

# Turning the Swan River Right-Side Up

October 9, 2019

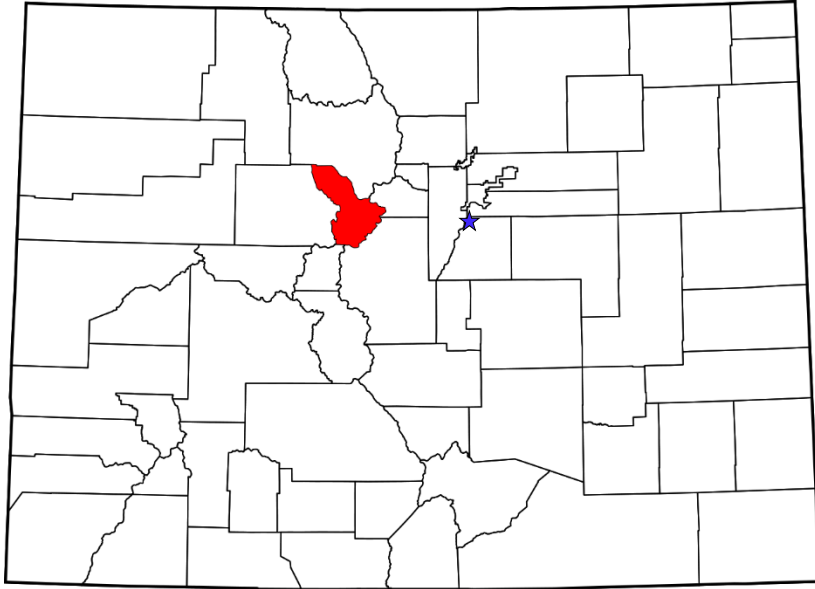
Troy Thompson, Ecological Resource Consultants, Inc.  
Jason Lederer, Summit County Open Space and Trails



# Project Location

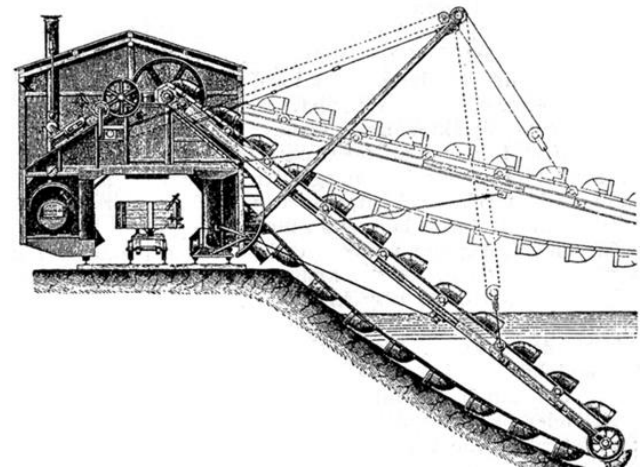
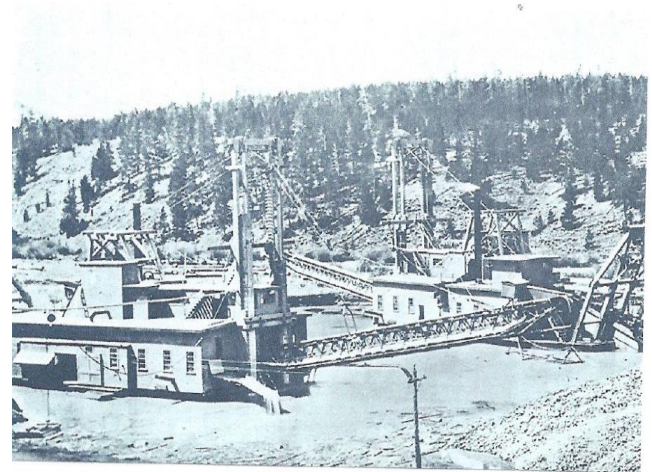
## Summit County, Colorado

2



# History of the Swan River Valley

- The discovery of gold in the valleys around Breckenridge in the late 1800s had a lasting impact on the streams and river valleys throughout the region
- Dredge boats were used to turn up the alluvial material to depths of up to 70 feet in the quest for riches
- As a result, the Swan River was one of the local stream systems that was ravaged in the process





# DREDGE OPERATIONS





# REMNANT DREDGE PILES AND POND





# SITE CONDITIONS



Stream at Surface

Dry stream channel

Dredge Rock

Rock Island Rd

6



# Project Goals & Objectives



- Create a natural, stable channel
- Improve water quality and water conservation
- Restore stream, riparian, floodplain and upland habitat and function
- Provide passive water treatment
- Create instream aquatic habitat for metapopulation of native Colorado River cutthroat trout
- Mitigate aquatic barrier that exists at Tiger Road
- Enhance local economy by creating public open space with opportunities for water-based recreation
- Utilize project for educational and demonstration purposes highlighting restoration techniques for historic mine impacts





# Project Implementation

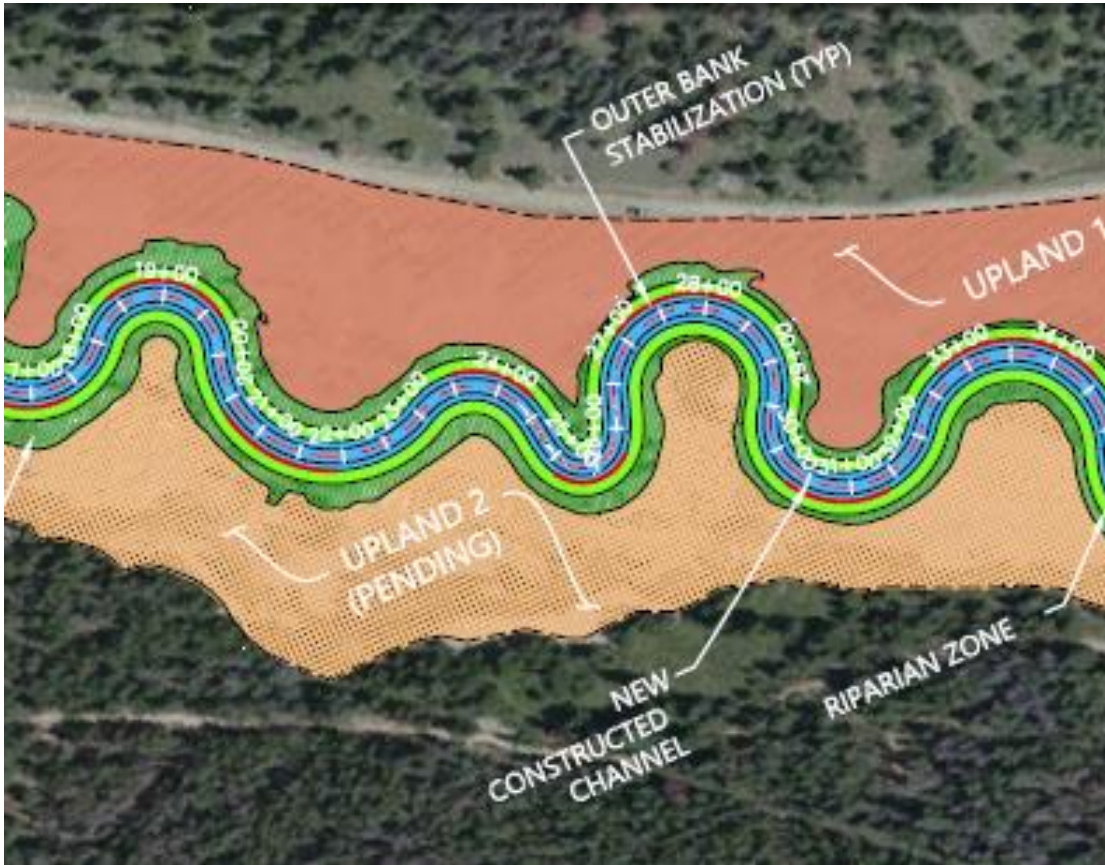
- Design/build process selected with the idea that the work approach would need to be nimble to account for uncertainty in conditions
- Work was undertaken in a true design/build approach where contractor was involved starting in design process and designer was in the field throughout construction
- Design work started in 2015 and construction occurred in 2016. Revegetation completed in 2017.



An aerial photograph of a volcanic landscape. In the foreground, a large, dark, rocky crater with a central vent is visible. The surrounding area is a mix of dark volcanic ash and patches of green vegetation. In the middle ground, a dense forest of evergreen trees covers the valley. In the background, a large, conical mountain peak rises against a clear blue sky. The overall scene is a mix of rugged volcanic terrain and lush forest.

# Main Design Challenges





- Keep stream away from Tiger Road on the north and old mine workings at the southeast to minimize water quality impacts
- Create new downstream road crossing that reduces crossings from 2 to 1 and eliminates 8 foot vertical barrier
- Upstream tie into a dry channel

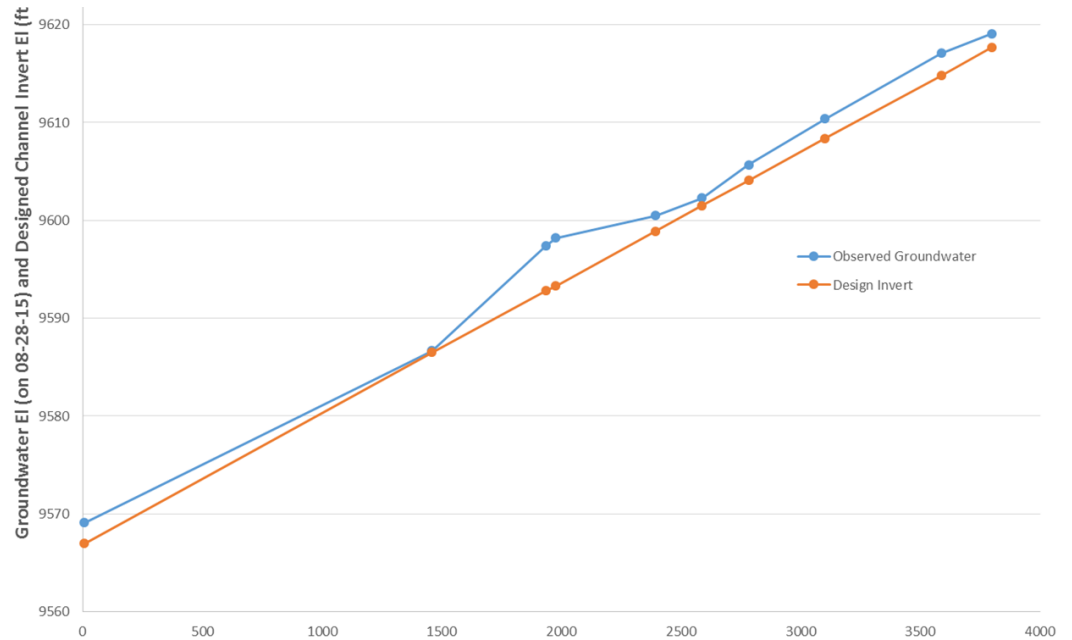
Develop a Planform that Fits Constraints and Mimics Natural Stream System



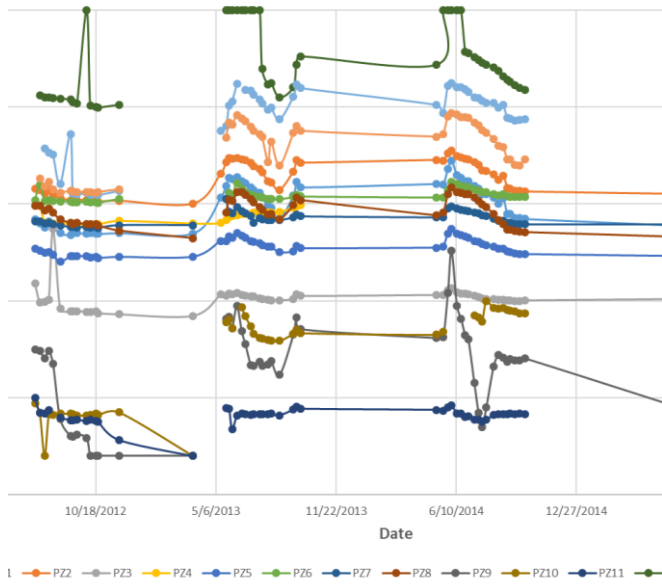
# Why Not Stage 0?

- Tailings Concerns
  - Water quality protection
- Sediment Transport – Not a Response Reach
  - Almost no incoming sediment load
- Geomorphic Grade Line
  - Water 10 feet below
  - Would have required additional 500K CY excavation





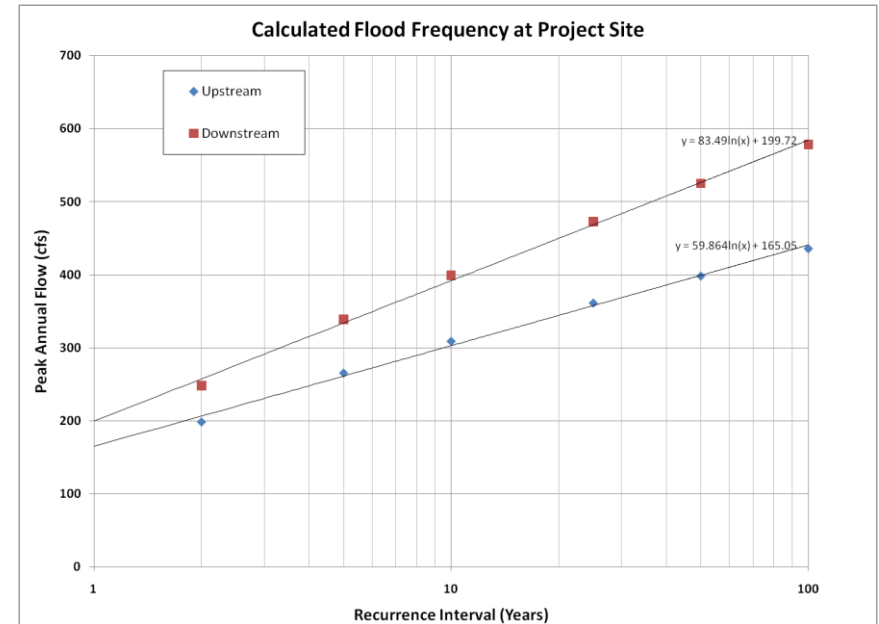
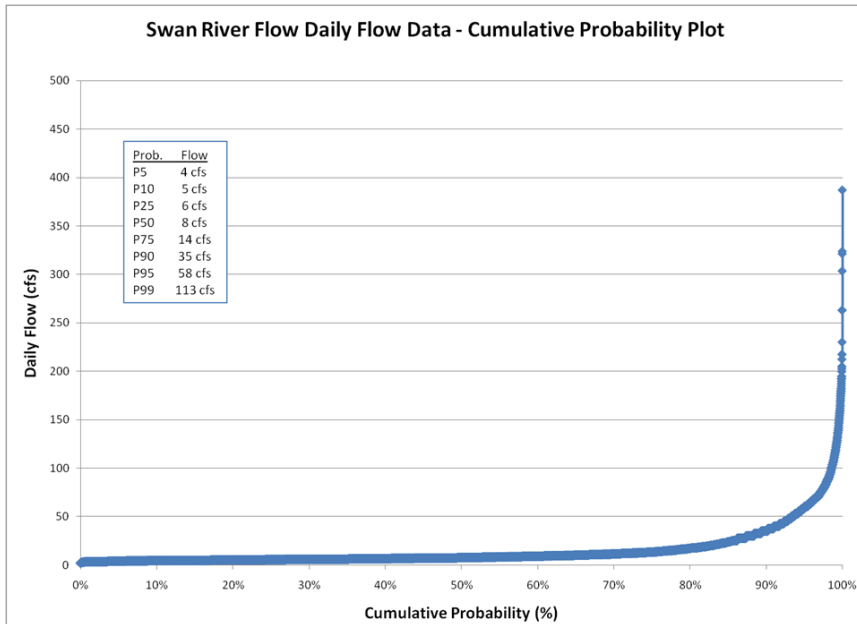
Historical Piezometer Readings in Swan River Valley



Understand Groundwater Levels to Achieve Gaining Stream



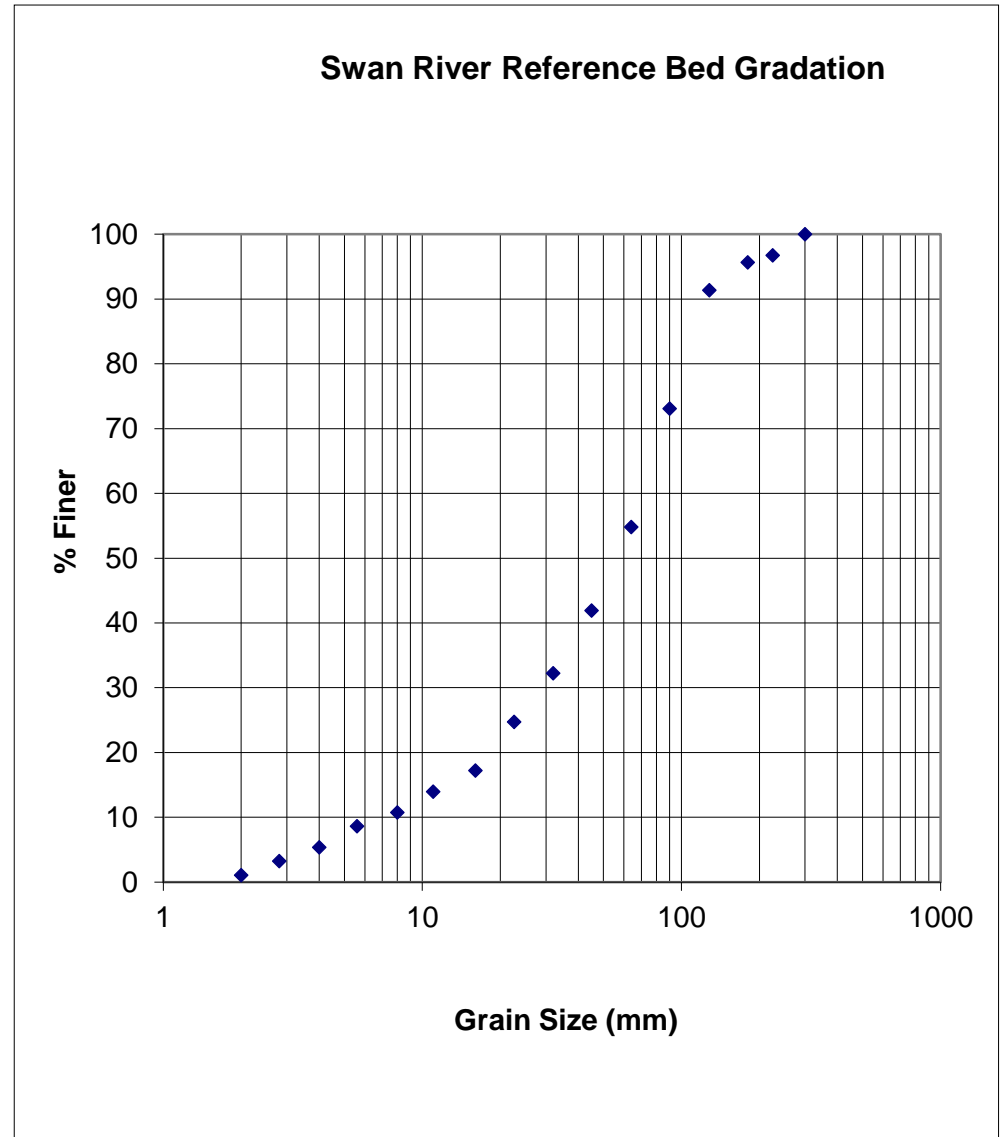
# Define Flows for Subsurface Stream Bankfull Discharge (~230 cfs) & Flow Frequency





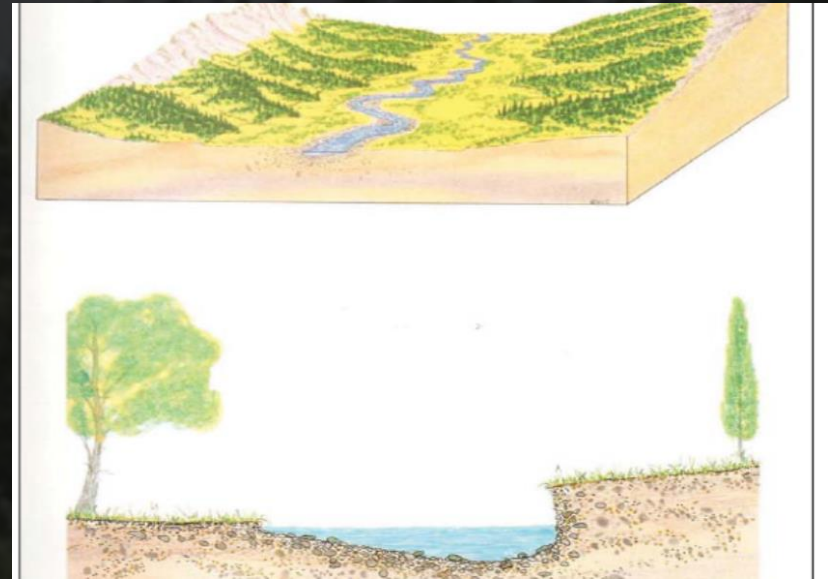
Design a Natural, Low Permeability Liner that Could be Manufactured from On-Site Materials

- Didn't want to use a synthetic liner
  - Cost
  - Natural system
  - Promote surface/GW interaction
- Used Fuller-Thompson method and sediment sampling in reference section to define gradations for a natural, low permeability liner



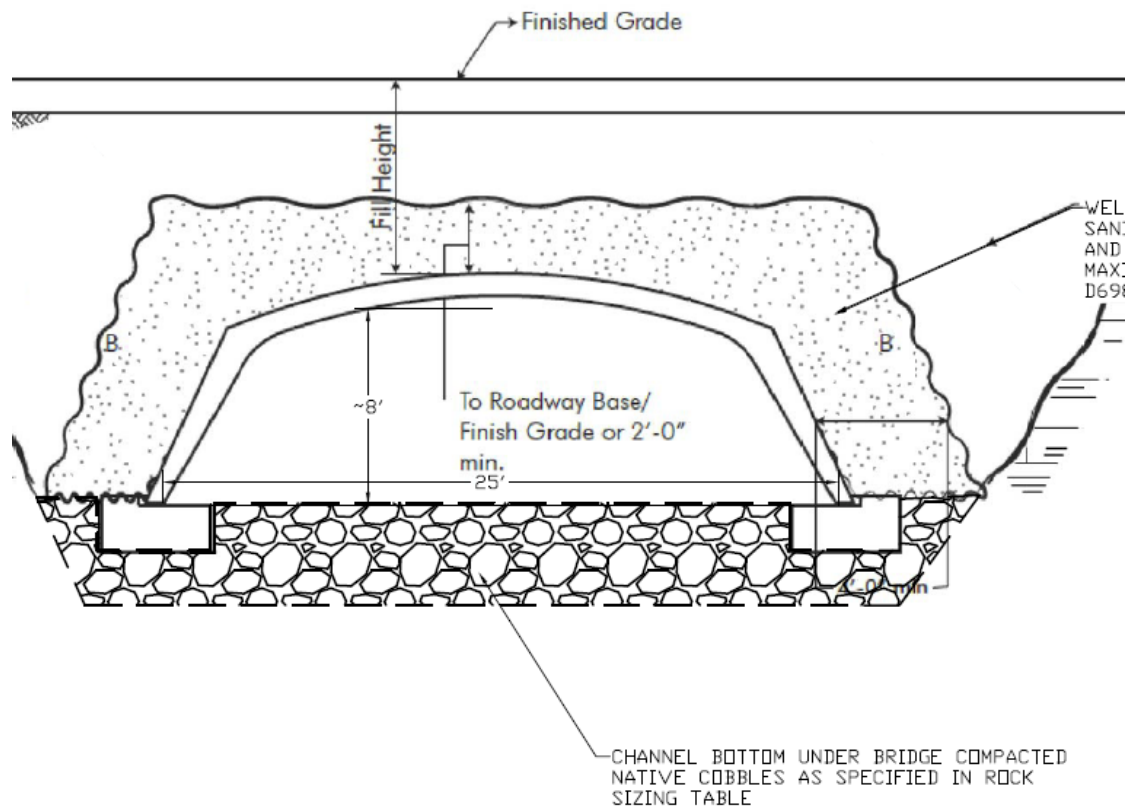


# Obtain Floodplain Connectivity



- Have flows access its riparian floodplain above bankfull
- Entrenchment ratio  $> 3$
- Mimic a natural Montgomery-Buffington Pool/Riffle and Rosgen Type C stream





- Remove existing 8 foot vertical barrier created by Tiger Road
- Bridge width exceeds bankfull channel width
- Passes 100-year flood with ~ 3 feet of freeboard
- Natural bottom promotes passage of aquatic organisms

Design Cost Effective Bridge at Tiger Road that Meets Project's Ecological Objectives



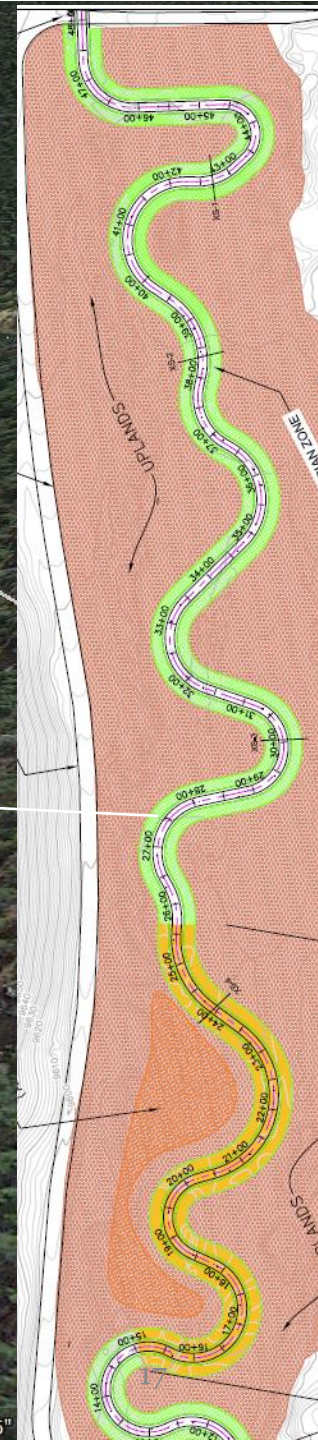
# CONSTRUCTION 2016

RIVER FLOWS  
SUBSURFACE

RIVER FLOWS  
CONFINED TO  
EDGE OF ROAD

DESIGN  
RIFFLE/POOL  
SYSTEM

1st Rough Grading







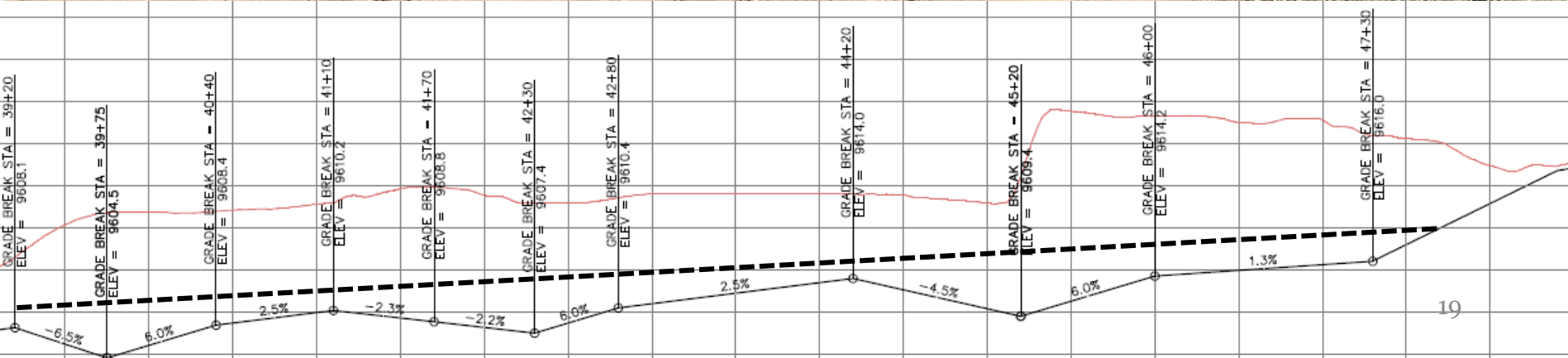
# Use of Native Materials

- Materials Generated On-Site
- Larger Cobbles (6" +)
  - Grade control
  - Bank stabilization
  - Riffle heads
- Smaller Cobbles (3" – 6")
  - Riffles
  - Banks
- Gravels (3/4" – 3")
  - Pools and glides
  - Non-critical banks
  - Random fill
- Finer Material (<3/4")
  - Channel liner
  - Matrix for create planting soil
- Use of on-site material resulted in huge cost savings and makes sense from a true, natural restoration concept





# ROUGH GRADING 1<sup>st</sup> SEGMENT OF THE RIVER CORRIDOR





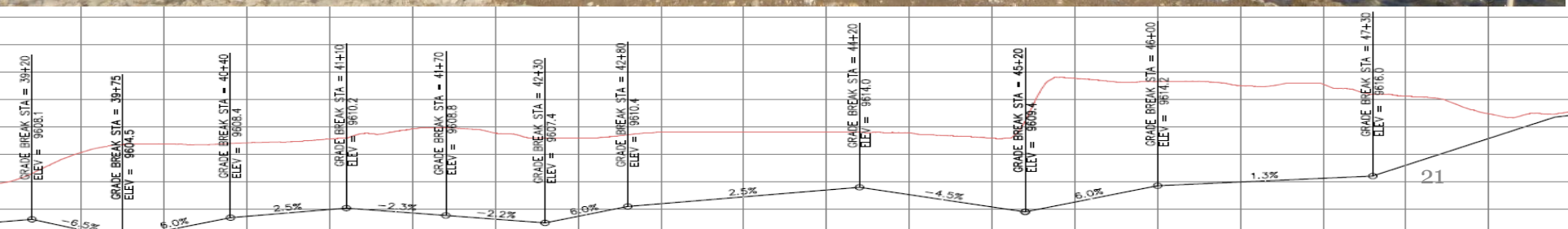


## BEFORE AND AFTER INITIAL CHANNEL EXCAVATION

---



# CONSTRUCTING RIFFLES & POOLS WITH NATIVE MATERIAL





# TRANSPLANTING WILLOWS







# ADDING HABITAT FEATURES





# NATURAL SINUOSITY





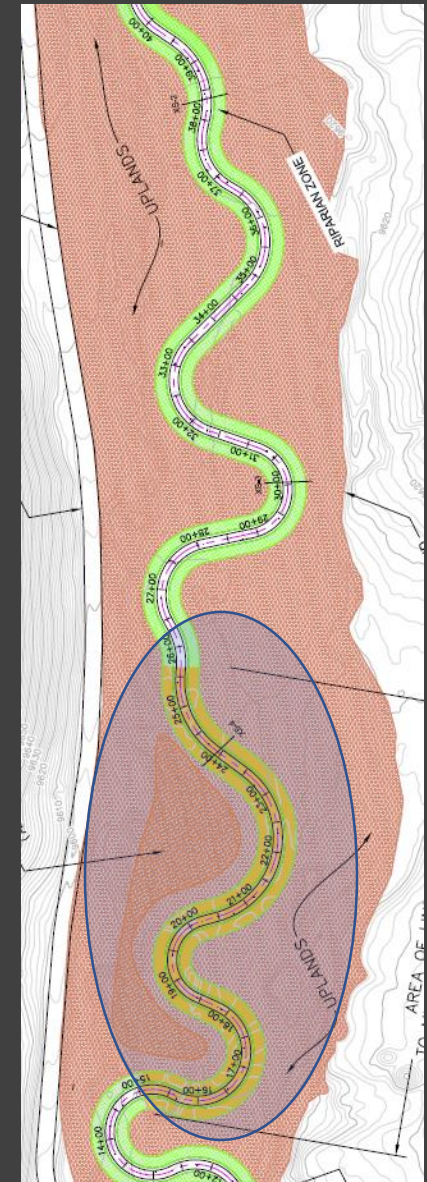
Encountered ~50,000 CY of mine tailings

Tested water and soils

Mitigation involved project sponsors, DRMS, USFS, EPA, CWCB, CDPHE and design/build team

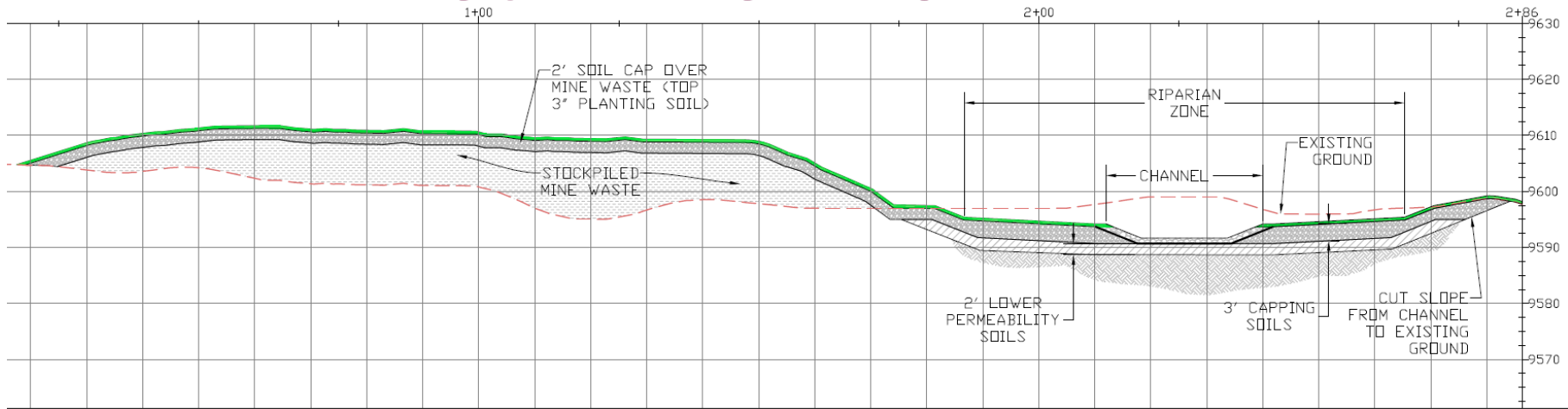
Devised remediation plan

## 2nd Phase of Rough Grading





# TAILINGS MITIGATION PLAN



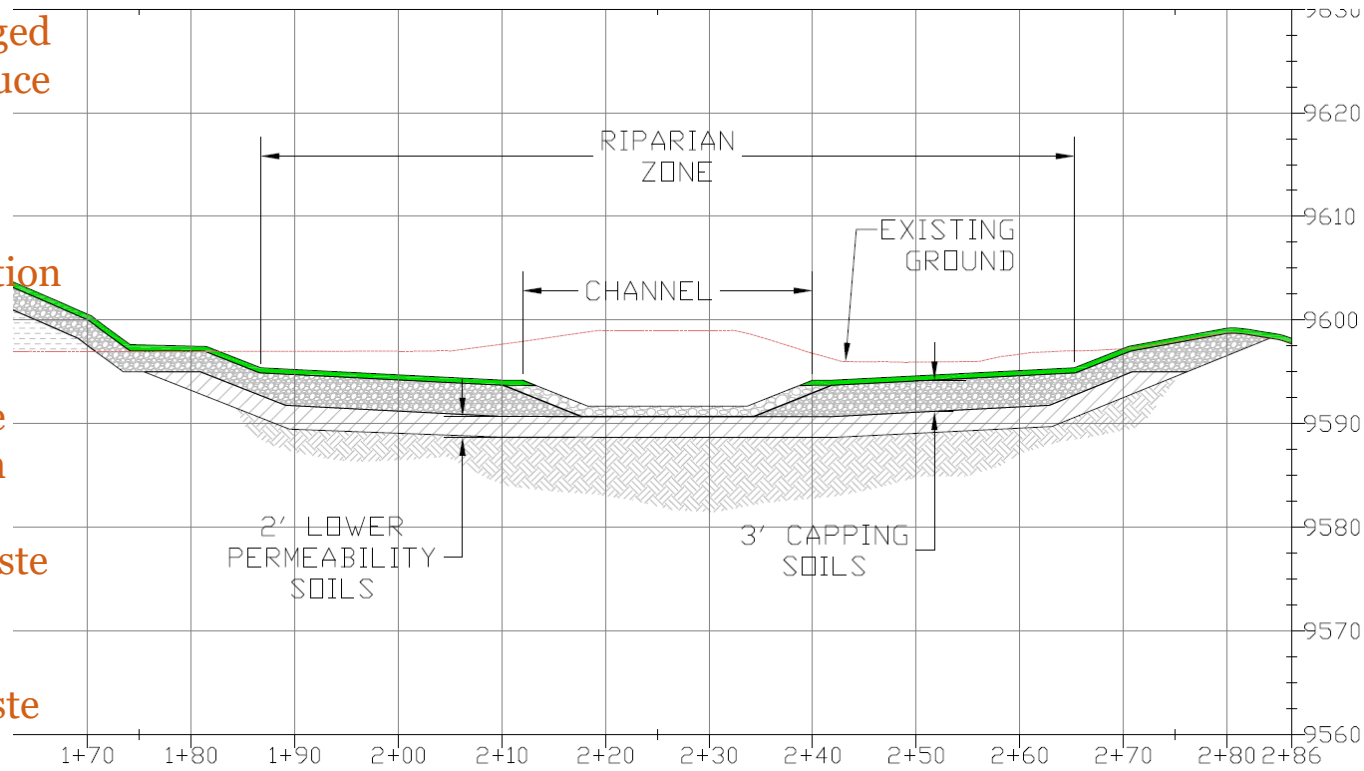
Reduced sinuosity and changed bedform to plane-bed to reduce vertical scour

Raised stream profile to minimize hydrologic connection between stream and waste

Armored stream to minimize lateral and vertical migration

Consolidated and capped waste

Changed construction sequencing to keep mine waste dry during construction







IMPLEMENTING  
TAILINGS  
MITIGATION PLAN





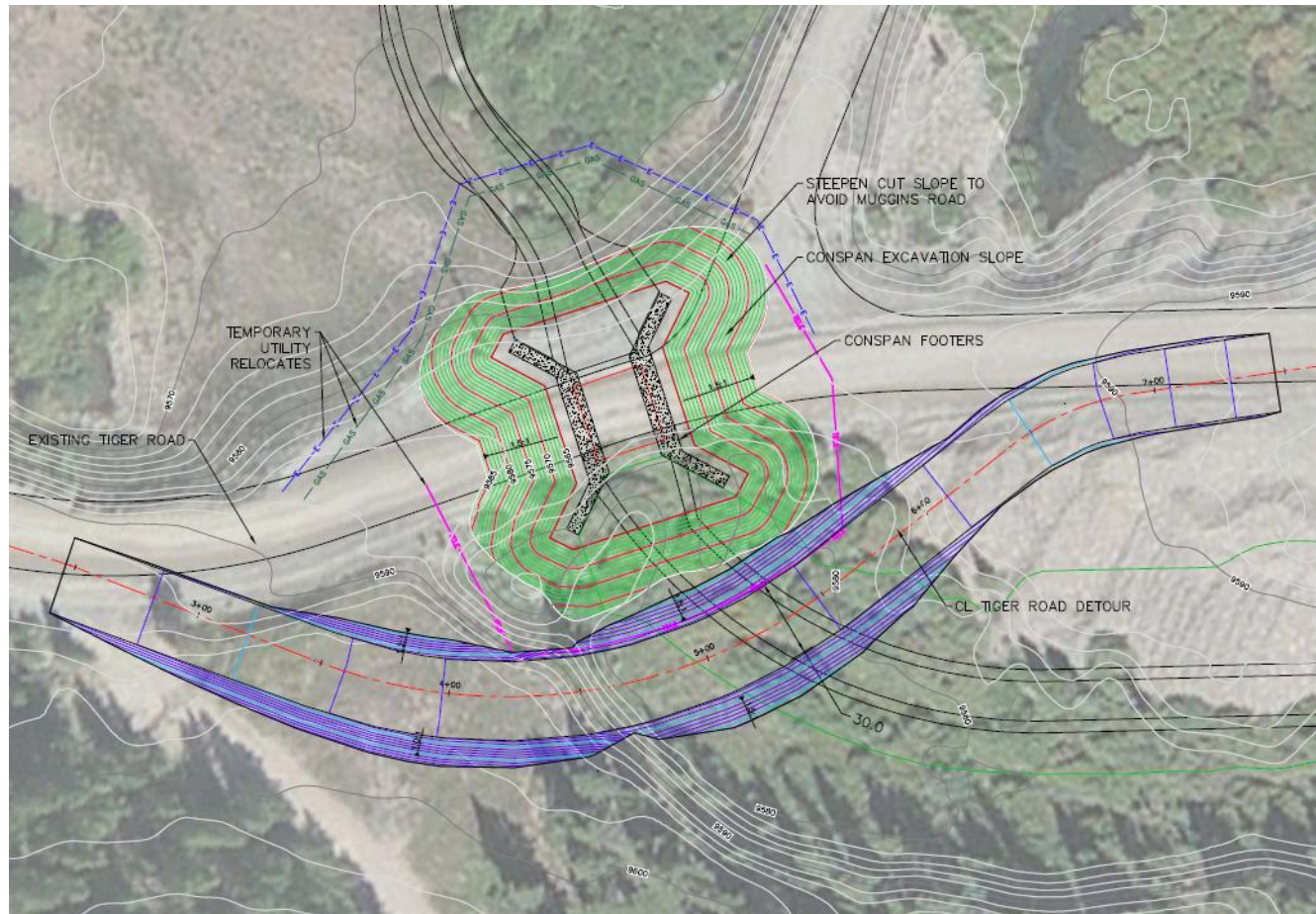
Tailings mitigated with  
no impacts to original  
schedule

---



# BRIDGE CONSTRUCTION

DESIGNED TO REDUCE NUMBER OF CROSSINGS, REMOVE EXISTING FISH BARRIER and ALLOW AQUATIC ORGANISM PASSAGE







Natural bottom promotes  
aquatic organism passage

---





# Revegetation

- Vegetation design was an integral component of stream design
- Native planting zones tied to hydrologic regime
- Seeding and site stabilization completed in 2016
- Plantings finished in 2017











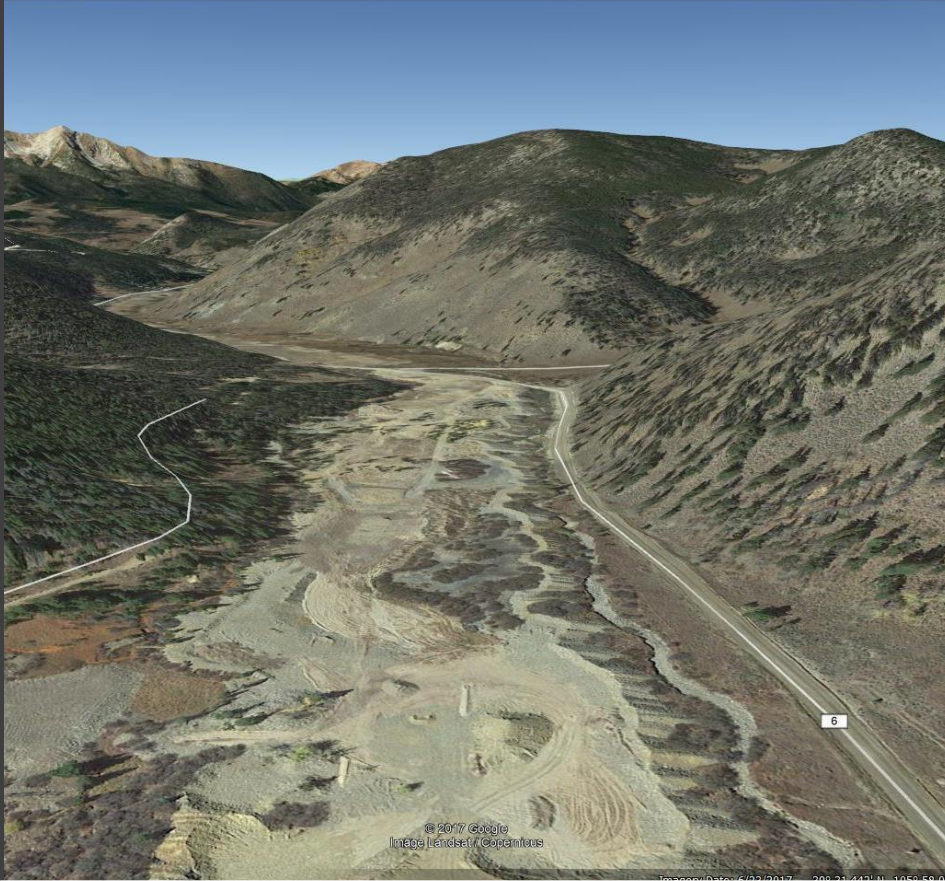


Pre Project



Before Planting





Pre Project

Before Planting



A scenic landscape featuring a river in the foreground, a grassy field with scattered trees and a yellow flag in the middle ground, and forested mountains in the background. The text "After Planting" is overlaid in the center.

# After Planting



# Moving Forward

37

- Plans progressing to extend restoration to upstream reaches





# Turning the Swan River Right-Side Up

October 9, 2019

Troy Thompson, Ecological Resource Consultants, Inc.  
Jason Lederer, Summit County Open Space and Trails