Constructed and restored wetlands' relationship to stream restoration using natural channel design

Upper Peninsula Power Company
Dead River Recovery, Marquette County, Michigan

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Agenda

1 Background

2 Post-construction stream

3 Post Construction wetlands

4 Wetland monitoring

5 Conclusions

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1 Background


L SUPERIOR, U.S. SHORE
Three (3) power companies operate four (4) power plants on five (5) reservoirs between Silver Lake at the headwaters of the Dead River and Lake Superior
SLATE R
Dead-Kelsey
YELLOW DOG R
PESHEKEE R
DEAD R
DEAD R
CARP R
CARP R
MICHIGAMME R
SPRUCE R
Michigamme
ESCANABA R, M BR
BRYAN CR
FENCE R
Escanaba

2003 Dead River Flood

- May 14, 5 pm - Dike at Silver Lake breaks
- An estimated 8 billion gallons of water released into the river

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Human Toll

- 2300 people evacuated
- 3 dams damaged, 2 dams failed
- 9 bridges damaged or destroyed
- 1 power plant damaged
- 2 parks and 3 public access sites damaged
- Homes and camps flooded
- 14 businesses impacted, including Northern Michigan University

Environmental Toll

- River channel realignments
- Soil and vegetation loss
- Sediment deposition
- Debris
- Sheen of undetermined origin at City of Marquette's Upper Harbor


JUL 15 2004


JUL 15 2004

Dead River Recovery Project

- Remove debris
- Create stable river alignment
- Prevent erosion and sedimentation
- Recover wetlands
- Replant vegetation

Design Goals

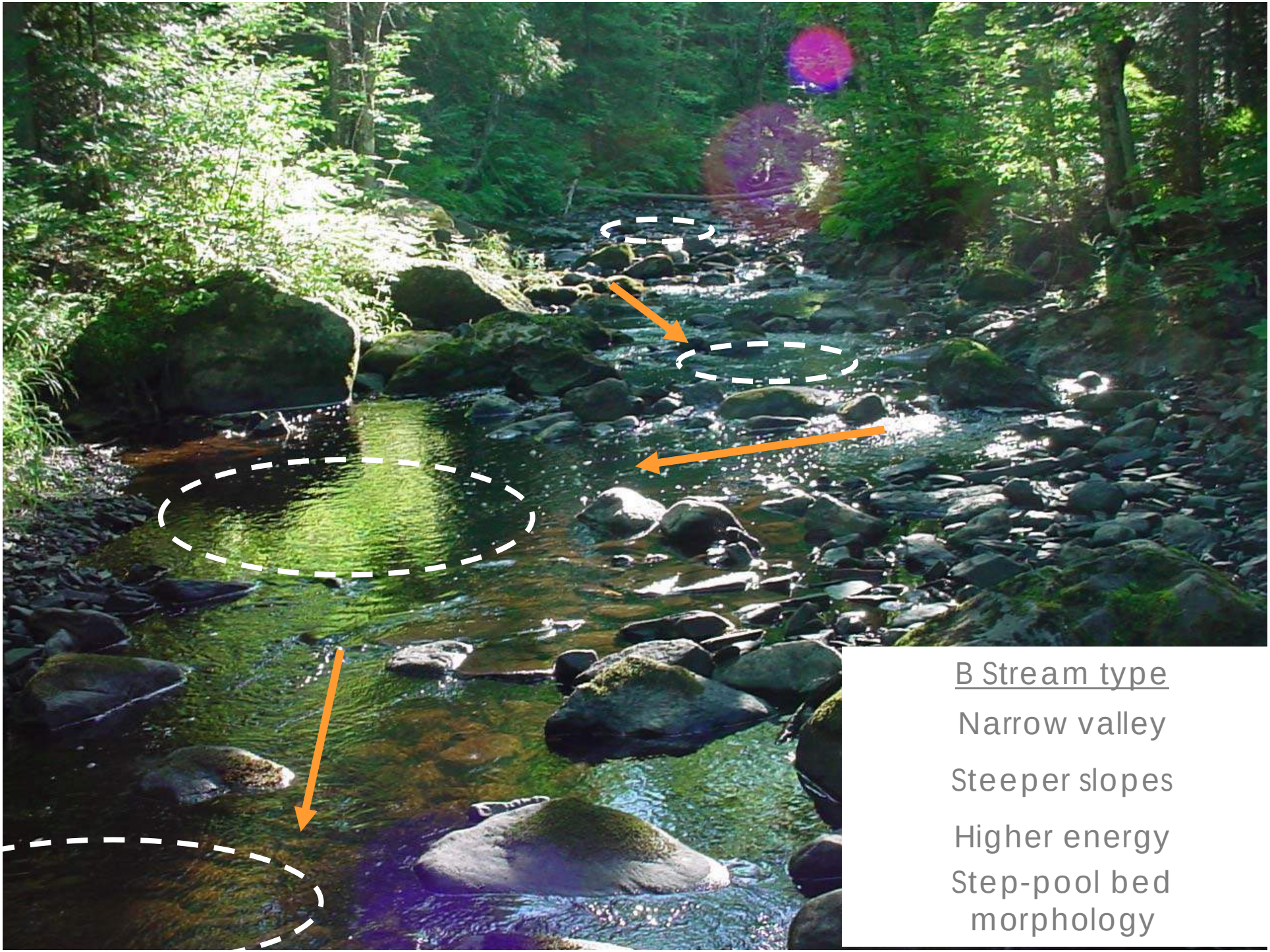
- Recover natural functions in corridor

River

- Design for valley type, slope

Wetlands

- Situate adjacent to stream on floodplain or terrace as appropriate



B Stream type

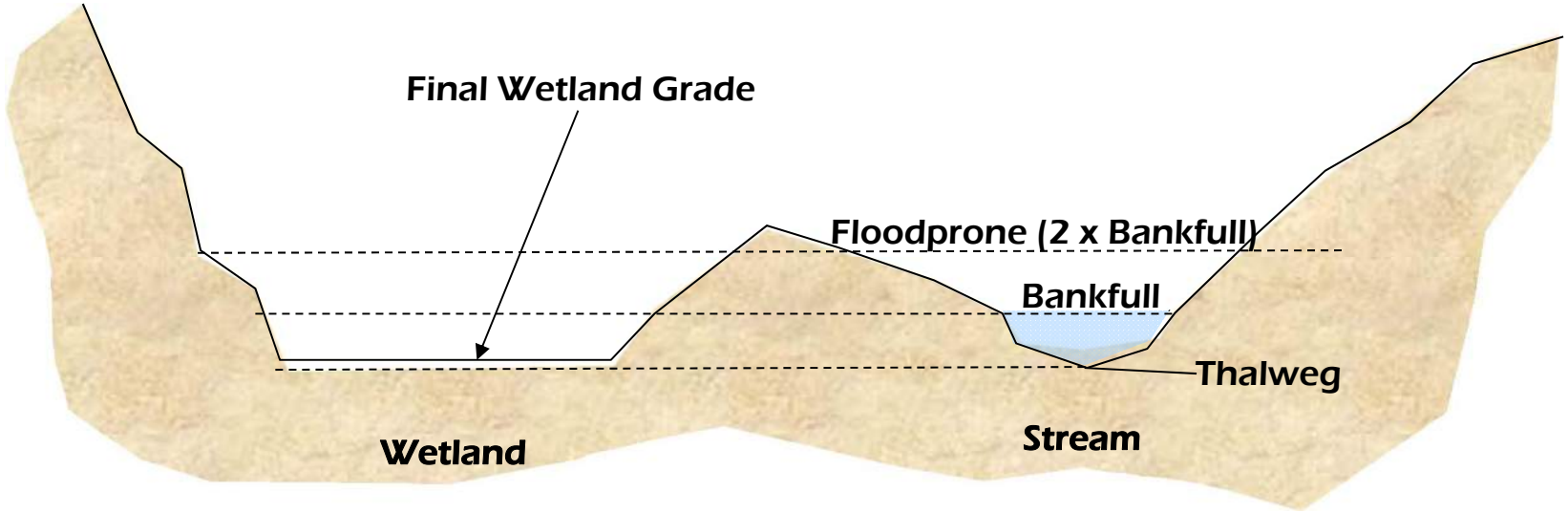
Narrow valley

Steeper slopes

Higher energy

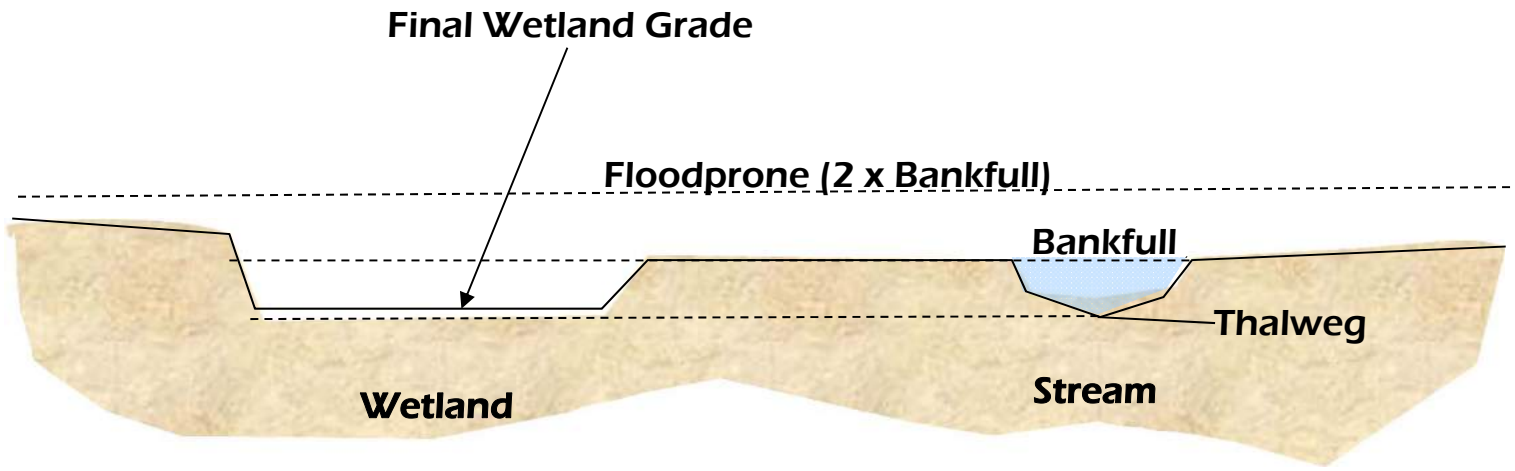
Step-pool bed morphology

Confined channel




C Stream type
Broader valley
Flatter slopes
Lower energy
Meander-pool bed morphology

Unconfined channel



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2 Post construction stream


JUL 15 2004

3 Post construction wetlands

4 Wetlands monitoring

Monitoring methods

- Vegetation
  - Trees and shrubs
  - Herbaceous
- Hydrology

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Monitoring methods

- Vegetation
  - Trees and shrubs
  - Herbaceous
- **Hydrology**

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Monitoring setup

- 4 piezometers were installed in project wetlands, 1 piezometer was installed in a reference wetland
- Measure near surface water table 4 times per day

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Equipment setup

- Piezometers:
  - 2” diameter PVC, 28” long with a slotted point and locked cap
  - Installed by hand, bentonite placed around the casing
- The data loggers:
  - Hobo® brand, suspended in the piezometer casing by a stainless steel cable attached to a steel washer

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Performance standard

- The performance standard for wetland hydrology includes:
  - Saturation in the root zone (i.e. upper 12” of the soil column) or
  - Inundation for minimum of 12.5% of the growing season
- In Marquette County growing season is 146 days; wetland hydrology must be present a minimum of **18 days**.

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Monitoring results

- Launched on May 24 (three project sites and reference wetland) and June 27 (additional project site)
- Shut down August 14 to prevent winter damage

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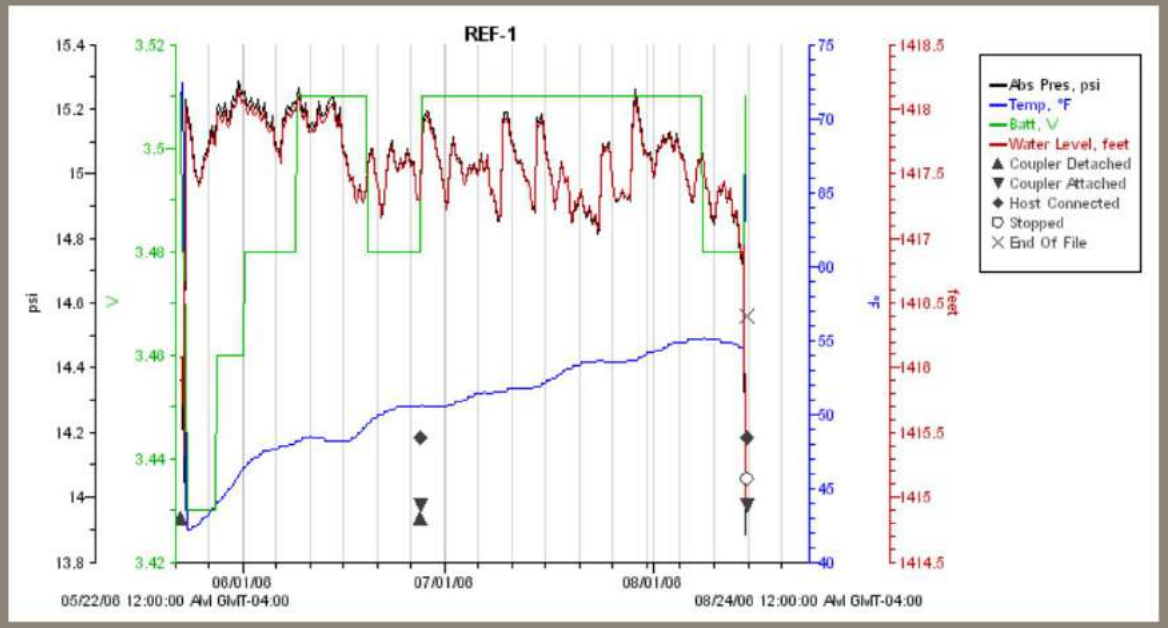
Reference wetland results

At or above 12” bgs until shutdown



> Standard

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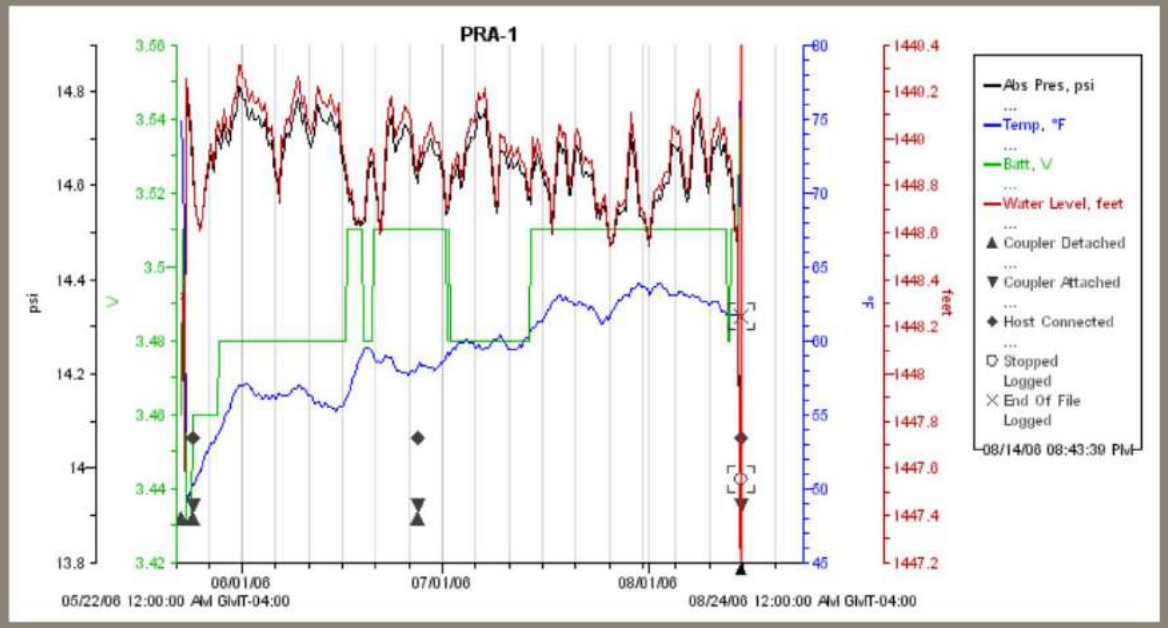
Confined channel #1 results

At or above 12” bgs
until July 28 (38 days)



> Standard

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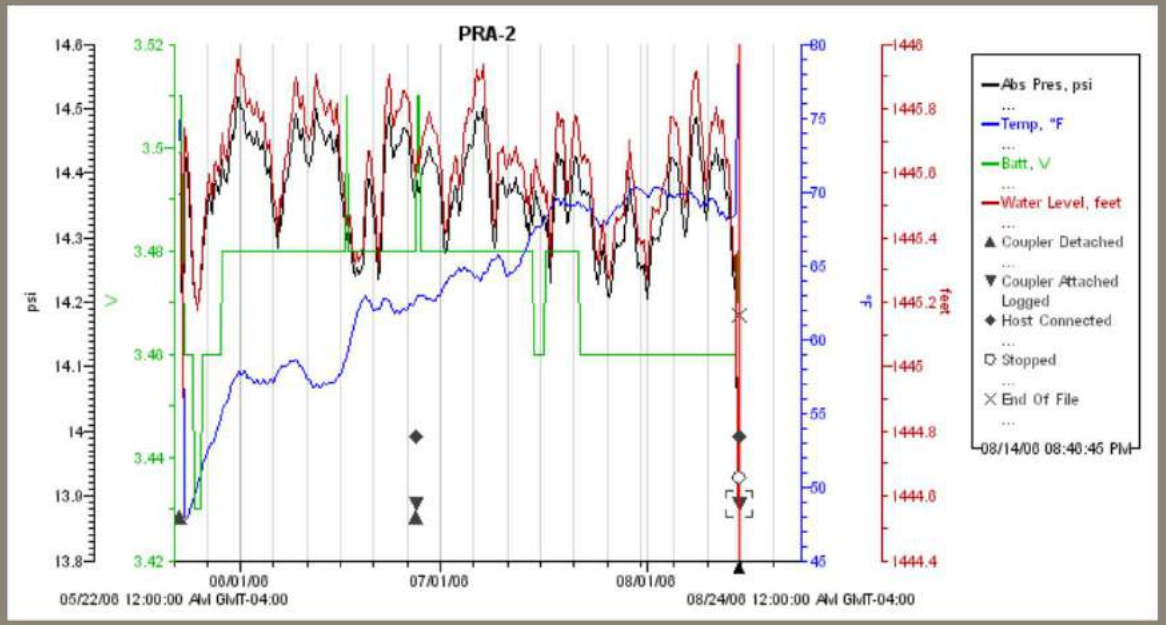
Confined channel #2 results

At or above 12” bgs
until shutdown



> Standard

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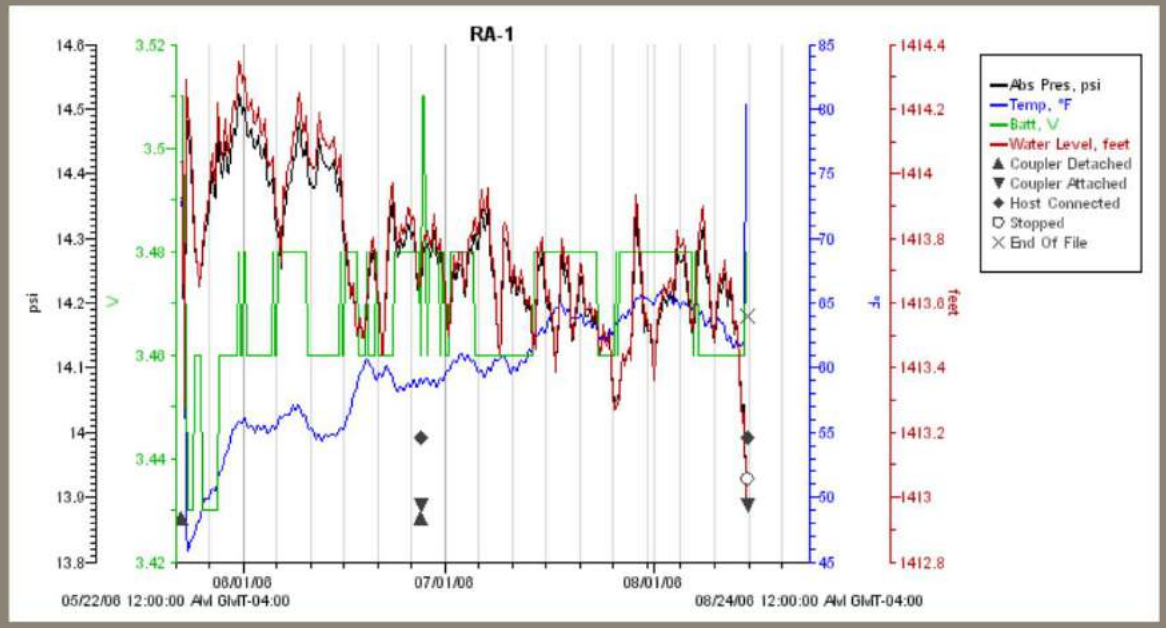
Unconfined channel #1 results

At or above 12” bgs
until June 6, very close
until July 10



< Standard

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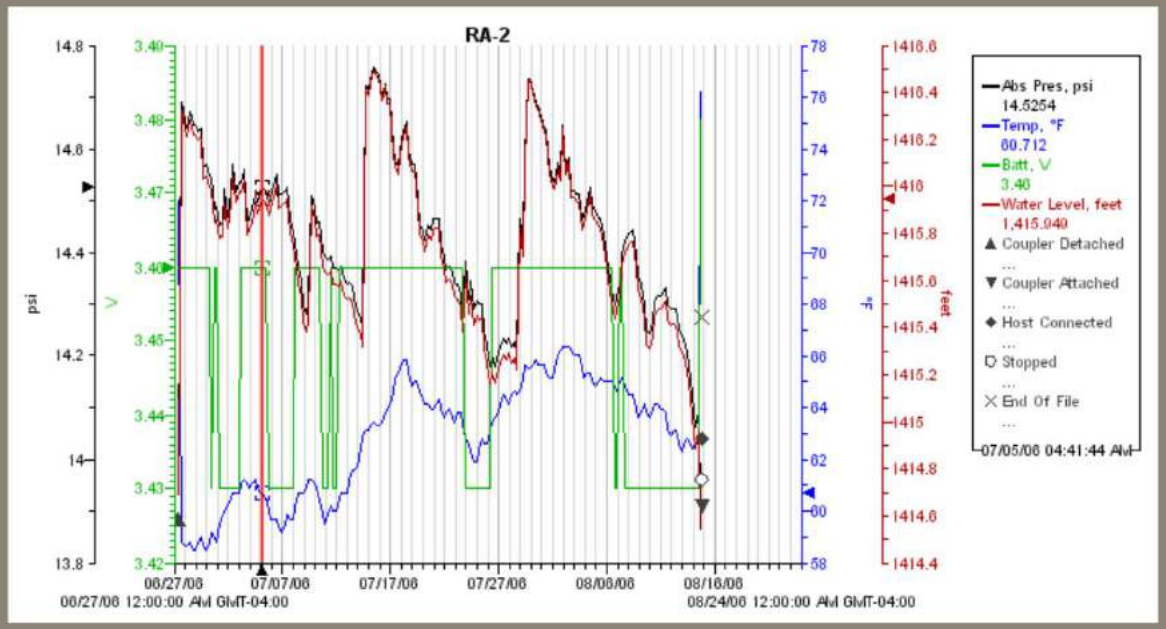
Unconfined channel #2 results

Wetland completed June 27; at or above 12” bgs until June 30, at 13.7” bgs until July 8



Incomplete

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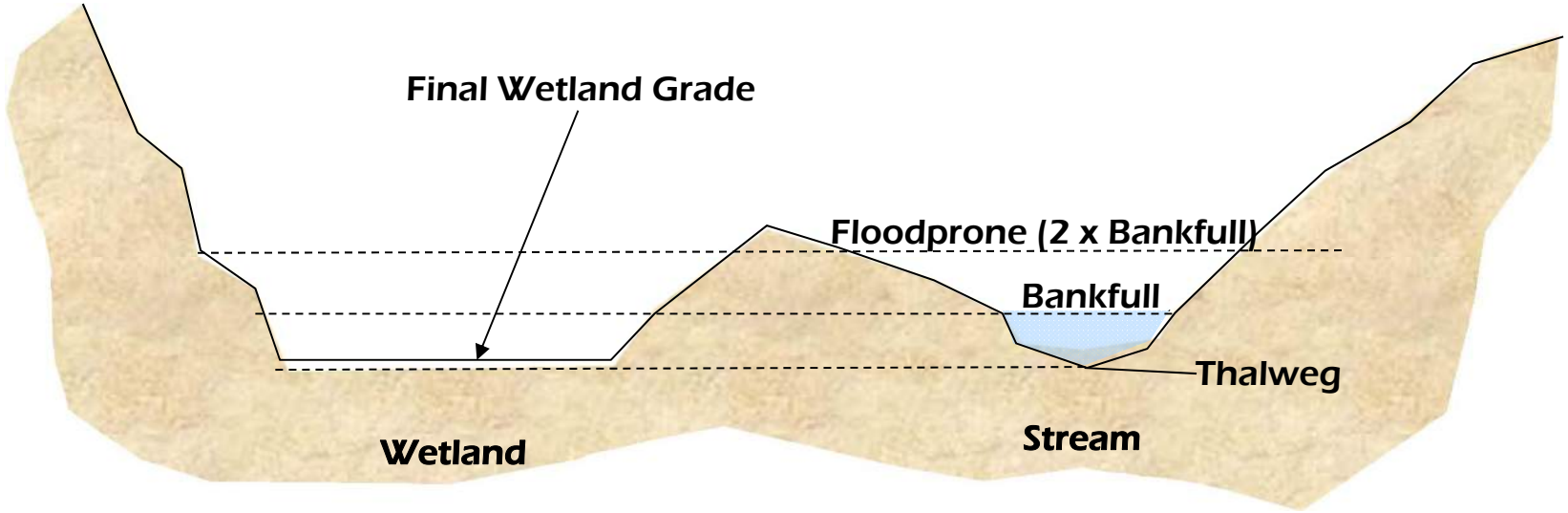
Confined channel

> Standard-all 5 years



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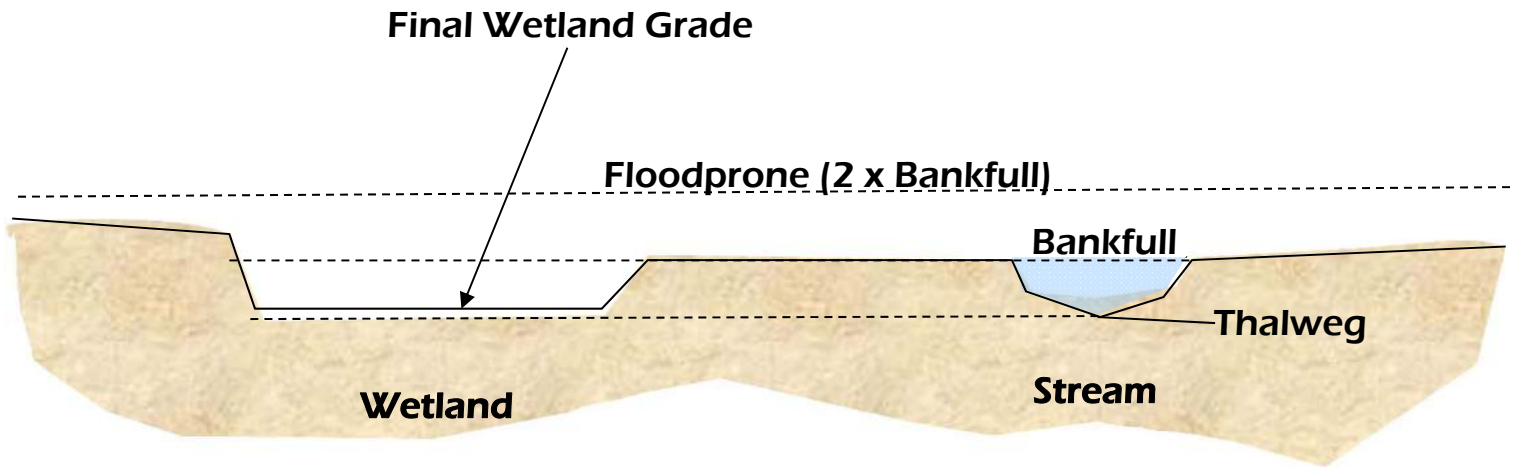
Unconfined channel

< Standard-years 1-3

> Standard-years 4&5



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5 Conclusions

Conclusions

Confined valleys

- Wetlands in confined valleys met standard immediately-receiving groundwater from adjacent terrace scarps.
  - Inlet control works not necessary.
  - Smaller area available for wetlands; do not neglect opportunities to include wetlands in narrow valleys.

Unconfined valleys

- Wetlands in unconfined valleys met standard within monitoring timeframe-required a longer period for groundwater levels to adjust between stream/wetland.
  - Inlet control works may be necessary.
  - Larger areas available for wetlands.

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Questions?

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