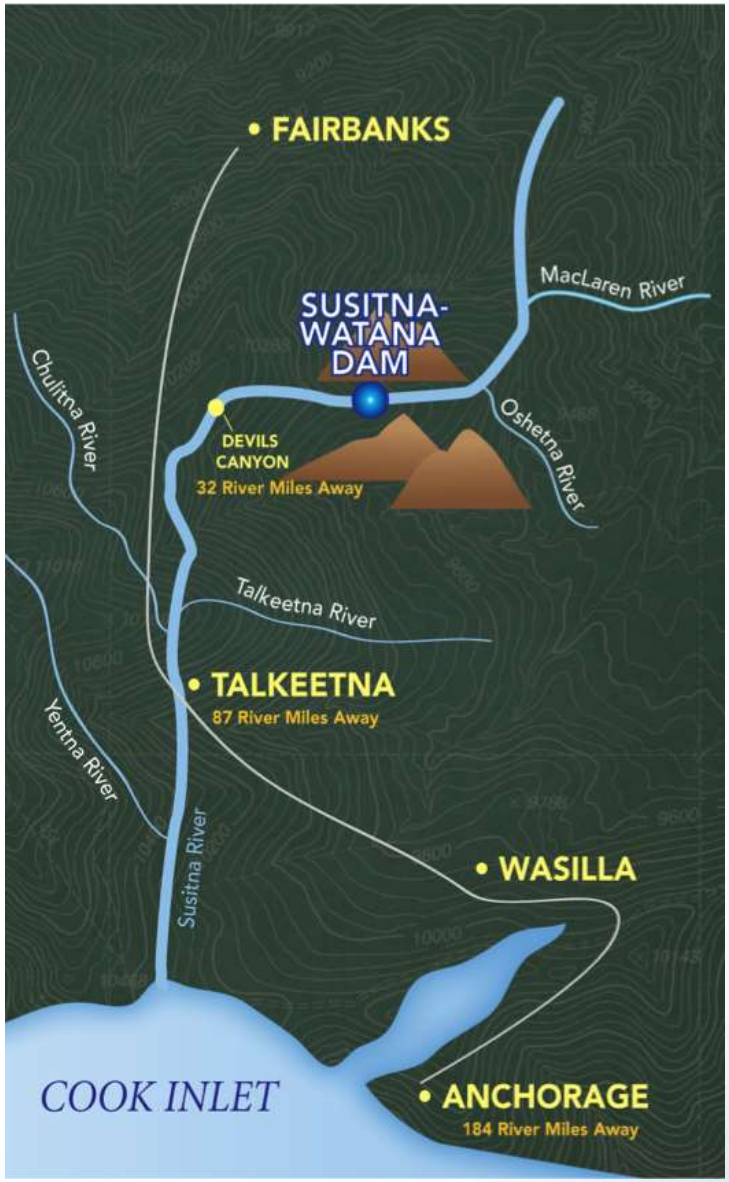
2012 Technical Memorandum:

Mapping of Geomorphic Features within the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials

Technical Workgroup Meeting
March 28, 2013
(April 5, 2013)

Prepared by: Tetra Tech
Prepared for: Alaska Energy Authority



SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

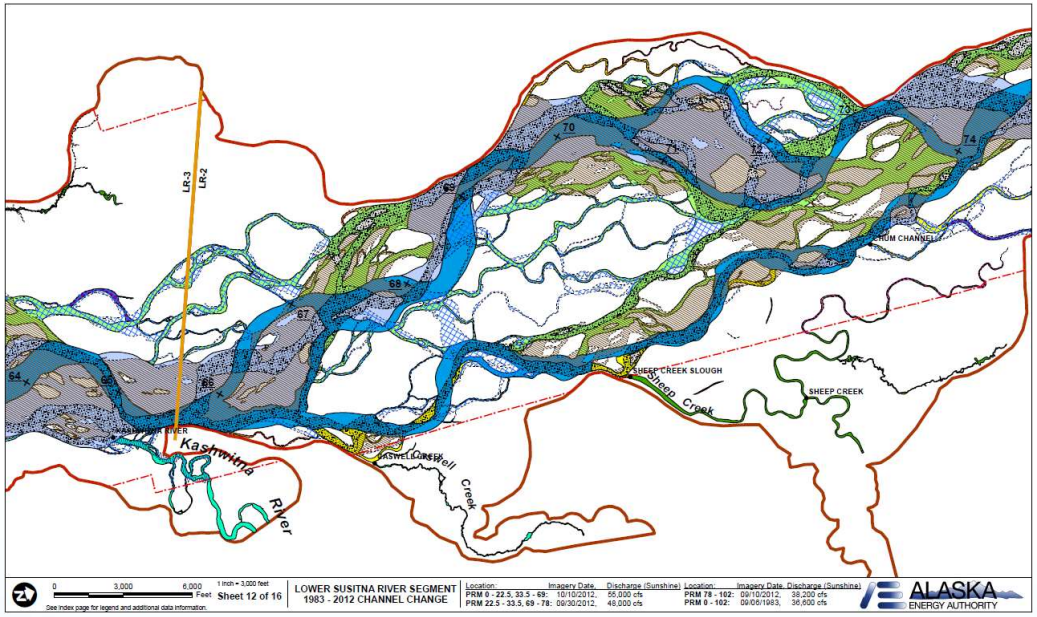
2012 Study Technical Memorandum: *Mapping of Geomorphic Features within the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials*

- Part of 2012 Study – G-S2: Aquatic Habitat and Geomorphic Mapping of the Middle river using Aerial Photography
- Part of 2012 Study – G-S4: Reconnaissance-Level geomorphic and Aquatic Habitat Assessment of Project Effects on Lower River Channel

- Date Filed with FERC: March 2013
- Date Posted to AEA website: March 2013

Overall Goal
Mapping of Geomorphic Features

- Assess the channel change that has occurred in Middle and Lower River Segments between the 1980s and 2012

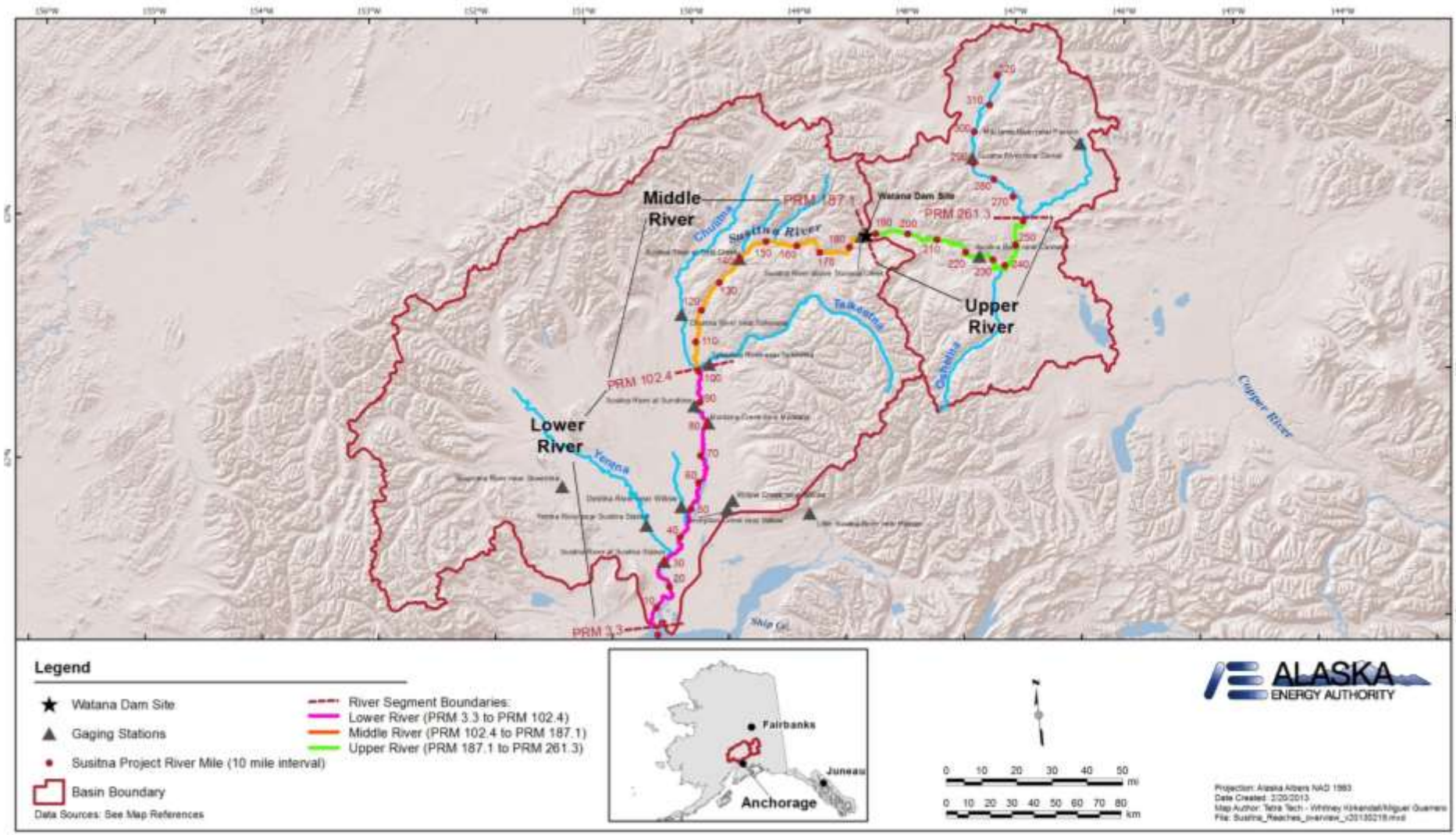


Geomorphic Mapping Objectives

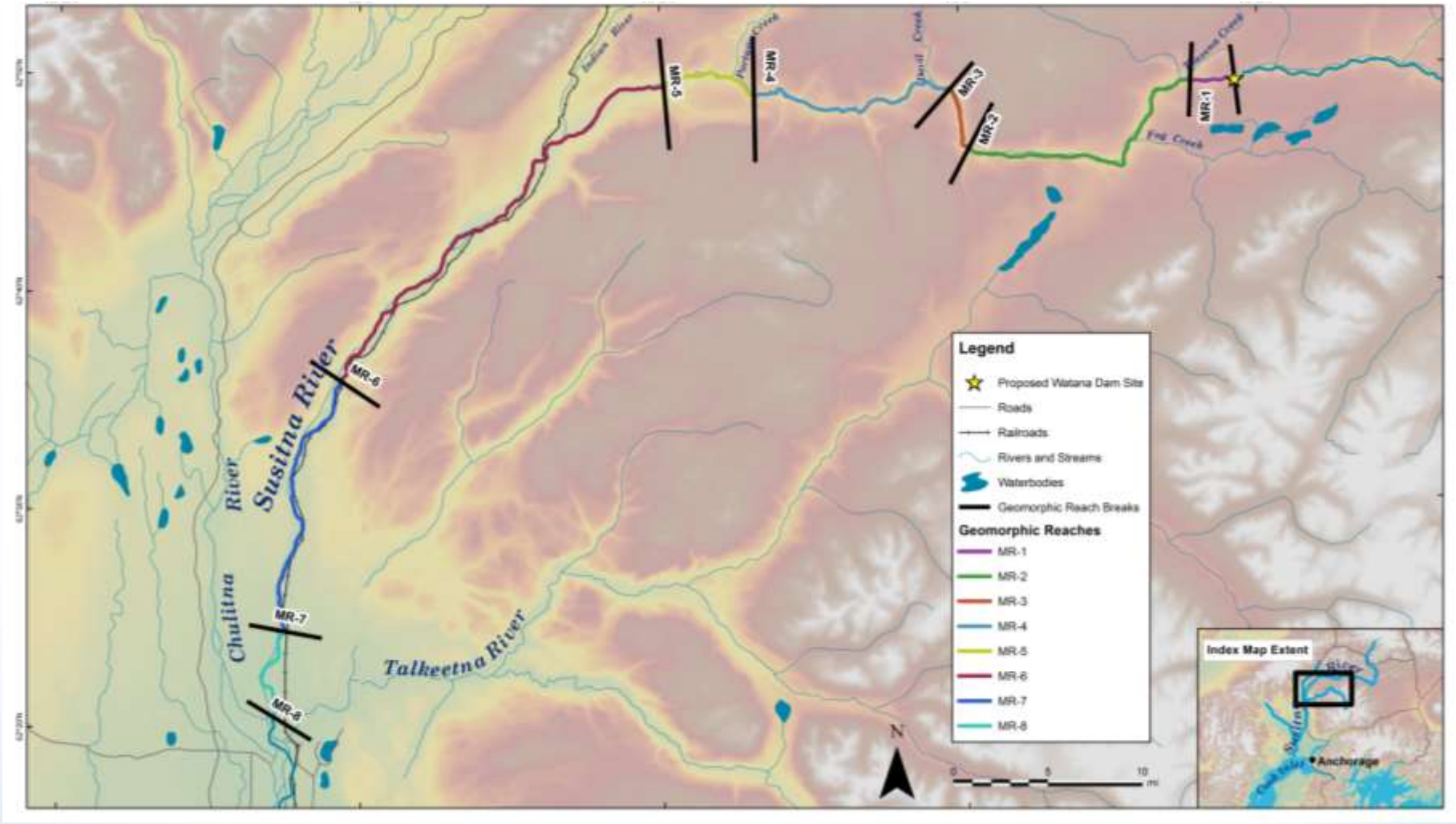
- Quantify geomorphic features in all of the Middle and Lower River Segments
- Compare areas
- Assess relative stability of river morphology under unregulated flow conditions
- Conduct geomorphic assessment of historical channel change
- Help assess applicability of 1980s data sets to describe and supplement current data

Study Areas

Middle & Lower River Segments



Study Area – Middle River



Middle River Methodology

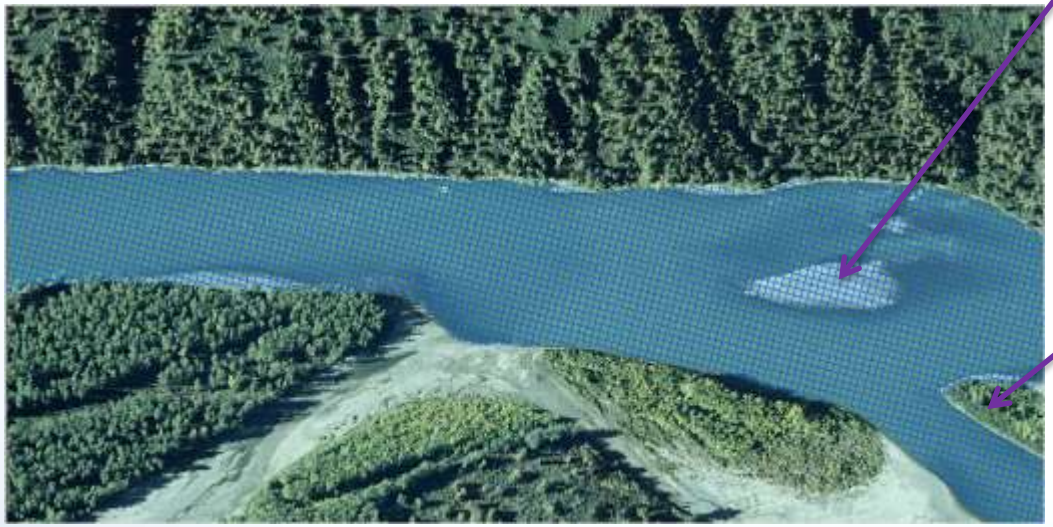
- Collect 1980s and 2012 aerials
- Delineate geomorphic features – entire segment
  - Define area of geomorphic delineation
  - Bank-to-bank
  - Includes wetted habitat, exposed substrate, low-lying areas
  - Wetted connection not required
- Geomorphic feature area tabulated by reach
- Geomorphic feature overlay analysis

Geomorphic Feature Classifications: Middle River

- Main Channel
- Side Channel
- Side Slough
- Upland Slough
- Tributary
- Vegetated Island

Main Channel

PRM 132 (within Slough 9 Site), 2012 aerial



- Turbid water
- Convey > 10 % flow (approx.)
- Exposed substrate was included in geomorphic feature area
- Vegetated islands were not included in geomorphic feature area

Side Channel

- Turbid water
- Convey < 10 % flow (approx.)

Side Slough

- Clear water
- Non-vegetated upper thalwegs
- When overtopped at moderate to high mainstem discharge convey turbid water and classified as side channels

Upland Slough

PRM 105.6 (within Whiskers Slough), 2012 aerial

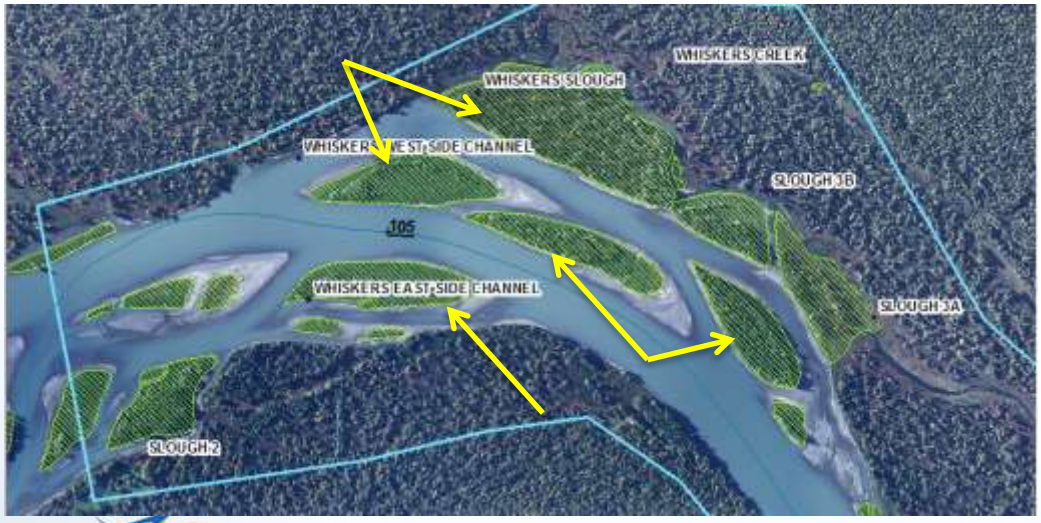
- Clear water
- Vegetated upper thalwegs
- Rarely overtopped by mainstem discharge

Tributary

- Clear water
- Portion of tributary channel flowing across floodplain

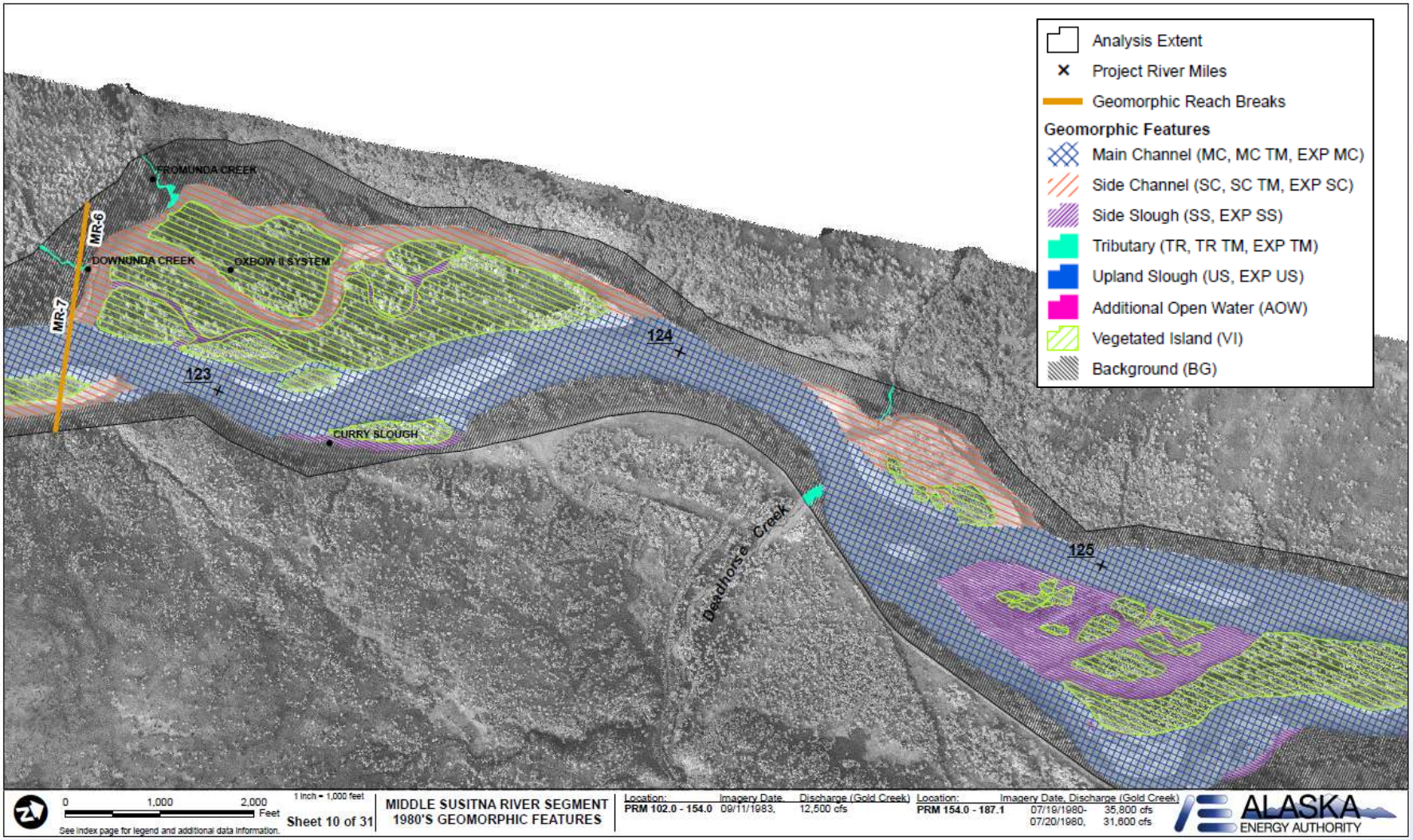
Vegetated Island

PRM 105 (within Whiskers Slough), 2012 aerial

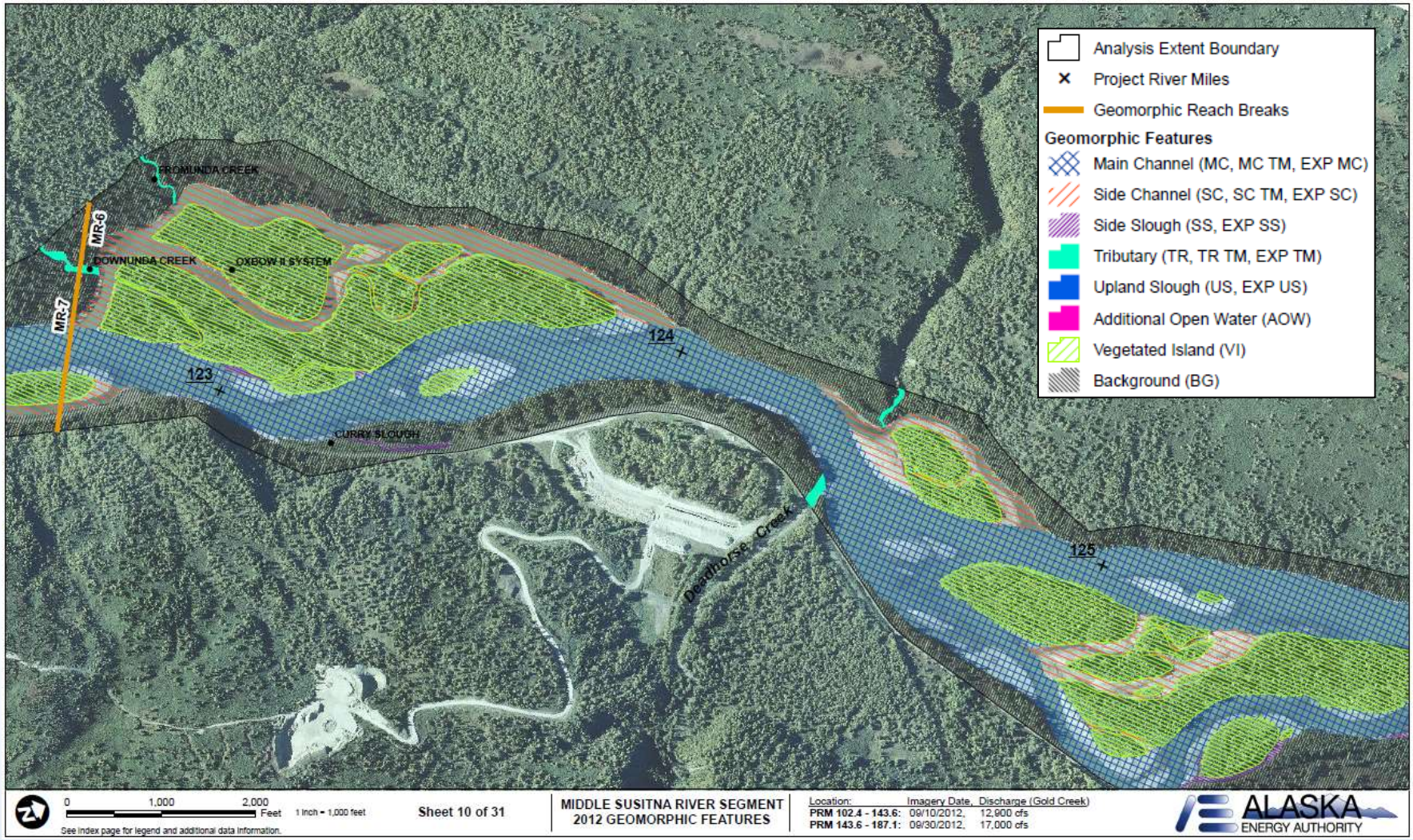


- Discrete, large vegetated island
- Have perimeters of perennial vegetation

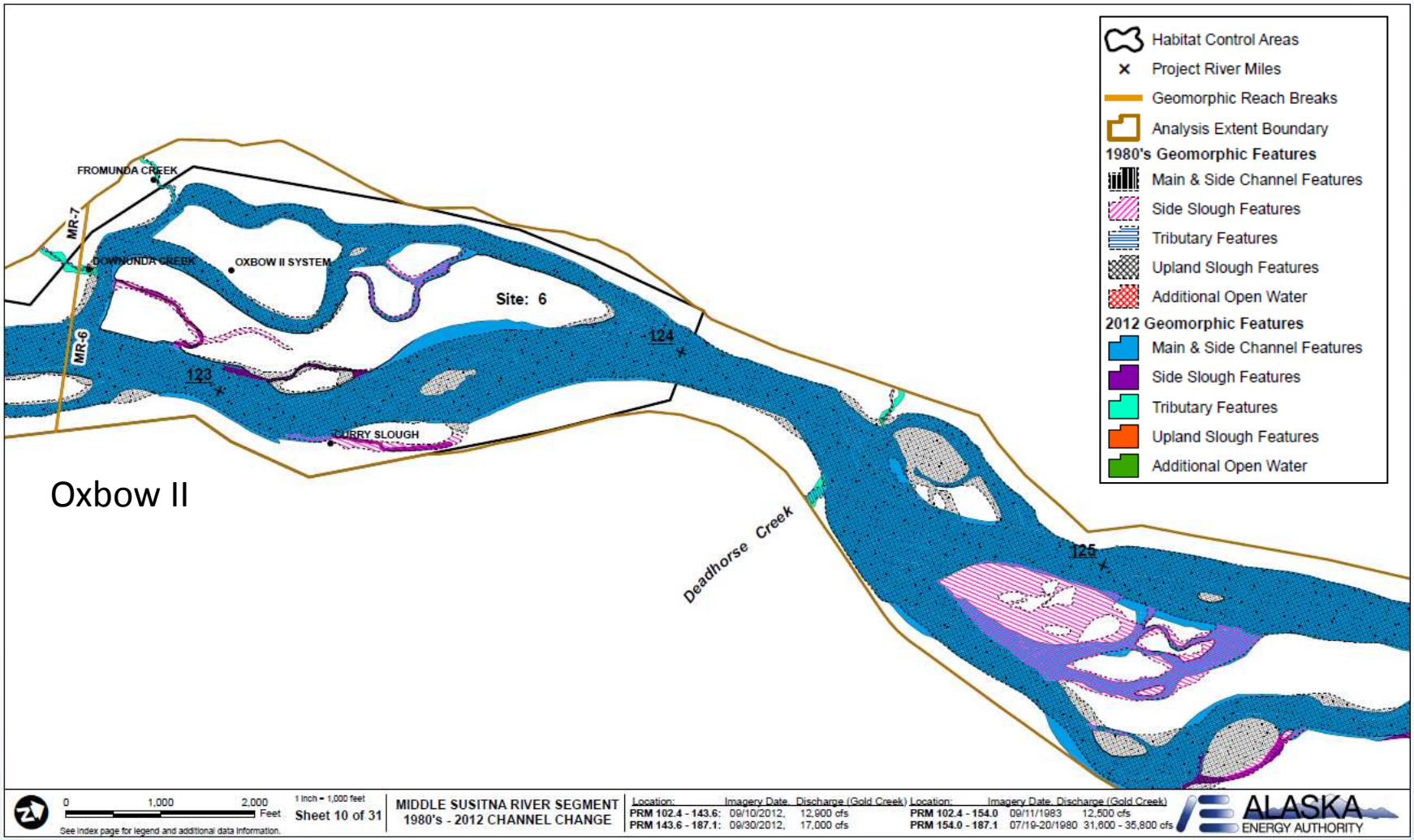
Geomorphic Feature Delineations (1983)



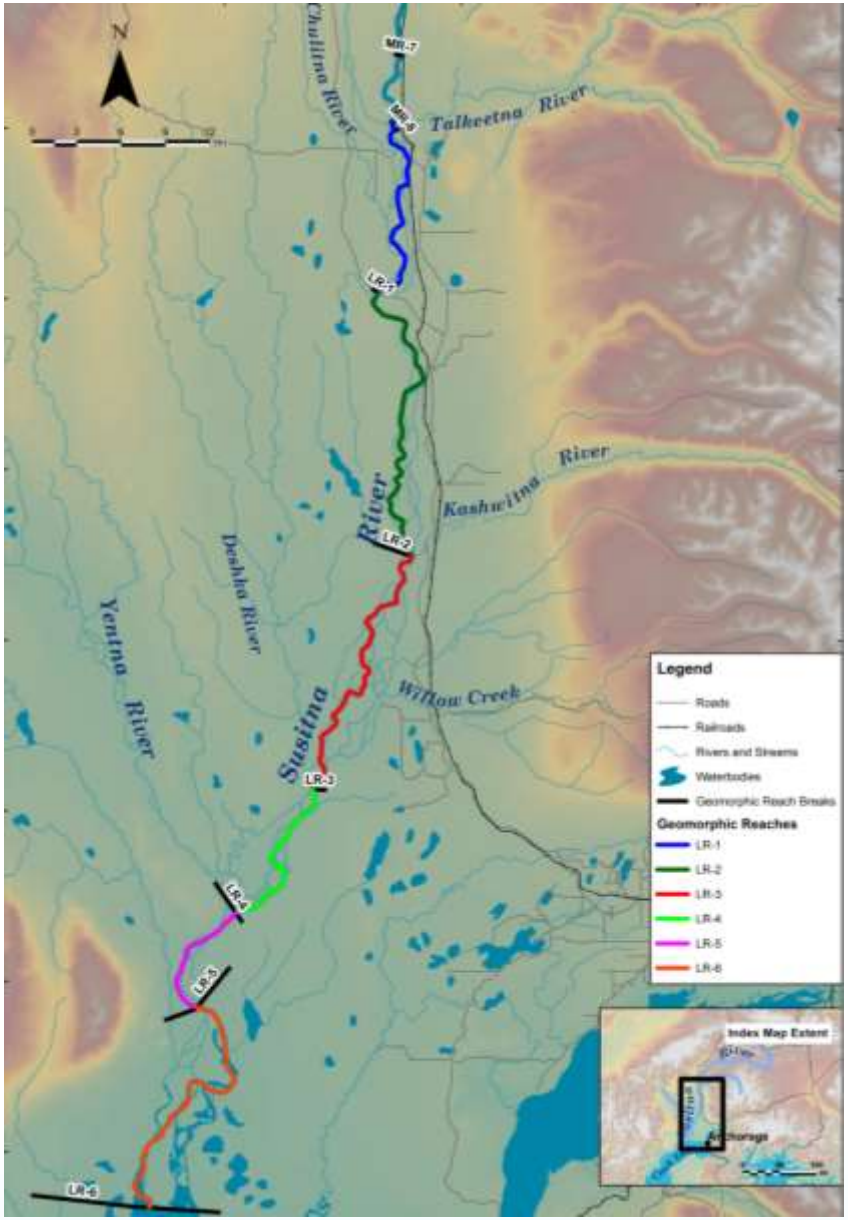
Geomorphic Feature Delineations (2012)



Channel Change Overlay



Study Area: Lower River



Lower River Methodology

- Collect 1980s and 2012 aerials
- Delineate geomorphic features – entire segment
  - Define area of geomorphic delineation
  - Bank-to-bank
  - Includes wetted habitat, exposed substrate, low-lying areas
  - Wetted connection not required
- Geomorphic feature area tabulated by reach
- Geomorphic feature overlay analysis

Geomorphic Feature Classifications: Lower River

- Main Channel
- Side Channel
- Side Channel Complex
- Bar Island Complex
- Bar/ Attached Bar
- Side Slough
- Upland Slough
- Tributary
- Tributary Delta
- Vegetated Island

Main Channel

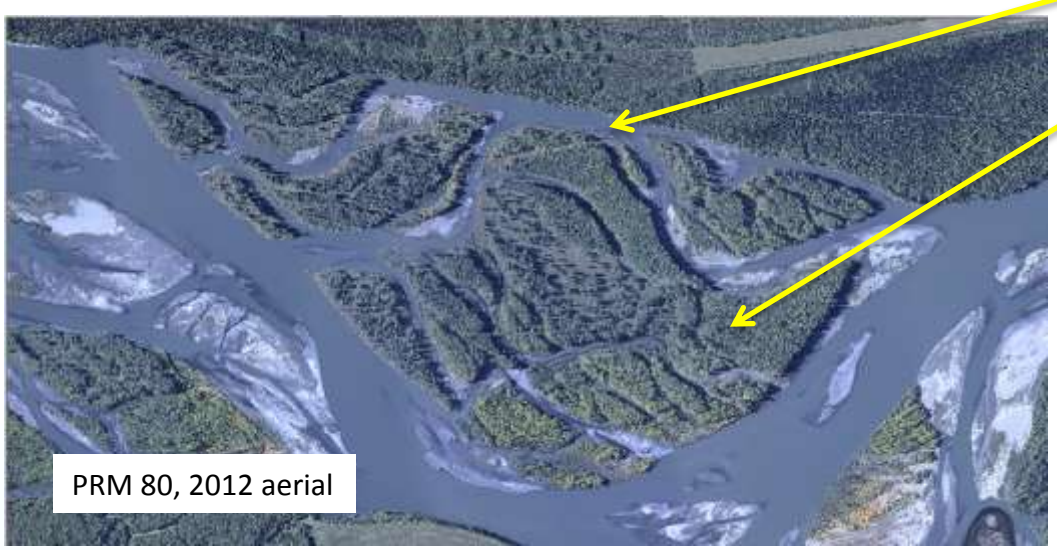
PRM 82-85, 2012 aerial

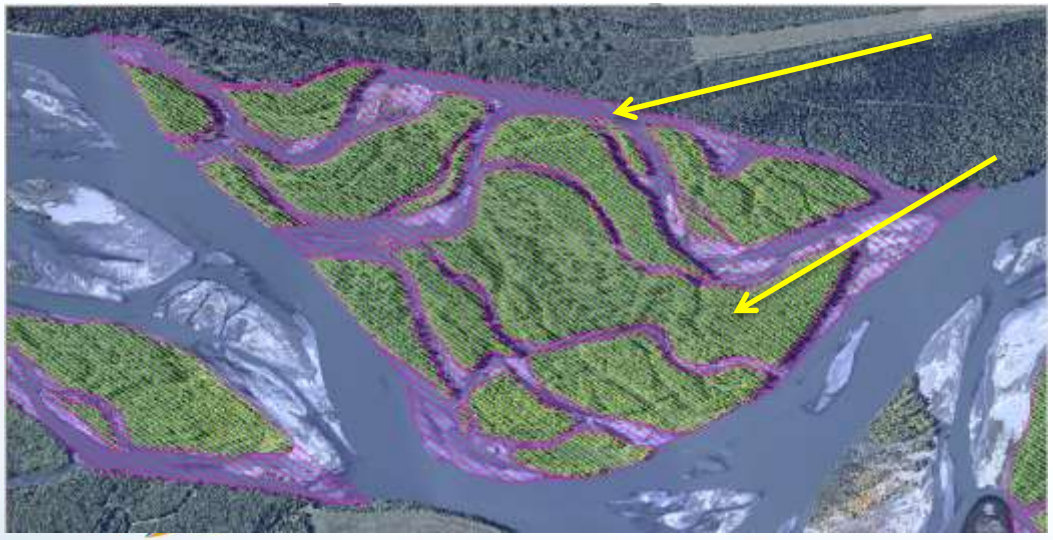
- Turbid water
- Convey > 10 % flow (approx.)
- VI, SCC, and BIC **not** included in MC area calculation

Side Channel (SC, VI SC)

- Turbid water
- Convey < 10 % flow (approx.)
- When upstream berms dewatered and contain clear water, classified as side sloughs

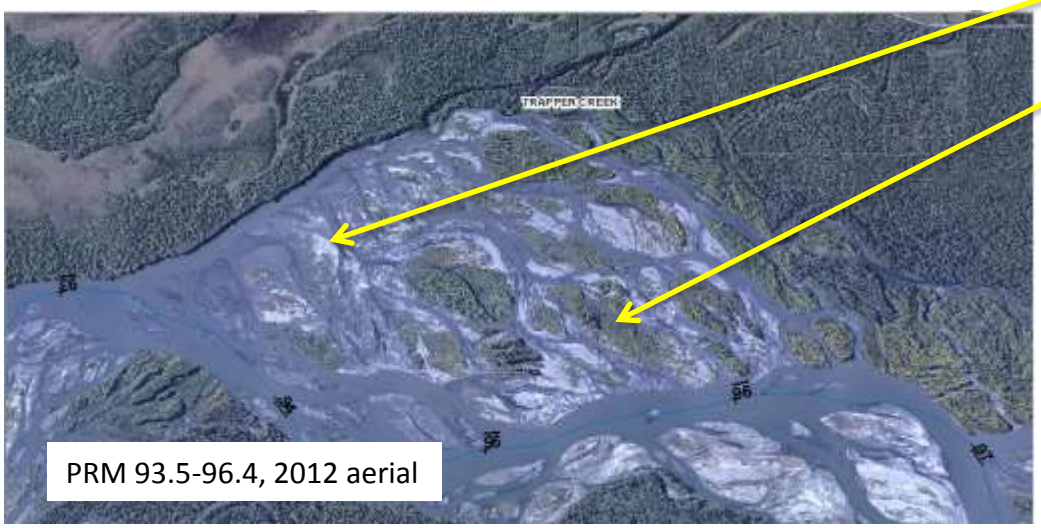
Side Channel Complex (SCC, VI SCC)



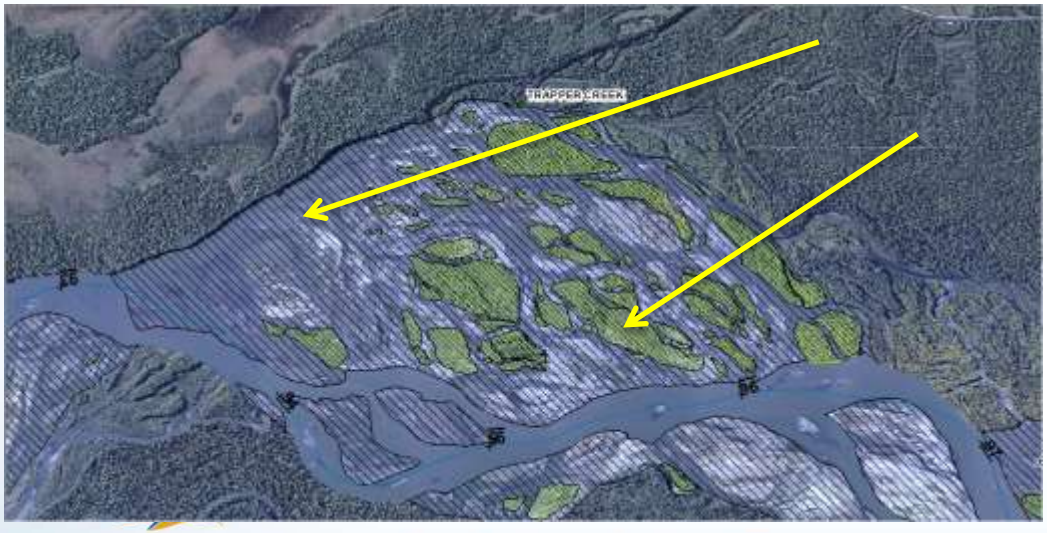


- Turbid water
- Area within mainstem that contain multiple channels separated by vegetated islands (VI)
- Veg. Islands > 50 % complex area

Bar Island Complex (BIC, VI BIC)



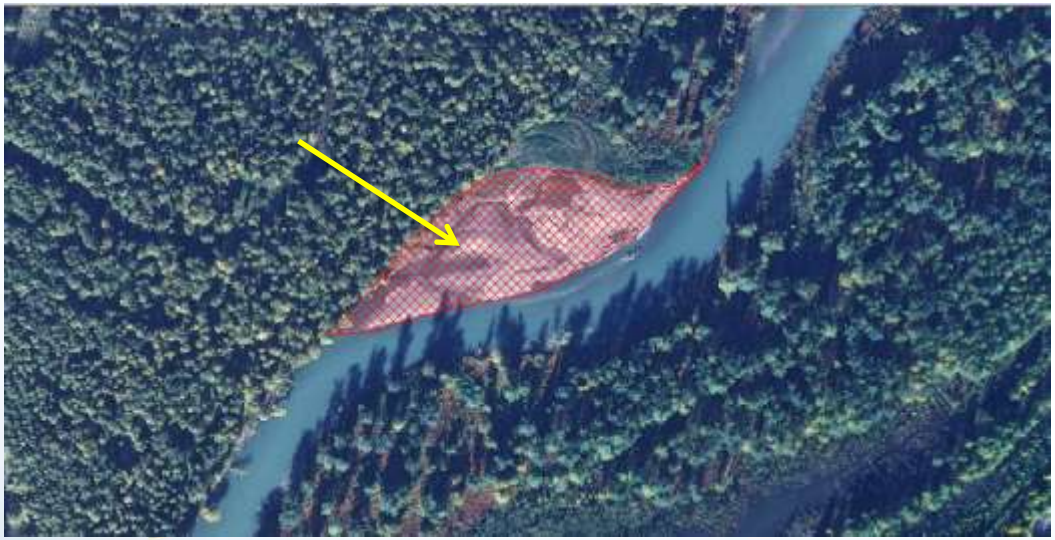
PRM 93.5-96.4, 2012 aerial



- Turbid water
- Multiple channels in braided patterns separated primarily by exposed substrate (EXP)
- Both VI and EXP can occur within BIC
- Veg. Islands < 50 % of complex area

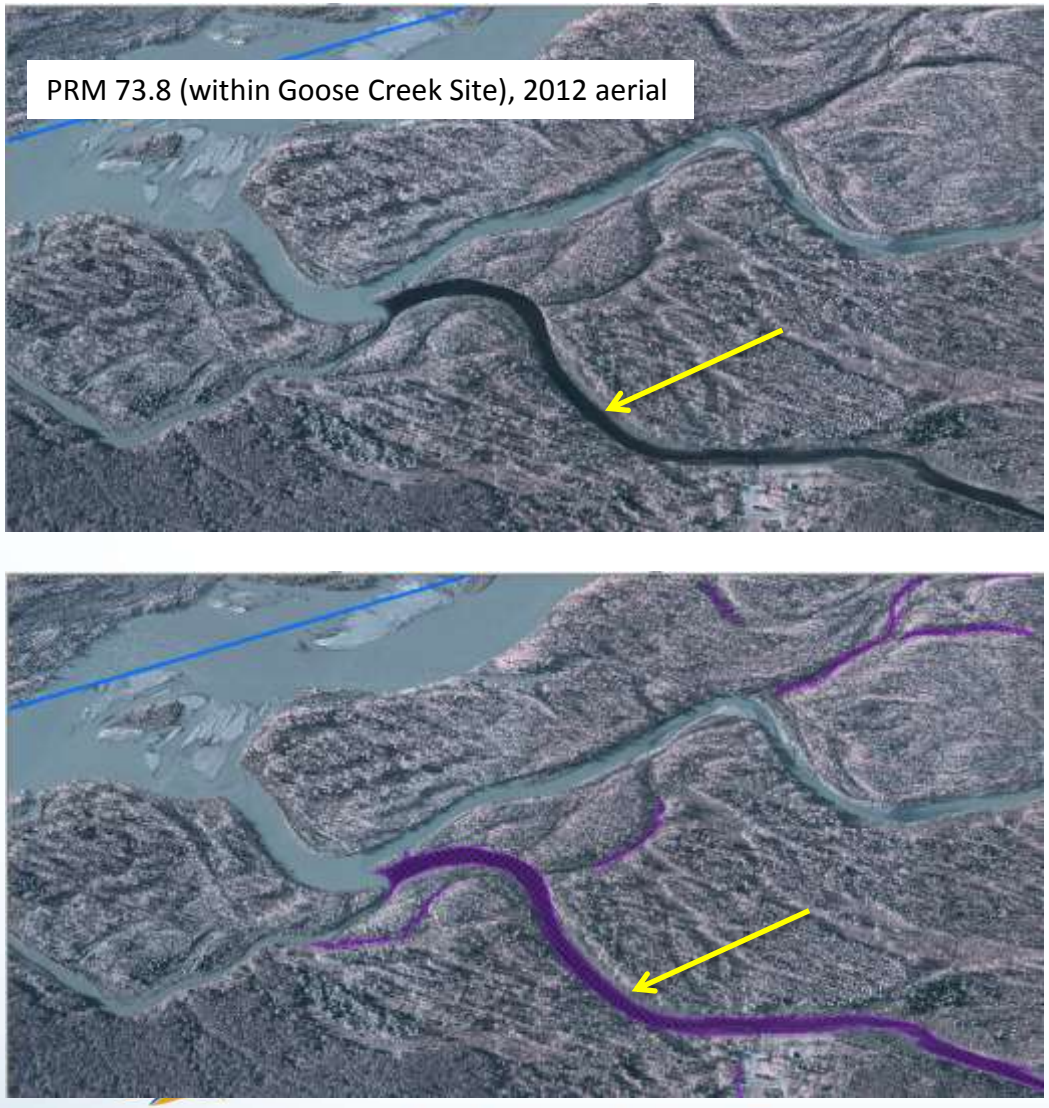
Bar/Attached Bar

Talkeetna River, adjacent to PRM 102.5, 2012 aerial



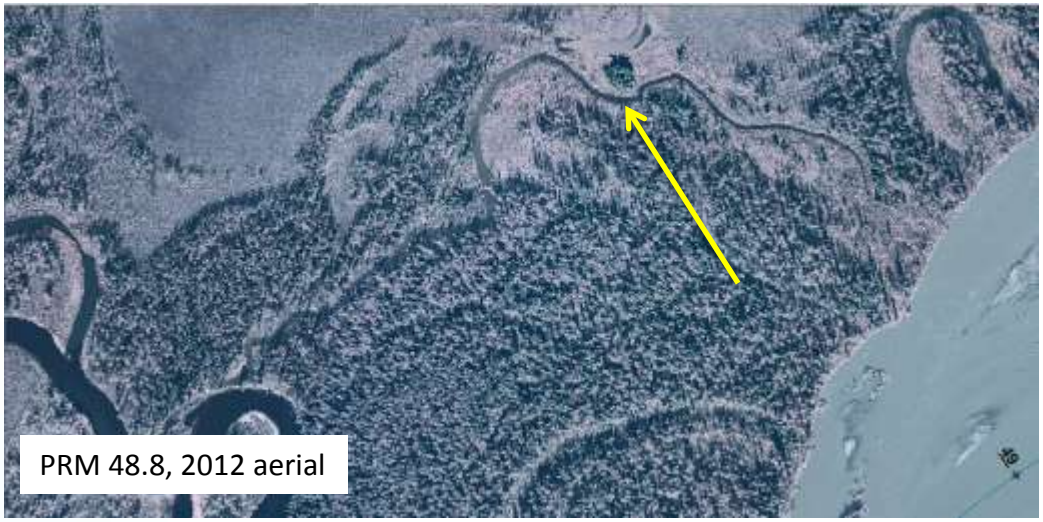
- Exposed substrate feature attached to banks of main channels
- Single, discrete point bars or alternate bars
- Not dissected by numerous channel threads

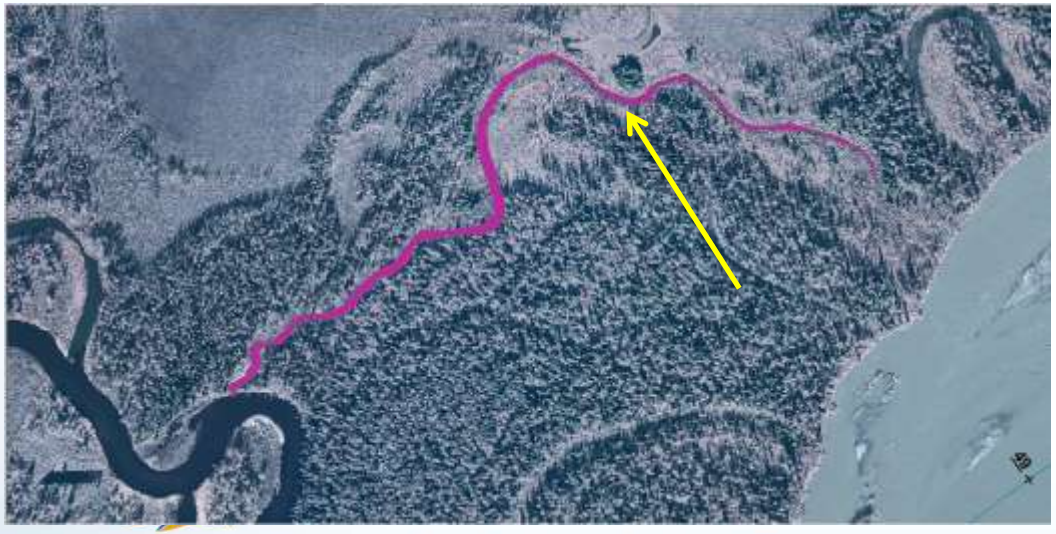
Side Slough



- Clear water
- Do **not** have numerous mature trees in upper thalwegs
- When overtopped at moderate to high mainstem discharge, convey turbid water and classified as side channels

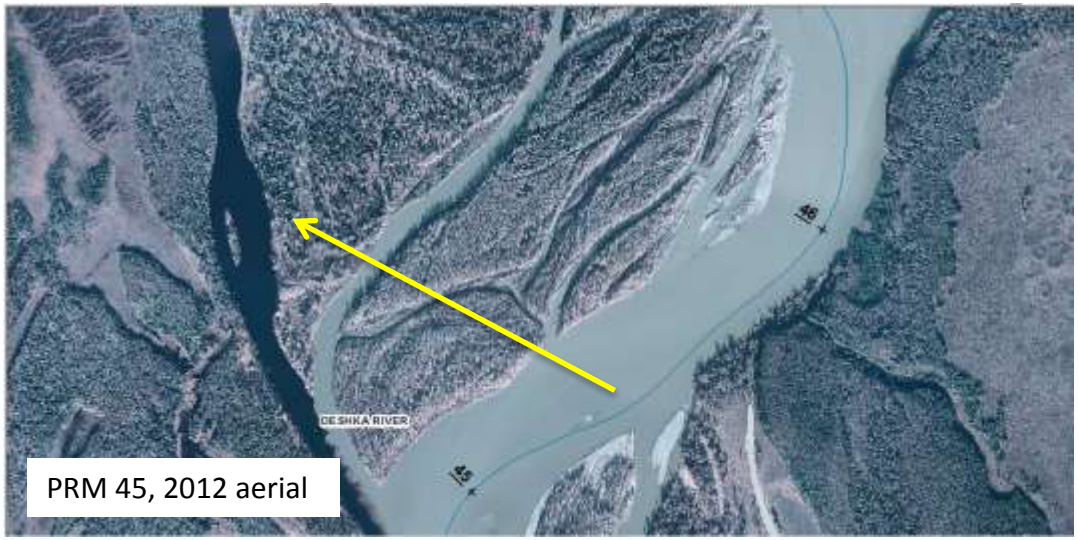
Upland Slough





- Clear water
- Mature trees in upper thalwegs
- Rarely overtopped by mainstem discharge

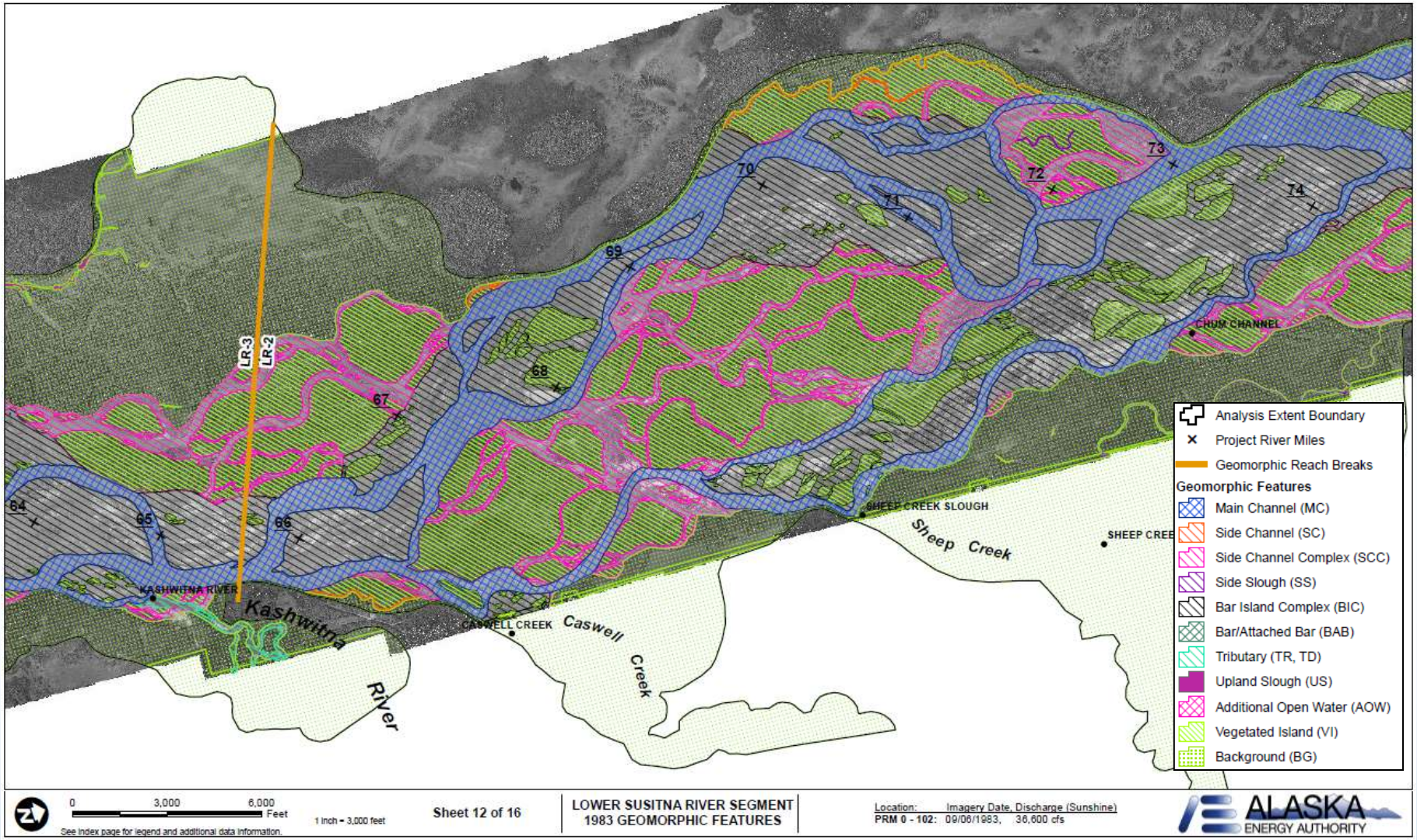
Tributary



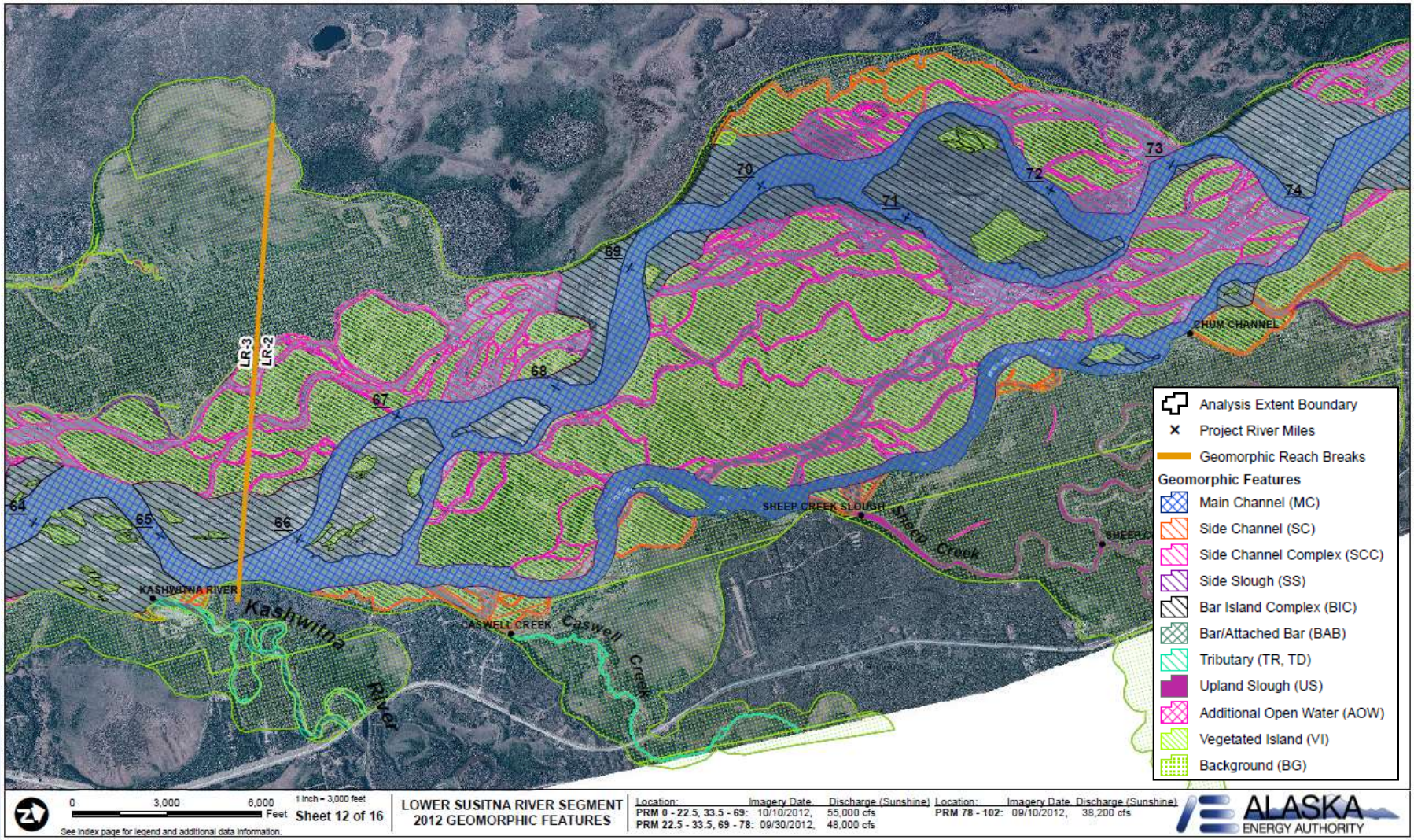
PRM 45, 2012 aerial

- Clear water
- Portion of tributary channel flowing across the floodplain

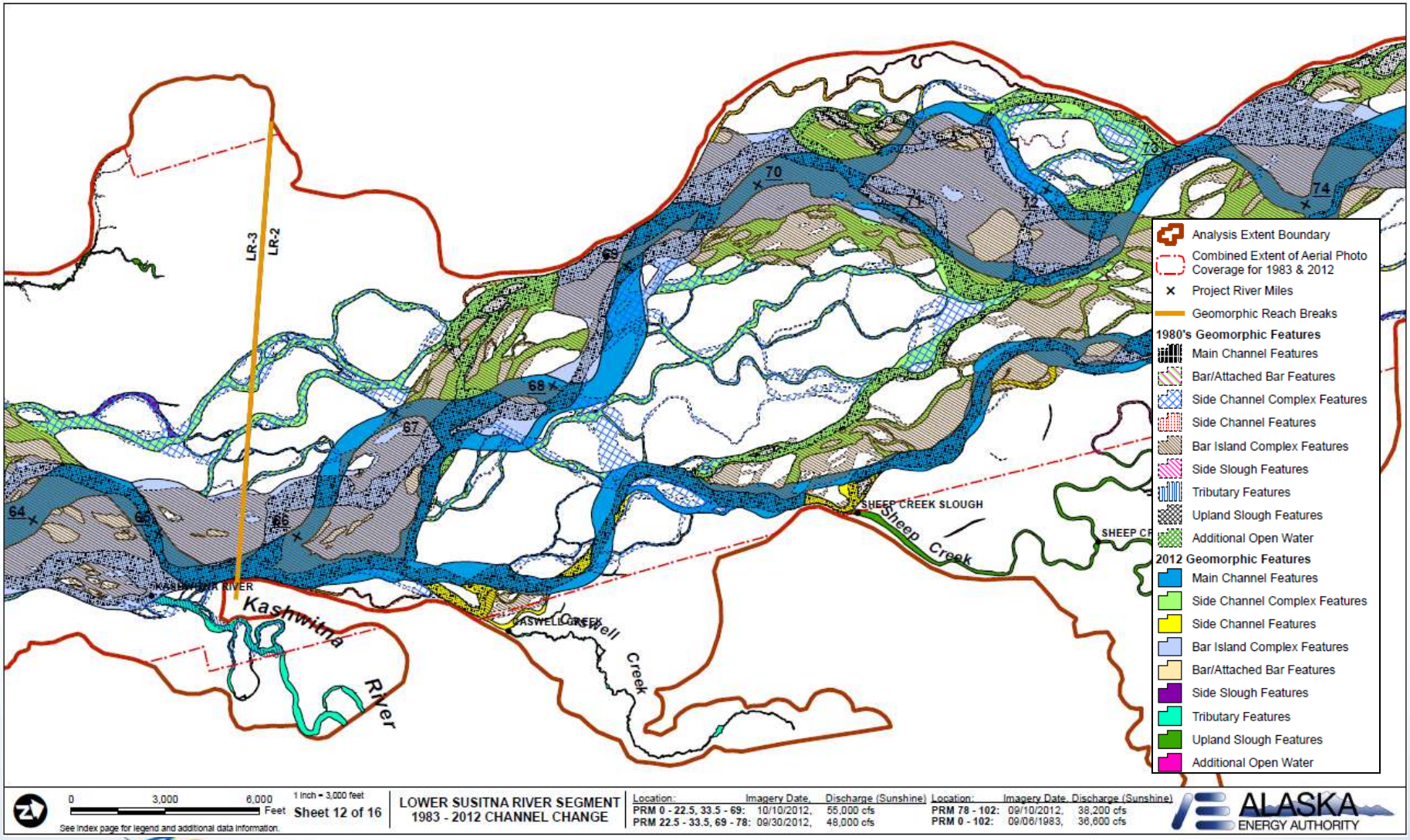
Geomorphic Feature Delineations (1983)



Geomorphic Feature Delineations (2012)



Channel Change Overlay

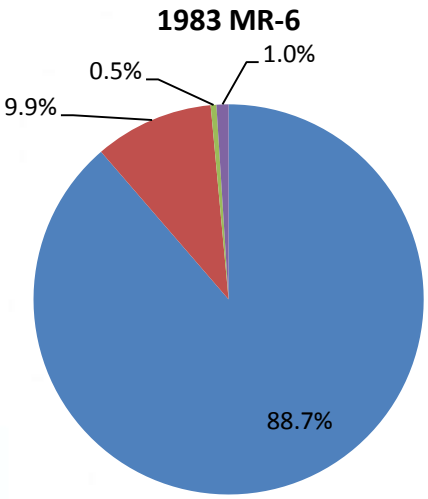


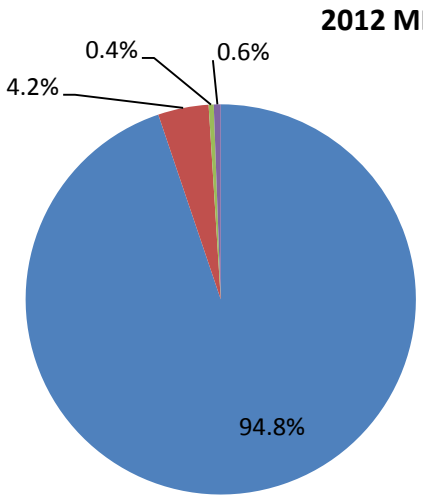
Summary of Findings: Middle River

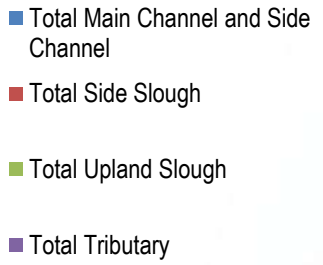
- Overall vegetation increase e.g. vegetation encroachment of main and side channels below Devils Canyon
- Overall reduction in side slough frequency and surface area
- Cycle of fan expansion and vegetation encroachment in tributaries

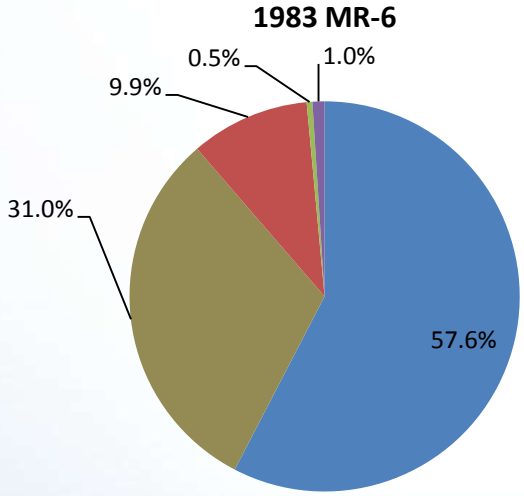
Summary of Findings: Middle River (cont.)

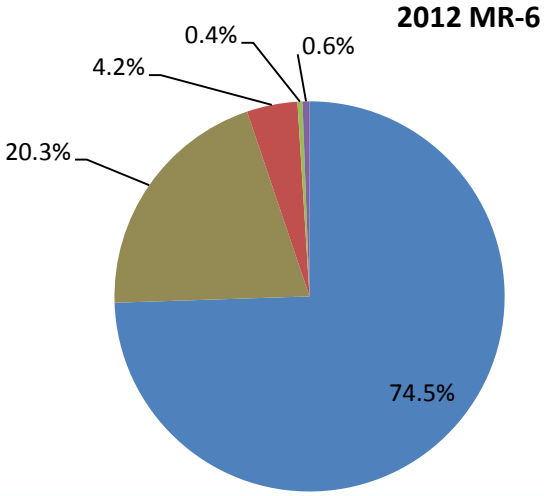
- Clearwater features comprise < 12 % total area of any reach
- Relative proportion change:
  - Side Slough = -66 % to -58 %
  - Upland Slough = - 13 % to 30 %
  - Tributary Features = -42 % to 58%

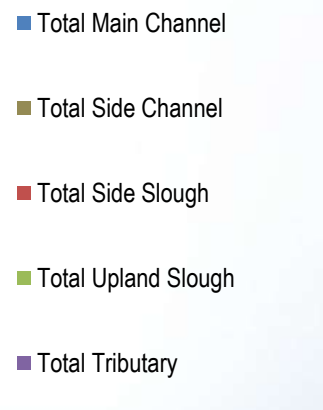

1983 MR-6
1.0%
0.5%
9.9%
88.7%


2012 MR-6
0.4%
0.6%
4.2%
94.8%


Total Main Channel and Side Channel
Total Side Slough
Total Upland Slough
Total Tributary


1983 MR-6
1.0%
0.5%
9.9%
31.0%
57.6%

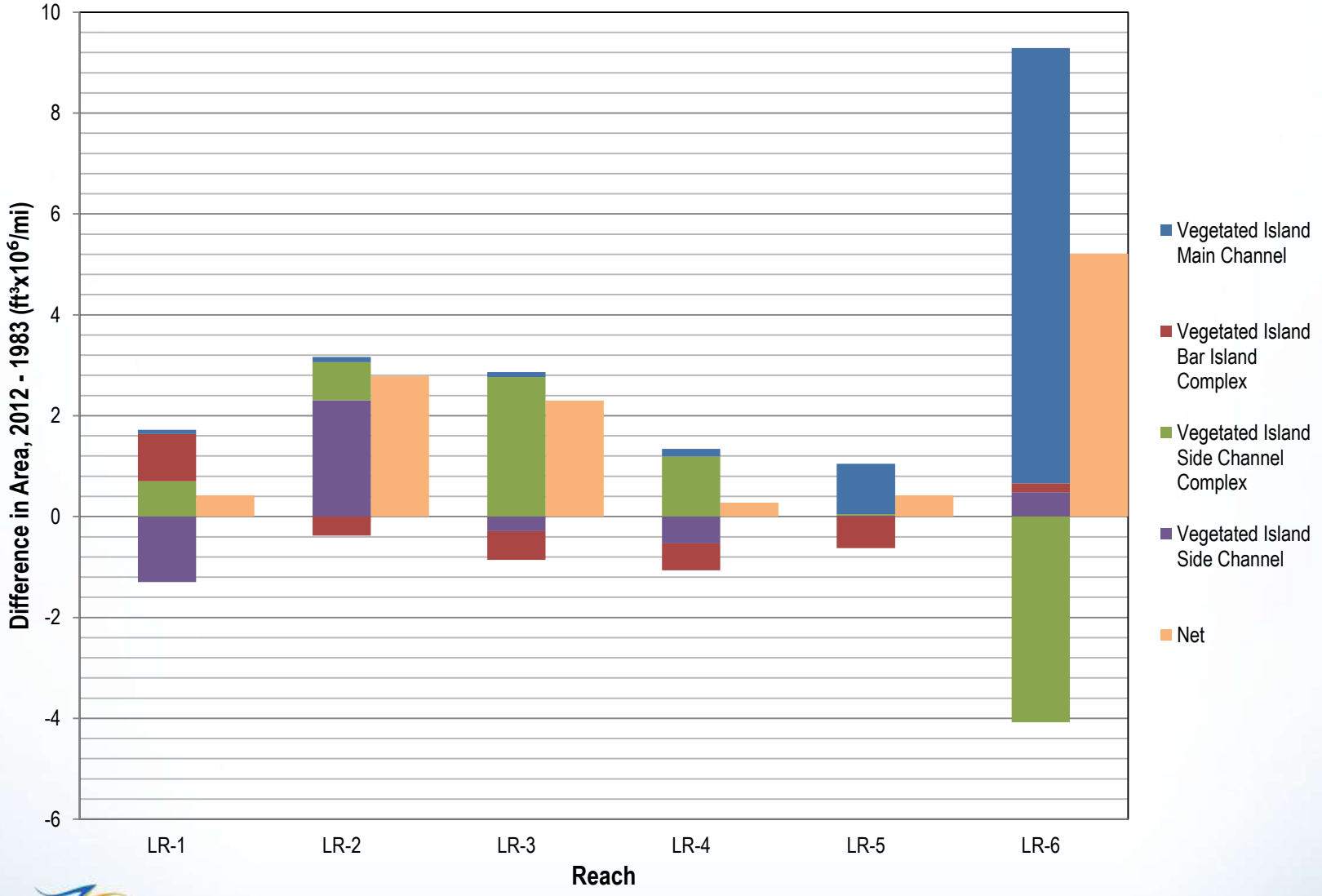

2012 MR-6
0.4%
0.6%
4.2%
20.3%
74.5%


Total Main Channel
Total Side Channel
Total Side Slough
Total Upland Slough
Total Tributary

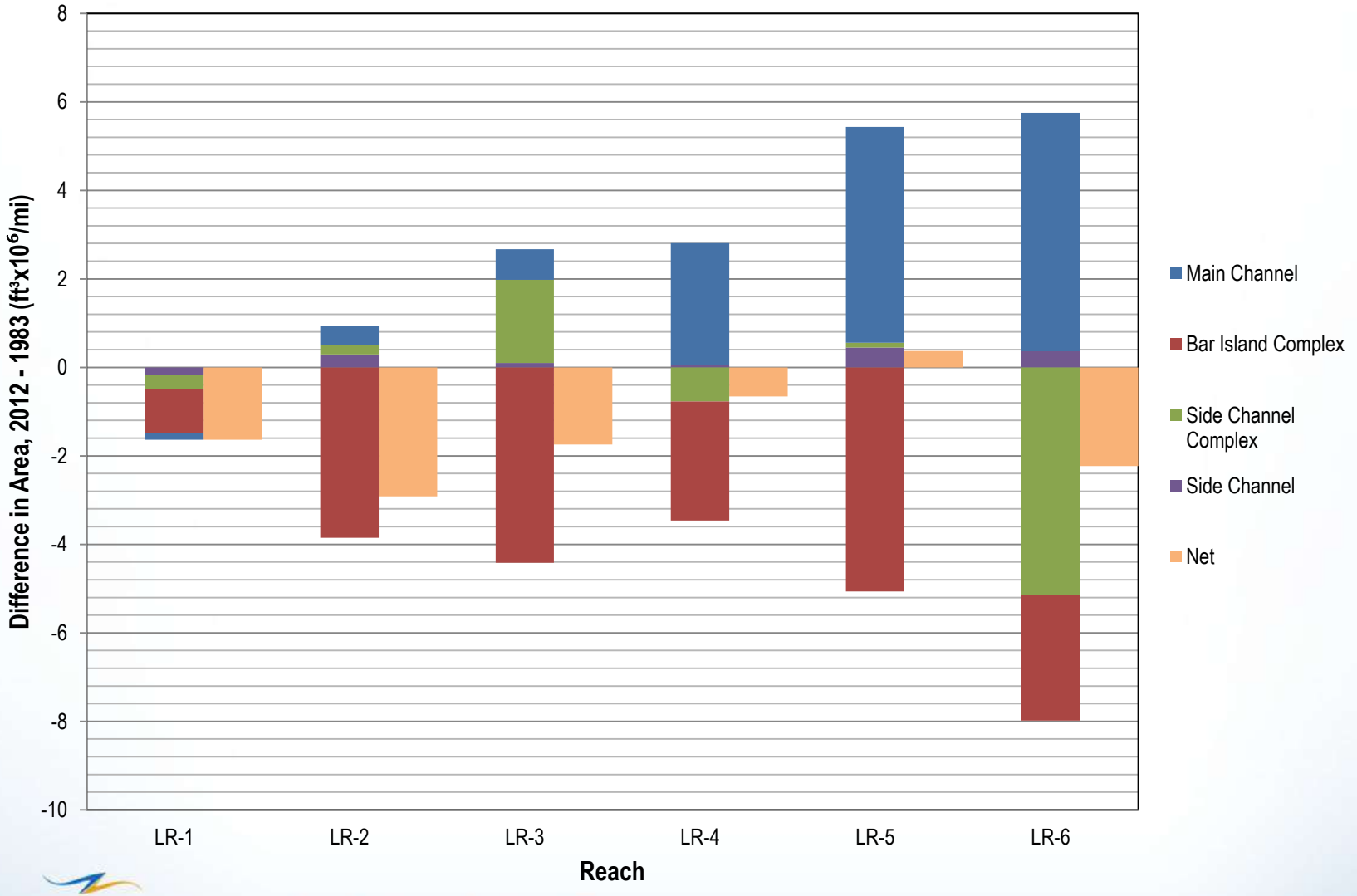
Summary of Findings: Lower River

- Overall vegetation increase, average island width range:
  - Low: 50 ft and 80 ft increase (LR-4 and LR-5)
  - High: 1,000 ft increase (LR-6)
- Area of primary conveyance features decreased in 5 reaches
- Net increase in lumped clearwater feature area (sloughs and tributaries combined) in all reaches, exception LR-6
- Relative proportion change:
  - Side slough = -100 % to 108 %
  - Upland slough = -1 % to 170 %
  - Tributary features = 2% to 67 %
- Clearwater feature changes due to main channel migration causing increased or decreased connectivity

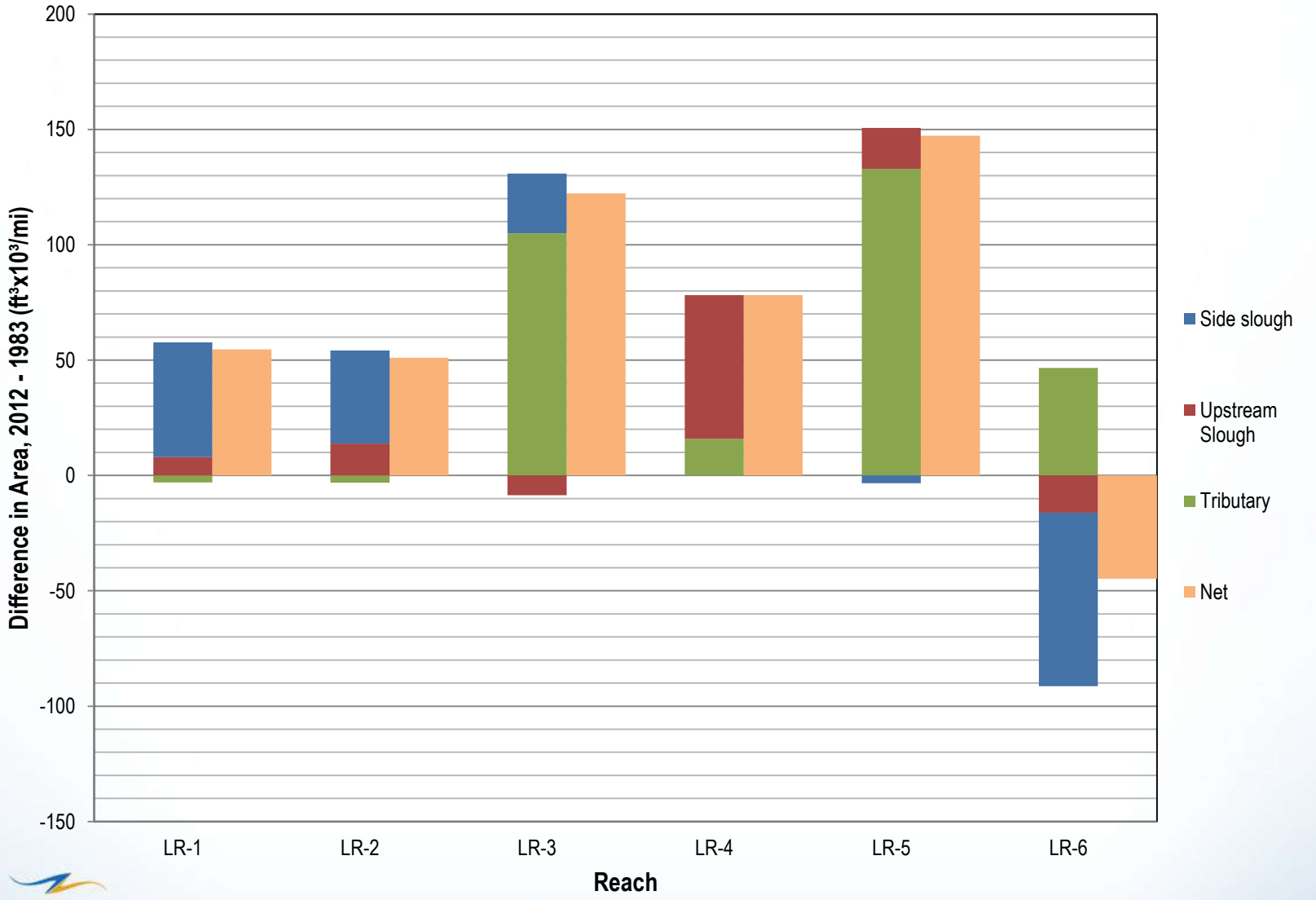
Primary Conveyance Features Vegetated Islands

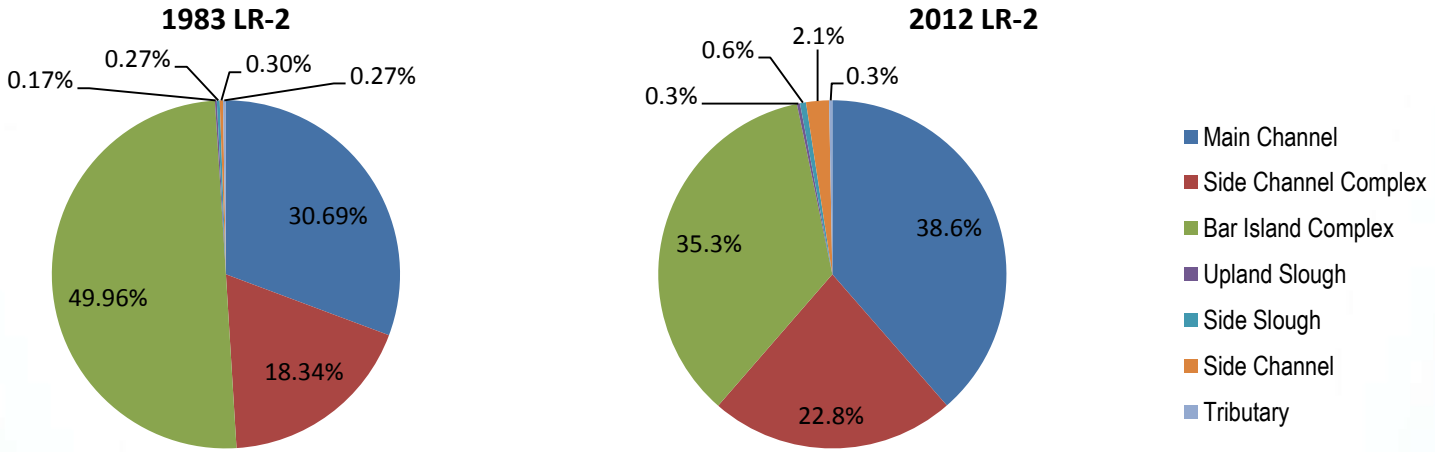


Primary Conveyance Features



Clearwater Features




1983 LR-2
0.17%
0.27%
0.30%
0.27%
30.69%
49.96%
18.34%
2012 LR-2
0.6%
2.1%
0.3%
0.3%
38.6%
35.3%
22.8%
Main Channel
Side Channel Complex
Bar Island Complex
Upland Slough
Side Slough
Side Channel
Tributary

Overall Conclusions and Recommendations

- Within both the Middle and Lower River Segments, the level of change in proportion of the various geomorphic features, particularly the clearwater features, between the 1980s and present, supports the recommendations in the *Mapping of Aquatic Macrohabitat Types* Technical Memorandum that the 1980s surface area mapping of the aquatic macrohabitats should not be the sole or primary information used to represent the current aquatic macrohabitat conditions.

Overall Conclusions and Recommendations: 2013 Studies

- Complete aerial acquisition at target flows
  - Middle River at 12,500 cfs (for PRM 143.6 to PRM 187.1)
  - Lower River at 36,600 cfs (for PRM 0 to PRM 78)
- Studies at tributary mouths
  - Trapper Creek
  - Birch Creek
  - Sheep Creek
  - Caswell Creek
  - Deshka River
- Reference discharges for feature differentiation (e.g. specific breaching flow assigned to determine difference between side slough and side channel)

END