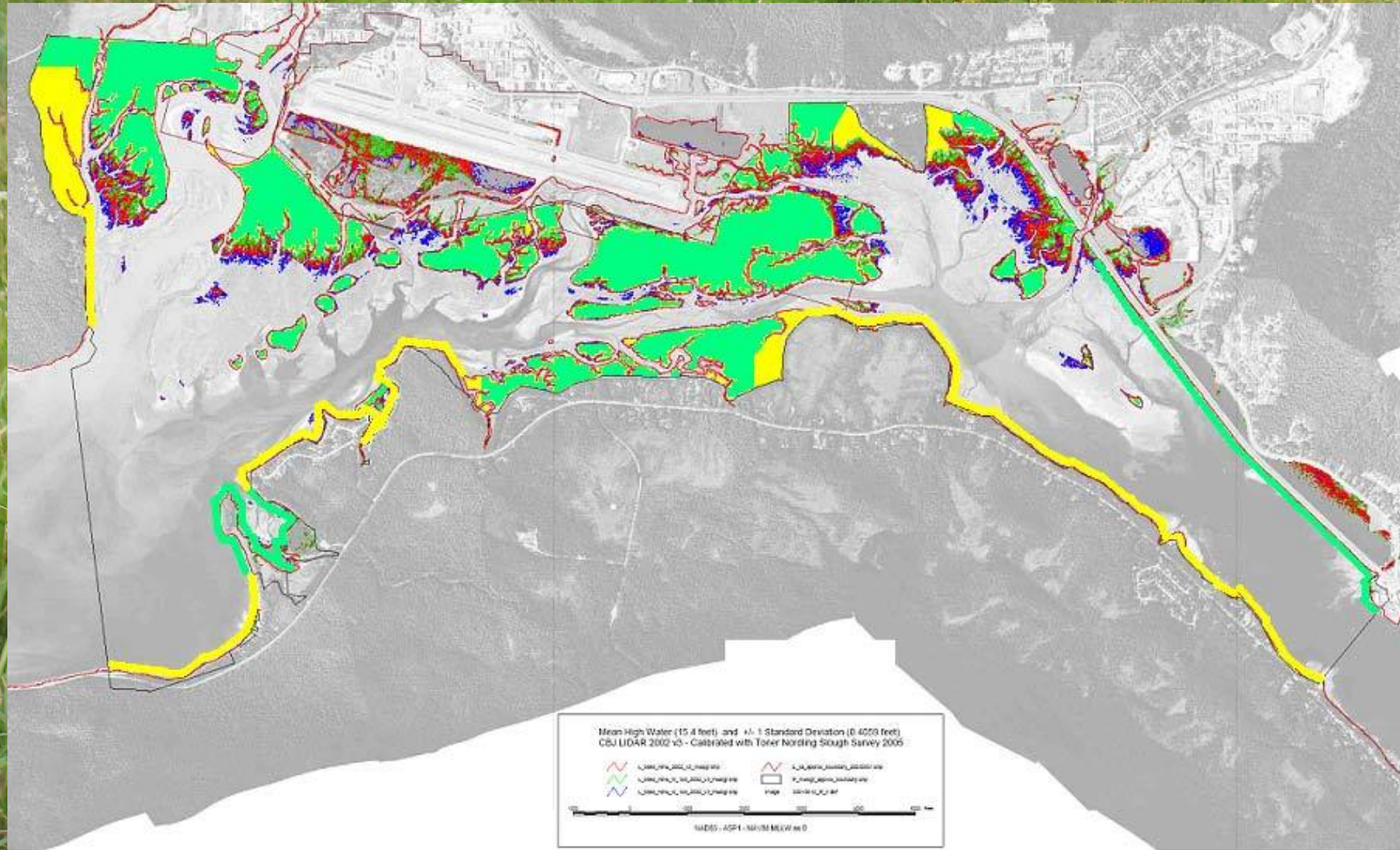
Mendenhall Refuge 2005 MHW

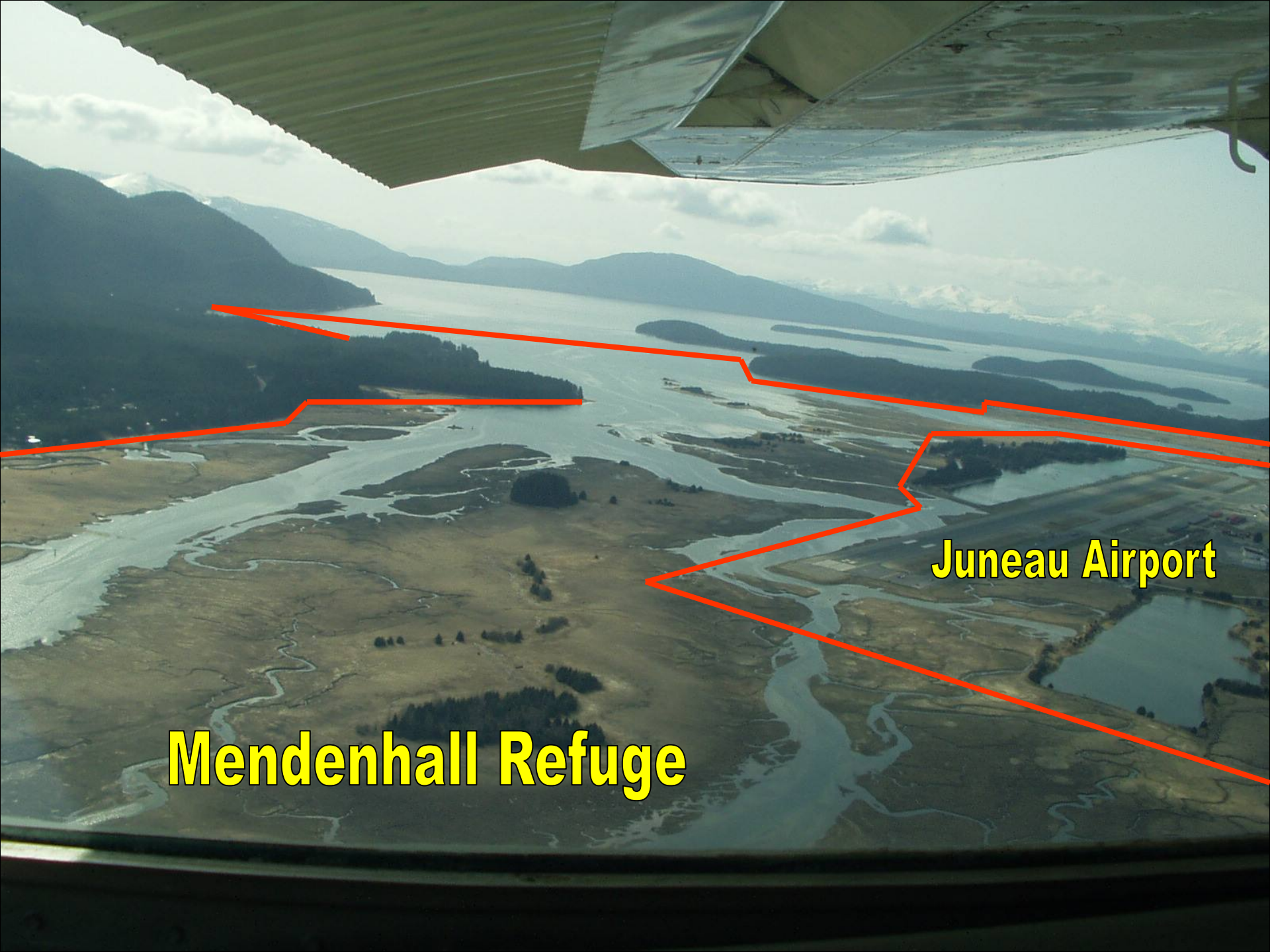


Mendenhall Refuge Accreted Lands, 2005



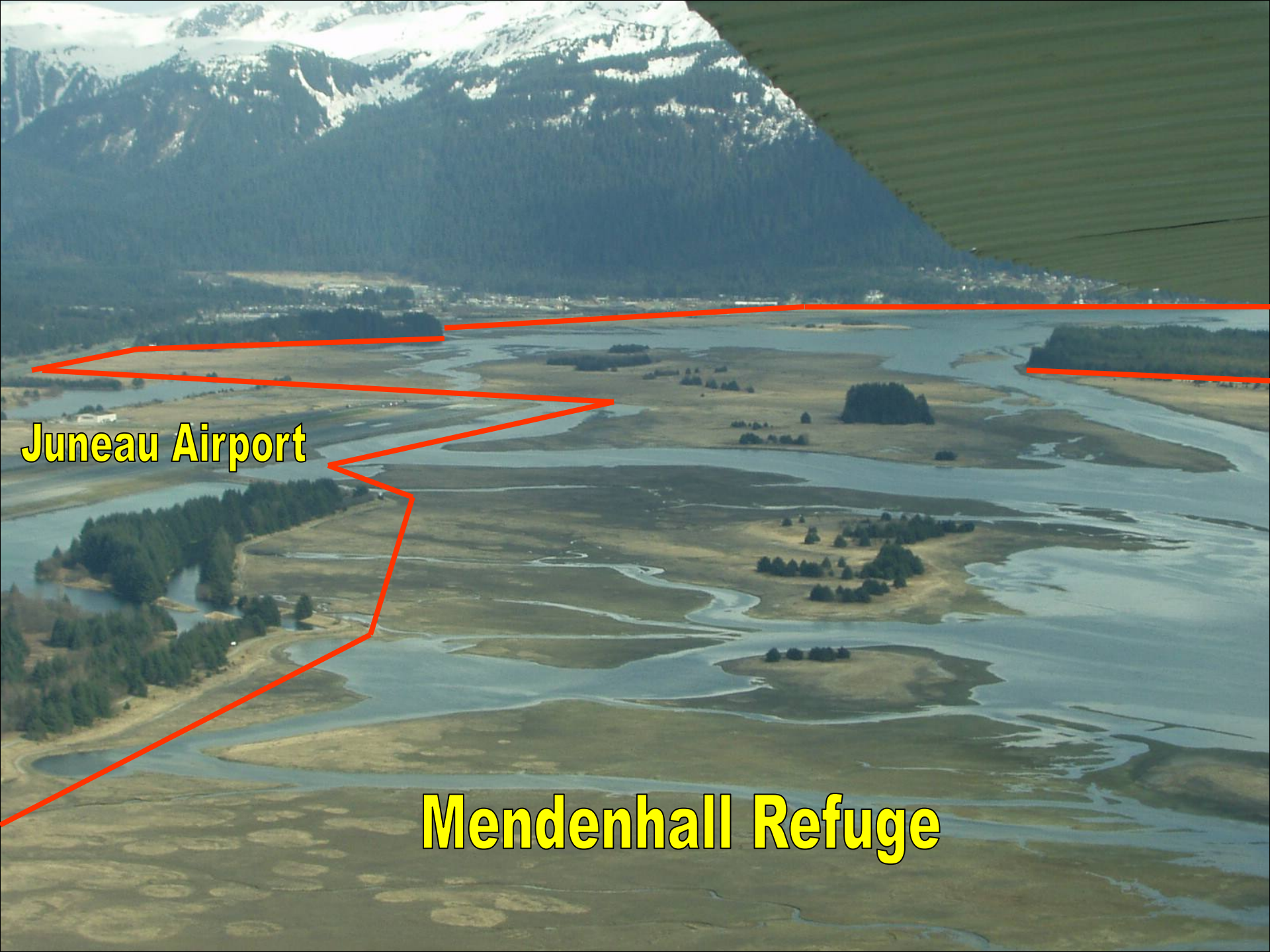
Mendenhall Refuge Lands with Clouded Title, 2005





Mendenhall Refuge

Juneau Airport



Juneau Airport

Mendenhall Refuge

Refuge Management



Issues, Solutions, and Challenges

Urban Hunting

WELCOME TO THE MENDENHALL WETLANDS STATE GAME REFUGE



WATERFOWL HUNTERS:

PLEASE PRACTICE SAFE FIREARM USE.



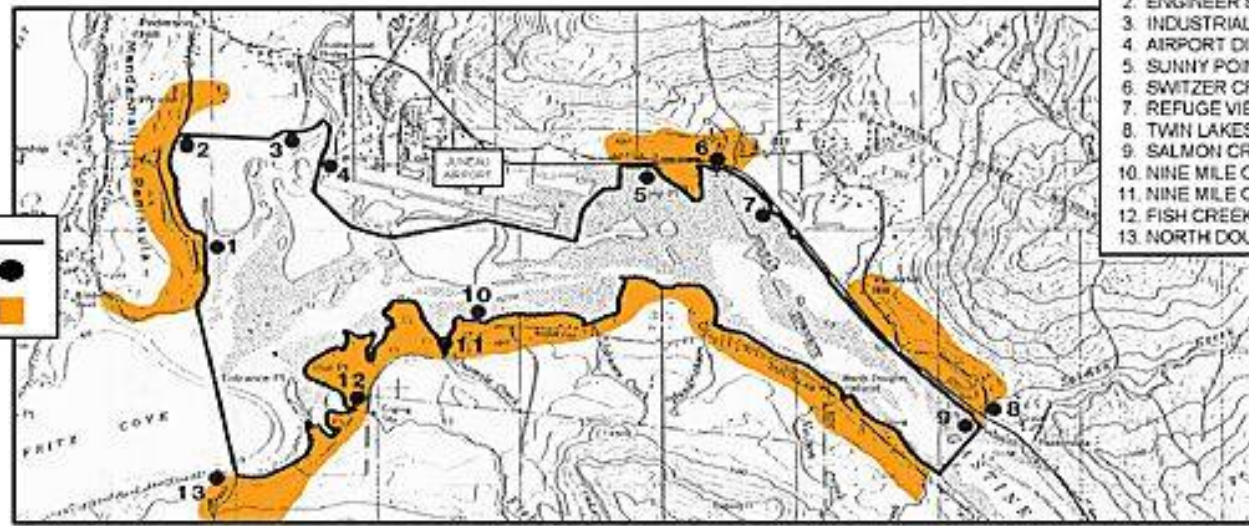
Know what is beyond your target.

Be respectful. Don't trespass on private property.

Don't shoot toward roads or residential areas.

- ACCESS POINTS**
1. MENDENHALL PENINSULA
 2. ENGINEER'S CUT-OFF ROAD
 3. INDUSTRIAL BLVD.
 4. AIRPORT DIKE
 5. SUNNY POINT DRIVE
 6. SWITZER CREEK
 7. REFUGE VIEWING PLATFORM
 8. TWIN LAKES
 9. SALMON CREEK
 10. NINE MILE CREEK ROAD
 11. NINE MILE CREEK
 12. FISH CREEK
 13. NORTH DOUGLAS BOAT RAMP

- Refuge boundaries
Public access points
Residential areas
-



The Alaska Department of Fish and Game manages the Mendenhall Wetlands State Game Refuge to protect natural habitat and game populations, especially waterfowl.

Development versus Conservation





Solutions

Conservation Easements

1. Undergo Quiet Title Action
2. Deed easement to a Land Trust

Solutions

- **Voluntary Buyback Program**
 - State purchase of lands from willing sellers for Placement back into the Mendenhall Refuge

Opportunity

A scenic landscape featuring a river in the foreground, a grassy bank, and a forest of evergreen trees. In the background, there are large mountains with patches of snow under a cloudy sky. A small airplane is flying in the distance.

Juneau Airport Expansion Project

- Land Conveyance/Wetland fill project
- Mitigation package ~\$5.8 million
- Money available to purchase lands?



Challenges

- Transaction cost is large
- Mitigation funds may be used elsewhere



Conclusion

- Riparian Boundaries add Complexity
- Understand Ownership and Title Issues
 - Manage and Plan for Changing Landscapes

Thank You!

Questions?

