

# Snow River Flood Mitigation

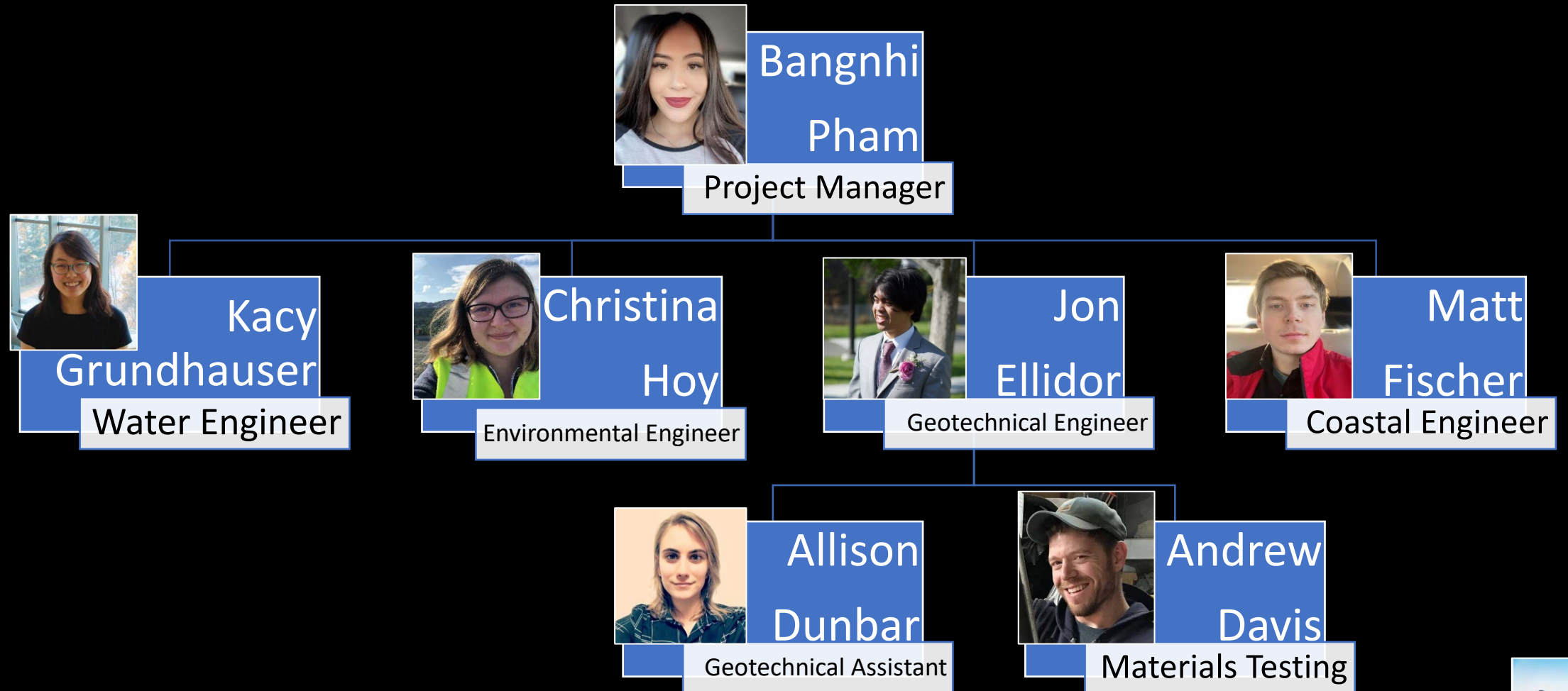
## Alaska Railroad Corporation

Final Presentation  
Malamute Consulting Firm (MCF)

March 24, 2020  
Zoom Online Meeting



# Project Team



# Overview

Background

Scope



Alternatives Analysis

Considerations



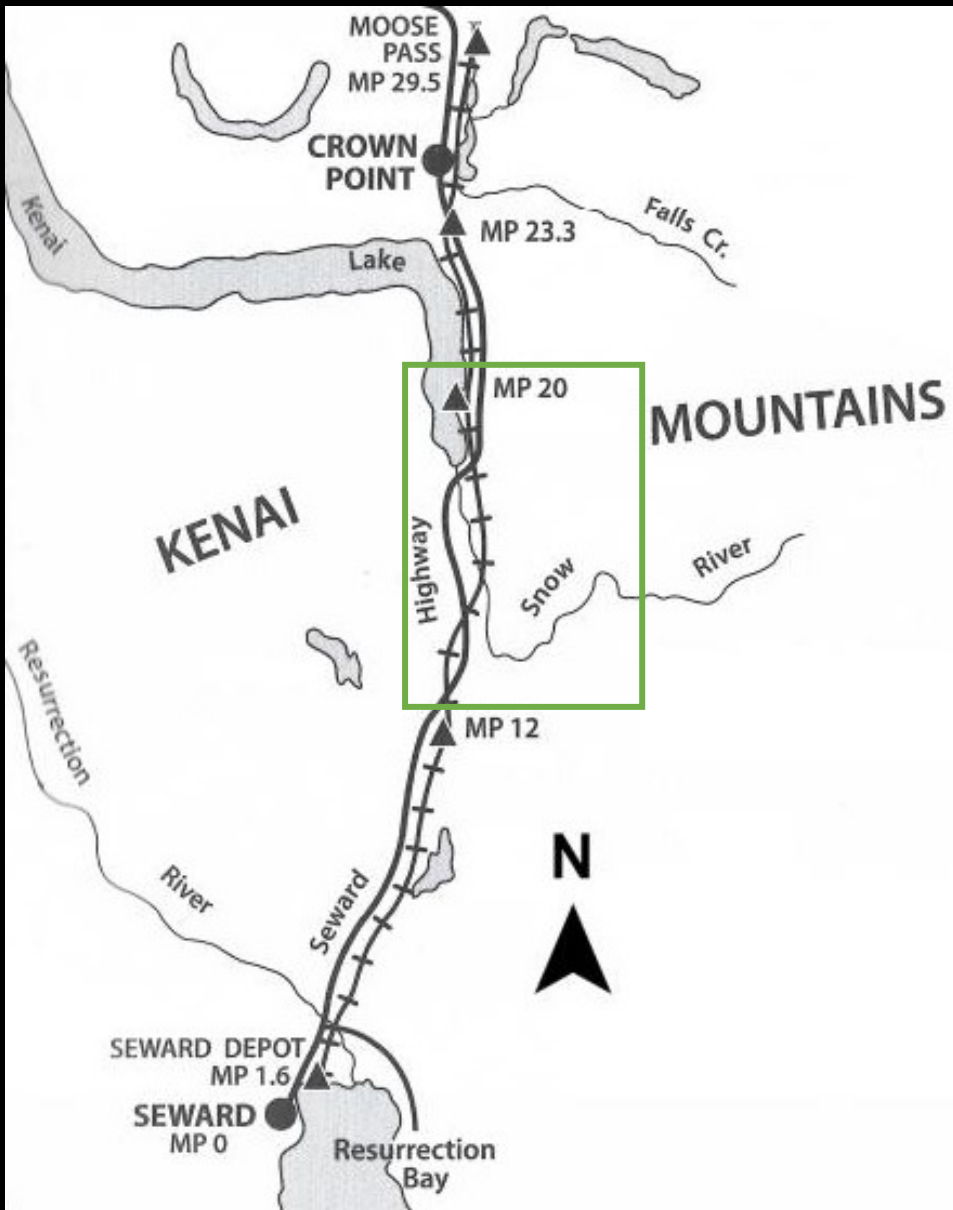
Final Design

Combination Solution & Budget



# Client Background

- Alaska Railroad Corporation (ARRC)
- Full-service freight and passenger railroad
- 482 miles of track
- Snow River 15 Miles N. of Seward






Alaska Railroad Rail Guide

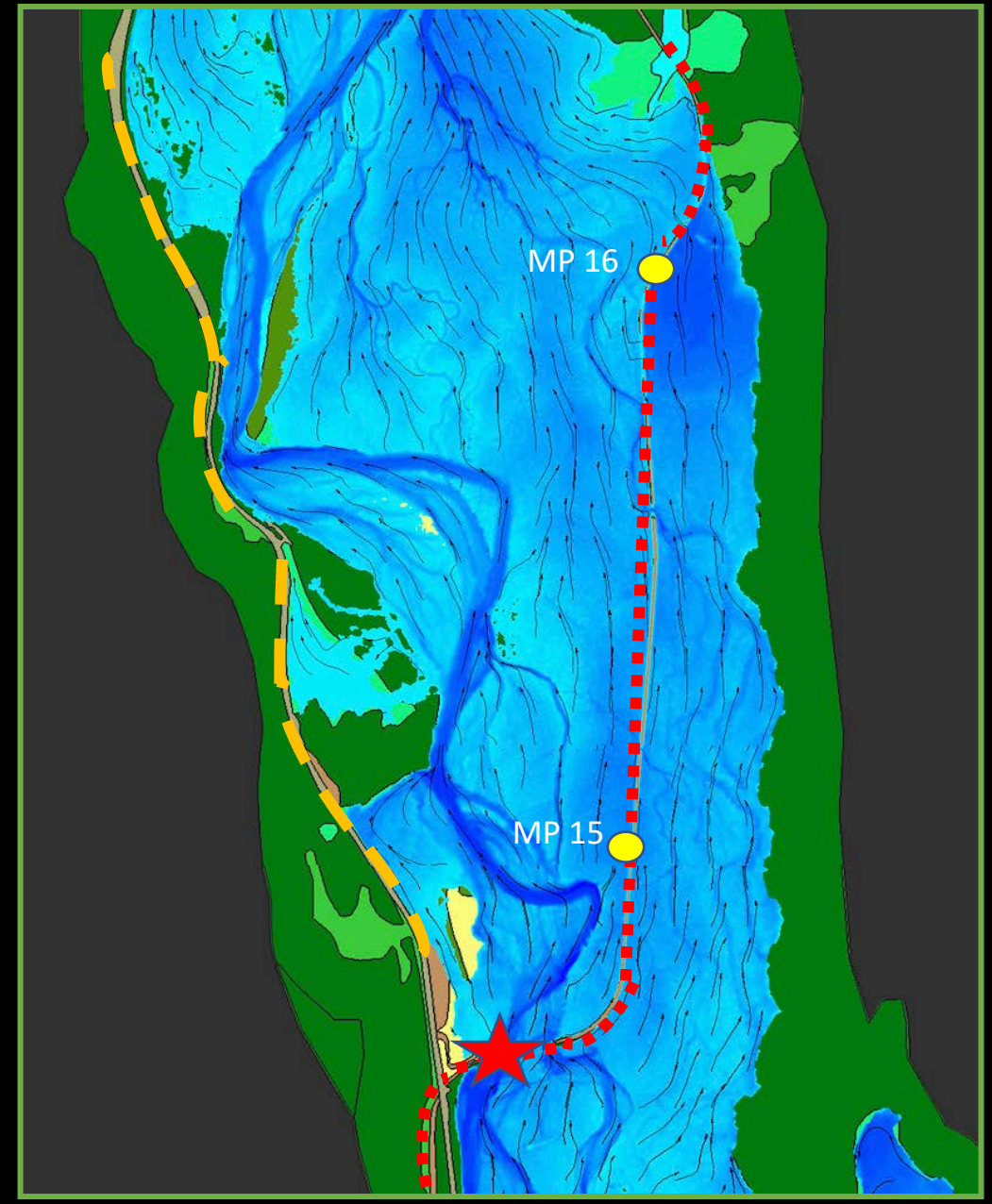
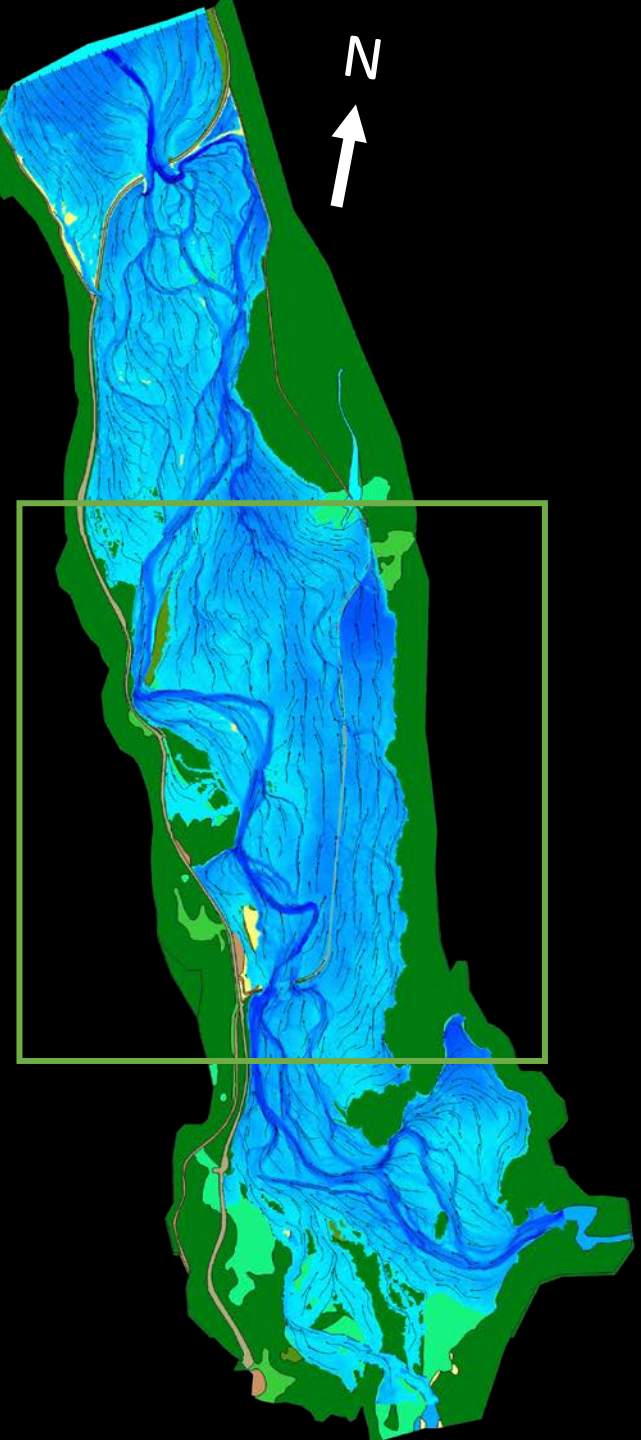


# Project Area



Legend

-  Railroad
-  Seward Highway
-  MP 14.5 Bridge

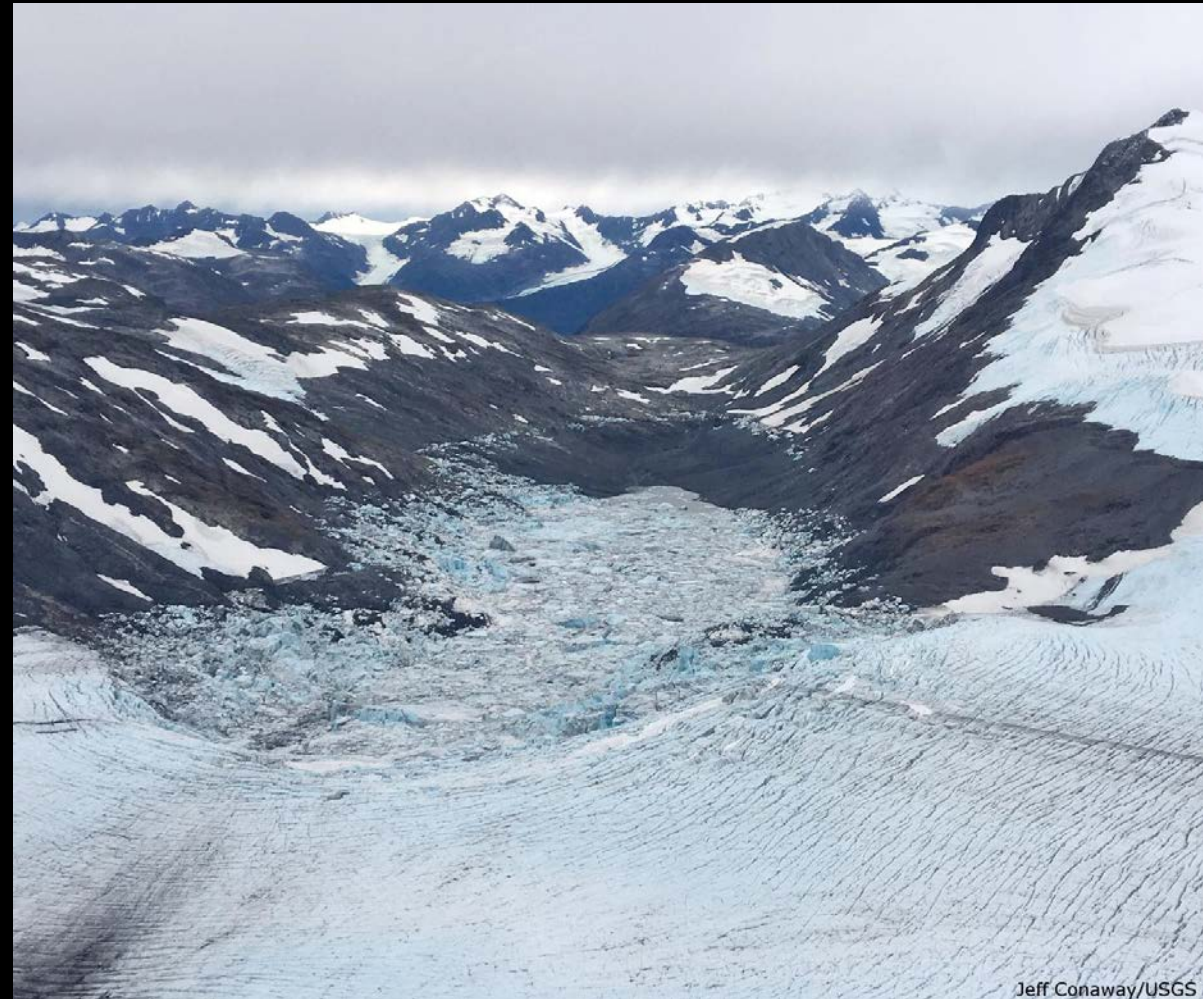


SMS 2D hydraulic model 2019 -USGS



# Project Purpose

- Flooding caused by Jökulhlaups effects tracks MP 14-18
- Snowmelt in the Spring
- Peak flow In the Fall
- \$350k damages in 2019



Jeff Conaway/USGS

Snow Glacier Dammed Lake, Jeff Conaway- USGS



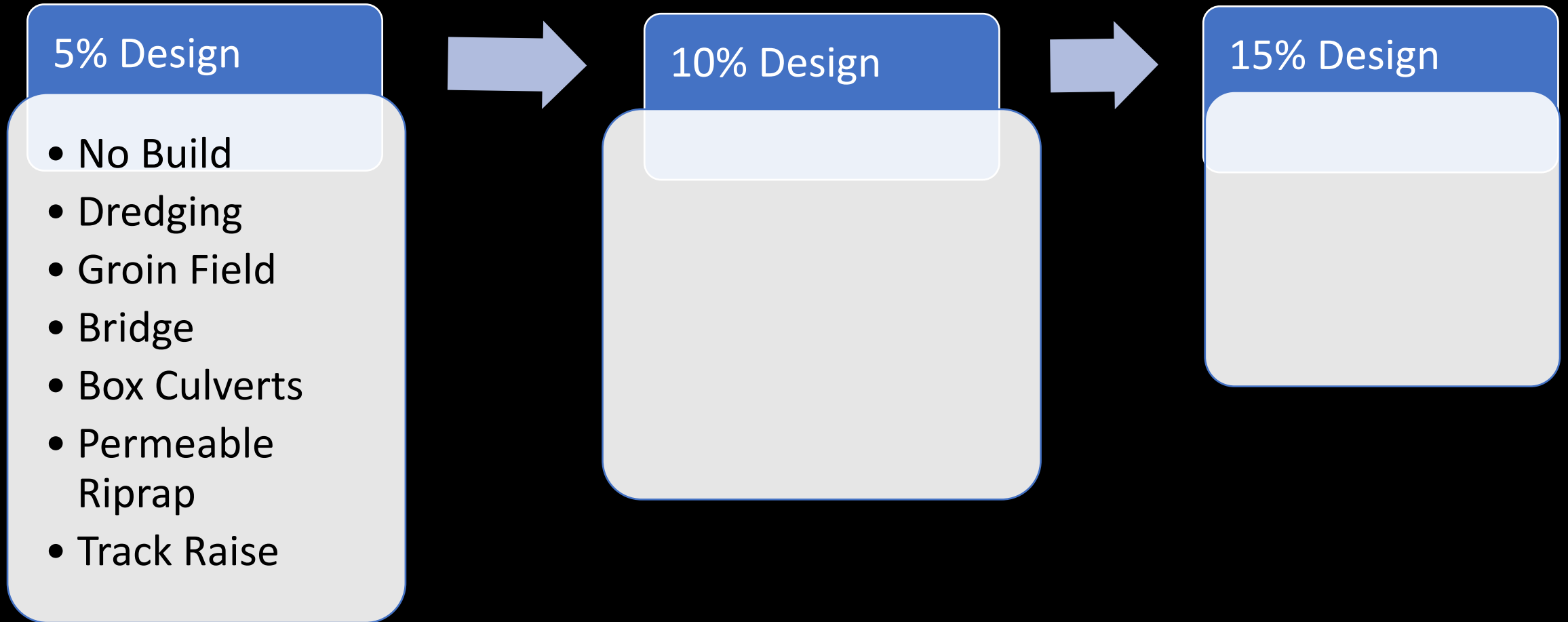
# Current Flood Mitigation Methods



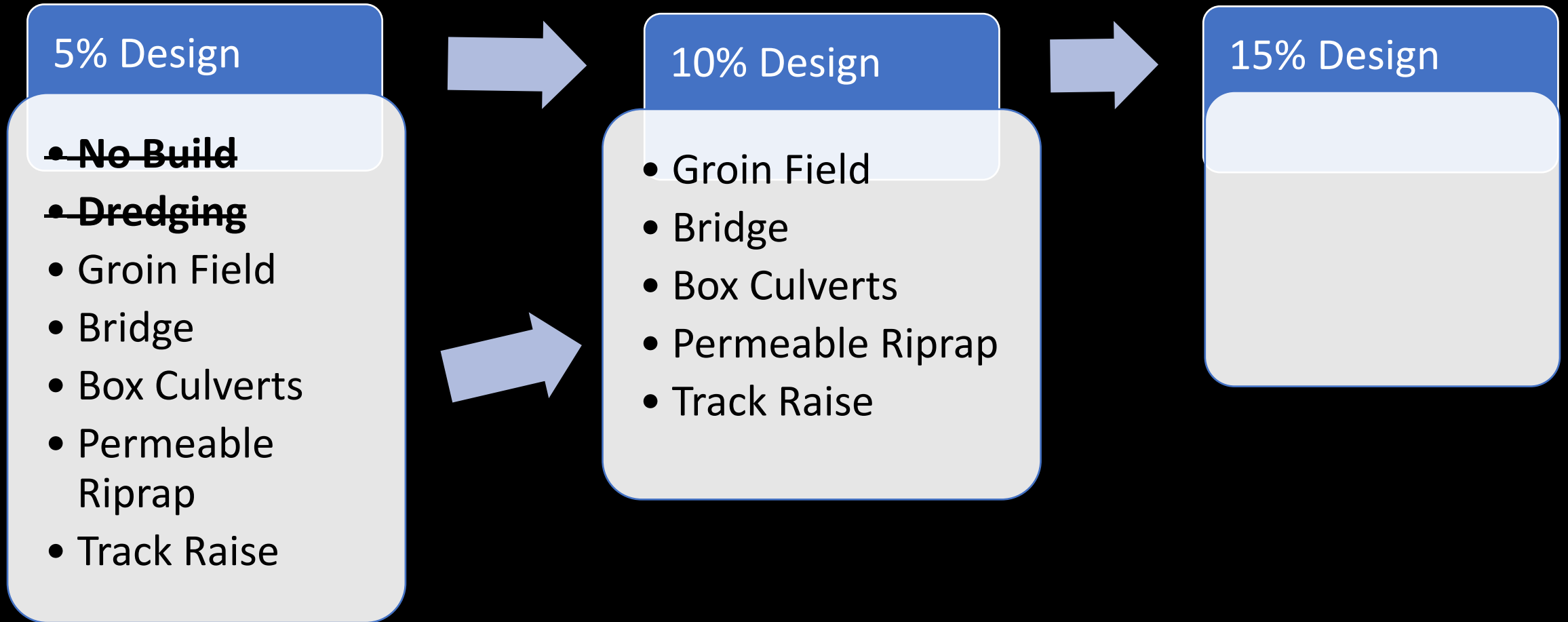
- Bridges: 6 total
- Culverts
- Dredging
- Armament for erosion control



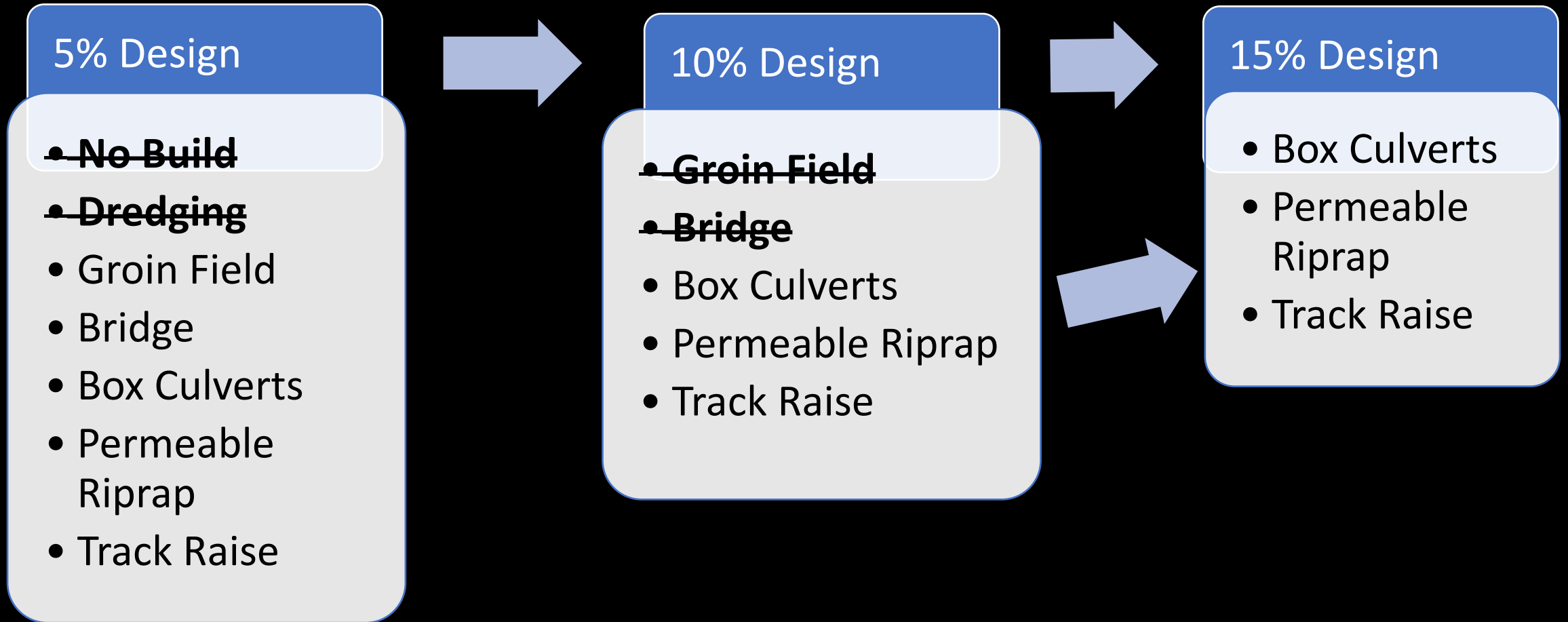
# Alternatives Considered



# Alternatives Considered



# Alternatives Considered





# Not Retained: Dredging

## Pros

- Improved capacity

## Cons

- Unknown if sediment is the main issue
- Maintenance
- Permitting constraints



Sediment Upstream of MP 14.5 Bridge



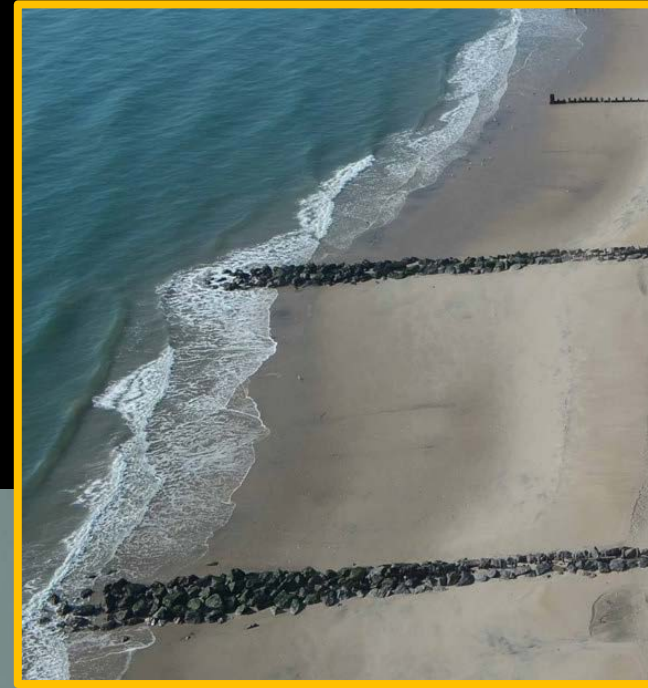
# Not Retained: Groin Field

## Pros

- Decreases erosion

## Cons

- Could cause downstream erosion
- Potential to impact wildlife



Groin Structures-National Park Service, ArcGIS Map-ArcGIS





# Not Retained: Bridge Addition

ARRC defines as conveyance openings of greater than 10 ft

## Pros

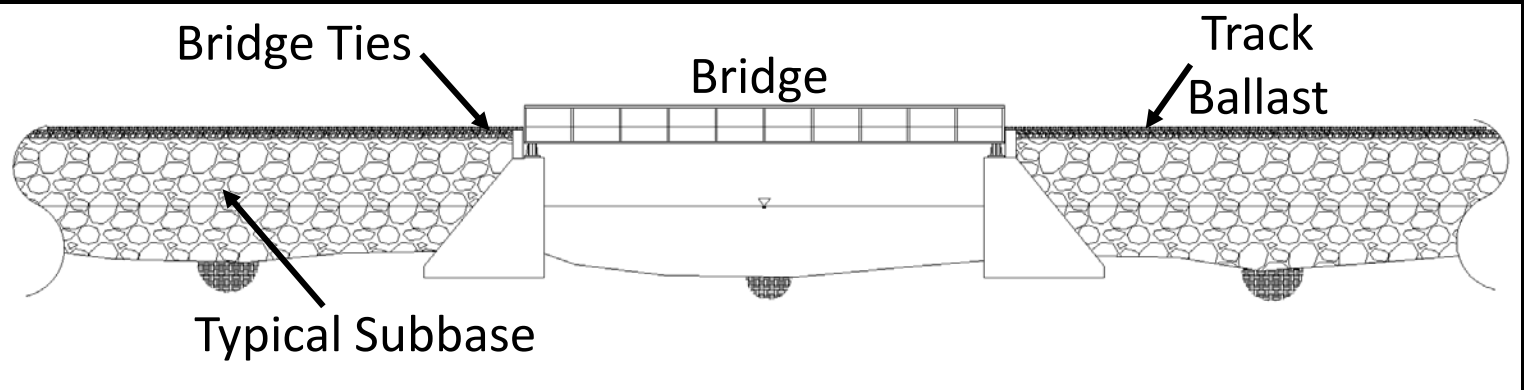
- Significant capacity

## Cons

- Long span
- Expensive



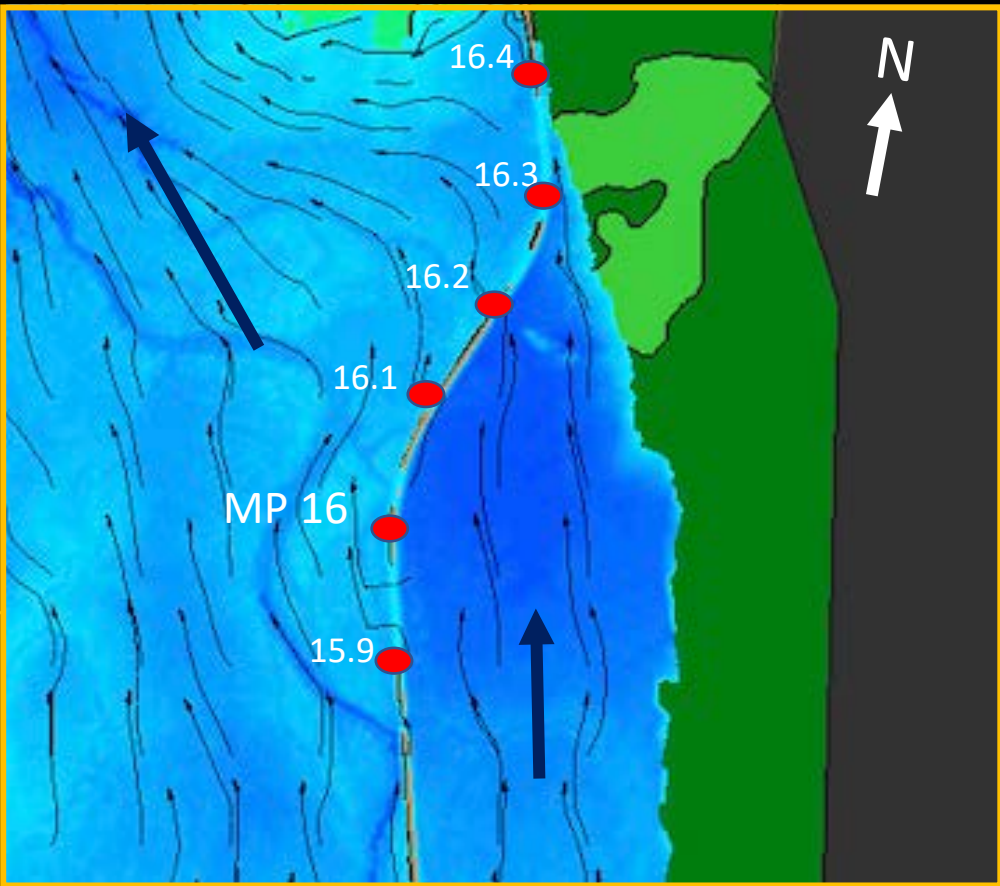
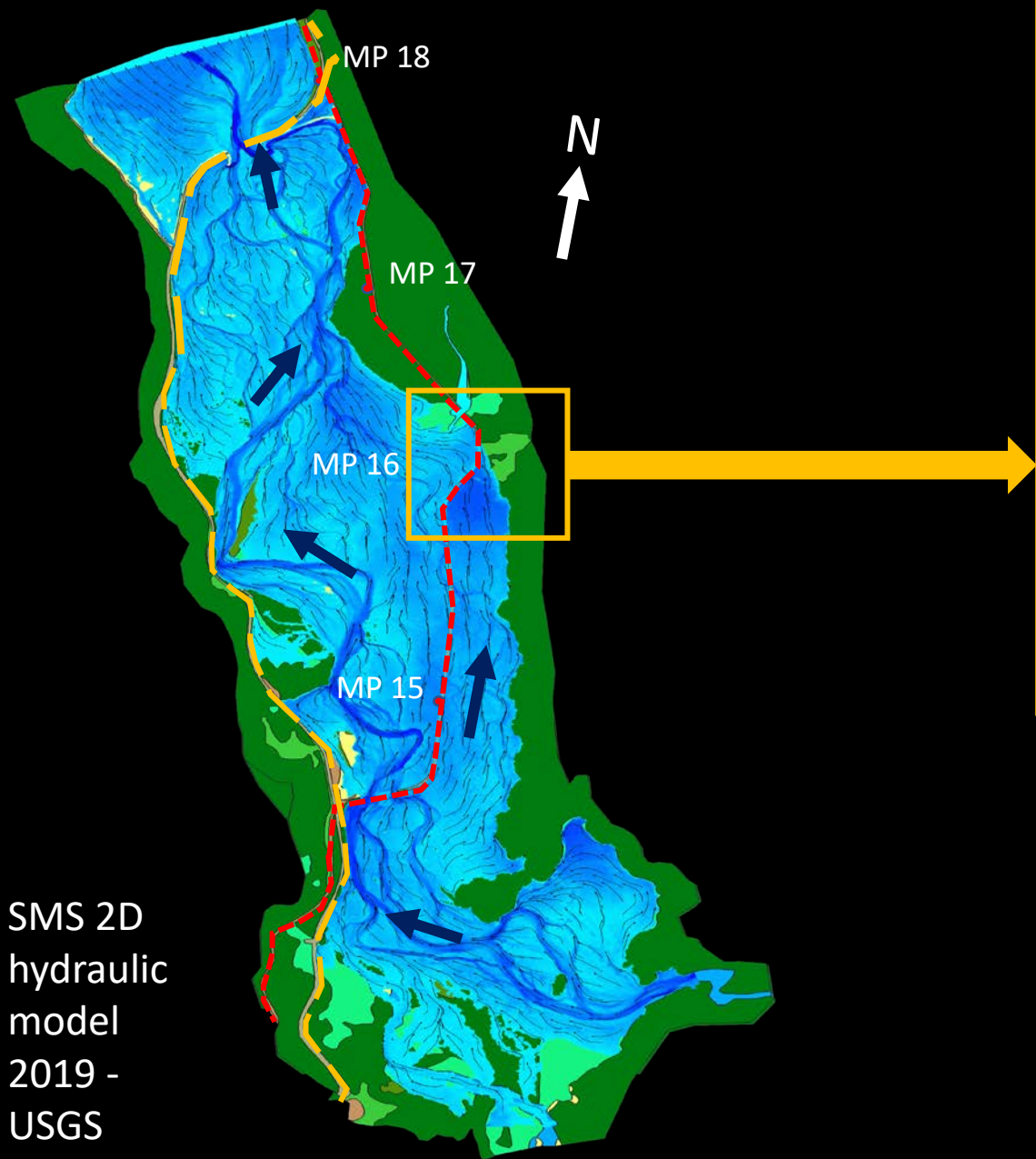
MP 16.2 Bridge During 2019 Flood -ARRC



Preliminary Bridge Design



# Final Design Considerations



## Assumptions

- Discharge: 7,102 cfs
- Velocity: 14.64 ft/s
- Factor of Safety: 1.1

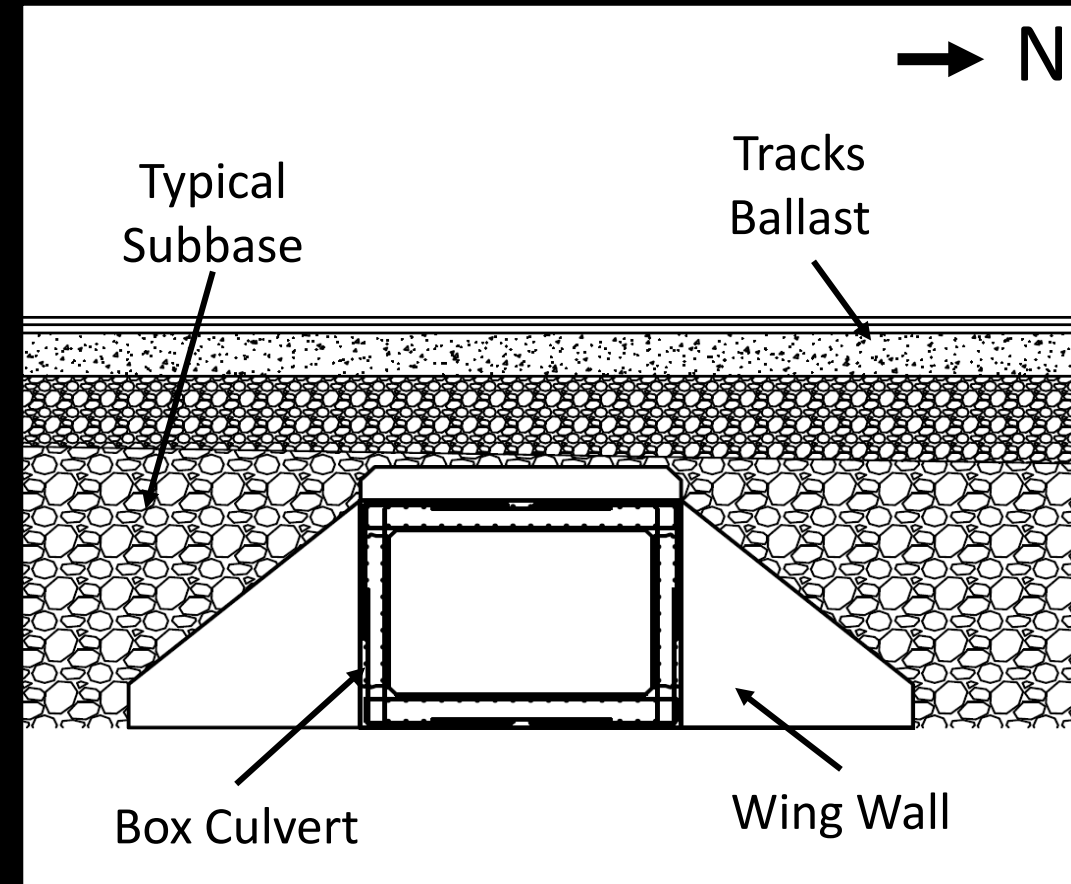


# Box Culverts

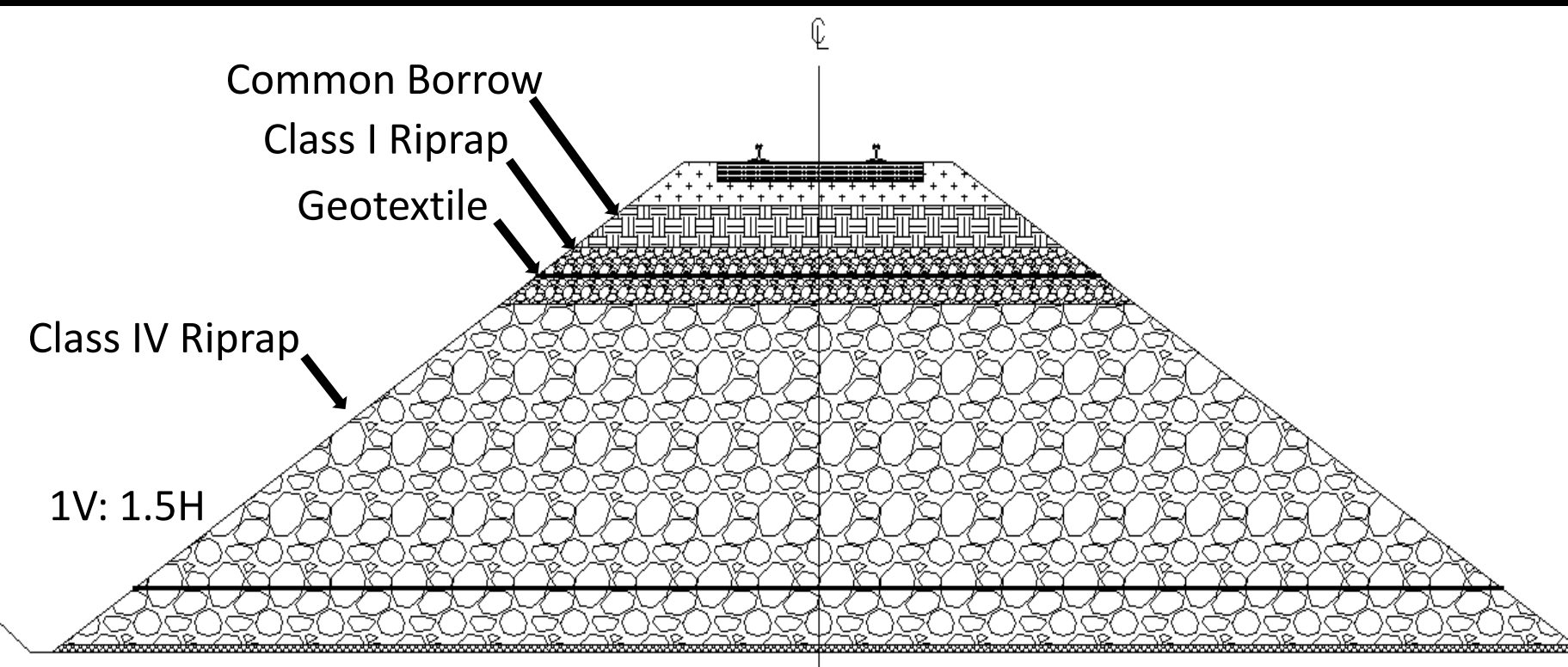
ARRC defines as conveyance openings of  $< 10$  ft

- Three
- 9 ft by 9 ft
- 10 ft spacing
- Discharge 4,606 cfs
  - (65% of total flow)
- 55 ft long
- Wingwalls direct flow and support riprap

Chosen Alternative at MP 16.15



# Permeable Riprap Substructure

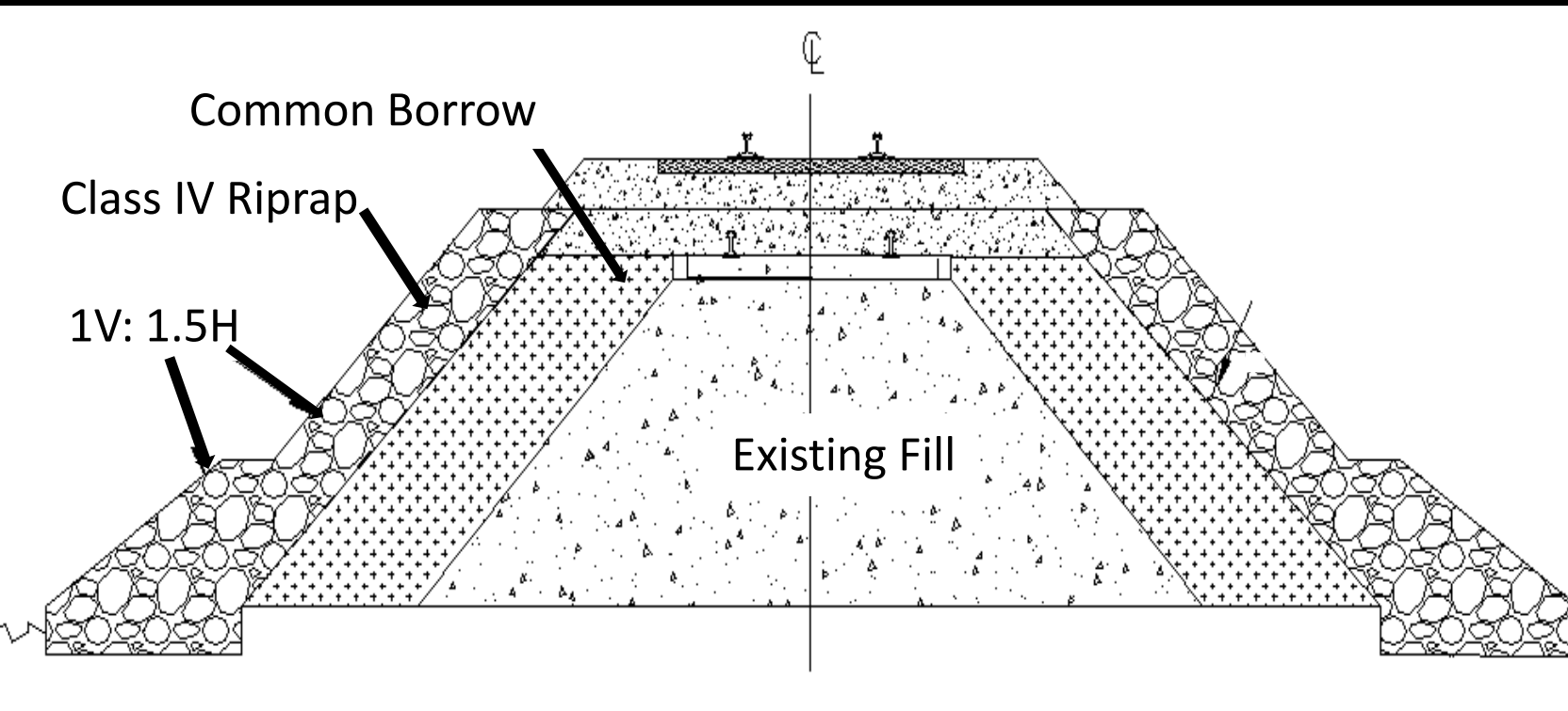


- Class IV Riprap
- Water Flows Through 10" Voids
- 125 ft. Total Length
- Accomodates 35% of Peak Flow

Permeable Riprap Substructure



# Track Raise

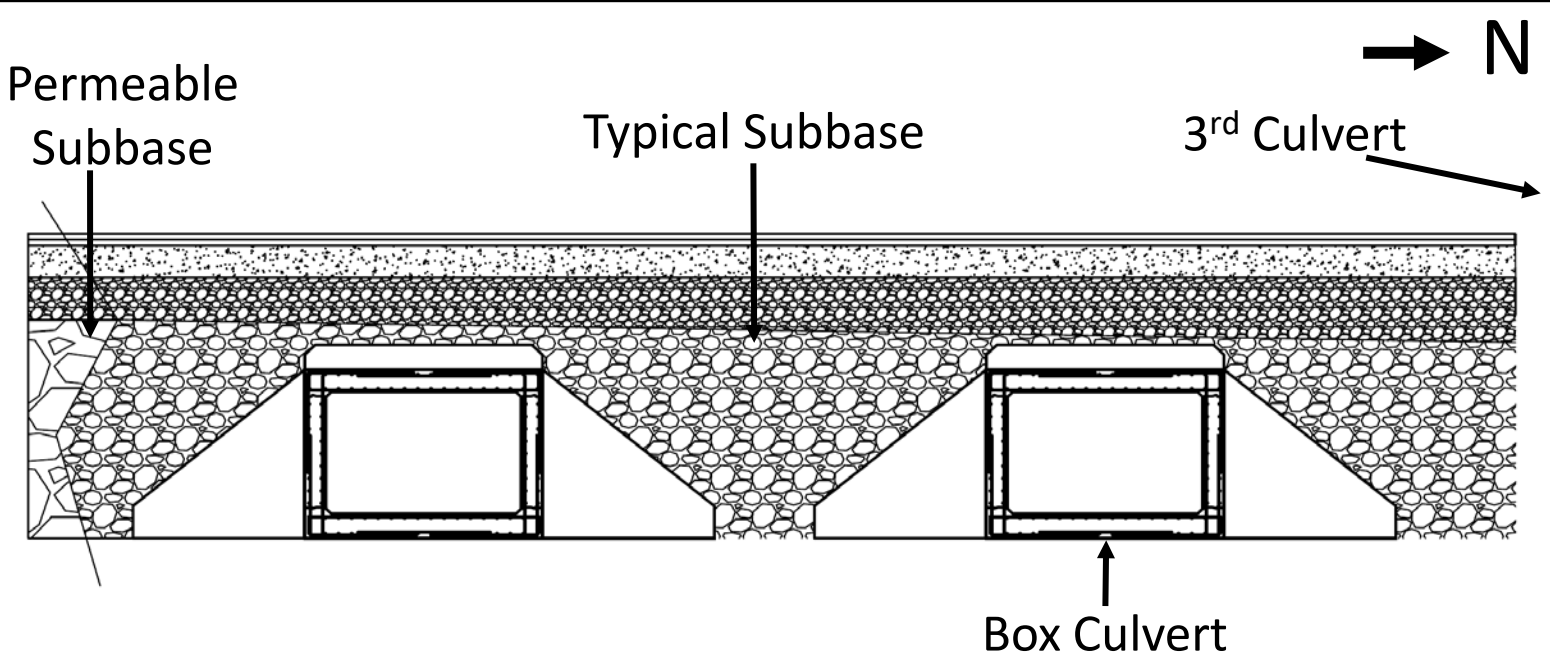


- 2% Grade Guidelines
- 25 mph Speed zone
- Set Elevations- MP 15.9 and MP 16.2 Bridge
- 6"-18" Raise

Track Raise Section-Hydraulic Opening



# Combination Solution

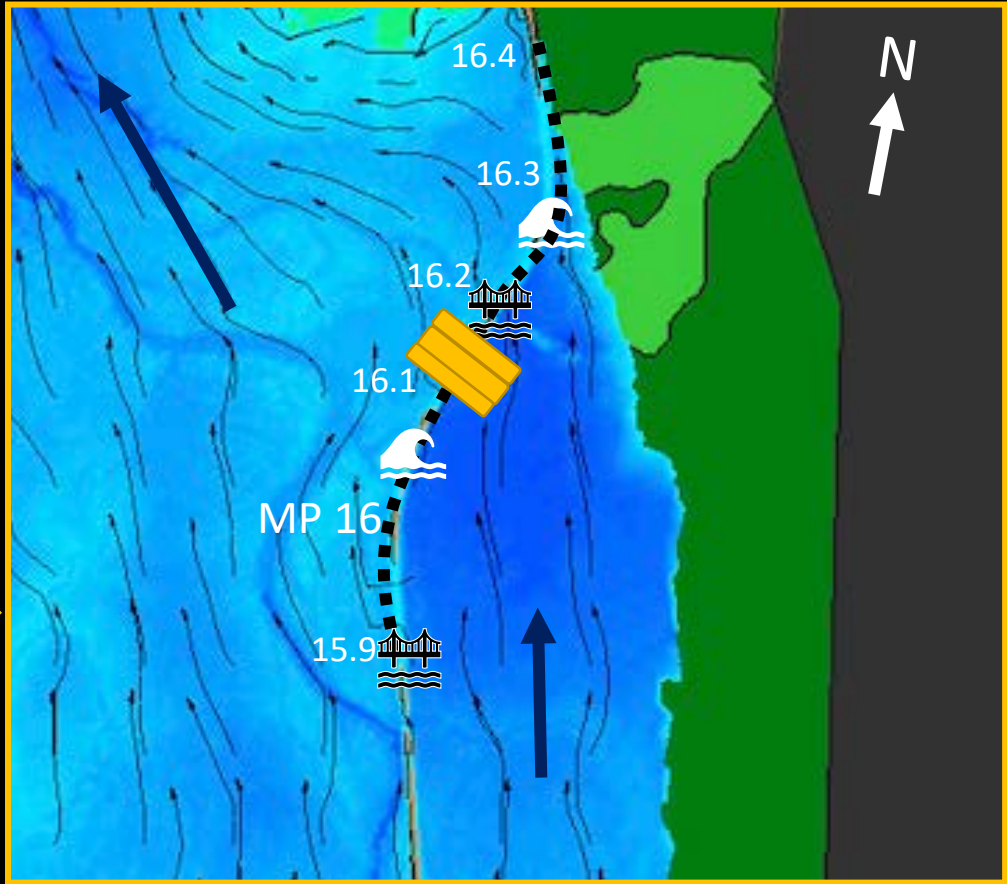
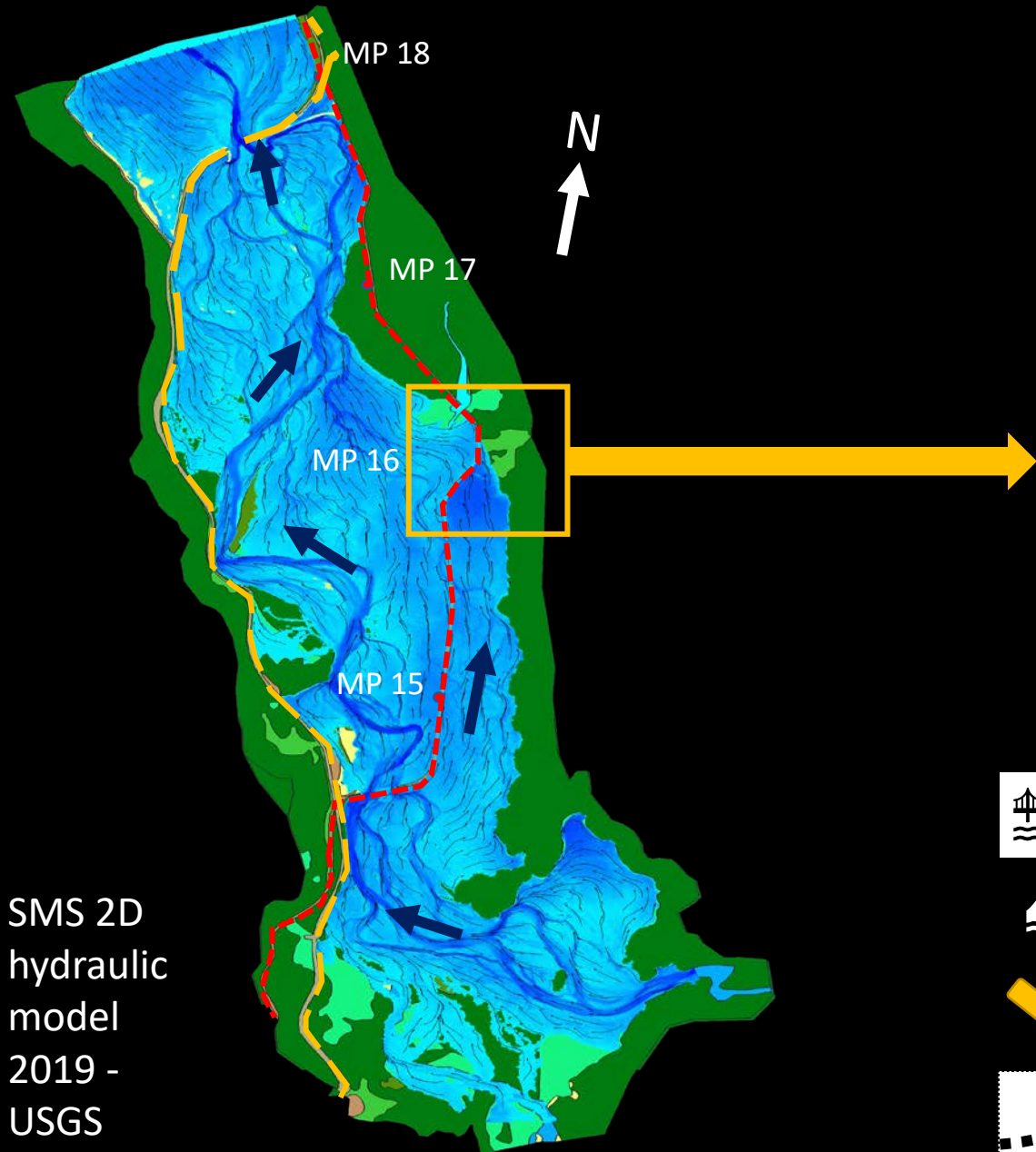


- Permeable Riprap: 125 ft
- Box Culverts: Three 9 ft X 9 ft
- Combined With Track Raise
- Max Flow Capacity: 8795 cfs

Rip Rap & Culvert Connection



# Final Design Locations



Existing MP 15.9 and MP 16.2 Bridge



Permeable Rip Rap Between MP 16.1, MP 16.3



Box Culverts Centered at MP 16.15



Track Raise from MP 15.9- 16.4

SMS 2D hydraulic model 2019 - USGS



# Cost Estimation

- Haul riprap from Curry – 18 days
- Staging site at MP 11.6 & 18.4
- On-site – 25 days
- ANC and SEW labor and equipment
- 3 culvert placements
- Reuse existing riprap for track raise

Description	Total
<b>Permeable Riprap Retrofit</b>	
Equipment	\$ 198,009
Labor	\$ 664,715
Materials	\$ 317,134
Contracts	\$ 3,125
<i>Subtotal -</i>	<i>\$ 1,183,000</i>
<b>Track Raise &amp; Reconstruction</b>	
Equipment	\$ 164,338
Labor	\$ 199,129
Materials	\$ 69,192
<i>Subtotal -</i>	<i>\$ 429,700</i>
<b>Culvert Construction</b>	
Equipment	\$ 15,879
Labor	\$ 23,632
Materials	\$ 73,500
<i>Subtotal -</i>	<i>\$ 113,000</i>
<b>Design &amp; Support</b>	
Engineering and Design	\$ 166,000
Management	\$ 191,100
<b>GRAND TOTAL -</b>	<b>\$2,102,300</b>



# Environmental Impacts

- Project Area includes Habitat for fish
  - Coho salmon
  - Pink salmon
  - Dolly Vardon
- Anadromous Fish Act (AS 16.05.871- .901) should be considered when proceeding with design implementation
- Further environmental analysis is necessary

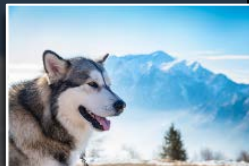


Sockeye Salmon – Oceana Canada



# Budget By Phase

	Phase I	Phase II	Phase III	Phase IV
Cumulative Budget	\$21,990	\$55,200	\$82,500	\$87,840
Cumulative Amount Billed	\$21,470	\$45,055	\$63,450	\$87,295
Difference	+520	+10,145	+19,050	+545
Underbudget?				Yes



# Acknowledgments

- Client: Gabriel Thomas, EIT, ARRC
- Professional Mentor (PM): Brian O'Dowd, PE, ARRC
- Lead PM: Sean Baski, Alaska DOT&PF
- Faculty Advisor: Dr. Calhoun & Dr. Yang, UAA
- Support:
  - Blake Adolfae & Jesse Moose, ARRC
  - Dr. Hamel, PE, SE, & Dr. Vasudevan, PE, UAA



# Bibliography

- Alaska DOT&PF gradation Spec Sheets 2020
- Alaska Department of Fish & Game (ADFG) Anadromous Water Atlas Seward B-7
- ARRC owned photos
- Eastern Vault Box Culvert Image
- Melgaard Construction Riprap Image
- National Park Service Groin Photo
- Oceana Canada Sockeye Salmon
- USGS SMS provided 2D hydraulic model 2019
- USGS, Jeff Conway, Snow Glacier Lake Image

Questions?

