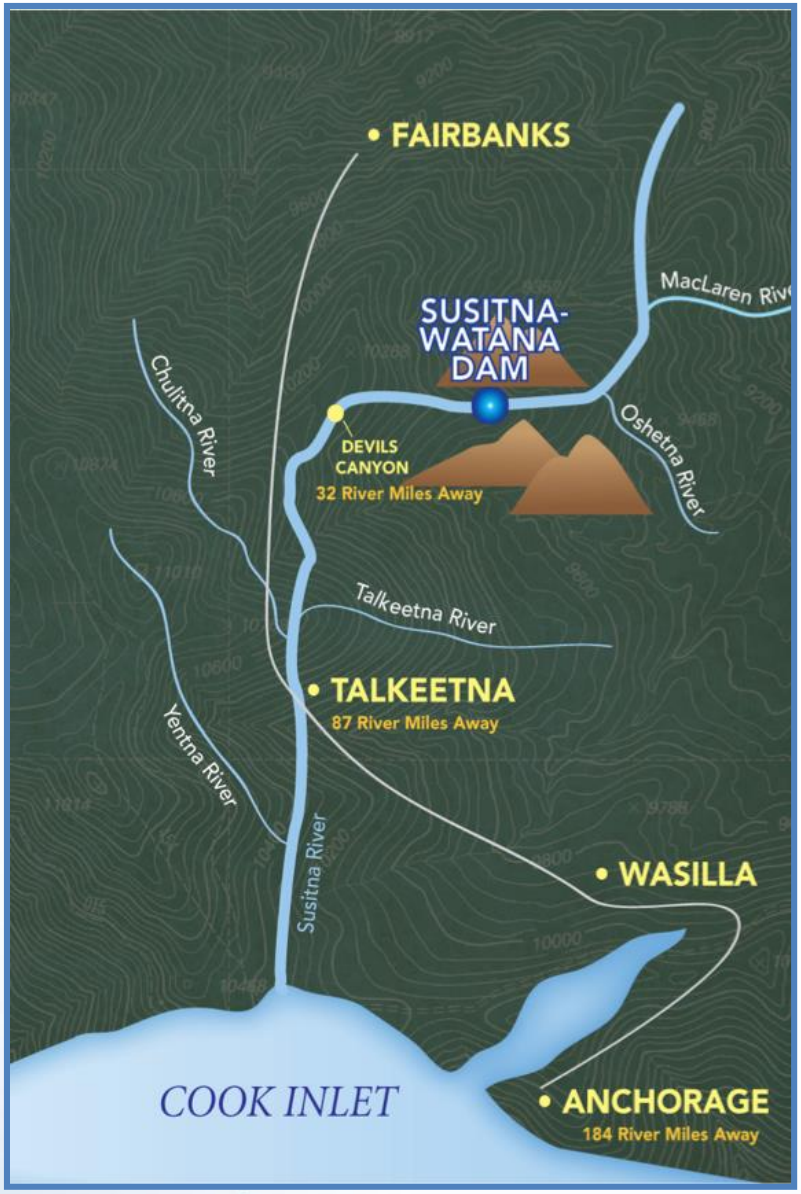


SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Technical Team Meeting

Fish and Aquatics Instream Flow

2013 HSC Data Collection

17 May 2013

Prepared by R2 Resource Consultants

Topics of Discussion

- Selection of Priority HSC Species and Life Stages
- 2013 HSC and Stranding & Trapping Data Collection
  - ✓Methods, timing/frequency, locations
  - ✓Other potential data sources
    - Fish distribution and abundance
    - Water quality
    - Groundwater
    - River productivity
    - Fish passage/connectivity

Fish Species Distribution

Common Name	Susitna River Segment		
	Lower	Middle	Upper
Arctic grayling	X	X	X
Dolly Varden	X	X	X
Humpback whitefish	X	X	X
Round whitefish	X	X	X
Burbot	X	X	X
Longnose sucker	X	X	X
Sculpin	X	X	X
Eulachon	X		
Bering cisco	X		
Threespine stickleback	X	X	
Ninespine stickleback	X		
Arctic lamprey	X	X	
Chinook salmon	X	X	X
Coho salmon	X	X	
Chum salmon	X	X	
Pink salmon	X	X	
Sockeye salmon	X	X	
Rainbow trout	X	X	
Northern pike	X		
Lake trout	X		

(Jennings 1985, Delaney et al. 1981

2013 Priority Species and Life Stage

Common Name	Low	Moderate	High
Arctic grayling			x
Dolly Varden		x	
Humpback whitefish		x	
Round whitefish	x		
Burbot		x	
Longnose sucker		x	
Sculpin	x		
Eulachon		x	
Bering cisco	x		
Threespine stickleback	x		
Arctic lamprey	x		
Chinook salmon			x
Coho salmon			x
Chum salmon			x
Pink salmon			x
Sockeye salmon			x
Rainbow trout			x
Northern pike	x		
Lake trout	x		

- Target high priority species and life stage?
- By river segment?
- By season winter/summer?
- Goal >100 measurements per species and life stage
- If goal reached, consider focusing on next highest priority?

2013 HSC Data Collection

2013 Data Collection Effort:

- Collect microhabitat use and availability data across a broad range of habitat conditions for development of site-specific HSC preference curves
- Evaluate relationship between other variables (water quality & chemistry, groundwater upwelling) and fish presence where possible

2013 HSC Sampling Summary

- Focus on priority species and life stage, but collect HSC data on all fish observed/captured
- Goal of >100 measurement per life stage
- Sample Timing: June – September
  - 6-8 samplings efforts (8-days each effort) by 1-2 field crews
- All HSC sampling within Middle River FAs
- Methods:
  - snorkel, seining, electrofishing, pedestrian
- Review field activities (sampling areas and methods) for other disciplines to reduce redundant sampling and increase efficiency
    - Fish distribution
    - Water quality
    - Groundwater
    - River Productivity

2013 HSC Site Selection

Concentrate on 4 Focus Areas with known fish use and highest diversity of macrohabitat types:

- FA-104 Whiskers Slough
- FA-113 Oxbow I
- FA-128 Skull Creek
- FA-141 Indian River

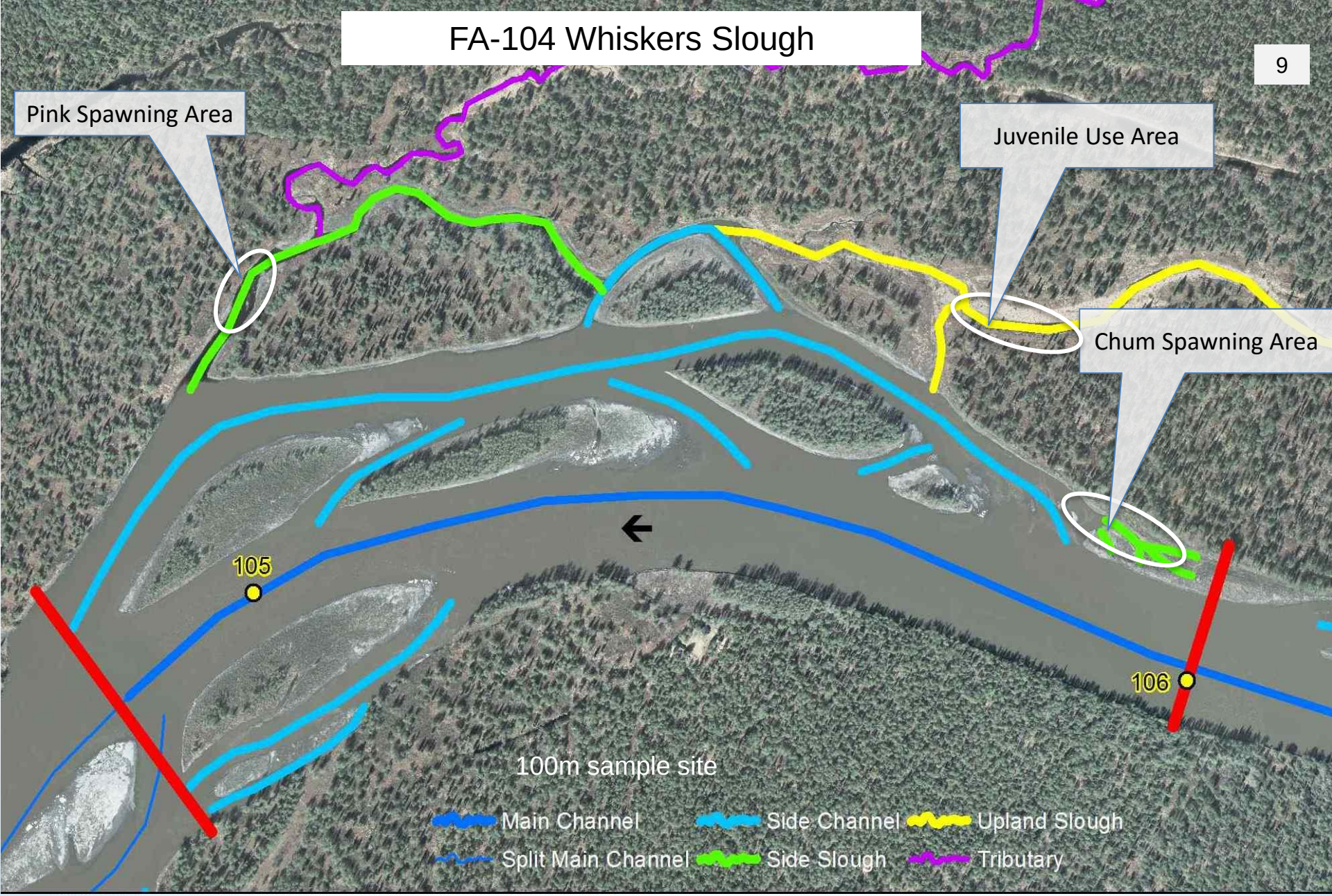
Subjectively select macrohabitat types to be sampled

- If two or more units available, select two of each type present
- If only one unit available, select that unit

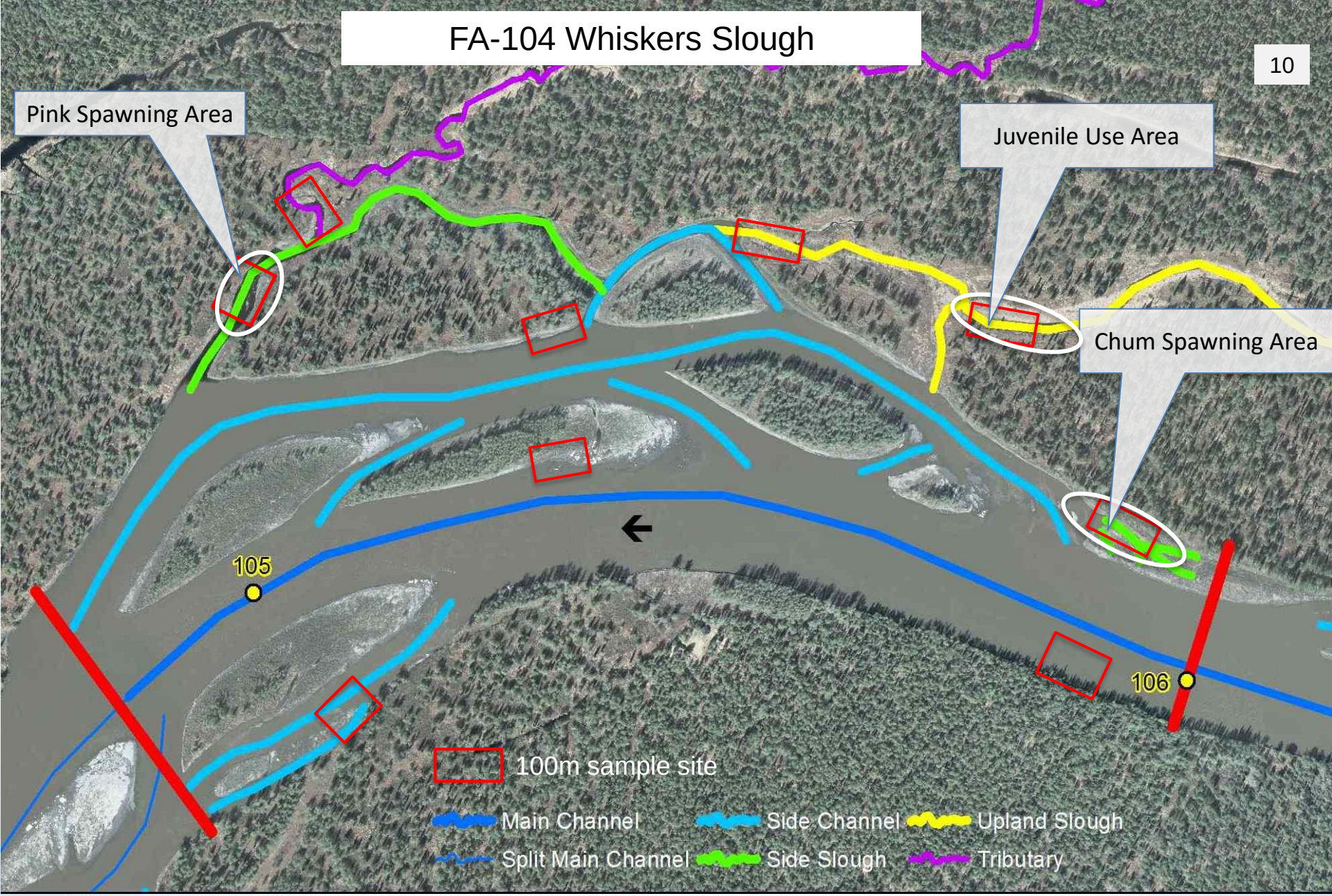
2013 HSC Site Selection

- Select individual sampling sites
- Most habitat units too long to sample entire unit
- Site Selection Criteria:
  - Areas with diverse distribution of microhabitat (slow and fast velocity, deep and shallow water)
  - Areas of expected fish use
  - Areas with fish cover (LWD, depth, vegetation, velocity shelter)
- Propose one, 100m sampling sites from within each selected macrohabitat type

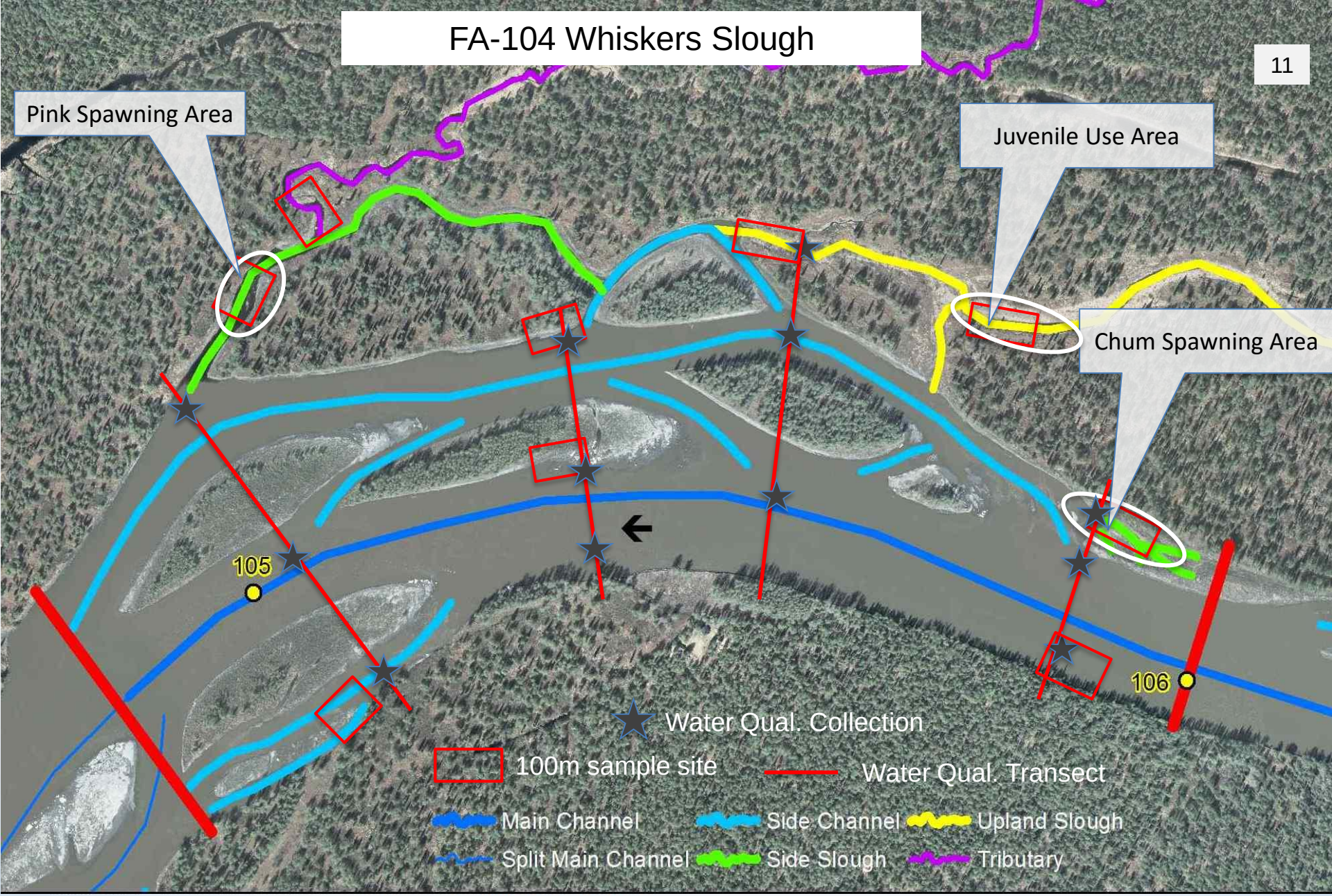
FA-104 Whiskers Slough



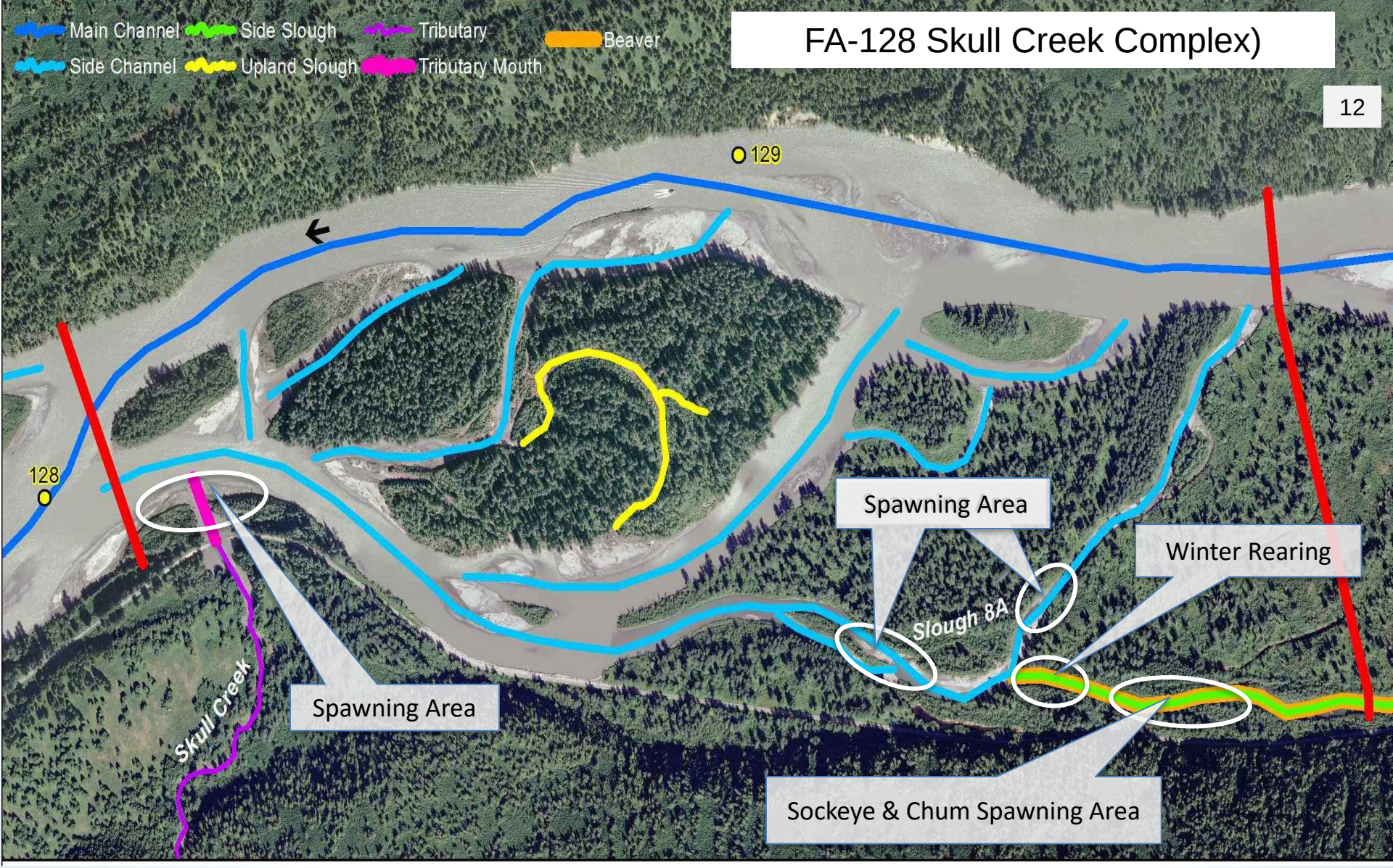
FA-104 Whiskers Slough



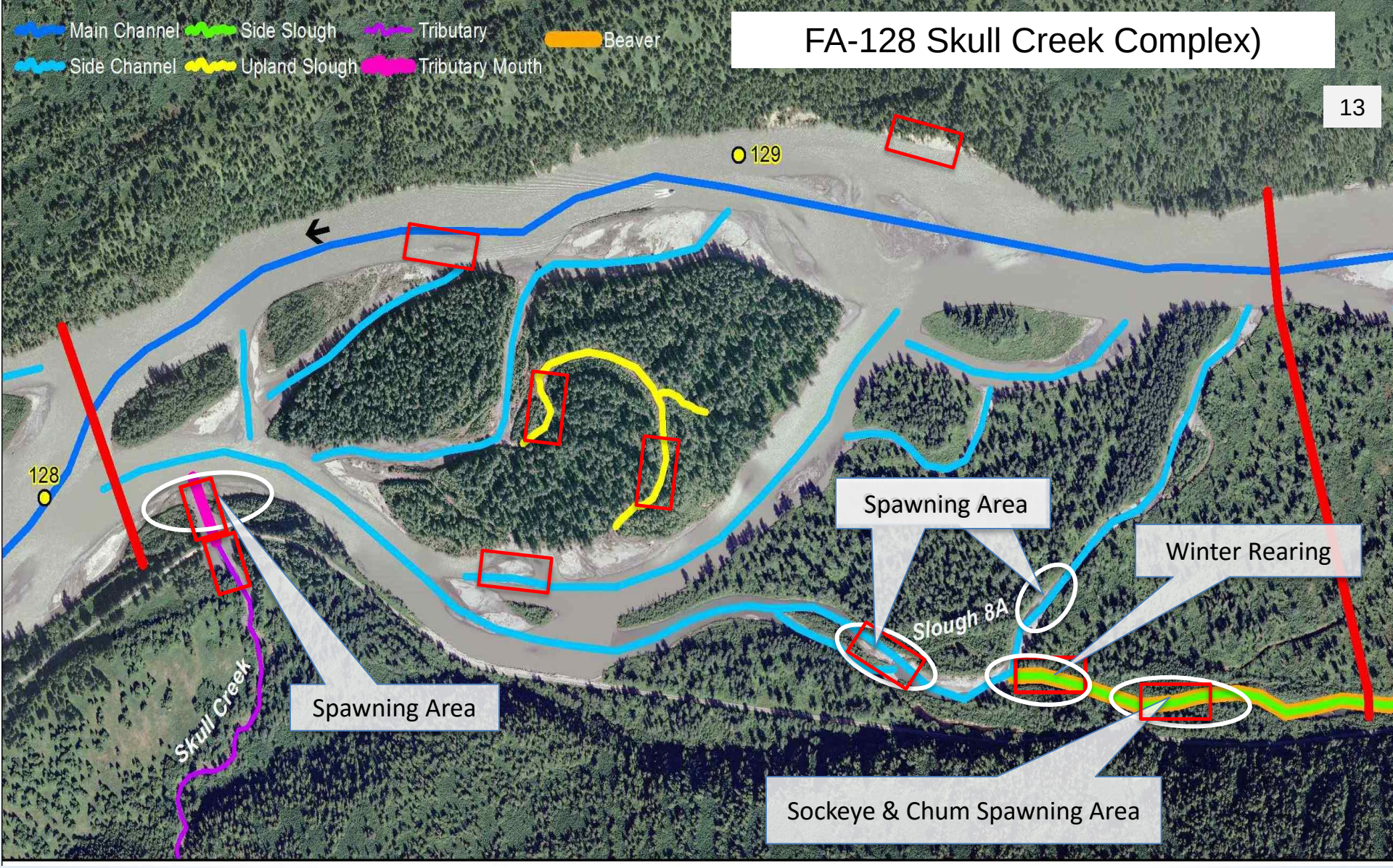
FA-104 Whiskers Slough



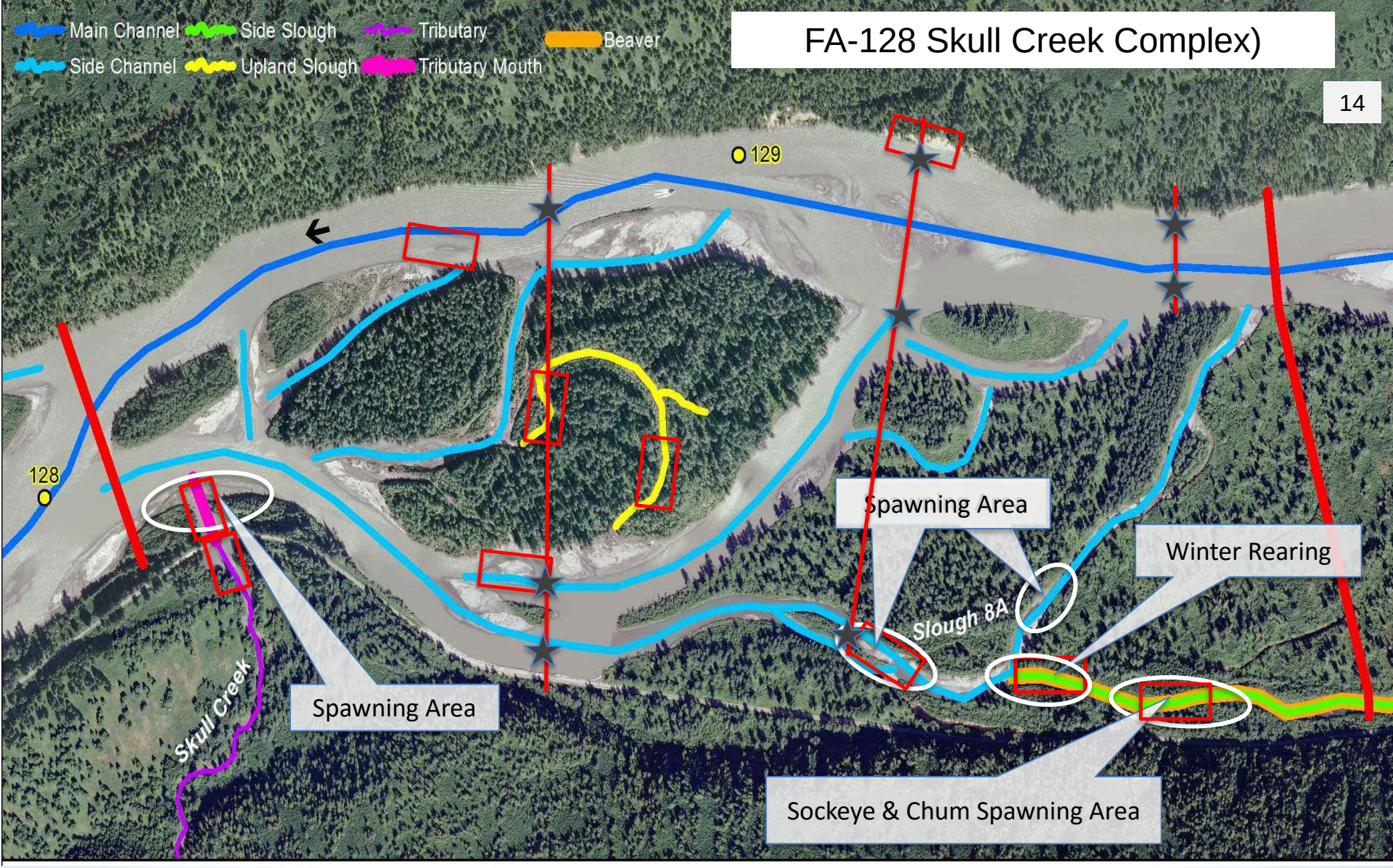
FA-128 Skull Creek Complex)



FA-128 Skull Creek Complex)



FA-128 Skull Creek Complex)



Integrate Baseline Water Quality Monitoring

Field Parameters:
Temperature Dissolved
Oxygen
Conductivity
pH

Metals:
Mercury (total)
Methylmercury (dissolved)
Aluminum (dissolved and total)
Iron (dissolved and total)

General Chemistry Parameters
Chlorophyll-a
Hardness
Total Nitrogen
Nitrate + Nitrite- Nitrogen
Total Phosphorus
Organic Carbon (dissolved and total)
Soluble Reactive Phosphorus

Proposed HSC Data Collection

Collect microhabitat data for both occupied (utilization) and unoccupied (availability) areas:

- ✓ Utilization measurements collected at all FA sites
- ✓ Availability measurements collected at FA-113 & FA-141
- ✓ Availability data for FA-104 & FA-128 obtained from 2-D hydraulic modeling (available fall 2013)

Proposed HSC Data Collection

Utilization Data Collection Methods:

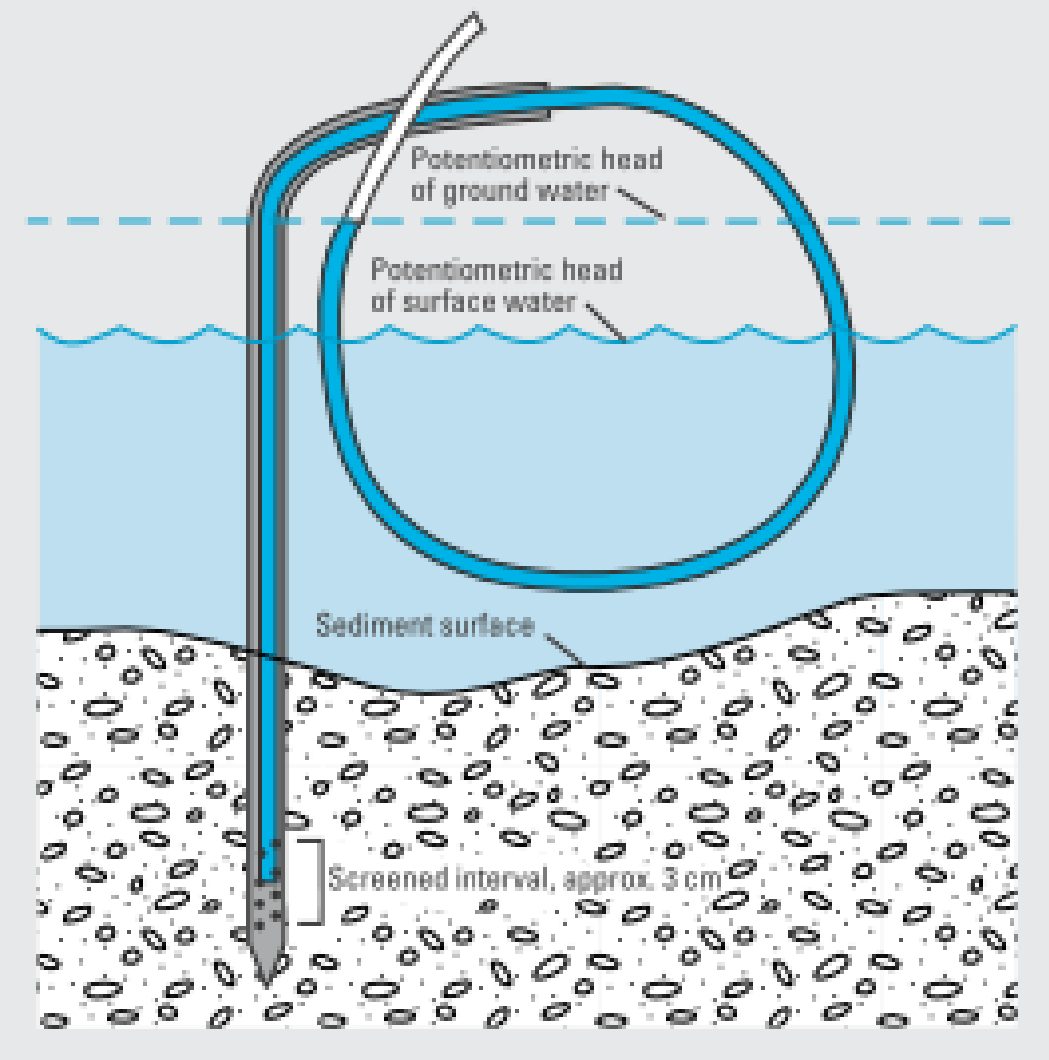
- ✓ Snorkel Surveys – microhabitat measurements made at location of each observed fish. Only undisturbed fish will be measured. Only used in areas with clear water (>2m visibility).
- ✓ Seining Surveys – multiple depth and velocity measurements made within seining area. Measure area fished by seining. Used in turbid water areas.
- ✓ Electrofishing Surveys – location of each captured fish marked or noted. Used in short burst to avoid pushing or herding fish. Used in turbid water areas. Single pass sampling.
- ✓ Pedestrian Surveys – Only used for spawning fish. Must observe fish defending, holding over, or constructing redd. Water clarity must allow for species ID and redd location.

Proposed HSC Data Collection –

Site specific data collection:

- Geomorphic reach
- Macro and mesohabitat type
- Presence and/or mapping of groundwater upwelling (visual, temperature, vertical hydraulic gradient) locations
- Water quality (temp, conductivity, pH, turbidity)
- Survey area length and width
- Presence and location of cover (woody debris, aq. veg., boulder, undercut banks)
- Potential stranding and strapping areas
- Start & end location coordinates (GPS)
- Representative photographs

Detecting Groundwater Upwelling



Proposed HSC Data Collection – Adult & Juvenile Rearing

Fish utilization data collection:

- Electrofishing, snorkel, and seining surveys
- Species identification
- Fish length and age class (fry, juvenile, adult)
- Distance to cover (woody debris, boulder, vegetation, etc.)
- Distance from water's edge
- Water depth – measured to nearest 0.1 ft
- Water velocity – measured to nearest 0.01 ft/sec
- Proximity to velocity sheer zone (<3.0 ft)
- Sheer zone velocity (highest available)
- Substrate composition (dominant, subdominant, % dominant)
- Water quality (temperature)
- location coordinates (GPS)
- Area sampled (length and width)

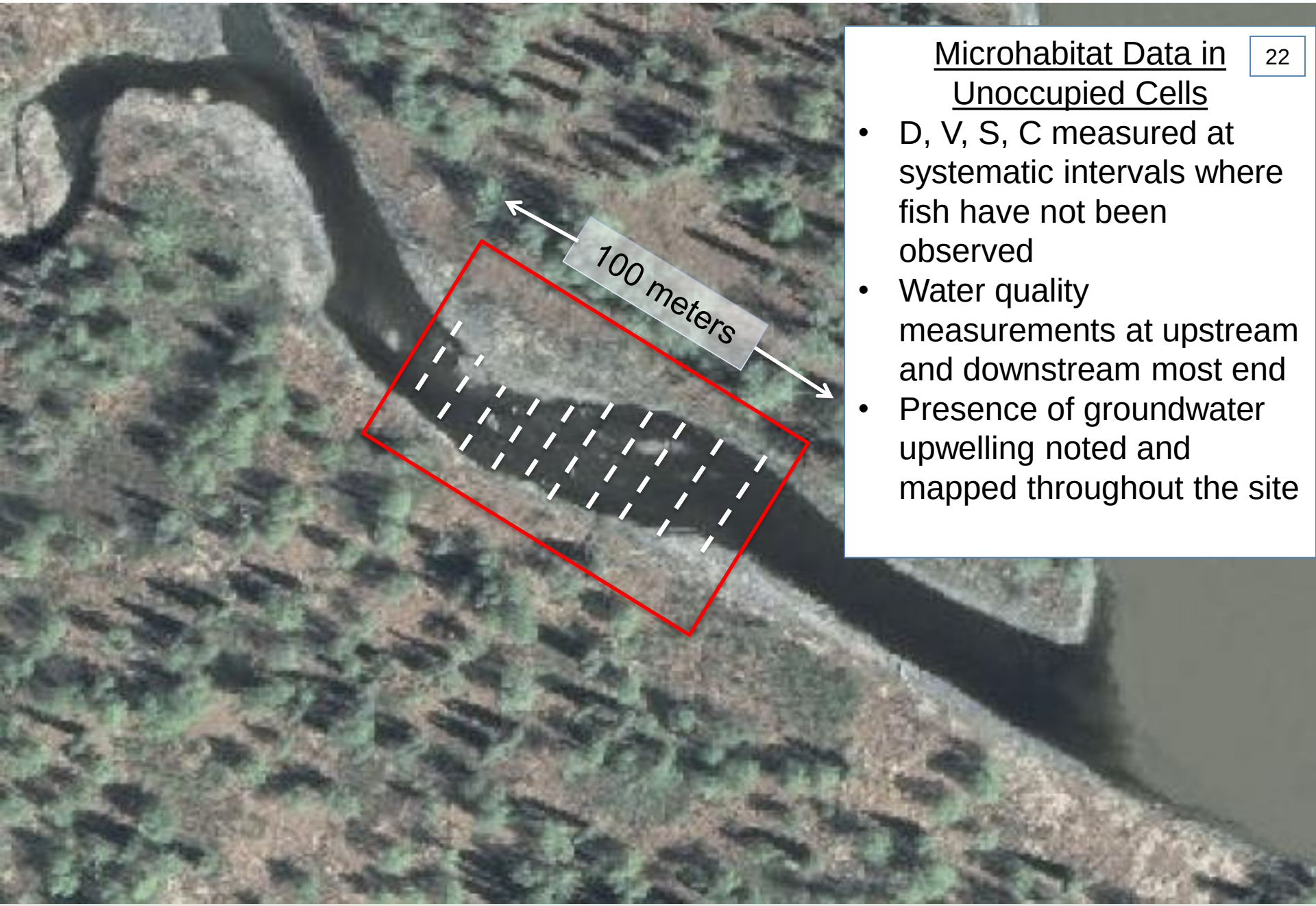
Proposed HSC Data Collection – Spawning

Redd specific data collection:

- Pedestrian surveys
- Species identification
- Water depth at u/s end of redd – measured to nearest 0.1 ft
- Water velocity – measured to nearest 0.01 ft/sec
- Substrate composition (dominant, subdominant, % dominant)
- Presence of groundwater upwelling
- Water quality (temp, turbidity)
- Location coordinates (GPS)

Microhabitat Data in Unoccupied Cells

- D, V, S, C measured at systematic intervals where fish have not been observed
- Water quality measurements at upstream and downstream most end
- Presence of groundwater upwelling noted and mapped throughout the site



2013 Stranding and Trapping Data Collection

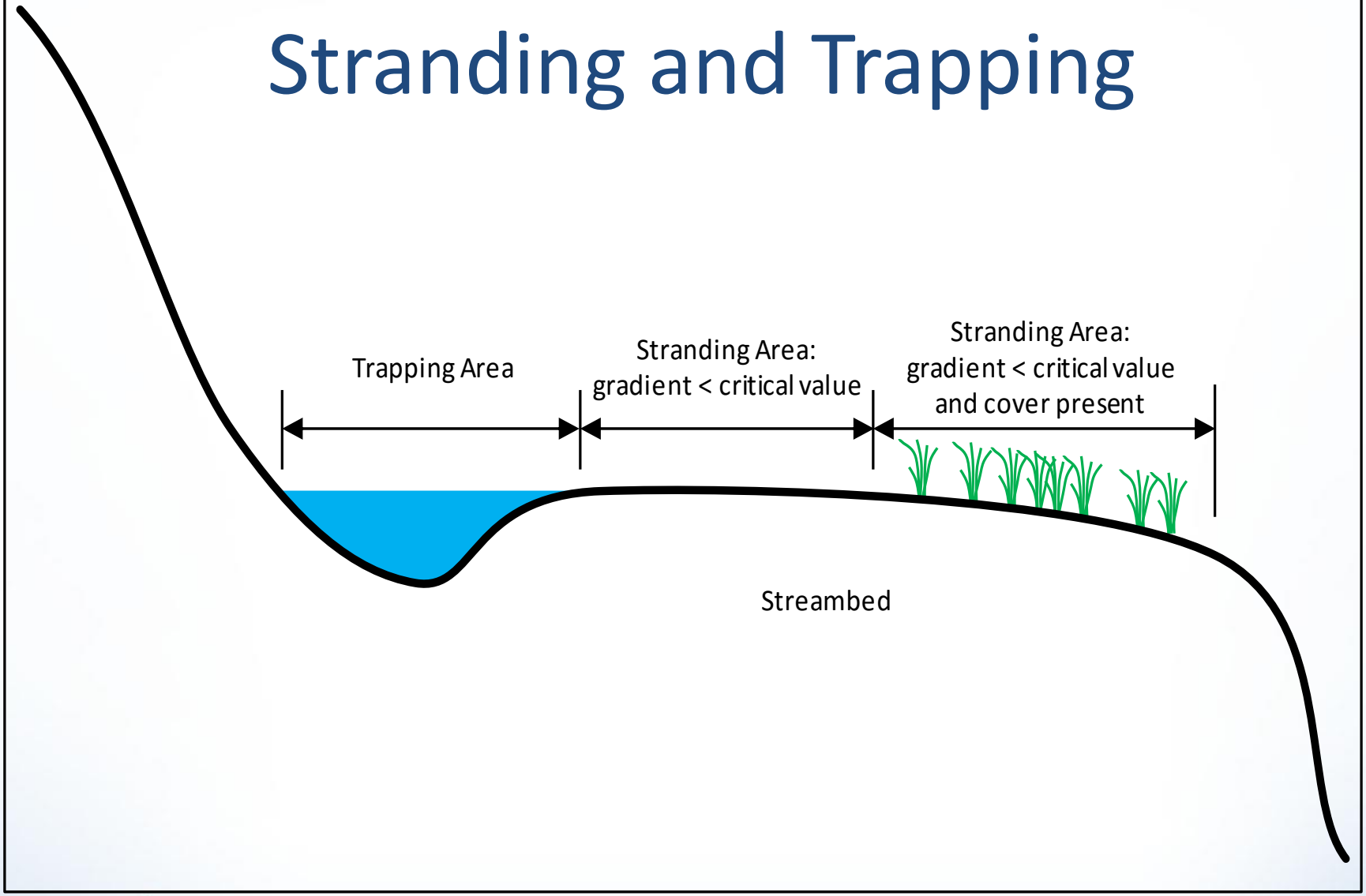
- Fluctuations in the Susitna River flow cause portions of the channel to alternate between wet and dry conditions
- The frequency, timing, and magnitude of flow fluctuations will change under proposed Project operations.
- Flow fluctuations have the potential to cause stranding or trapping of fish.
- This study is designed to identify, characterize, and sample habitats that may expose biota to stranding and trapping.

Stranding and Trapping

Definitions:

- Stranding is the breaching of fish as water level recedes (typically in low gradient areas)
- Trapping is the retention of fish in depressions as water levels recede
- Trapping can be followed by stranding if water in depression drains

Stranding and Trapping



Stranding and Trapping

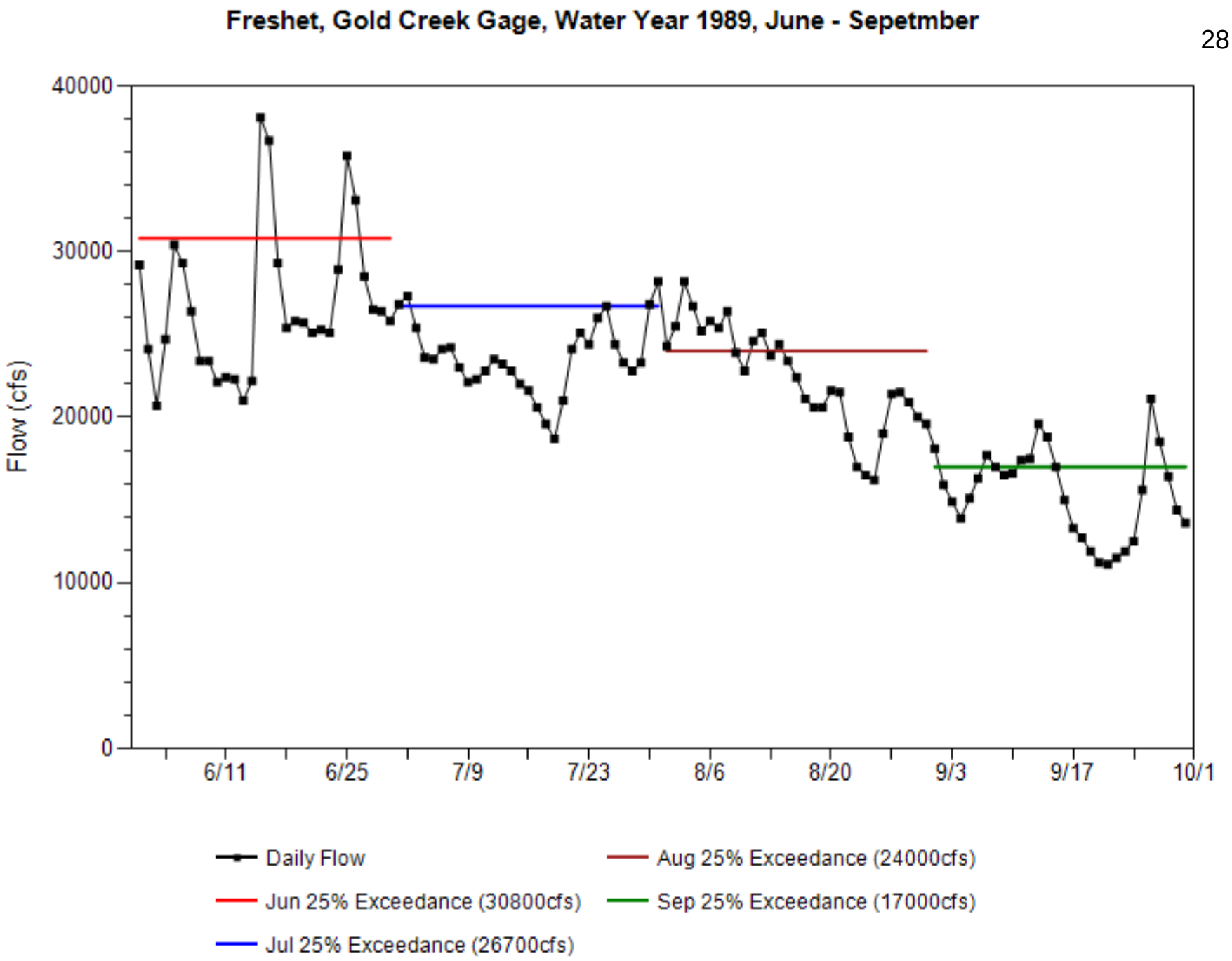
Likelihood of S&T influenced by a suite of biological, hydrologic, and geomorphologic factors

- Fish species, size, time of day, season/periodicity
- Use of cover (LWD, emergent veg.)
- Hourly change in water surface elevation
- Channel bed slope (<4% gradient)
- Velocity in area prior to downramping

Stranding and Trapping

2013 Data Collection Effort:

- Sample timing based on trigger flow/freshet
  - Immediately following ≥25 percent monthly exceedance flow event as reported at Gold Cr. or sharp flow reduction
  - 2-3 opportunistic sampling events (June-September)
- Identify areas with high potential for S&T
  - Utilize aerial video to identify potential S&T areas
    - Lateral pools
    - Wide, shallow gravel bars
    - Cover (LWD, emergent veg, exposed boulders)
    - Known juvenile fish use (1980's, 2012 HSC, 2013 FD&A)
  - Select 2-3 representative sample sites upstream of Devils Canyon
  - Select 3-5 representative sample sites Talkeetna to Devils Canyon


Freshet, Gold Creek Gage, Water Year 1989, June - Sepetmber
Flow (cfs)
40000
30000
20000
10000
0
6/11
6/25
7/9
7/23
8/6
8/20
9/3
9/17
10/1
Daily Flow
Jun 25% Exceedance (30800cfs)
Jul 25% Exceedance (26700cfs)
Aug 25% Exceedance (24000cfs)
Sep 25% Exceedance (17000cfs)

Stranding and Trapping

2013 Data Collection Effort – continued

– Site specific data
  - Office-delineate S&T polygons
  - Map location on aerial photographs
  - Field sample features exposed following freshet
  - Measure channel bed slope of stranding area
  - Fish species, size, estimated number, and location
  - Cover type(s) present and proximity to cover
  - Status of carcass to assess timing – dried, gills fresh, etc.
  - Residual pool outlet elevation and pool depth (hand level)
  - Composition of exposed substrate
  - Mainstem and isolated pool water temperatures (using handheld thermometers)

HSC and S&T Data Collection – Next Steps

- Finalize 2013 site selection and sampling protocol
- Identify potential stranding and trapping sites
- Continue integration and coordination of other data sources into HSC sampling design and site selection:
  - ✓ Fish Distribution
  - ✓ Groundwater
  - ✓ River Productivity
  - ✓ Water Quality Monitoring
  - ✓ Fish Passage and Connectivity
- Possible mid-season adjustment based on number of observations and preliminary data analysis