

Vermilion River Restoration Effectiveness Monitoring: Year One and More to Come

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Sims Reach of Vermilion River Post Restoration – Nicole Stine

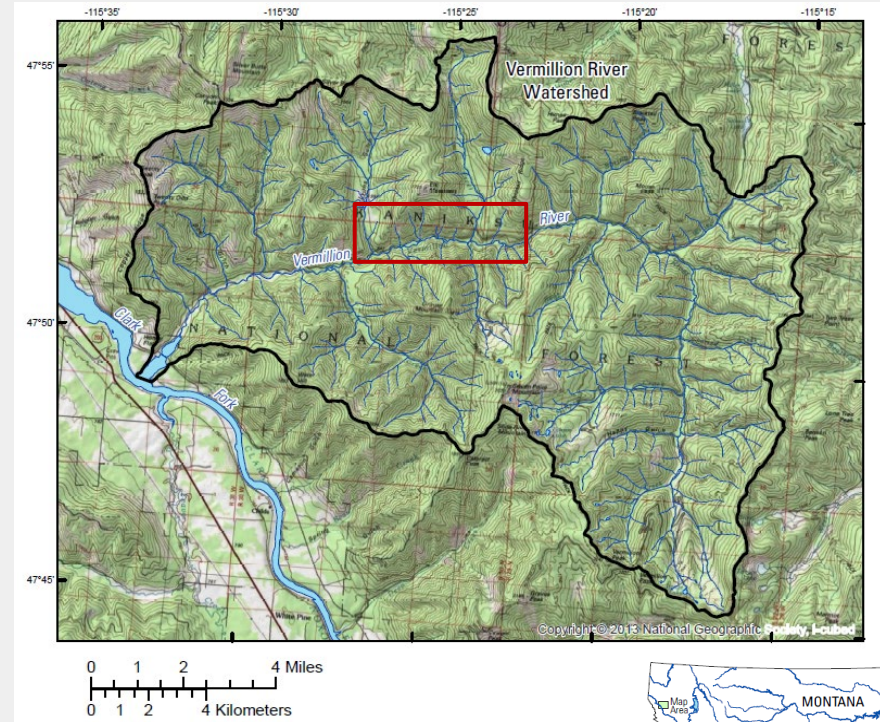
Presentation Overview

- Background/History
- Restoration Efforts
- Problem Statement
- Study Objectives
 - Phase 1
- Current Status
- Products



Background: Study Area

- Vermilion River
 - Tributary to the lower Clark Fork River
- Prime bull trout habitat degraded due to:
 - Larger magnitude flooding impacts
 - Channel instability due to mining
 - Natural channel instability



Location of Vermilion River watershed, study area in red box



Background: Mining and channel instability

- 1874 - placer mining
 - Destabilized and straightened channel, simplified habitat
- 1950-1970 - clear-cut harvest and road building
 - Elevated peak flows during runoff events



Background: Natural Channel Instability

- Unstable Glacial Lake Missoula terraces
- Unvegetated, highly- erodible, coarse, alluvial streambanks
- Rain on snow dominated hydrology – flashy runoff events



Restoration Efforts: USFS

Improve native fish habitat:

- Restore degraded stream channel and floodplain
- Regenerate native riparian vegetation
- Increase habitat complexity with large woody debris
- Improve the stability of the stream channel



Pre-Restoration



Sims Reach-2,500 ft

Post-Restoration

Need for Study - USGS

- USFS - Restoration ongoing since 2012.
- Effectiveness monitoring of restored segments has mostly assessed geomorphic changes.
- Three more reaches for restoration
- Grouse Creek begins 2024

An increased scientific understanding of the effectiveness of USFS restoration techniques is needed to guide future restoration efforts.

USGS-USFS-Lower Clark Fork Working Group – Cooperative Project: Goals/Objectives

“A restoration effectiveness monitoring program that over the next 5 years will evaluate how effective the restoration work is at affecting the habitat by monitoring the physical, chemical, and biological changes in the stream and watershed.”

Phase 1 (FY2023--FY2024)

- Establishment of effectiveness monitoring network
- Uncrewed LiDAR and thermal imagery survey

Phase 2 (FY2024--FY2028?)

- Evaluate effectiveness of USFS stream restoration to improve aquatic fish habitat using chemical and biological indicators

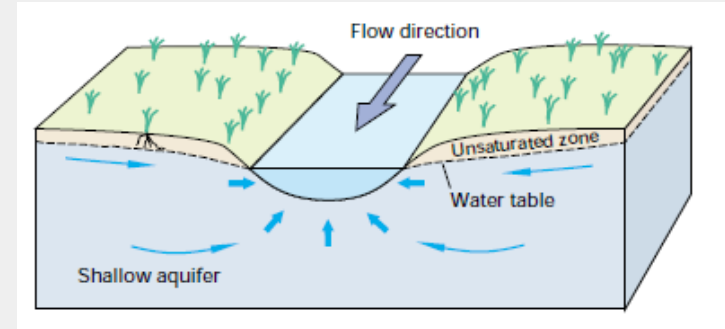
USGS-USFS: Phase 1

Task 1: Establish and install effectiveness monitoring infrastructure

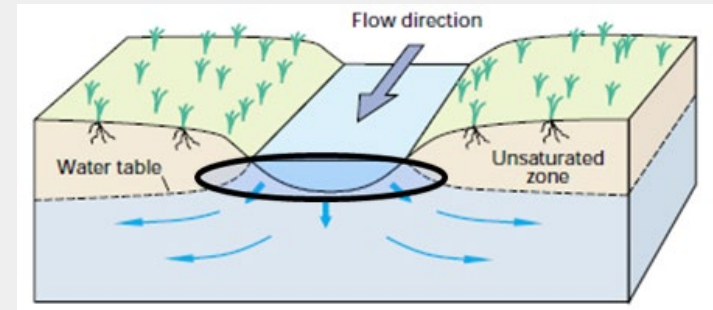
Network to monitor the physical conditions of the groundwater/surface-water system

- Monitoring well network
- Stream staff gages
- Temperature

Gaining Reach



Losing Reach



Considerations

- Hydraulic heads – relative
- Unconfined/confined conditions
- Hydraulic conductivity (K) of aquifer and streambed

Task 1: Installation of groundwater/ surface-water monitoring network

- Stream staff gages installed at selected locations
- Shallow wells (<10 feet deep) installed to examine water-level gradients near the river
- Annual elevation survey of all sites



Task 1: Continuous high-spatial density stream-temperature monitoring (March – October)

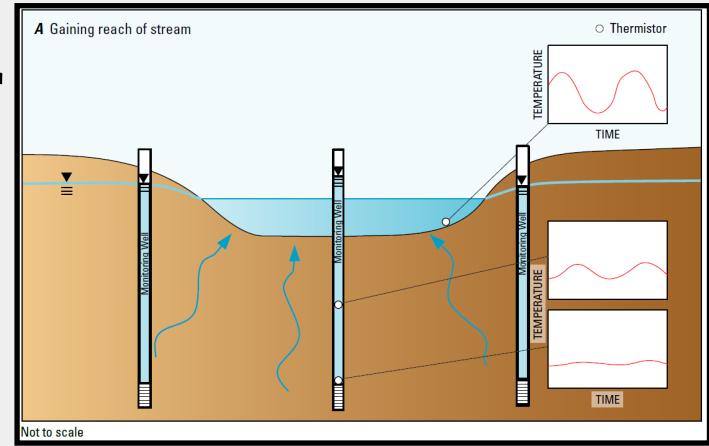
- Thermistor loggers deployed in multiple locations
- Detect diel temperature and longer-term temperature variations



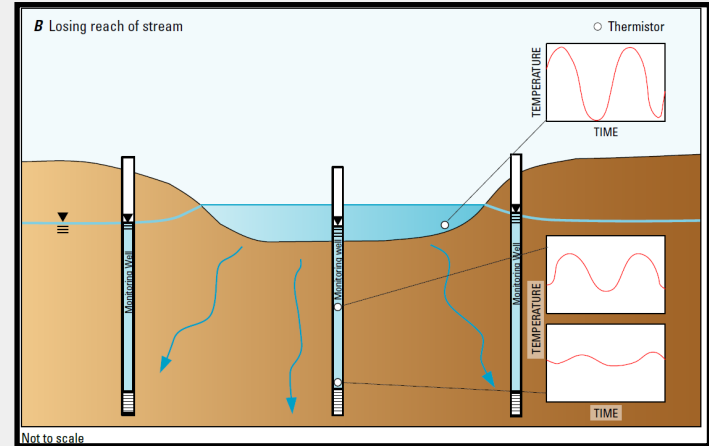
Task 1: Monitoring groundwater/surface-water network

- Selected wells will be instrumented with pressure transducers to continuously measure groundwater levels.
- Wells and river will be instrumented with thermistors to evaluate gw/sw interaction

Gaining Reach



Losing Reach



Task 2: Conduct LiDAR/Thermal Infrared survey of the project area (August – October, 2023)

- Scan of the bare ground surface at a 0.5 meter or finer resolution to develop a Digital Elevation Model (DEM)
- Thermal Infrared survey of the water column



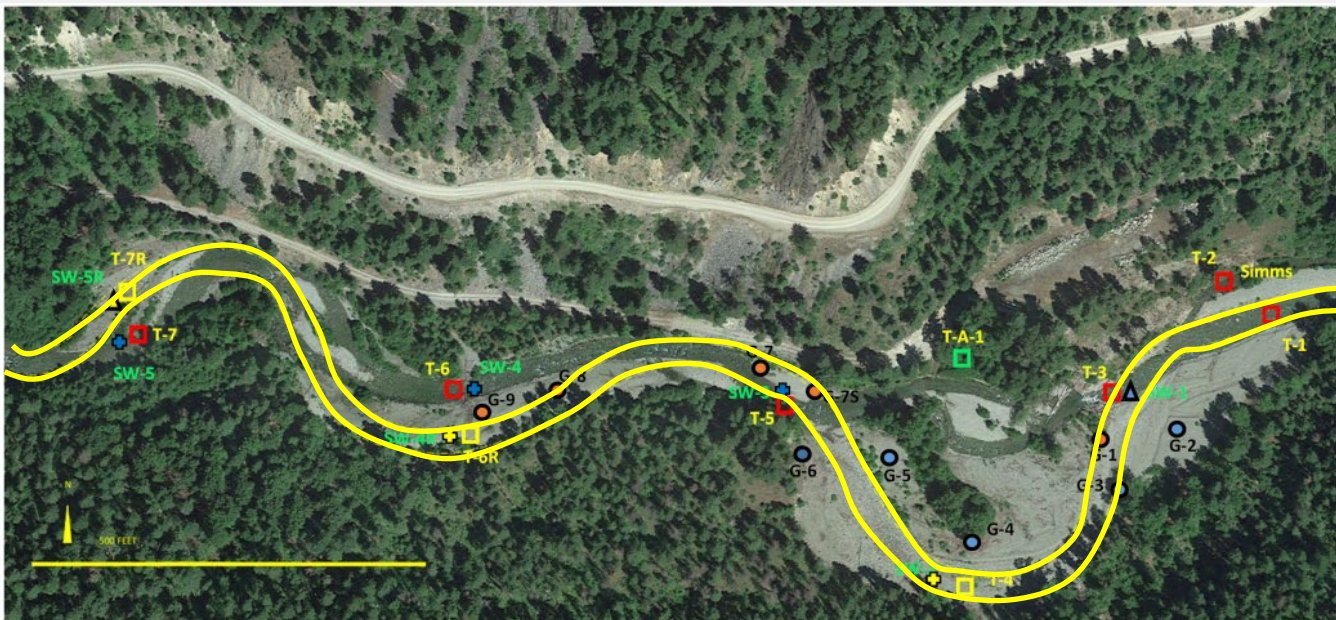
Preliminary Thermal Infrared Lidar Results



Current Status – Phase 1

- **July 2023** - Study initiated
- **August 2023** - Initial network established
 - Installed 17 near-stream shallow monitoring wells
 - Installed 9 in-stream thermistors and 3 air thermistors
 - Installed stream stage reference pins
 - Initial LiDAR and Thermal Flight (technical difficulties)
 - Area-wide elevational survey of network
- **October 2023**
 - Develop wells
 - Repeat LiDAR and Thermal Flight
 - Select sample locations for future water quality/biological sampling

GW/SW Monitoring Network (Grouse Reach) - Example



- Monitoring well — 1-1/4" to 2" diameter (continuous temperature, discrete water level, discrete water quality)
- Monitoring well — 1-1/4" to 2" diameter (continuous temperature, continuous/discrete water level, discrete water quality)
- ▲▲ Stream staff gage (continuous temperature and stream stage, discrete water quality). Post-reclamation—yellow.
- ⊕ Stream pen (tape up for stage). Post-reclamation—yellow.
- Stream—Air temperature (continuous temperature). Red = stream. Yellow = stream post-reclamation. Air = green.

Products - Phase 1

- USGS-USFS data releases
- Project web pages
- USGS Scientific Investigations Reports

The screenshot shows the USGS Wyoming-Montana Water Science Center website. The header features the USGS logo with the tagline "science for a changing world" and navigation links for SCIENCE, PRODUCTS, NEWS, CONNECT, and ABOUT. A search bar is located in the top right corner, with "Latest Earthquakes" and social media icons above it. The main content area is titled "Publications" and features a large background image of a map with a green and yellow color scheme. Overlaid on the map is the text "USGS Publications Warehouse" and "Information about all USGS publications. Advanced searches available". A button labeled "Access Warehouse" is positioned below the text. At the bottom of the page, there are links for "HOME" and "SCIENCE", and a text link that reads "Links to all publications authored by WY-MT Water Science Center Scientists:".

Thank You!

Feel free to contact me or other Vermilion Project team members:

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