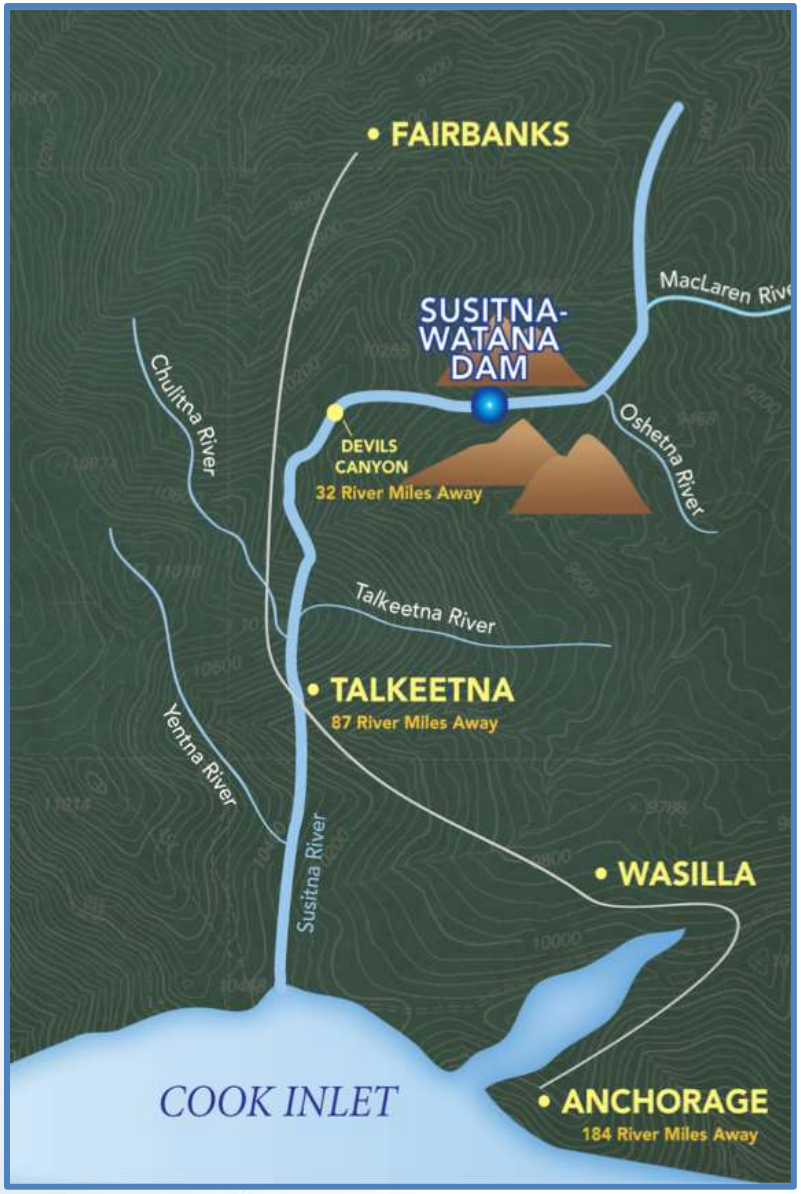


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# Technical Team Meeting

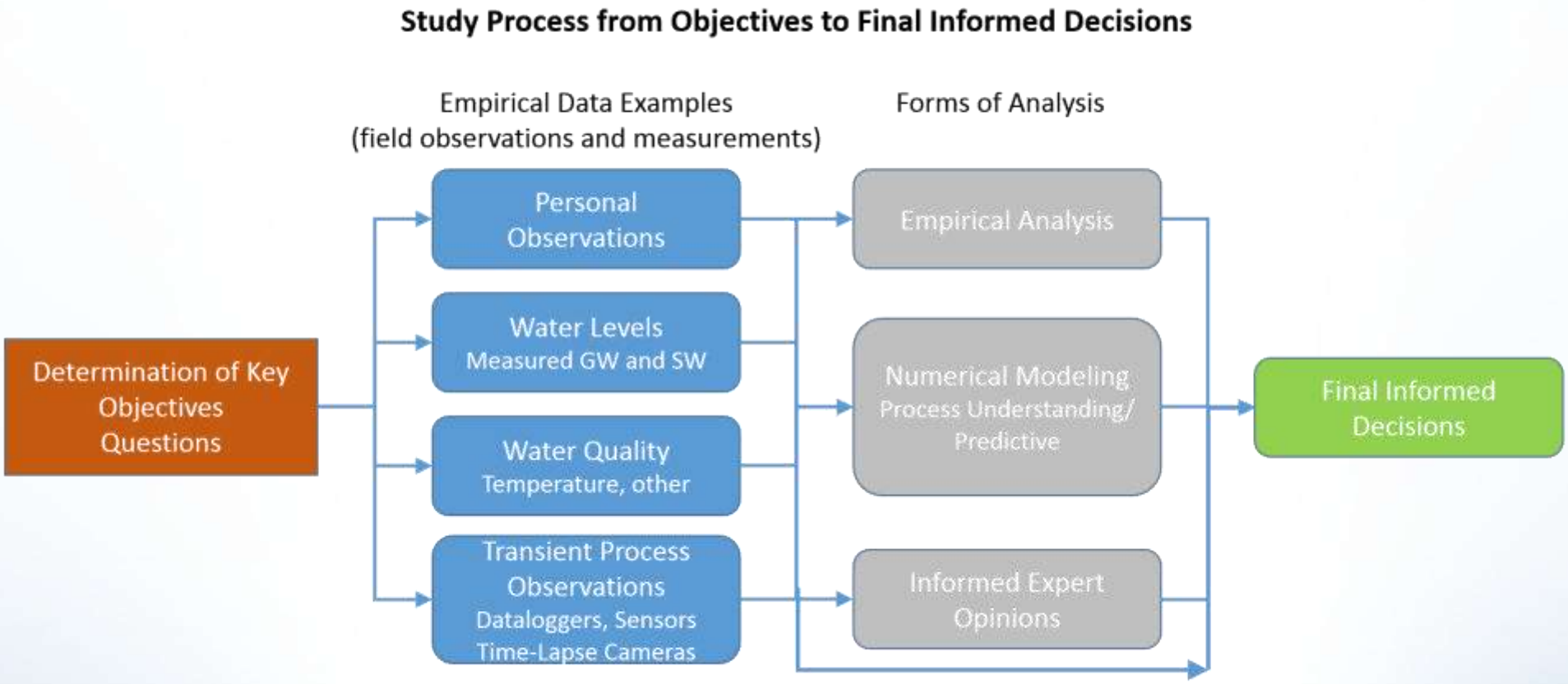
## Riverine Modeling Proof of Concept

## Groundwater Study Modeling & Analysis

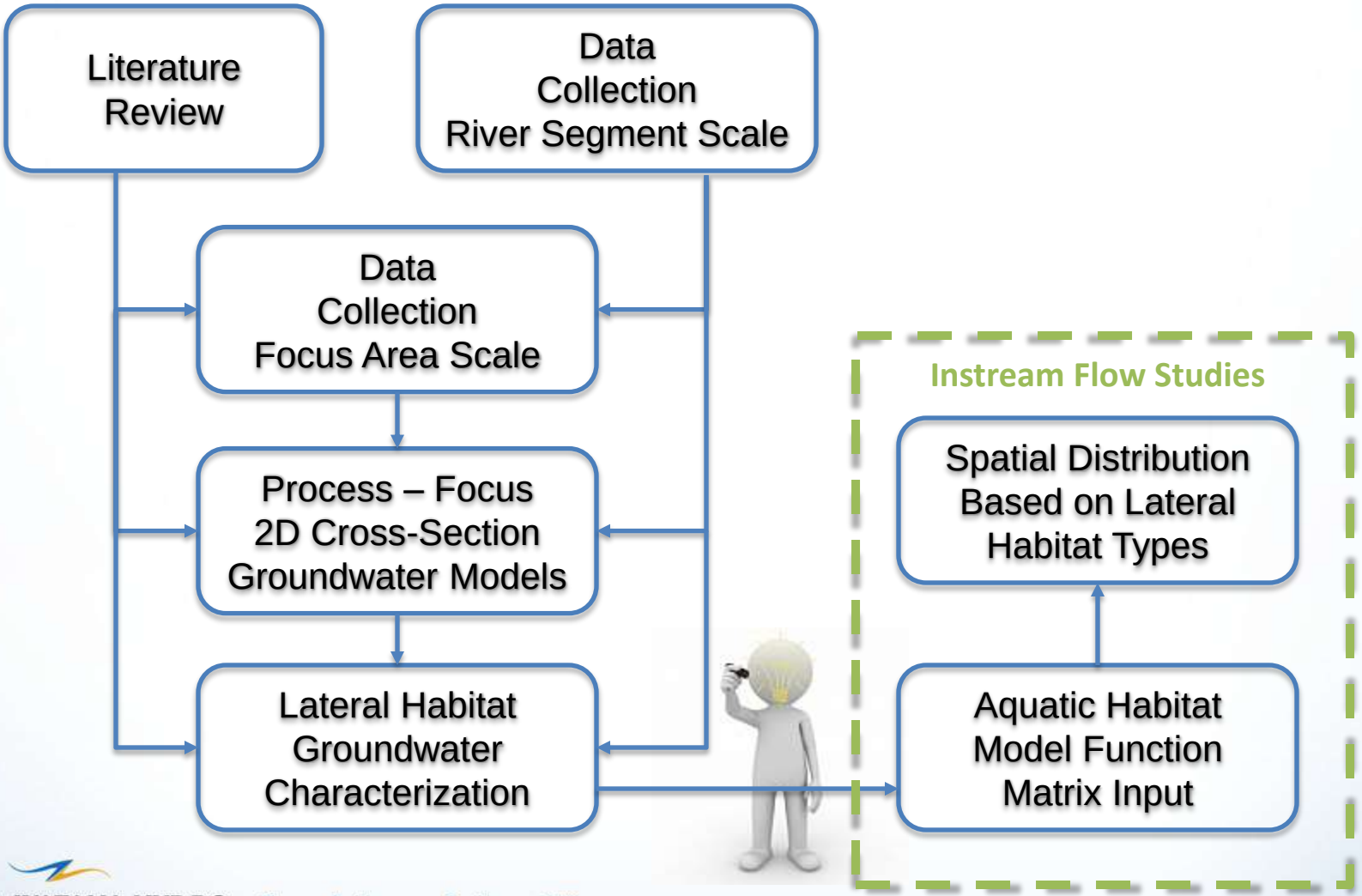
April 15-17, 2014

Prepared by
GW Scientific

# Groundwater Study Analysis Approach



# Groundwater Study Analysis Process

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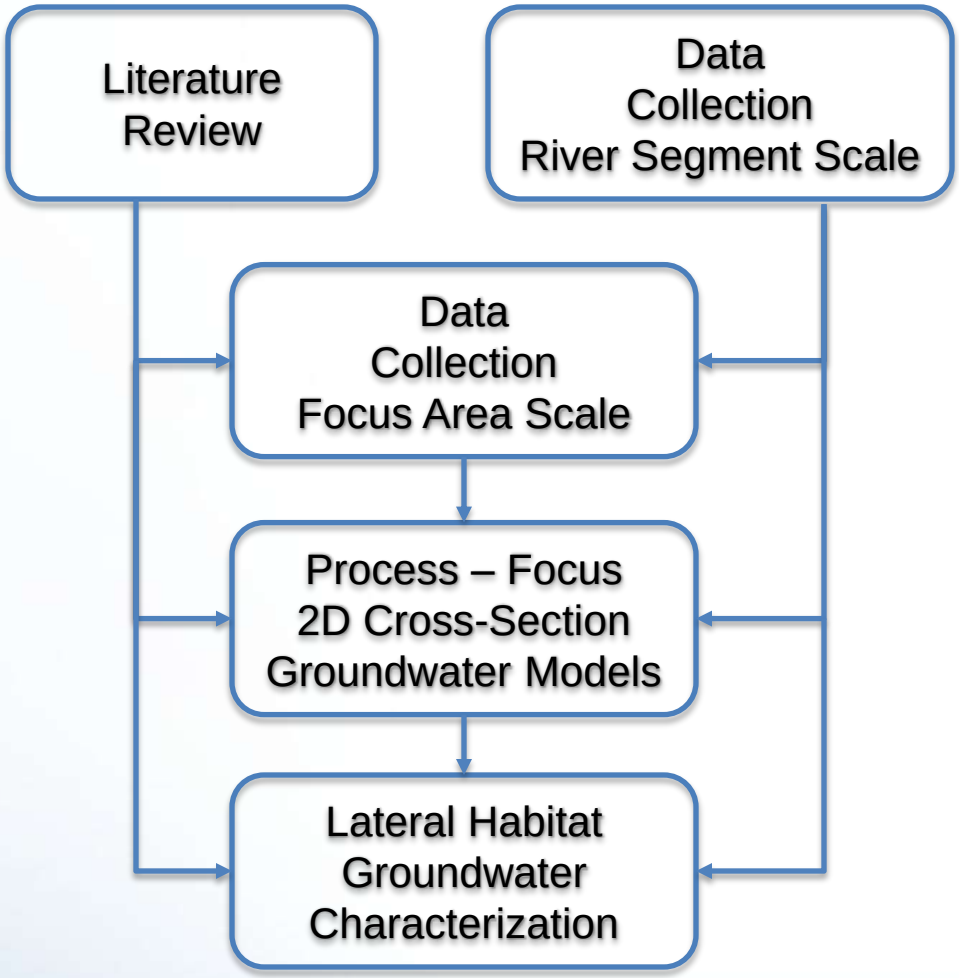
# Focus Area Example: FA-128 (Slough 8A)




Data Collection on Annual Basis

- Winter and Summer
- Time-Series Information on Transects
- Additional Manual Measurements
- Spatial Data Sets – Thermal Imaging, Aerial Images (Winter, Summer)

Conceptual Models

- Helps Define the Hydrologic System – Groundwater, Surface Water, Atmospheric

Numerical Models

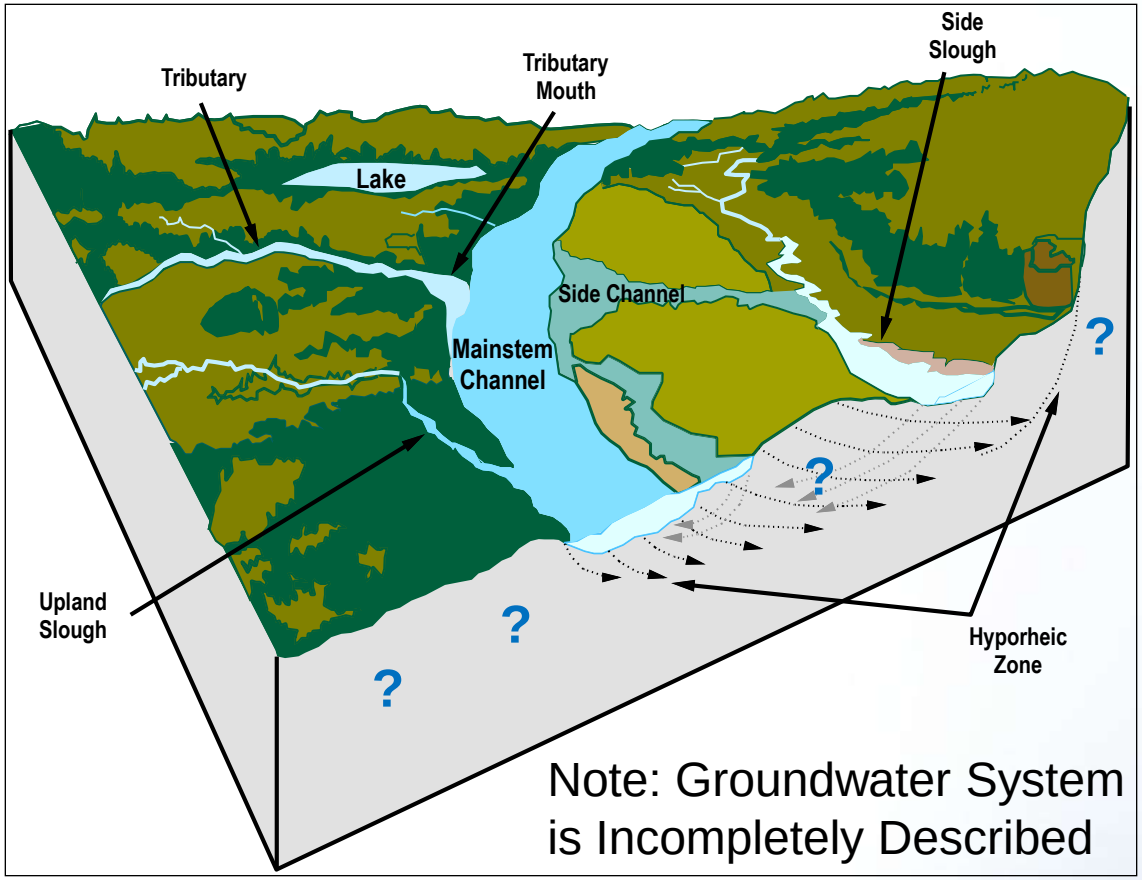
- Provide Process Understanding and Cause/Effect Analysis, Transient Analysis

# Groundwater Study Modeling

- Why Model?
  - Understand processes we can not easily see place
  - Bracket the range of processes interactions
  - Use in combination of other data and studies to guide reasonable estimates of groundwater conditions and potential changes outside the range of natural variability
  - To address specific questions

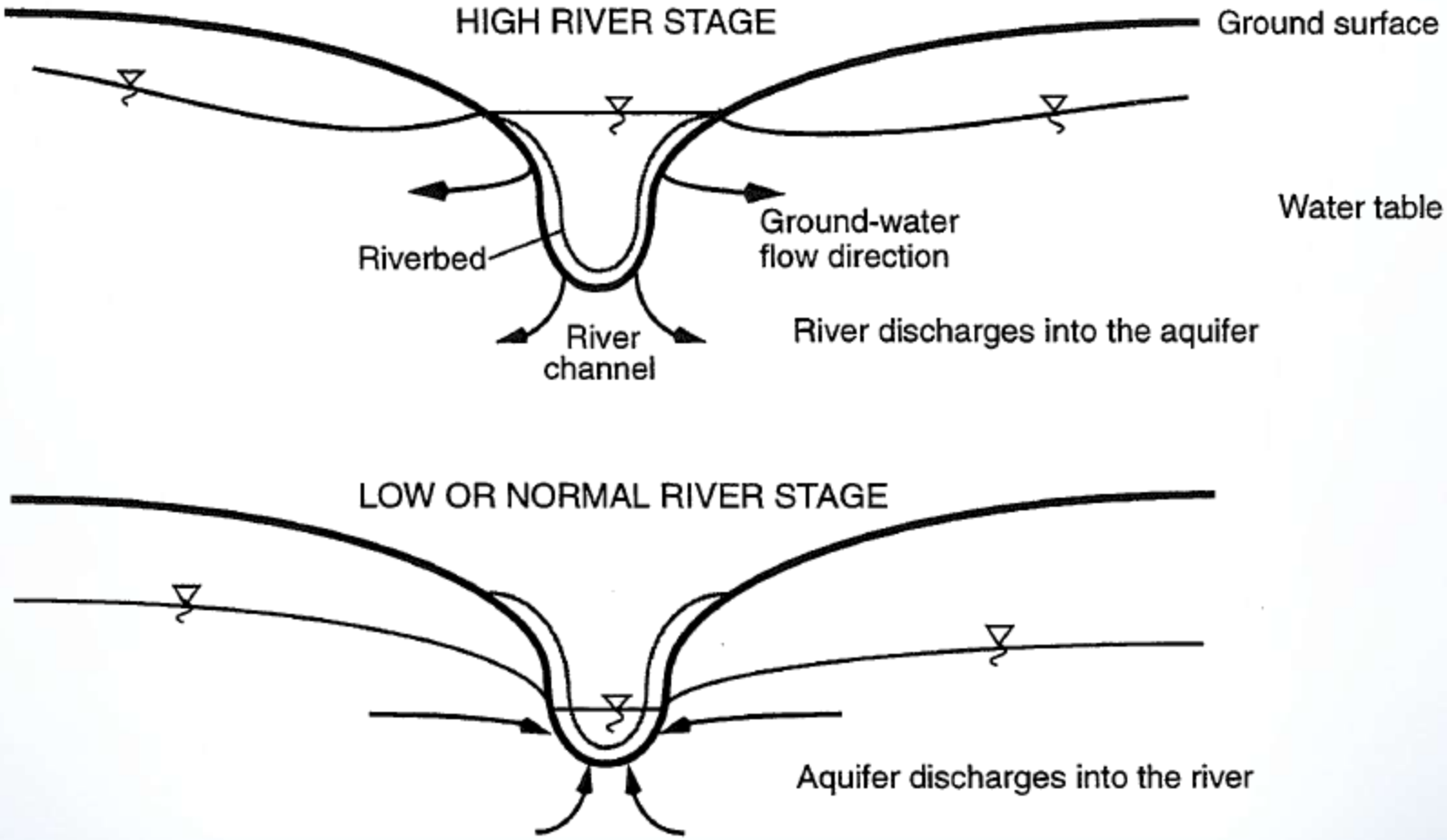
# Aquatic and Riparian Resources

- Inter-Related
- Impacts on Riparian = Impacts on Aquatic
- Groundwater Questions Have Many Overlaps

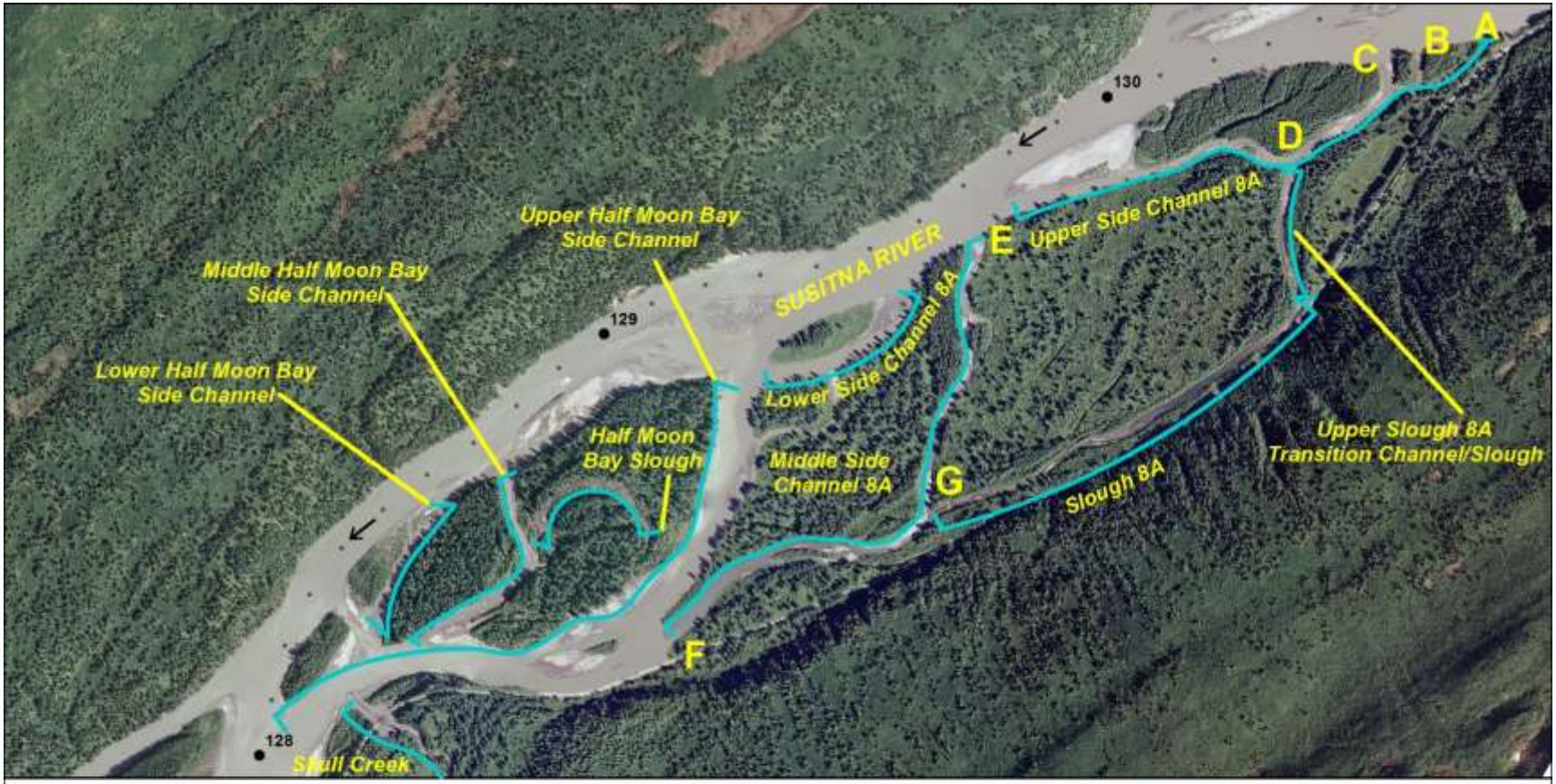



Habitat types identified in the middle reach of the Susitna River during the 1980s studies (adapted from ADF&G 1983; Trihey 1982).

# Groundwater/Surface-Water Interaction Processes



# FA-128 (Slough 8A) Hydrology Features




**FA 128 (Slough 8A) - Focus Area Groundwater Upwelling Features**

- Project River Mile
- Susitna Flow Direction
- FA 128 Side Channel/Slough Hydrological Features

ALASKA ENERGY AUTHORITY

0 1,500 Feet

Projection: AK SP Zone 4 NAD 1983
Date Created: 3/27/2014
Map Author: GWS - Cari Ruffino
File: POC FA128.mxd


Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project Data Sources: See Map References

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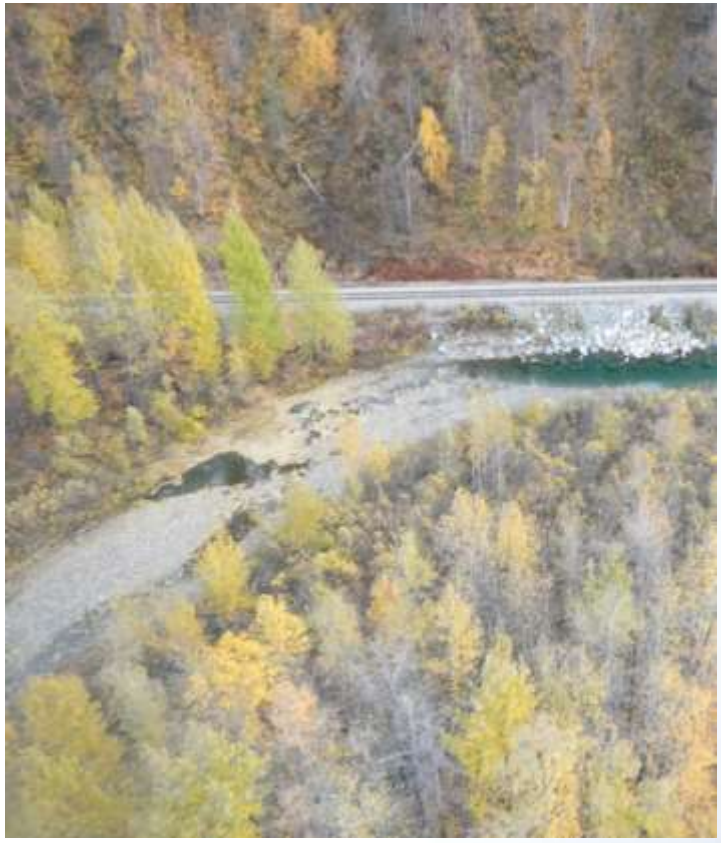
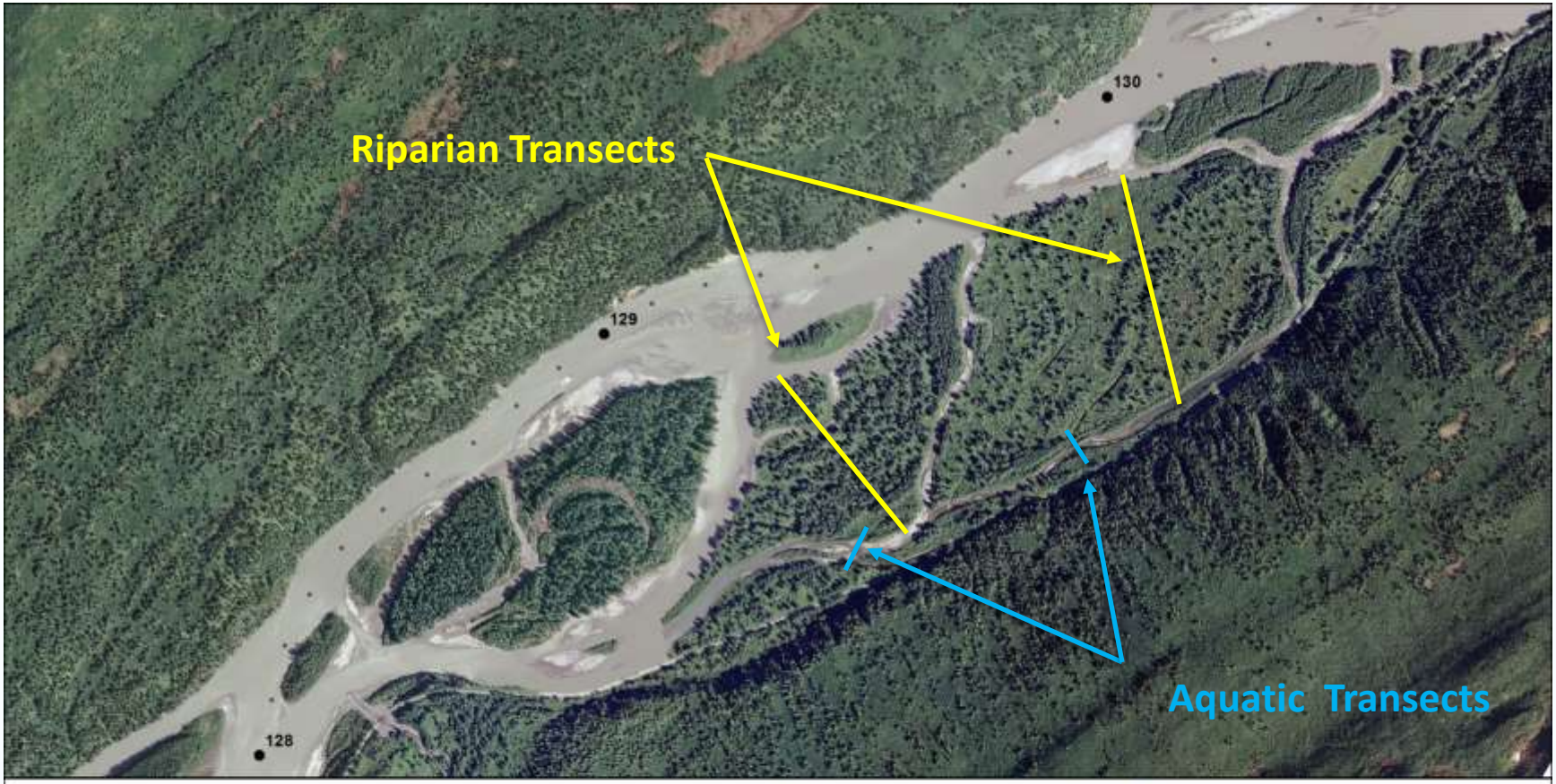
# FA-128 (Slough 8A) Hydrology Features (A-G)

- A, B, C - Inlets to Upper Side Channel 8A
- D - Inlet to Transitional Channel/Slough 8A
- E - Inlet to Middle Side Channel 8A
- F – Outlet of Middle Side Channel 8A
- G – Confluence of Middle Side Channel 8A and Slough 8A



FA-128 – (Slough 8a), Upland Slough, Upstream End, October 3, 2013

# FA-128 (Slough 8A) Analysis Transects

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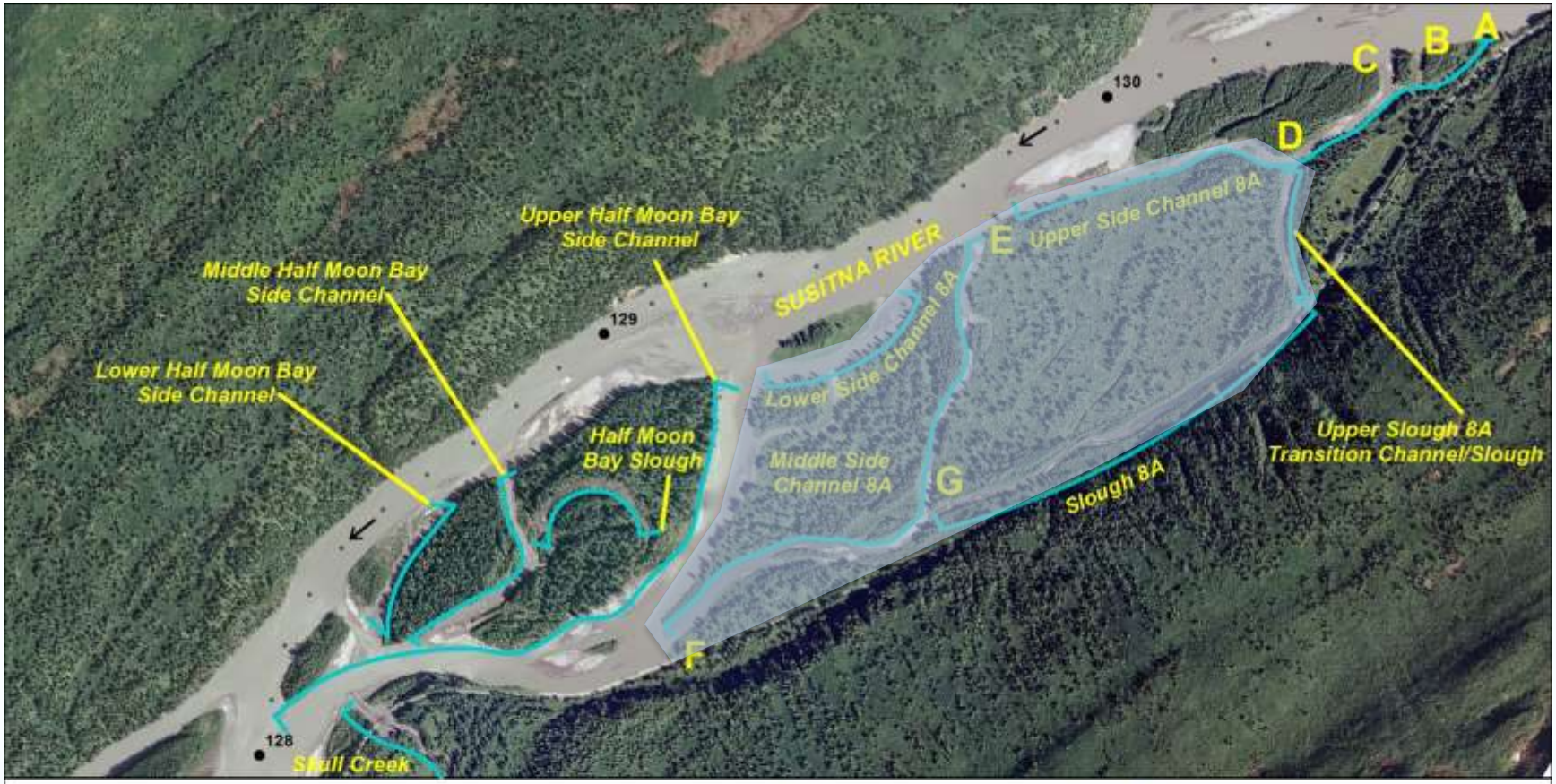
# FA-128 (Slough 8A) Primary Analysis Area

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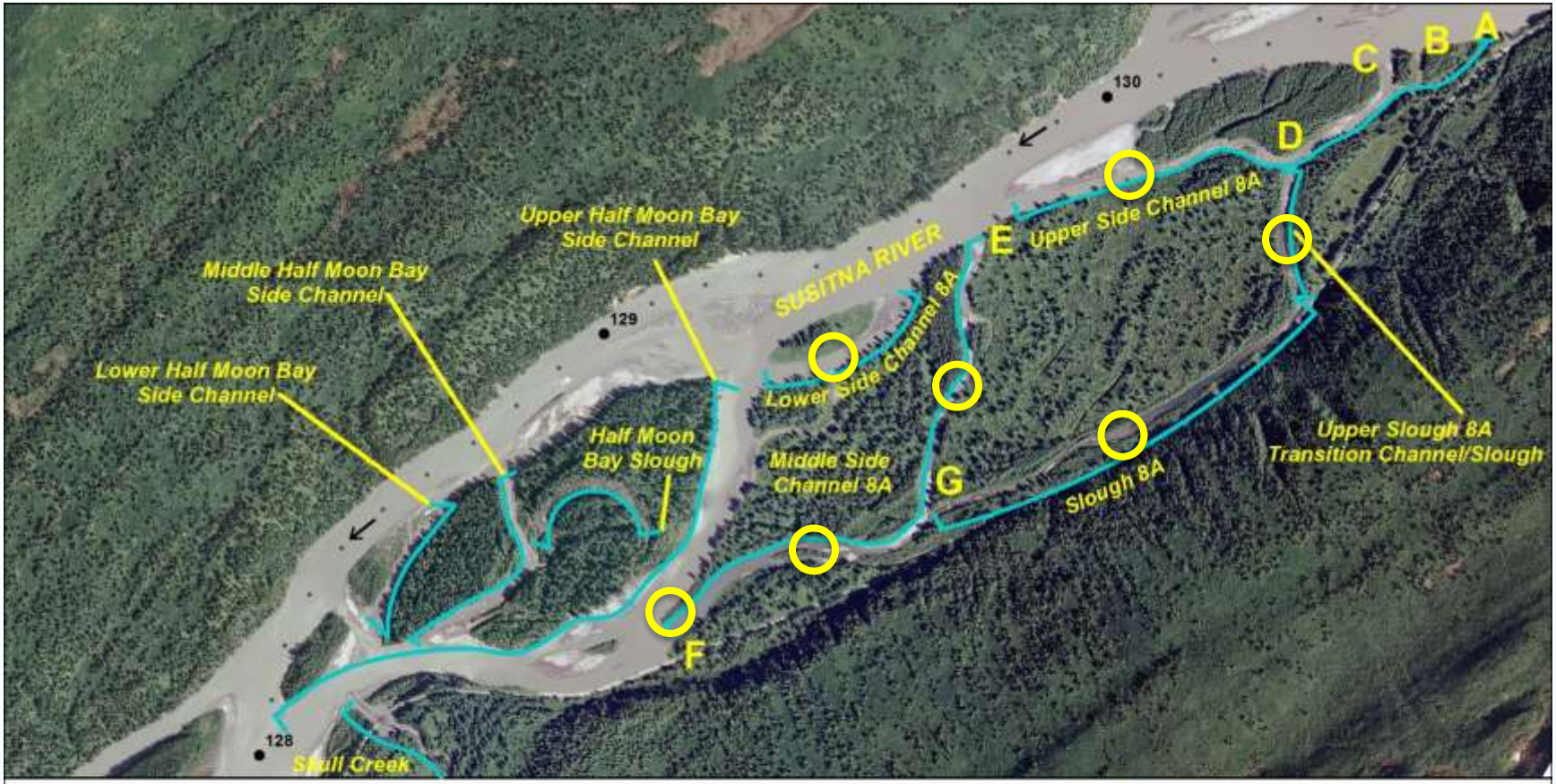
# FA-128 (Slough 8A) Key Hydrologic Boundaries

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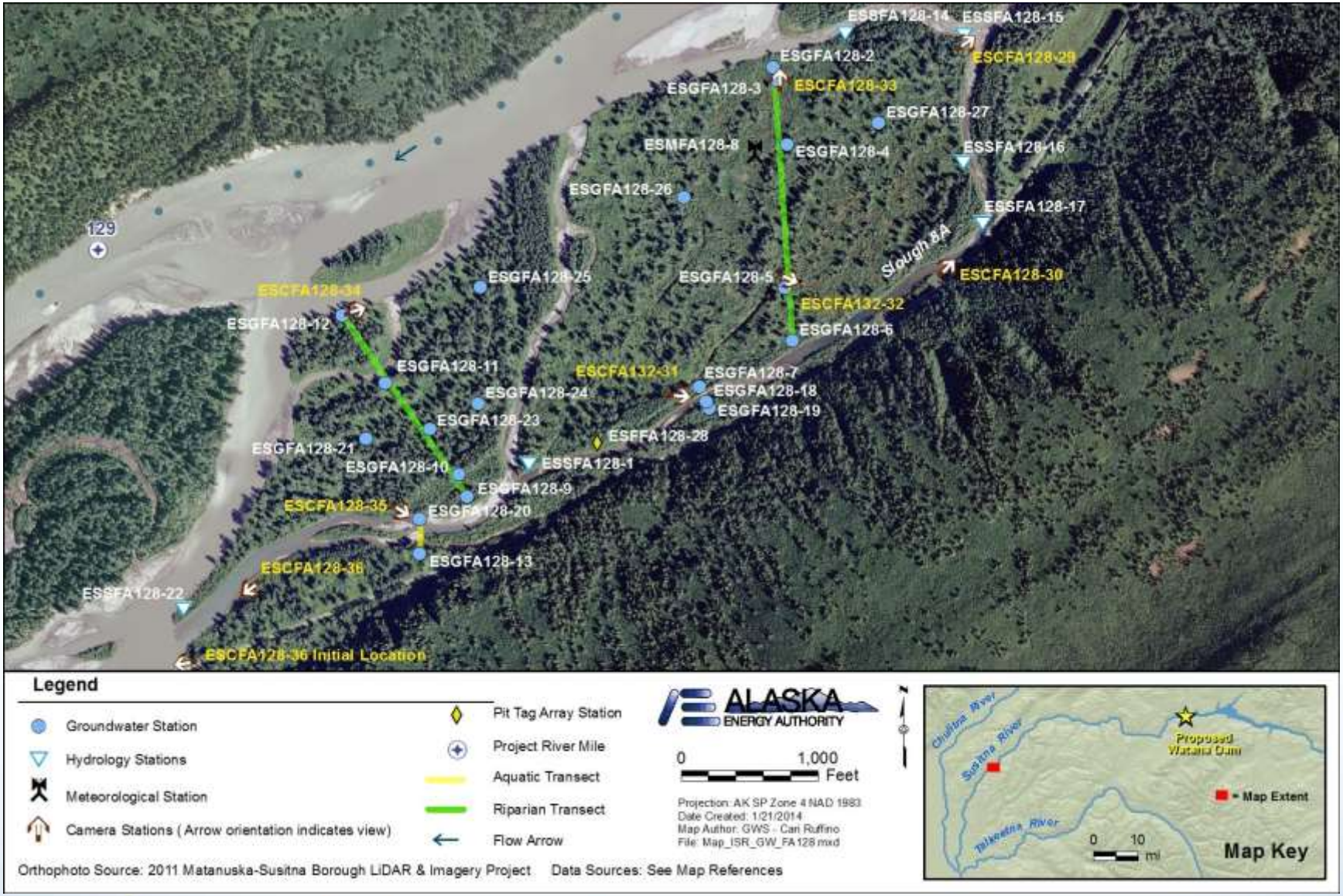
# FA-128 (Slough 8A) Data Stations

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# FA-128 (Slough 8A) Survey Control


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# FA-128 (Slough 8A) Groundwater Wells


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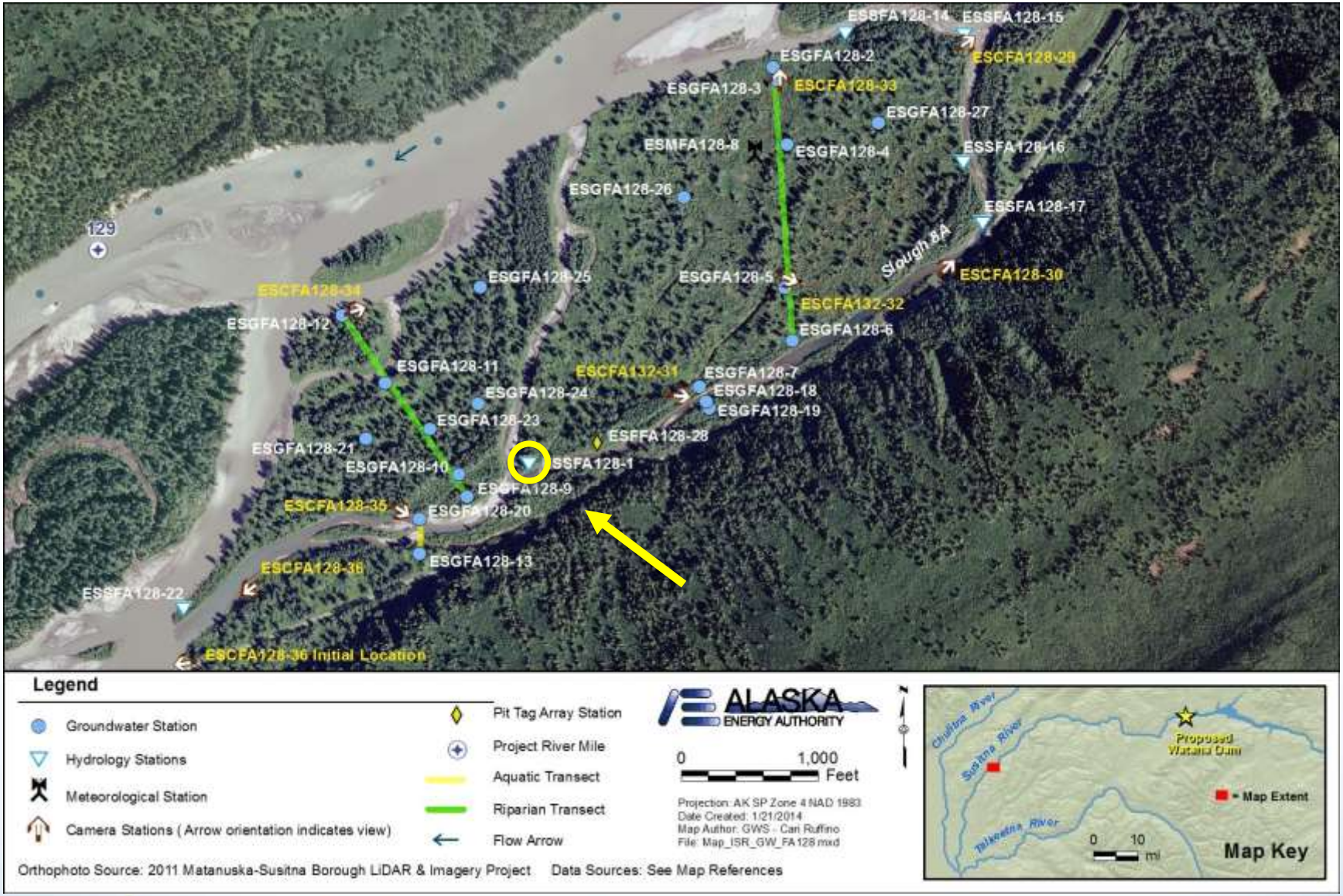
# FA-128 (Slough 8A) Aquatic Transect Stations

# GW/SW Examples – Aerial Images

FA-128 – (Slough 8A), Junction of Middle Side Channel 8A and Slough 8A, June 12, 2013
Susitna River at Gold Creek (12:20) = 35,900 CFS

FA-128 – (Slough 8A), Junction of Middle Side Channel 8A and Slough 8A, October 3, 2013
Susitna River at Gold Creek (15:45) = 9,130 CFS

# ESSFA128-1 Example - Time-Lapse Cameras

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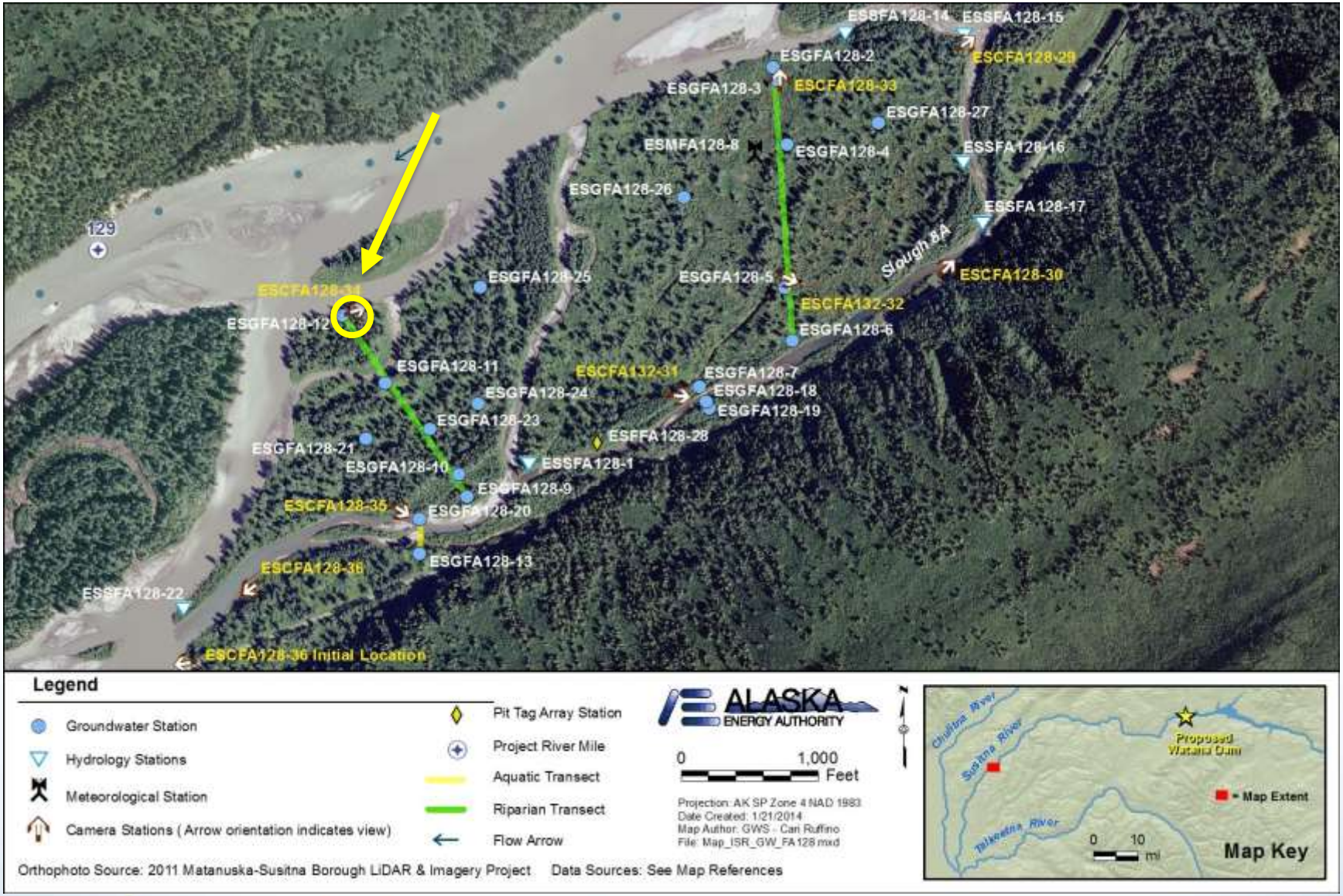
# ESSFA128-1 Example - Time-Lapse Cameras

# ESGFA128-12 Example – Temperature, Water Level

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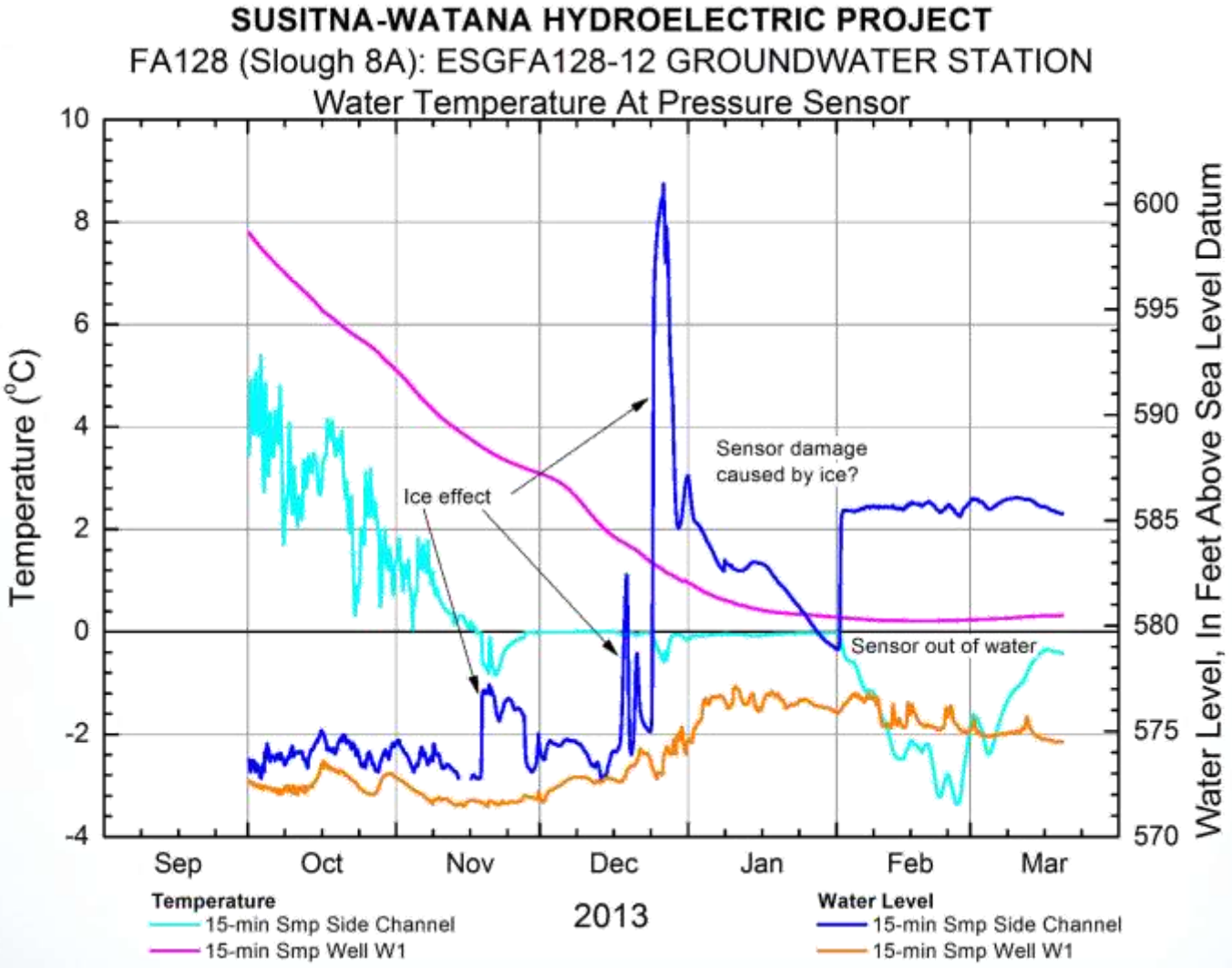
# ESGFA128-12 Example – Temperature, Water Level

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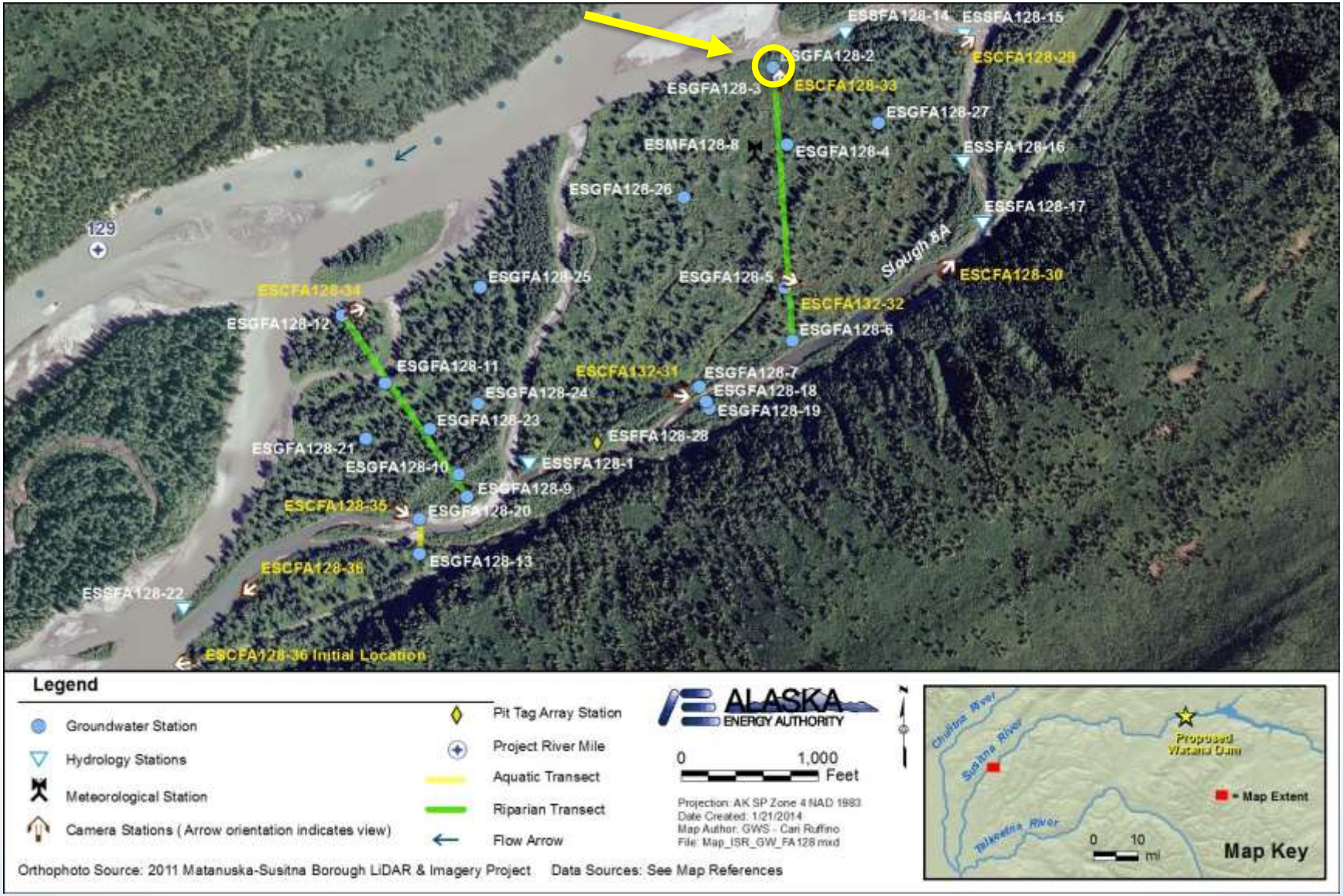
# ESGFA128-2 Example – Temperature, Water Level

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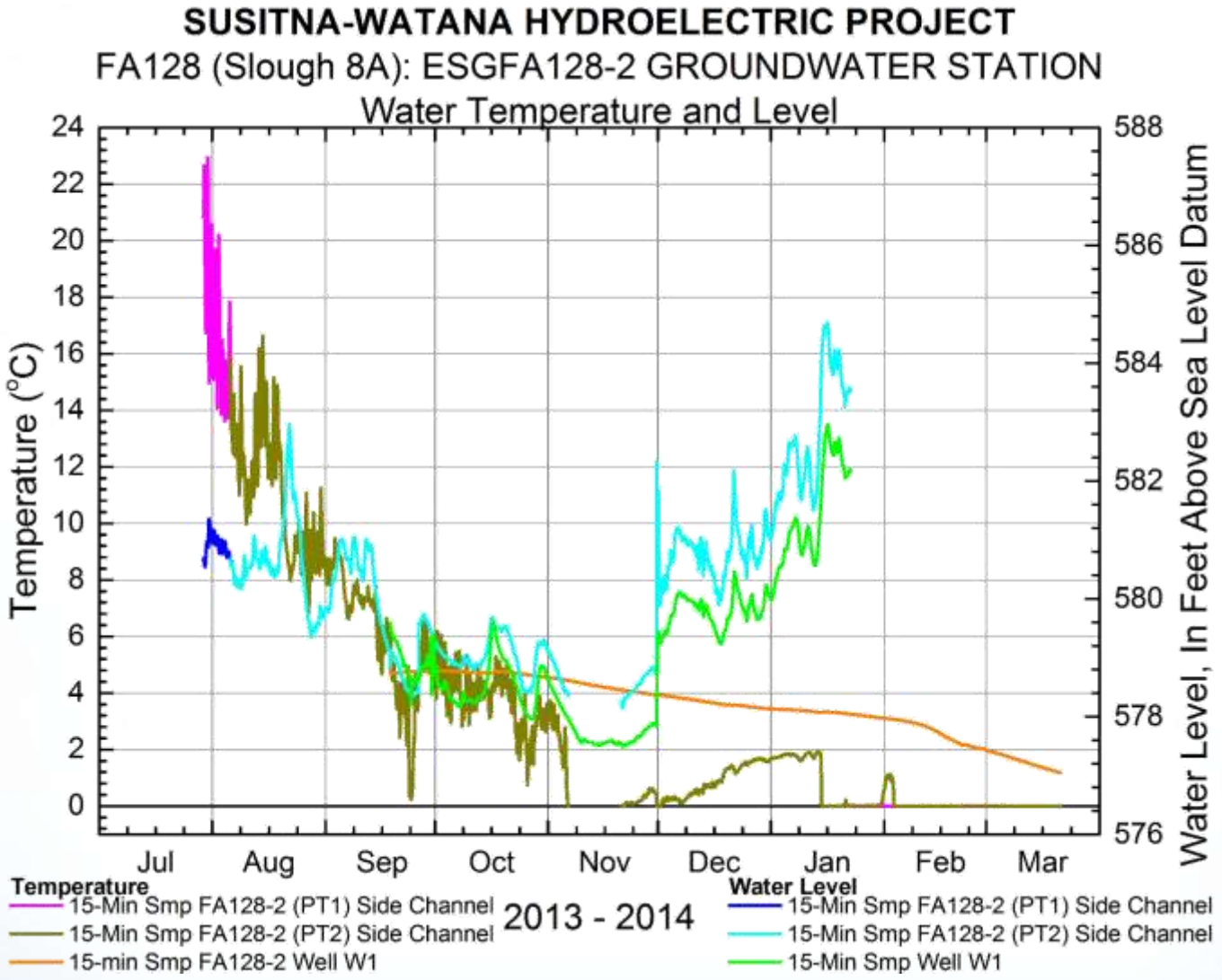
# ESGFA128-2 Example – Temperature, Water Level

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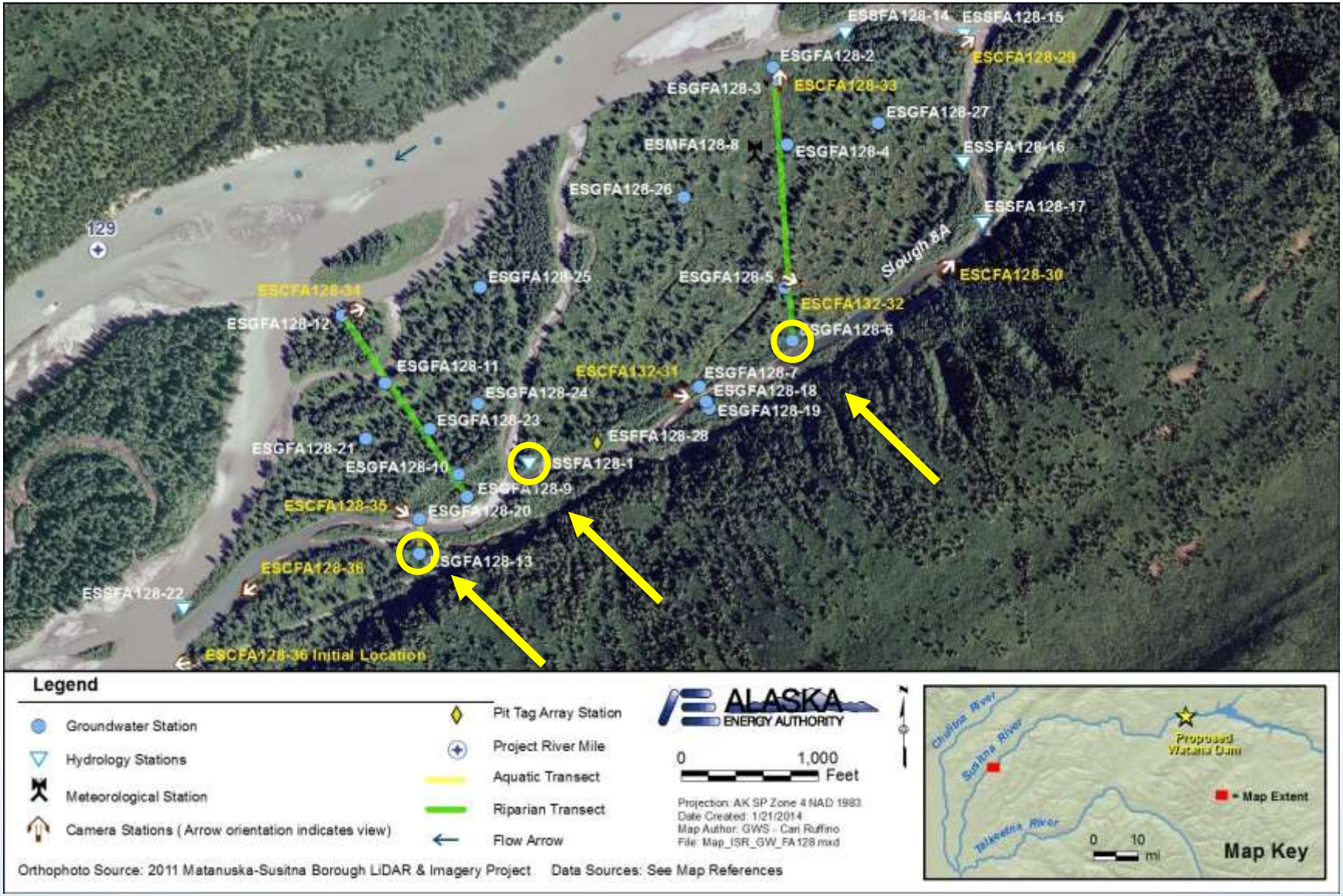
# ESSFA128-1, ESGFA128-6,-13 Example – Water Level

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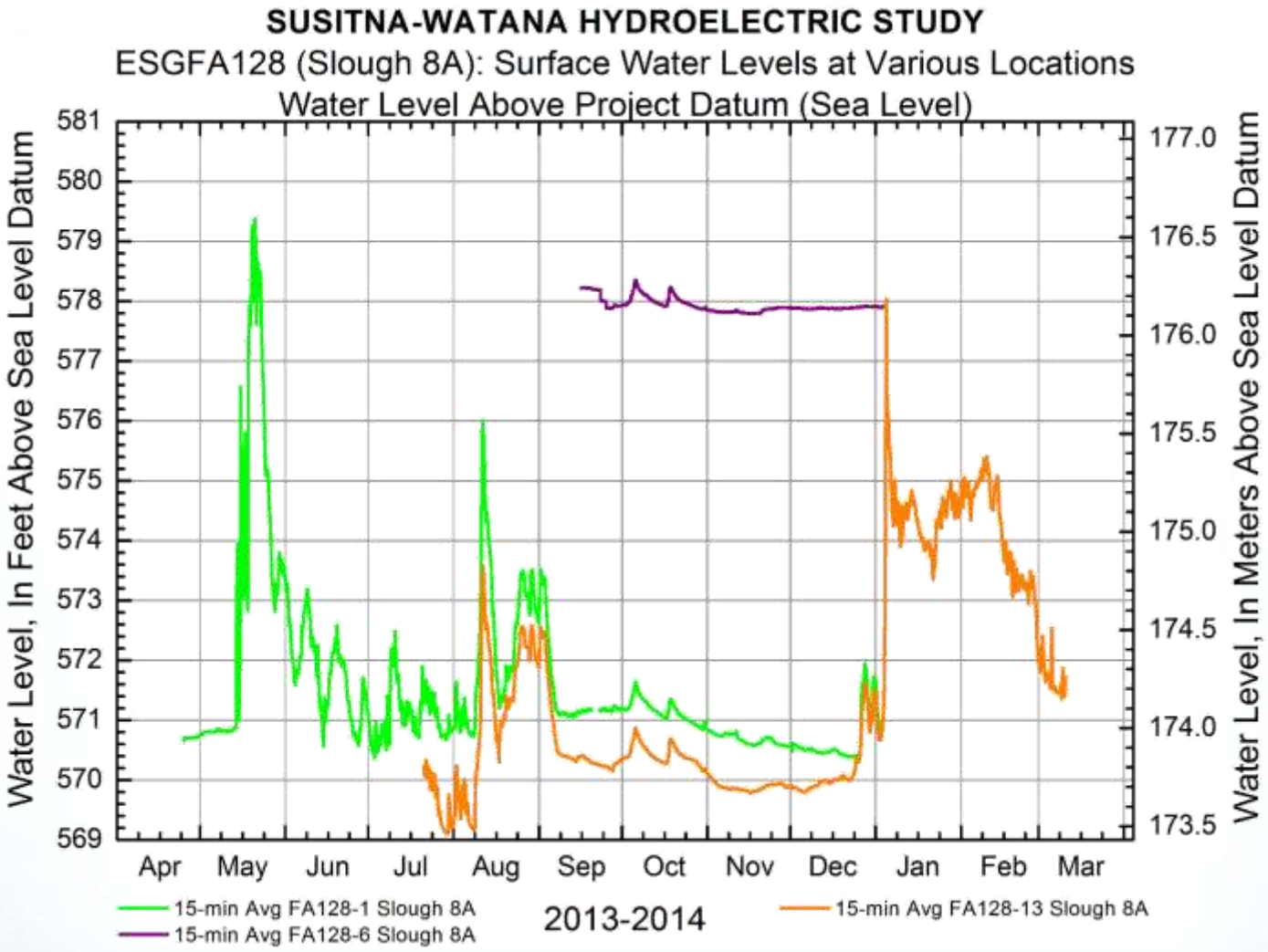
# ESSFA128-1, ESGFA128-6,-13 Example – Water Level

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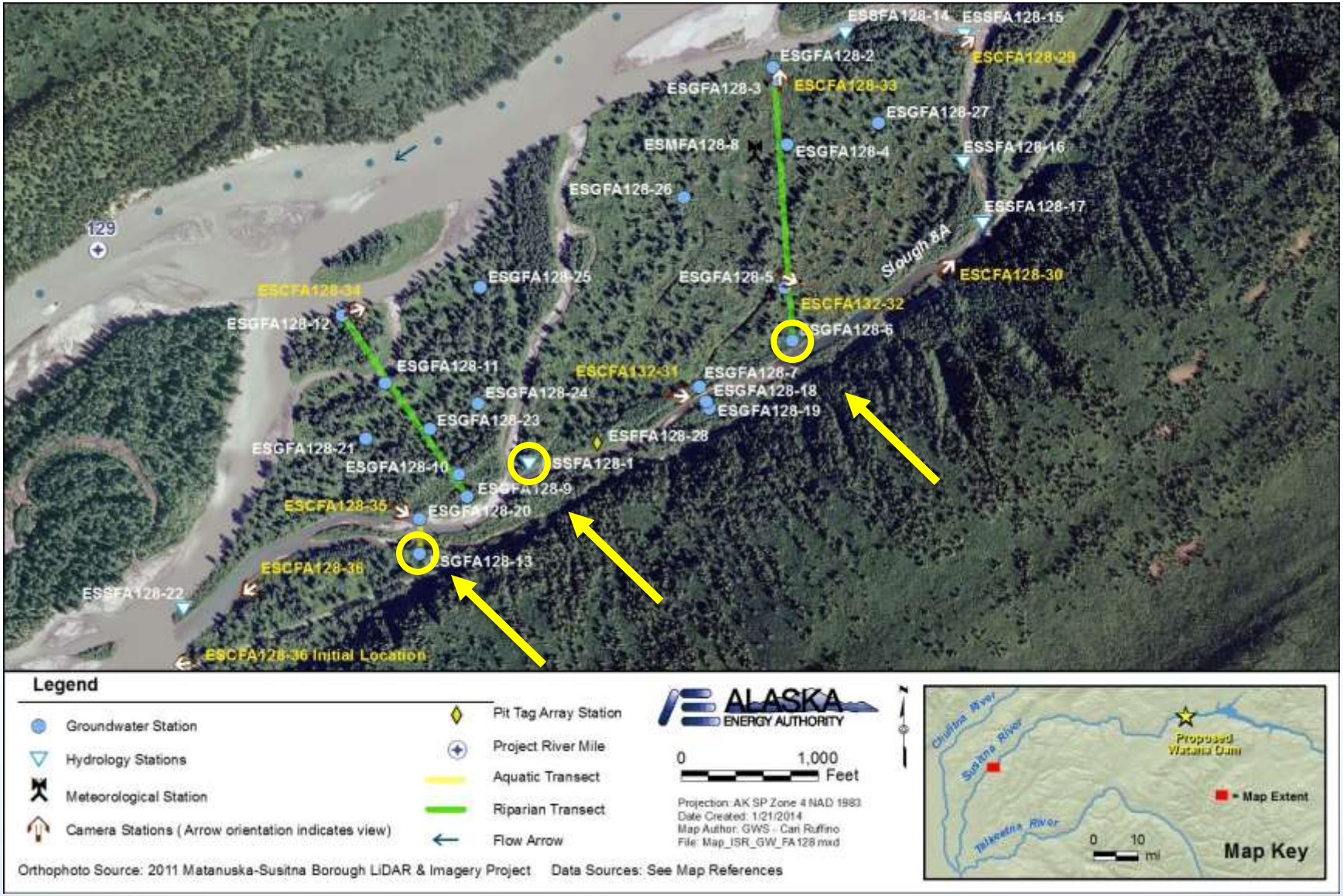
# ESSFA128-1, ESGFA128-6,-7,-13 Example –Temp

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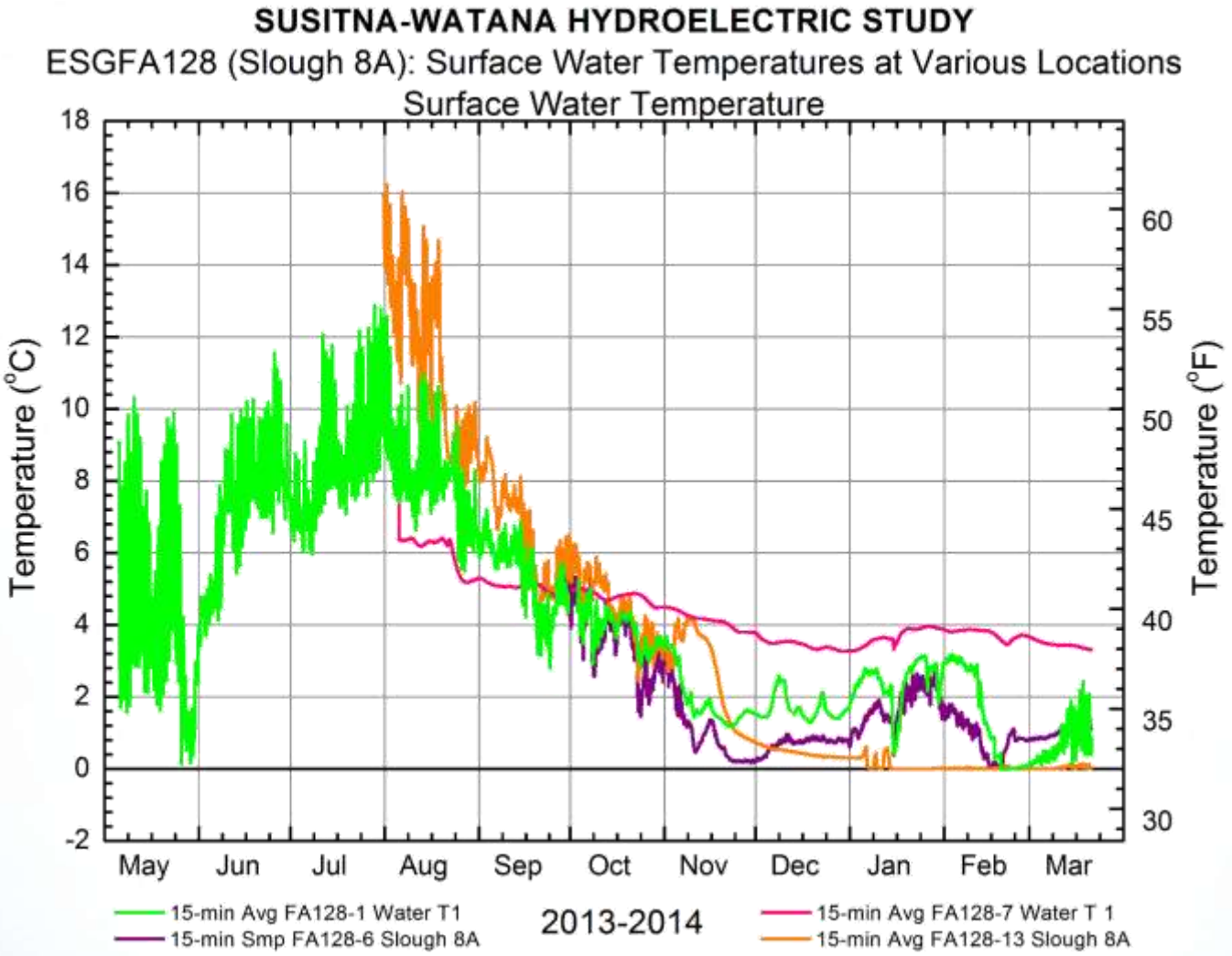
# ESSFA128-1, ESGFA128-6,-7,-13 Example –Temp

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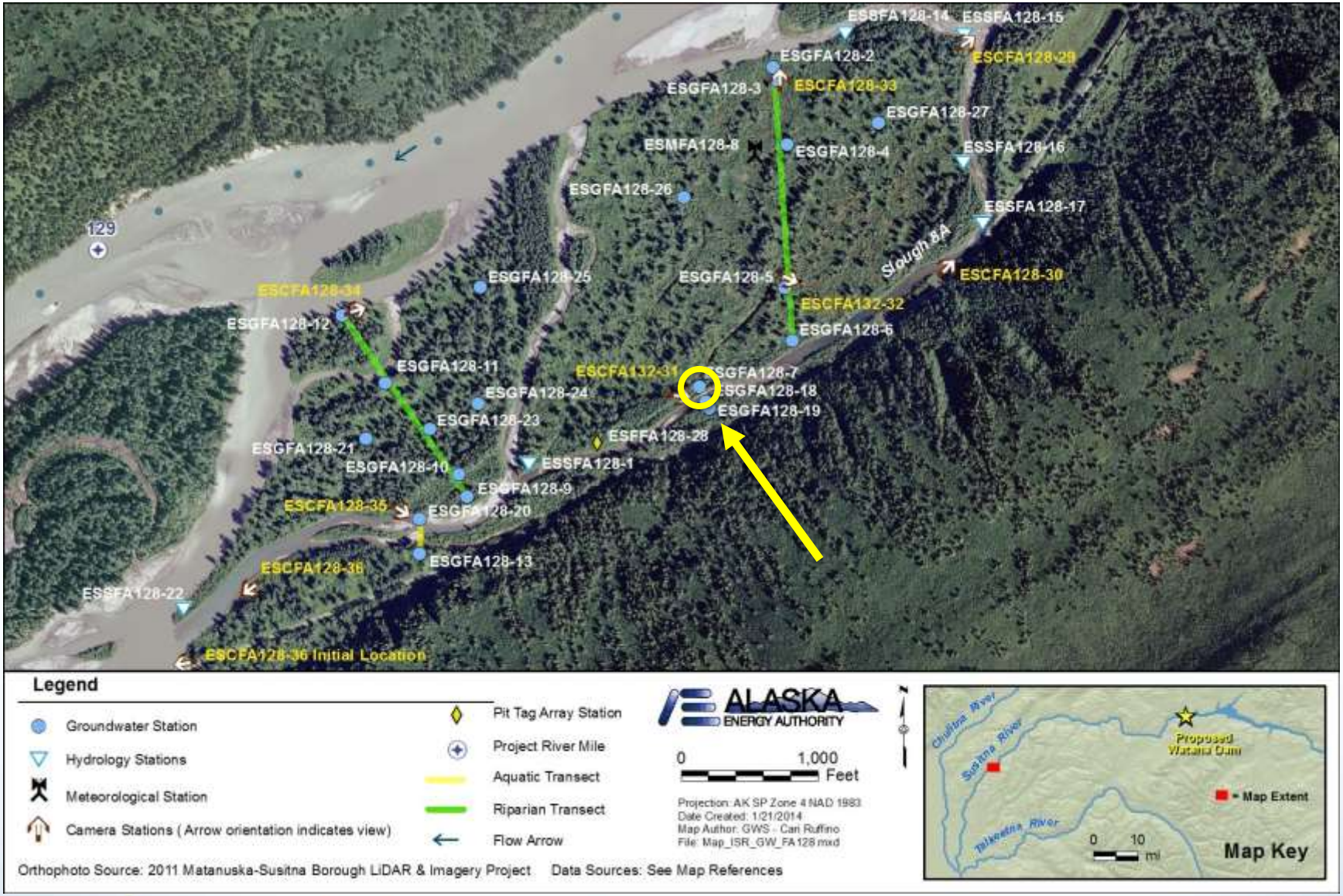
# ESGFA128-7 Example –Water Level, Temperature

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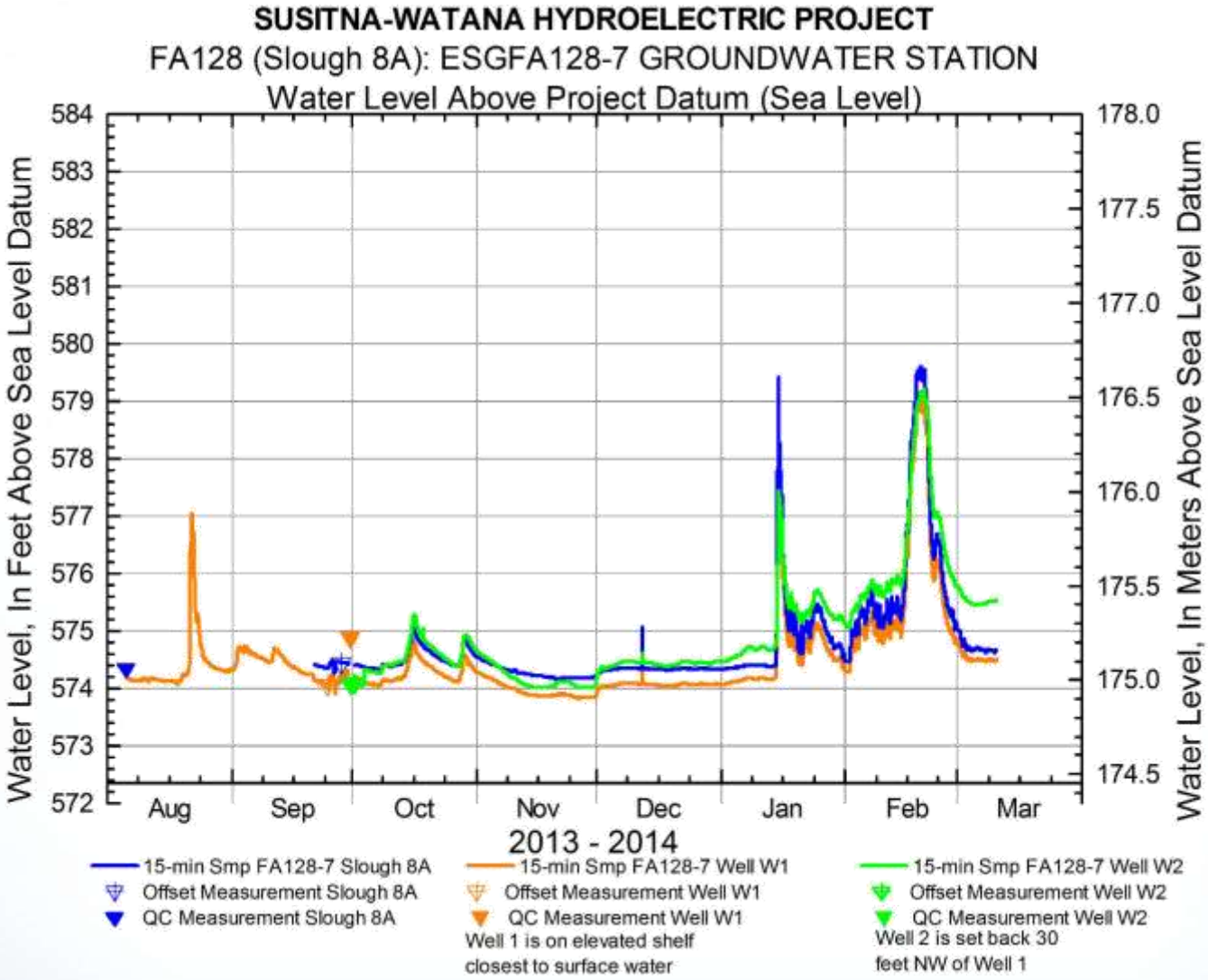
# ESGFA128-7 Example –Water Level

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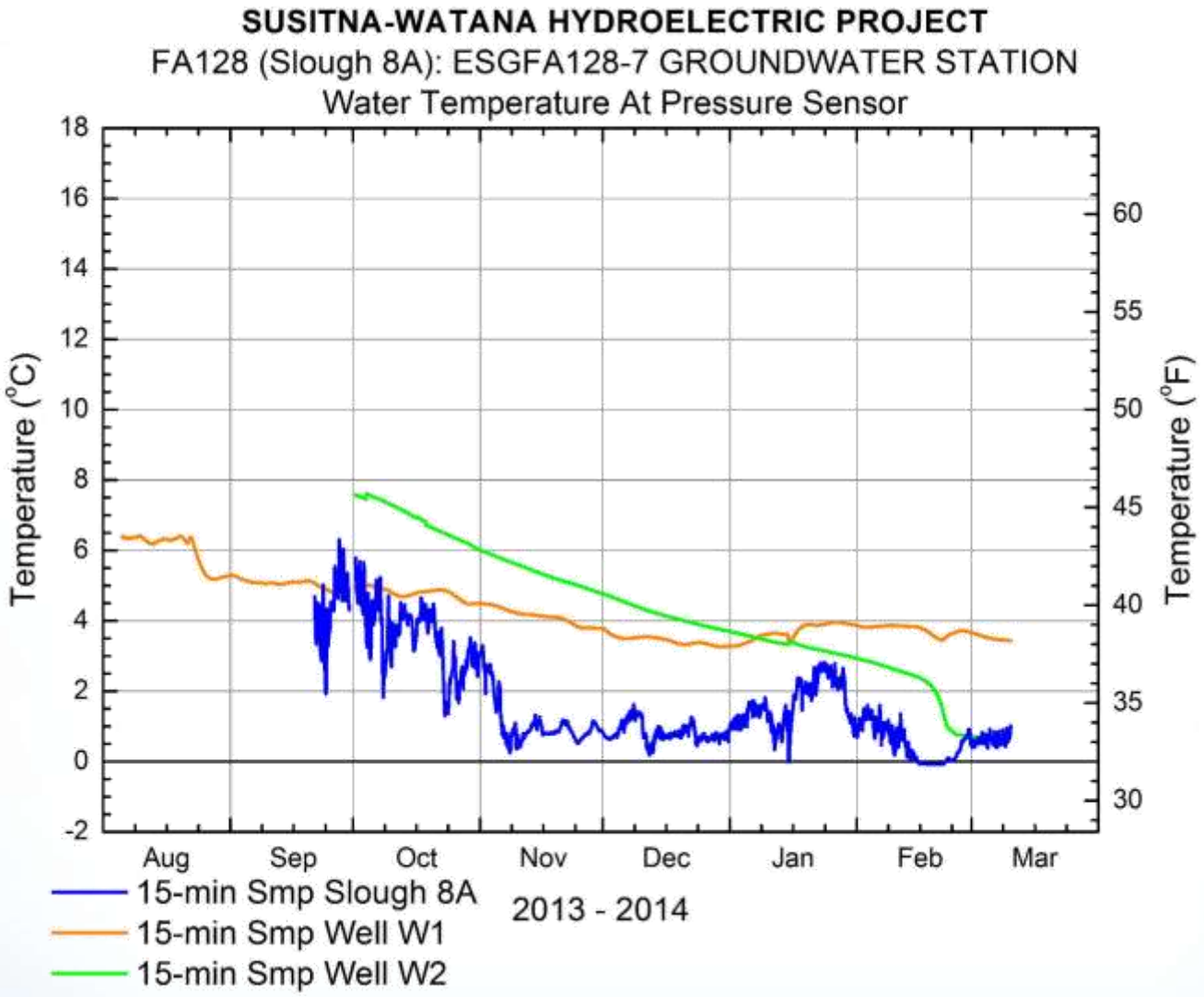
# ESGFA128-7 Example –Temperature

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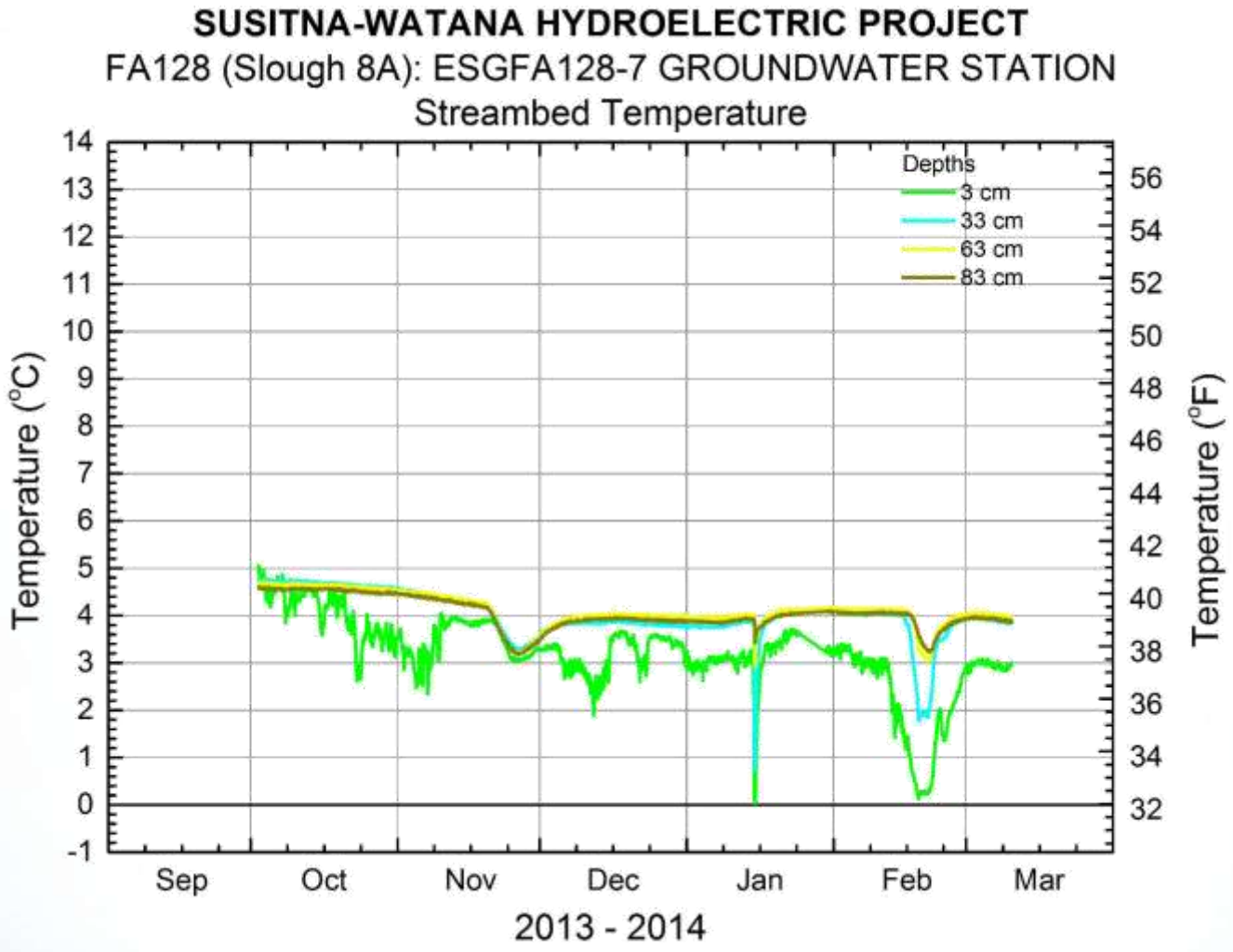
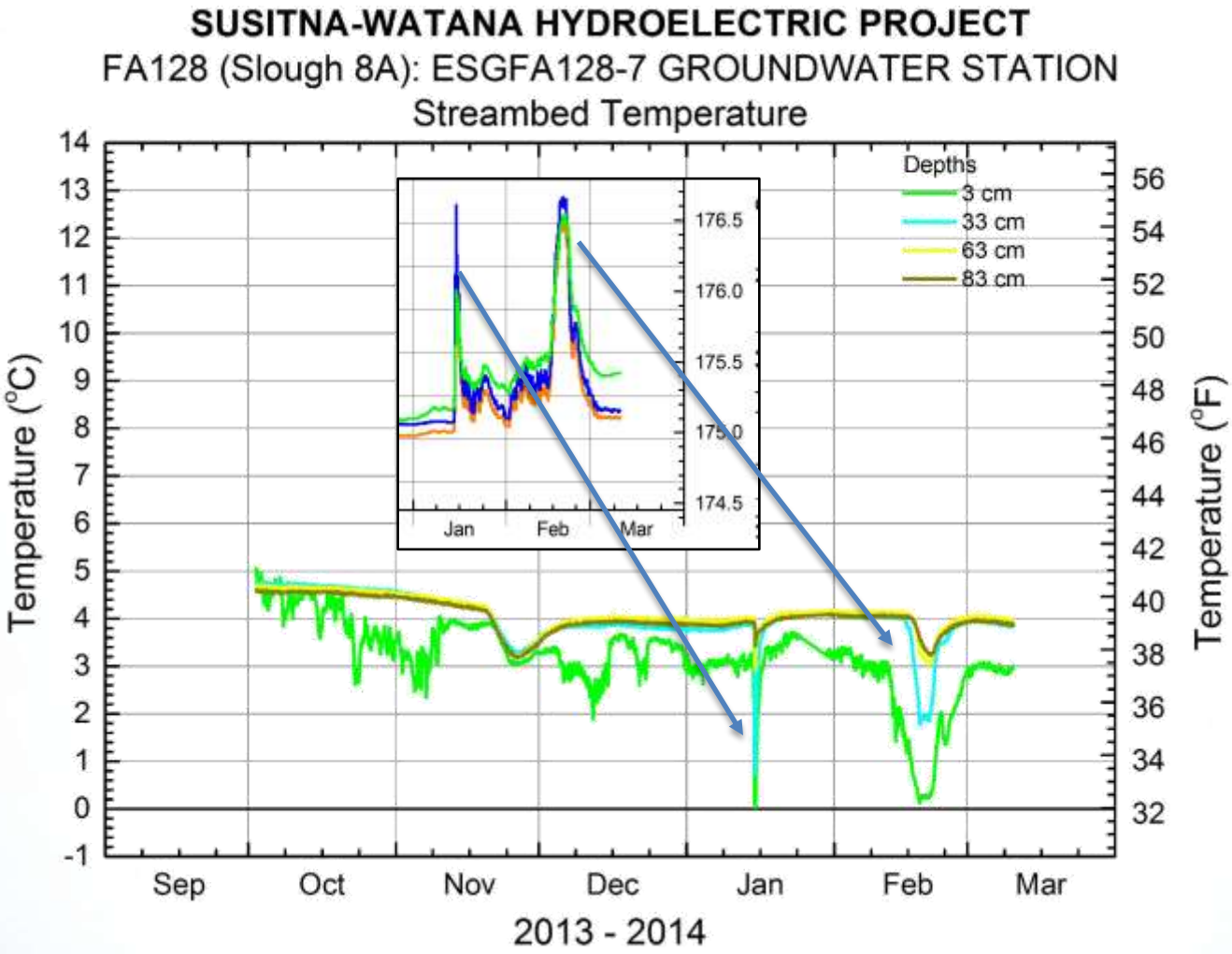
# ESGFA128-7 Example –Streambed Temperatures



# ESGFA128-7 Example –Streambed Temperatures

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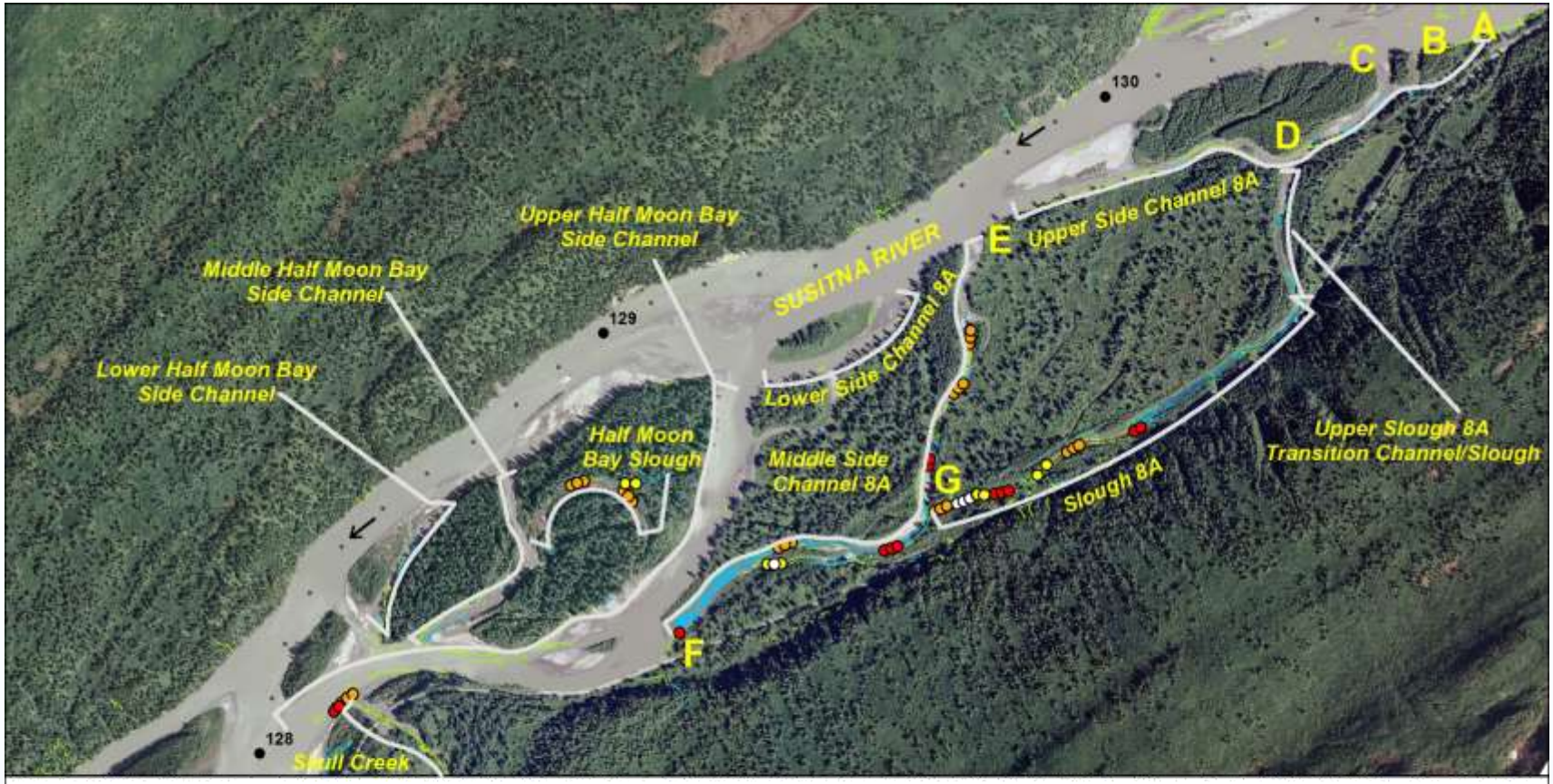
# GW/SW FA-128 (Slough 8A) Upwelling Data




**FA 128 (Slough 8A) - Focus Area Groundwater Upwelling Features**

**HSC Positive VHG Measurement**

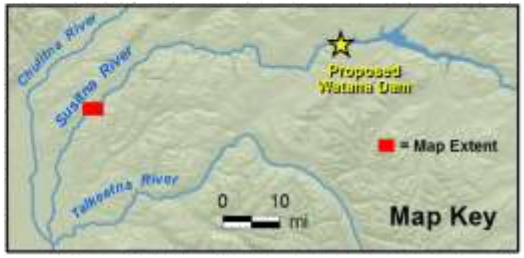
- June
- July
- August
- September

- TIR 2012
- TIR 2013
- Susitna Flow Direction
- Project River Mile

ALASKA ENERGY AUTHORITY

0 1,500 Feet

Projection: AK SP Zone 4 NAD 1983
Date Created: 3/31/2014
Map Author: GWS - Cari Ruffino
File: POC_FA_128_TIRVHG_HSC.mxd




Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project Data Sources: See Map References

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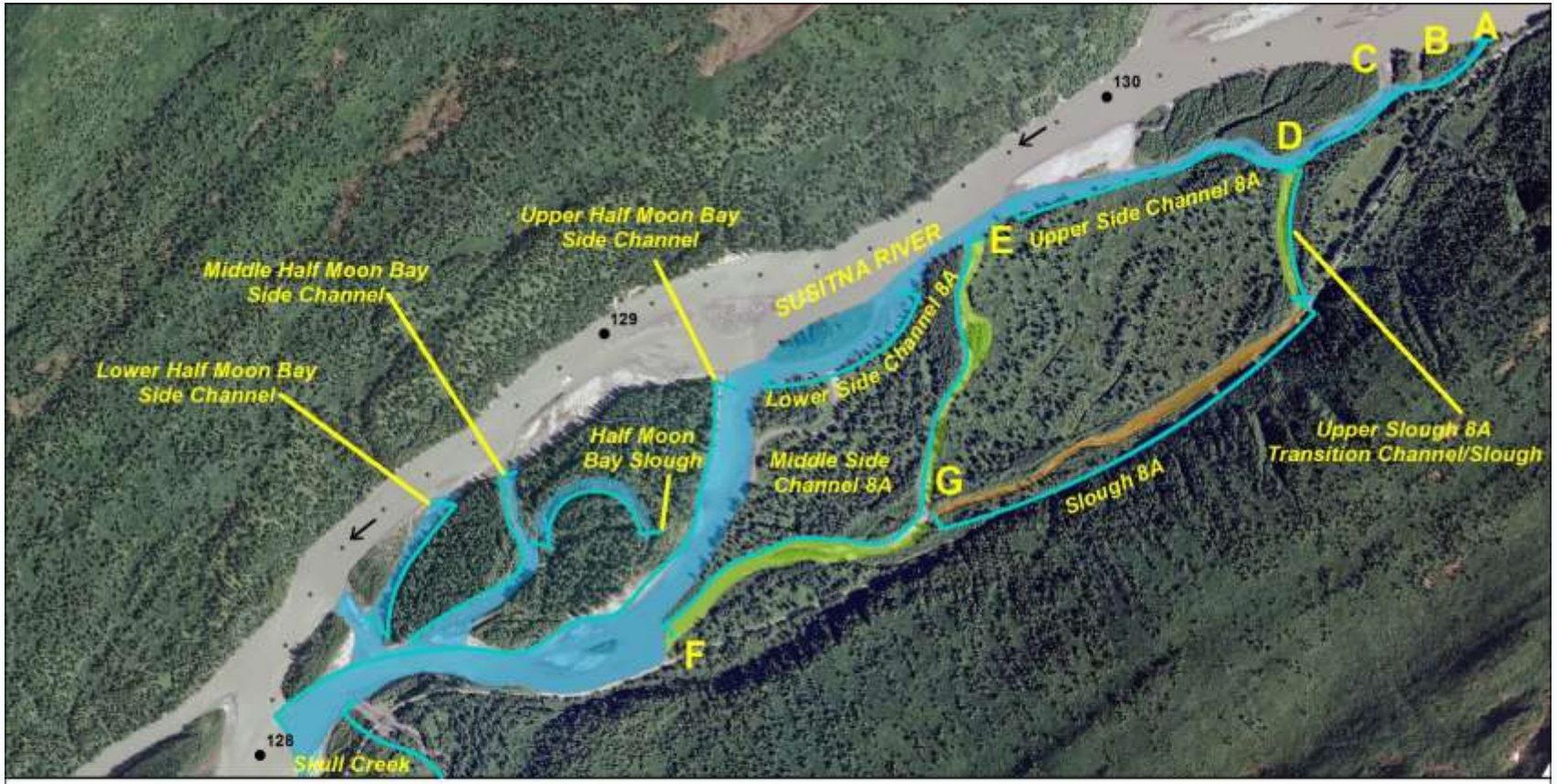
# GW/SW FA-128 (Slough 8A) Upwelling Zones

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# Focus Area Example: FA-128 (Slough8A)

- Aquatic Section FA128-2DM1 – Slough 8A
  - Upland Dominated, groundwater inflow, warm
- Aquatic Section FA128-2DM2 – Middle Side Channel 8A (Lower)
  - Both lateral groundwater inflow (warm) and mainstem surface water (cold – winter; warm – summer)
  - Riverine, Upland Transitional

FA-128 – (Slough 8a), Upland Slough, location of aquatic transect FA1282DM1, October 29, 2013

# Focus Area Example: FA-128 (Slough8A)

- Aquatic Section FA128-2DM1 – Slough 8A
  - Upland Dominated, groundwater inflow, warm
- Aquatic Section FA128-2DM2 – Middle Side Channel 8A (Lower)
  - Both lateral groundwater inflow (warm) and mainstem surface water (cold – winter; warm – summer)
  - Riverine, Upland Transitional

**Groundwater Upwelling Trends Matrix Input Table – Example Only**

| Month | Slough Lateral Habitat | Side Channel Lateral Habitat |
|---|---|---|
| Oct | Up, Increasing | Up, Increasing |
| Nov | Up, Increasing | Up, Increasing |
| Dec | Up, Increasing | Up, Increasing |
| Jan | Up, Increasing | Up, Increasing |
| Feb | Up, Increasing | Up, Increasing |
| Mar | Up, Stable | Up, Stable |
| Apr | Up, Stable | Up, Stable |
| May | Up, Stable | Up, Stable |
| June | Down, Increasing | Down, Increasing |
| Jul | Down, Increasing | Up, Increasing |
| Aug | Down, Stable | Up, Stable |
| Sept | Reversing | Up, Decreasing |

# Next Steps

- Continued Empirical Data Collection
- GW/SW Process Numerical Modeling (Year 2)
- Empirical Relationship Development
- Upscaling

FA-128 (Slough 8A), Slough 8A and Middle Side Channel 8A junction on October 29, 2013

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