Priest Lake Water Management Project

WEDA, October 29, 2021

Shane Phillips, P.E., D.PE, D.CE
John Dawson, P.E.

Project Area

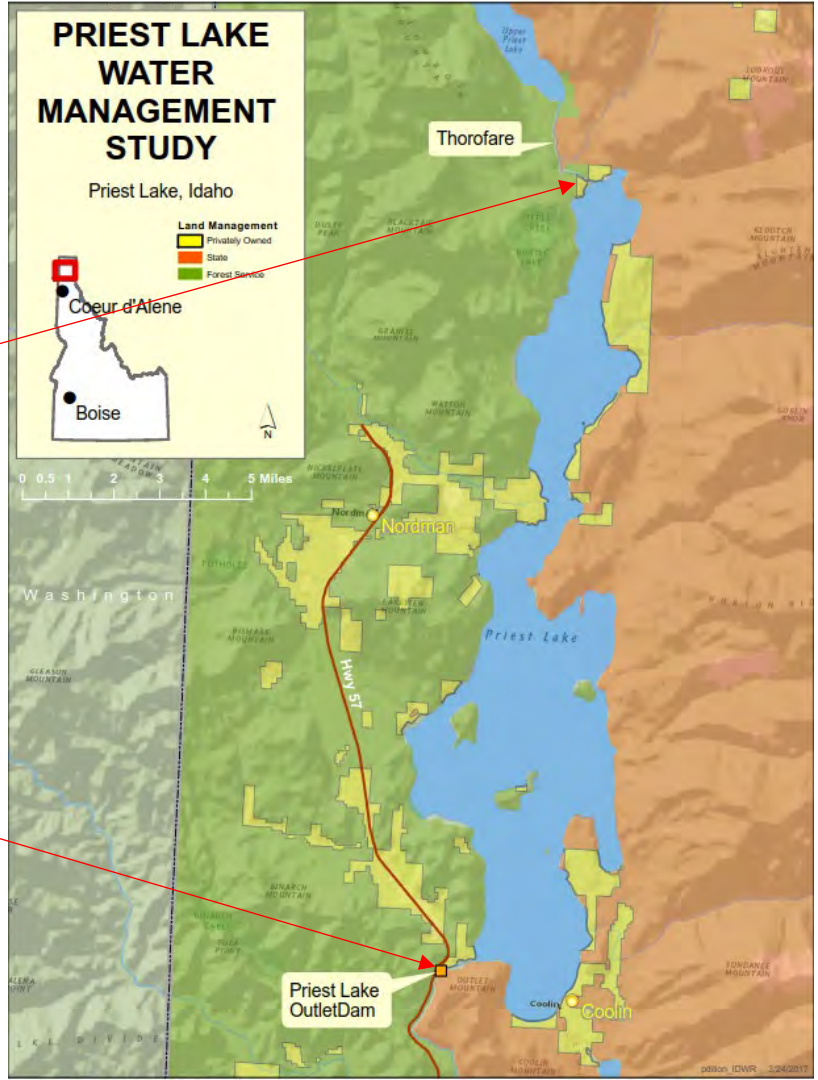
Recreational Boating Access to Upper Lake

Historical Use since 1930’

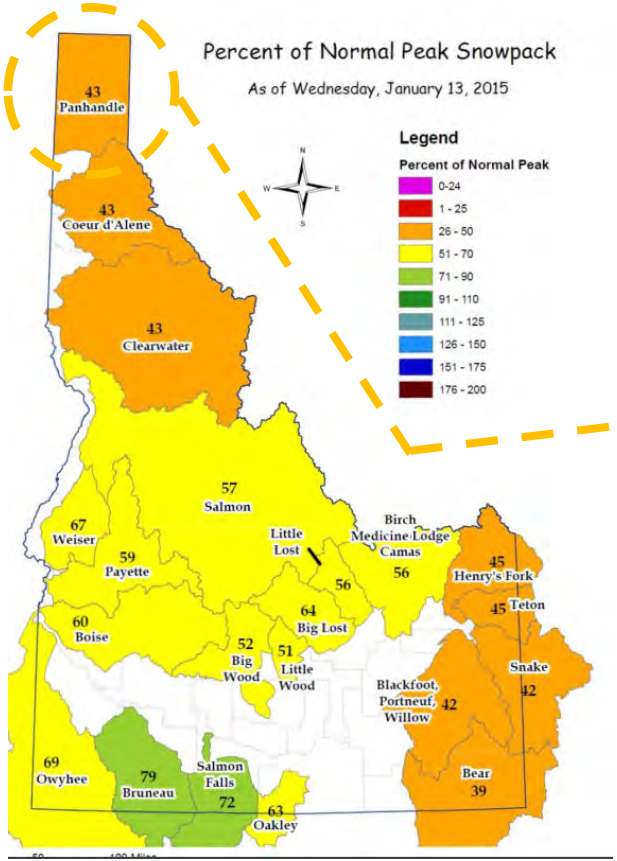
Dam built in 1950’s

Water Right Management

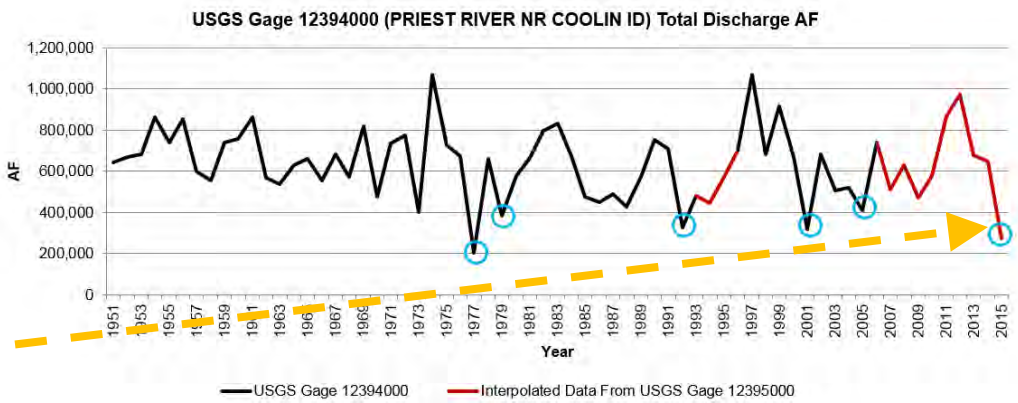
3ft Summer Lake Level



The Problem – Low Snowpack



Low Water Years



- More frequent Low summer flow & drought conditions
- Considerations for climate change should be part of the alternative water management plan evaluation.
- Idaho Department of Water Resources – Dam Owner/Operator, Water Management Responsibility, Funding Agency

The Problem – Water Management & Thorofare Shoaling

Low Snowpack/Dry Year

- Insufficient water storage
- Summer Recreational Water Level
- Instream Flow
- Ask: Feasibility to raise gates 6”

Overall Systems Approach

Navigable Access to Upper Priest Lake

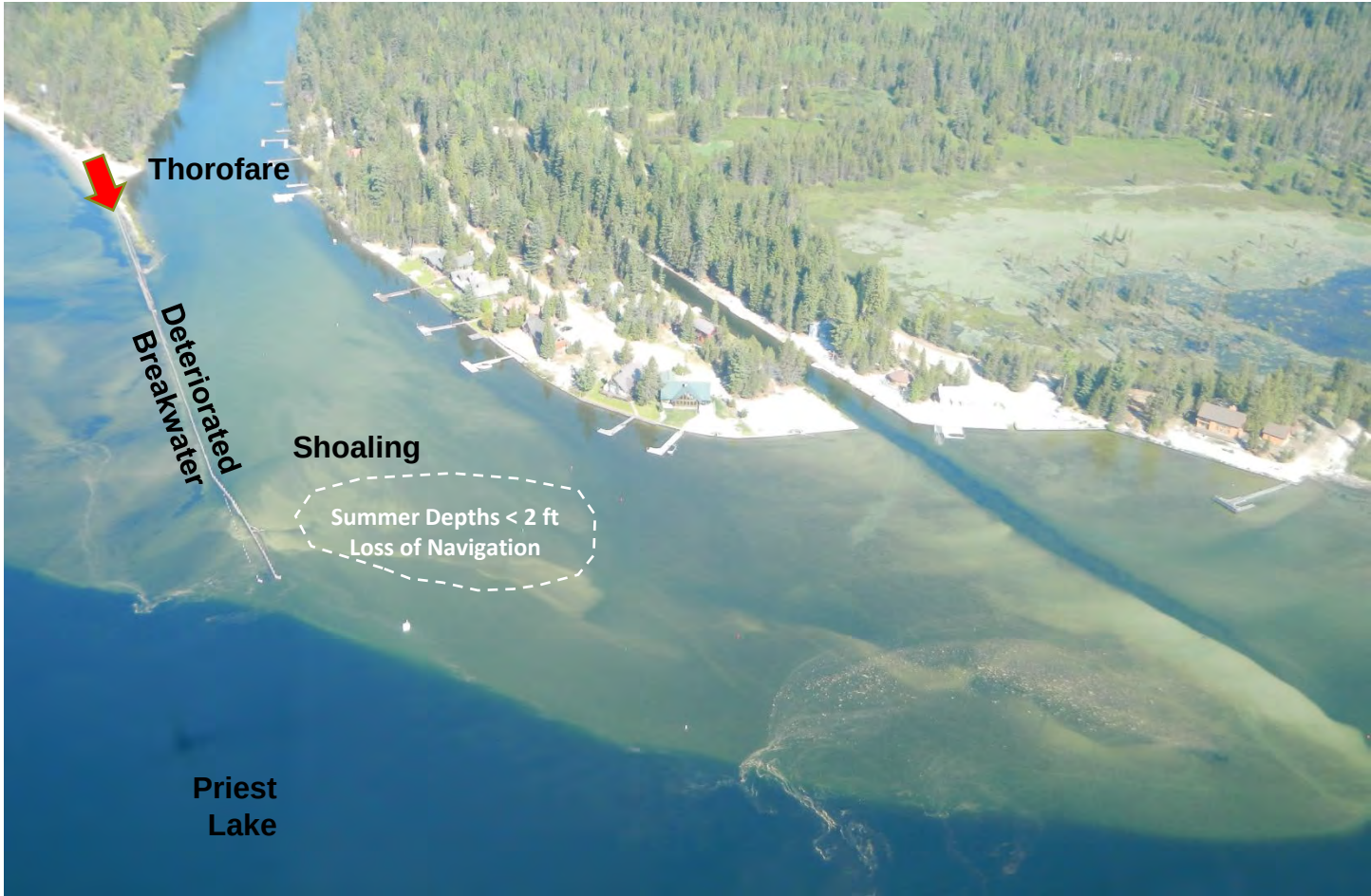
- Thorofare Shoaling
- Loss of Navigation
- Erosion Protection
- Breakwater Deterioration
- Ask: Improve Navigation Access

Thorofare Conditions & Project Objectives

Objective: Provide sustainable recreational vessel navigation into Thorofare for access between lower and upper Priest Lake

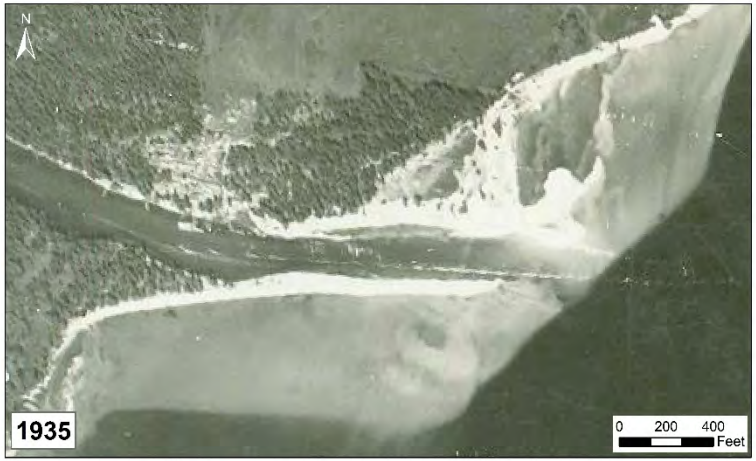
Condition: Combination riverine and coastal delta processes

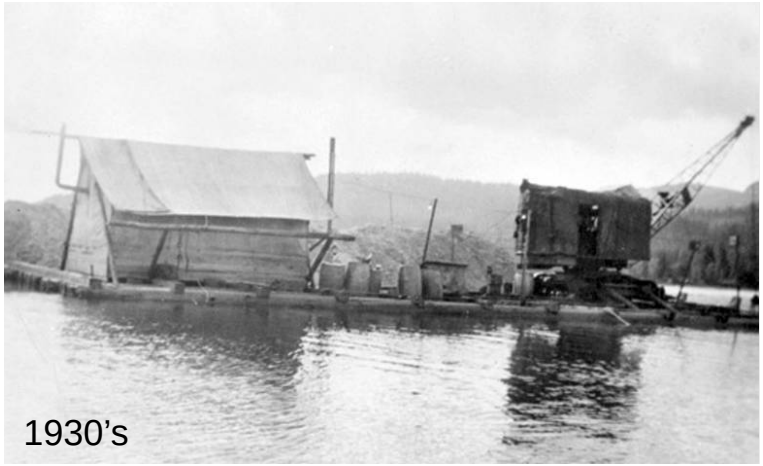
Approach: Assess Coastal & Riverine hydrodynamic conditions to evaluate alternatives



Thorofare History

- Thorofare Channel: Alignment of Jetty/Breakwater at Thorofare mouth was narrower in early years
- Dredging: Periodic from 1930’ up until 1990’s.
- Assessment: Change from active management with narrow channel to wider entrance with no, minimal dredging; reliance on breakwater/jetty structure




1930’s

Breakwater

- History
  - Original timber pile breakwater was constructed by USFS to facilitate access to Thorofare in 1933

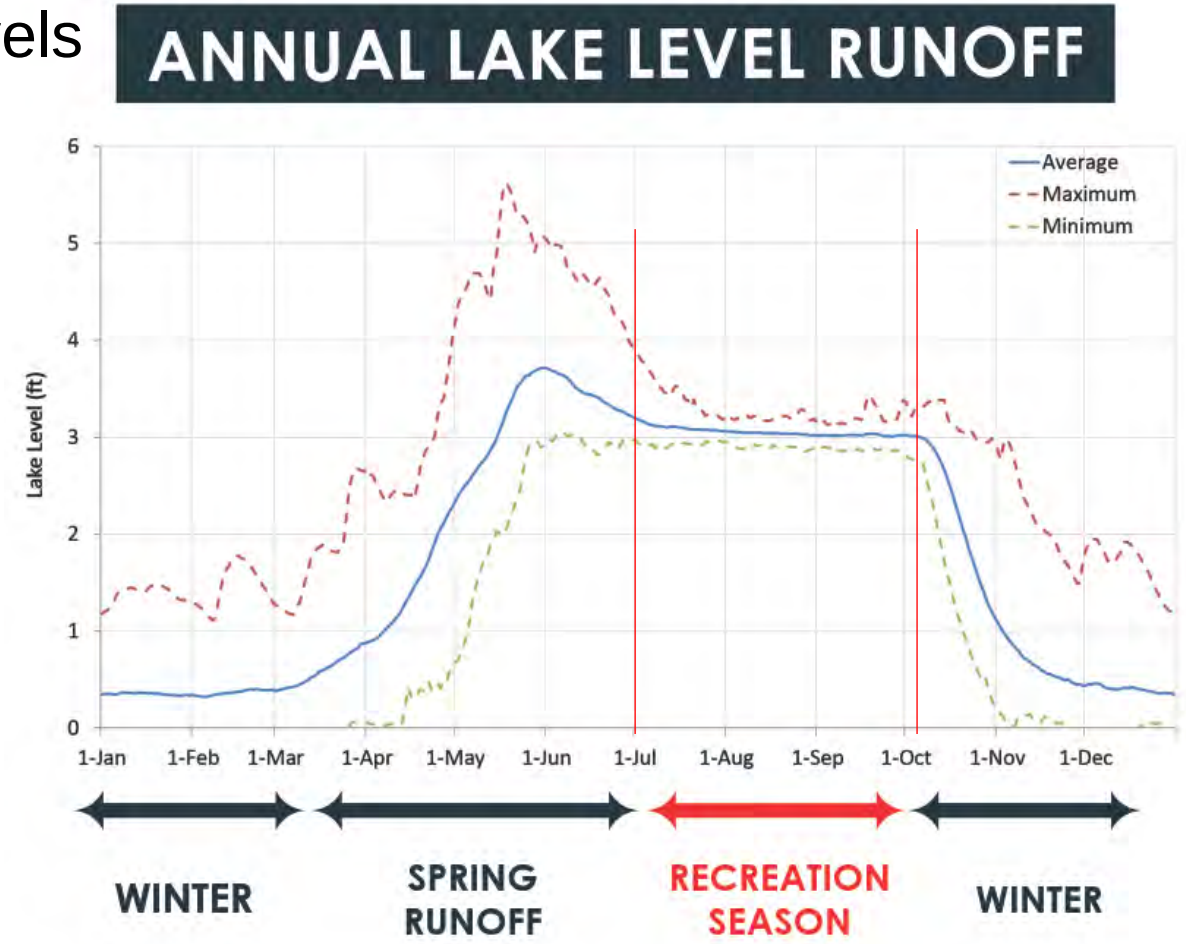
- Primary Purpose - Function as a Jetty to reduce channel sedimentation in combination with maintenance dredging

- Secondary Purpose - Provide wave shelter to lakefront properties in Sandpiper's Shore – later when developed

- Breakwater
  - Porosity ~ 20% to 35% due to bottom and slat openings
  - Multiple reconstruction/repairs over 80 years
  - End of Service Life

Seasonal Water Levels

- 3.0’ Gage during Recreational Season
- Creates a varying condition for wave driven nearshore sediment transport
- Limitations for construction time period – Winter



Hydraulics – Flow Spreading

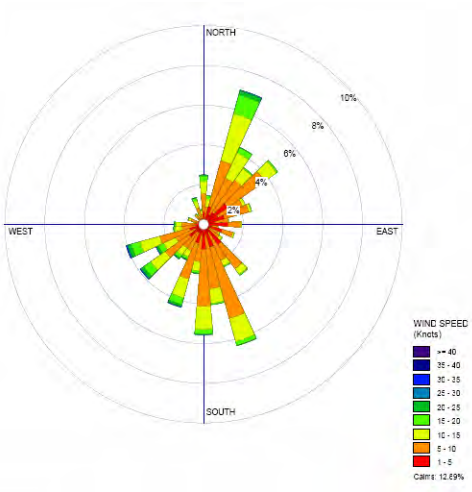
- Shallow sand bar at the mouth

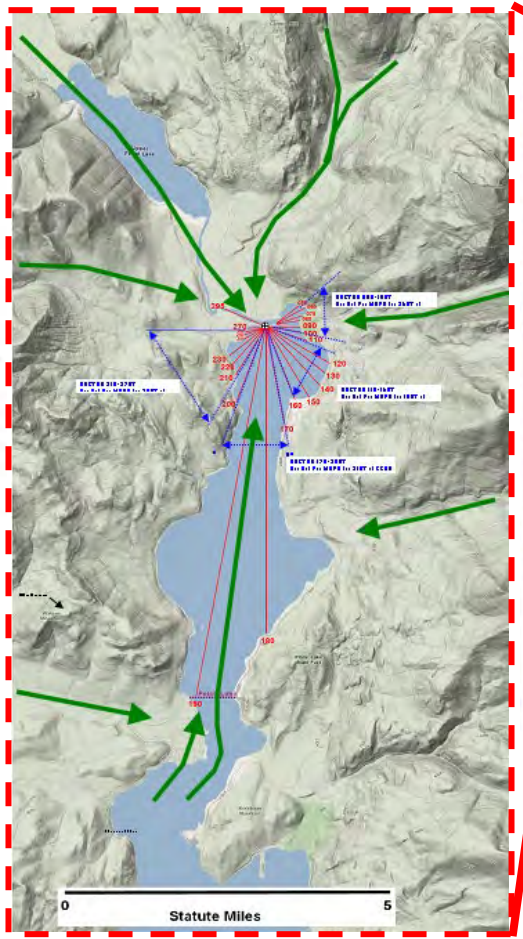
- Significant flow spreading & flow cutting into the sand bar and underneath the breakwater

- Unconfined hydraulic flow conditions and reduced sediment transport capacity

Wind Waves

- Winds aligned with longest fetch
- South-Westerly winds drive lake shoreline longshore sediment transport (south to north) at project site
- Susceptible to Seiche
- Varying seasonal water levels ~ 5ft low to high



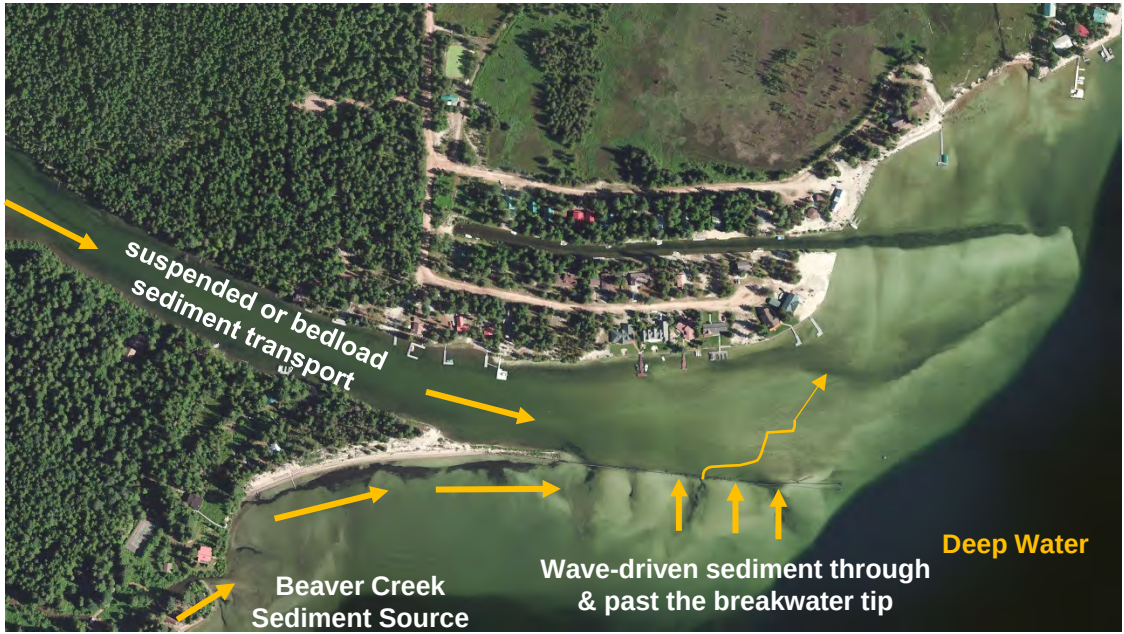


Thorofare Geomorphology Summary

- Two Geomorphologic processes
  1. Thorofare Bed & Suspended Sediment
  2. Lake nearshore Sediment Transport

- Sediment deposition is result of decreased transport capacity as low-gradient Thorofare with flow spreading meets zero-gradient Lake accentuated by the following factors:

  1. Loss of confined flow due to channel width and passage of flow through porous breakwater
  2. Wind wave driven sediments migrating through porous breakwater

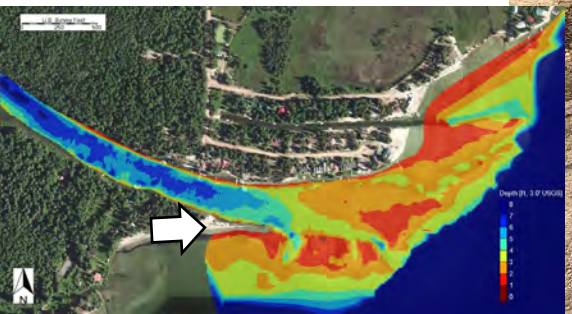


Low Pool

Longshore Sediment Transport

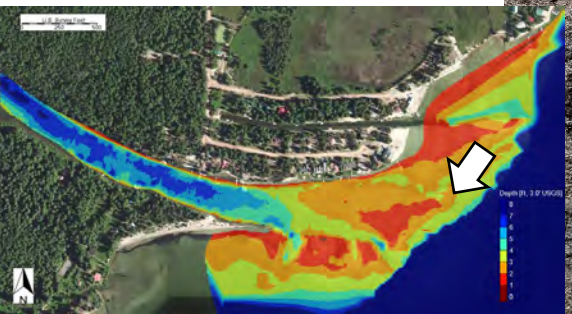
Location varies based on seasonal water level

Red areas on hydrographic survey



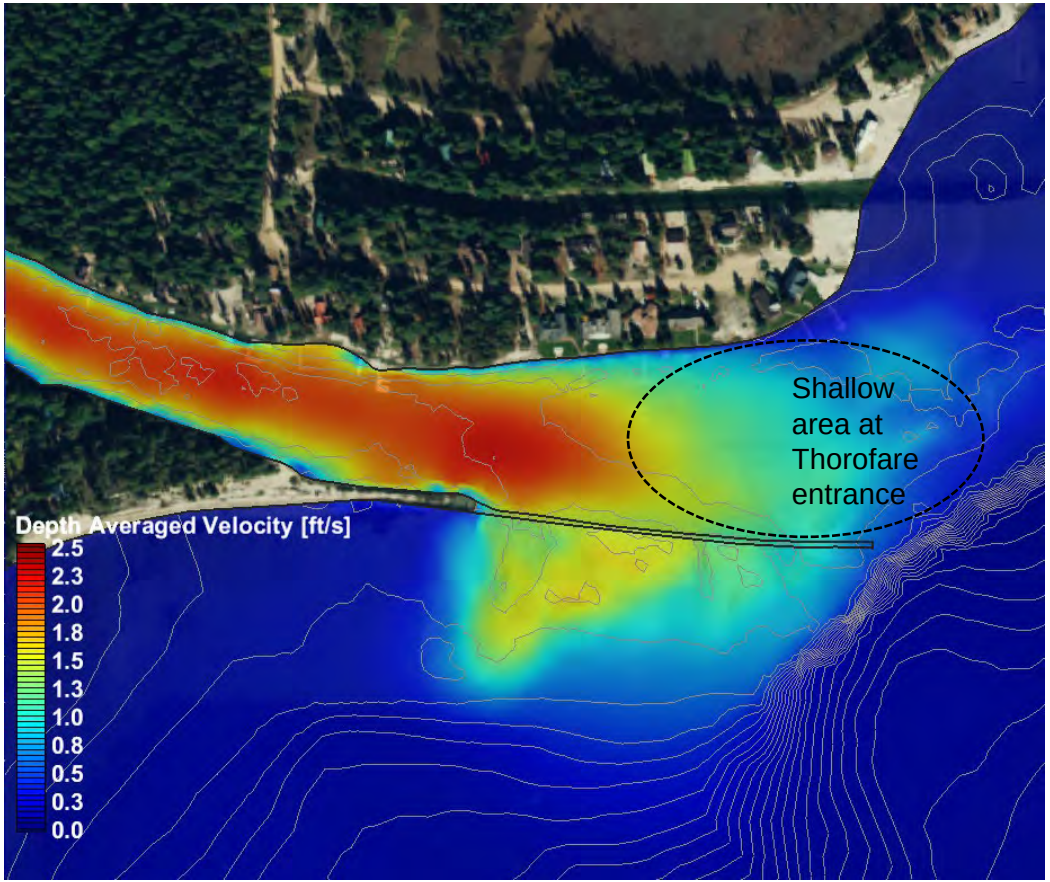
Low Pool

Freshly deposited longshore sediment transport



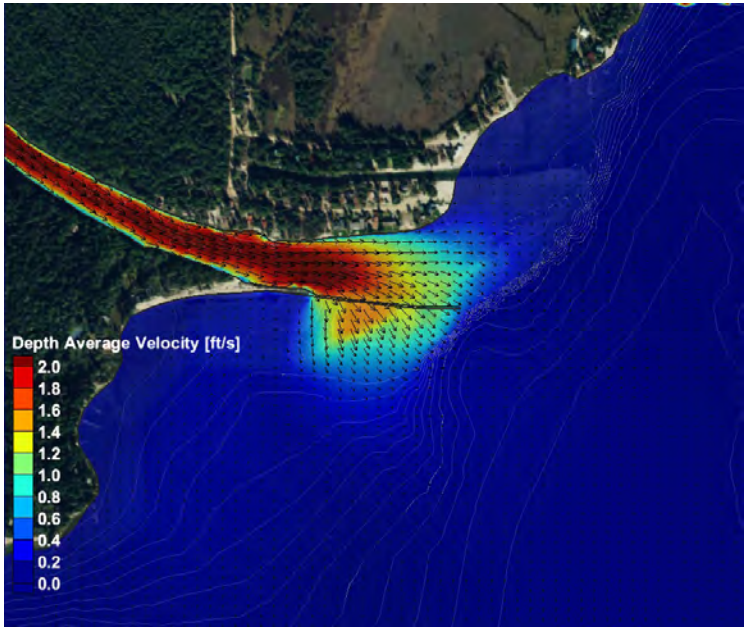
Modeling Results – Existing Conditions (Velocity)

- Delft3D Modeling
- Flow spreading along breakwater is represented in model results
- Significant drop in velocity at approximately ½ the length of the breakwater
- Velocity reduction zone corresponds with area of reduced depth (shoal) at entrance to Thorofare
- Increased flow velocity during spring runoff needed for improved channel condition

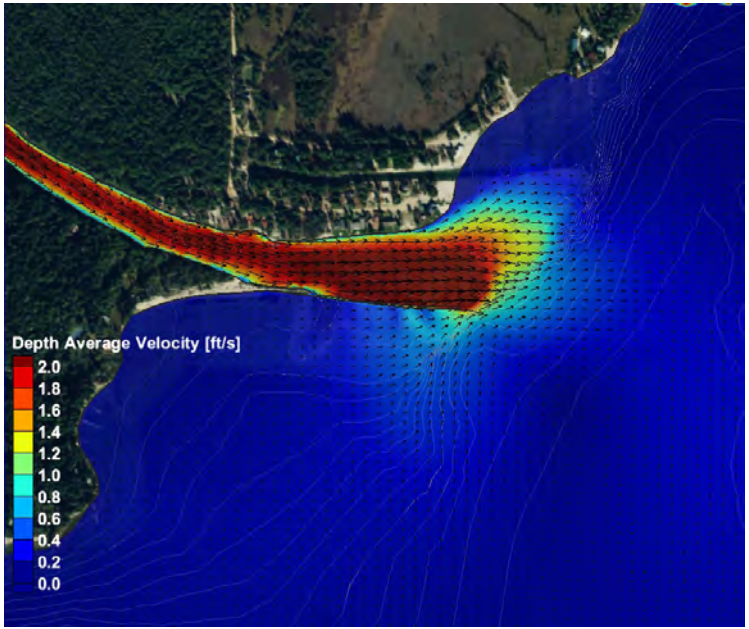


Modeling Results – Alternatives Evaluation

Snapshot of depth-averaged velocity for
Porous Breakwater vs. Solid Feature



Porous Breakwater

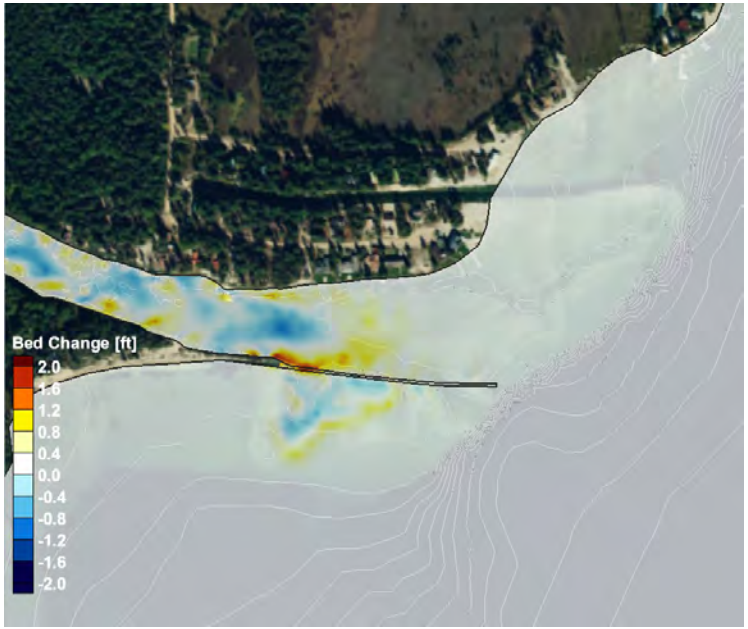


Solid Breakwater

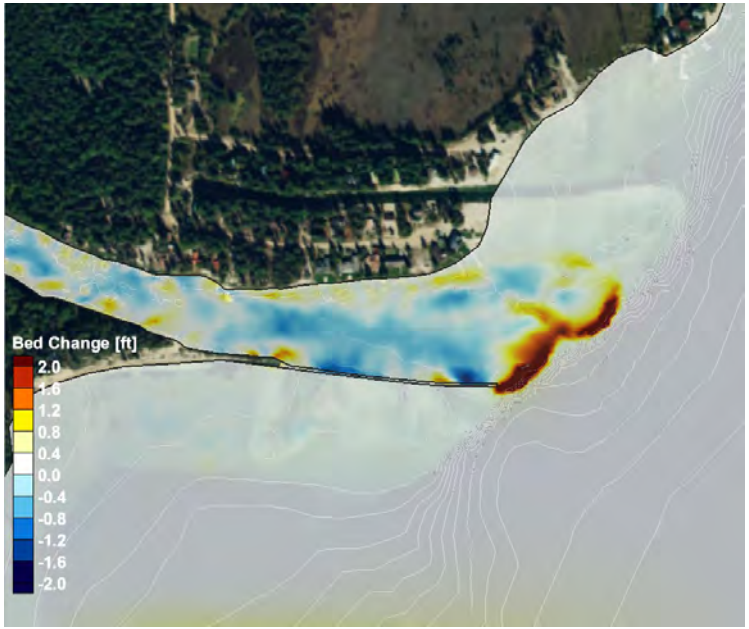
Modeling Results – Alternatives Evaluation

Maximum Bed Change (sedimentation/erosion) during the simulation period

Solid Feature: transports material and deposits them in deeper water past the feature end.



Porous Breakwater



Solid Breakwater

Solid Structure – Alignment Assessment

Existing, 15 degree, 30 degree

Preferred Concept

Solid Breakwater Structure, Dredging, Beneficial Re-use Dredged Materials
10 degree rotation from existing alignment

Final Design

- Final Engineering Analysis and Design
  - Access
  - Demolition
  - Dredging Design and Beneficial Use
  - Flow Diversion
  - Breakwater

- Stakeholder and property ownership coordination and access.

- Bidding and Procurement

Thorofare Access

ACCESS ROAD - SANDPIPER SHORES RD (LOOKING WEST)

CONSTRUCTION ACCESS POINT - LOT 10 (LOOKING NORTHEAST)

- Access Road Precon survey requirements
- Utility Protection Requirements
- Bulkhead protection measures
- Road maintenance
- Snow Plowing
- Site restoration

Project Overview – Site Access

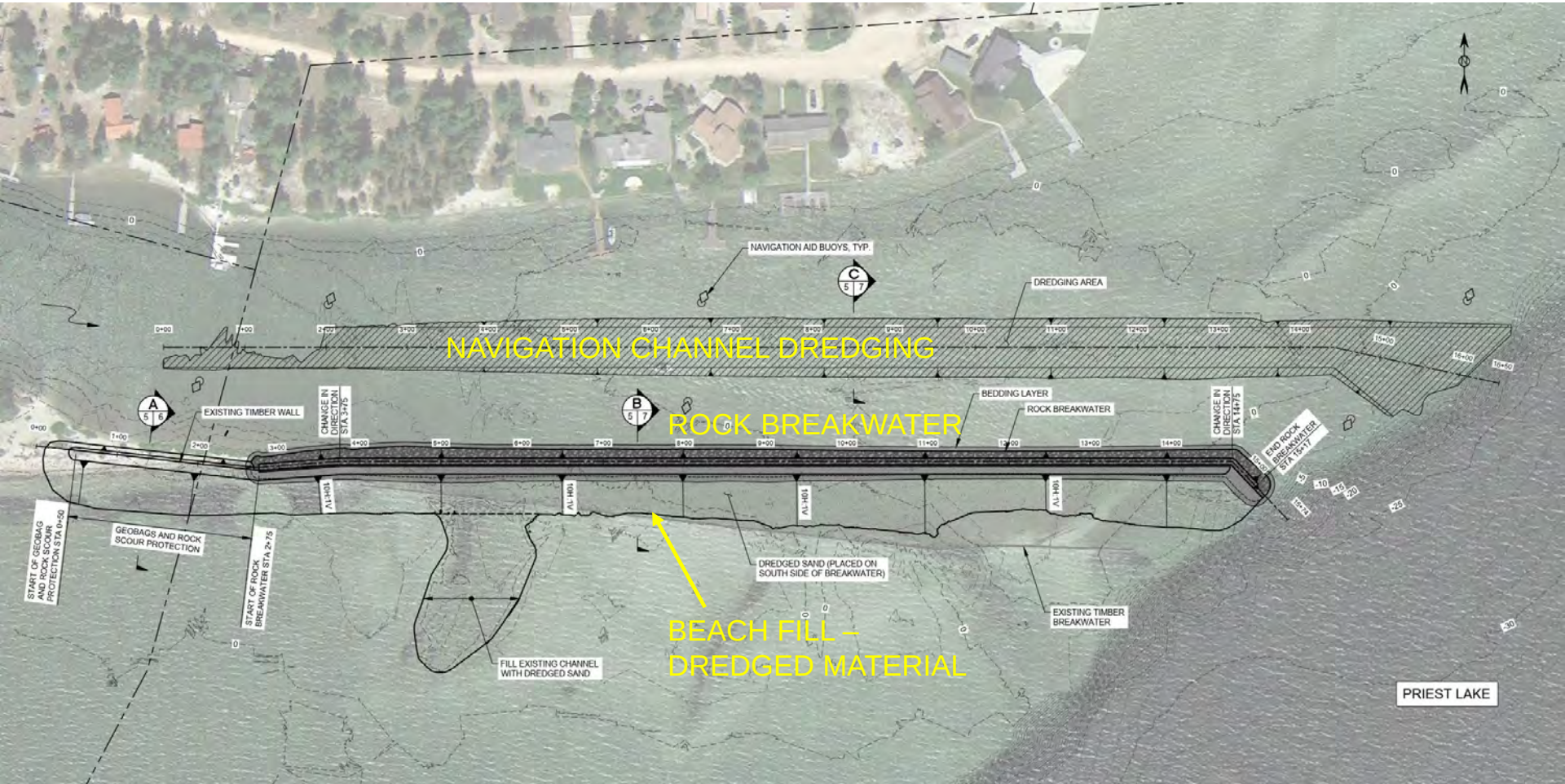
- Private HOA – Easement
- Utility Protection Requirements; Variable along route
- Access and use of lake bed allowable within the limits of construction – to be restored to pre-project conditions upon completion of work
- Low Water time period

Project Overview – Stream Diversion & Water Quality

- Stream Diversion to ensure work is done not in flowing water condition
- Access and use of lake bed allowable within the limits of construction – to be restored to pre-project conditions upon completion of work

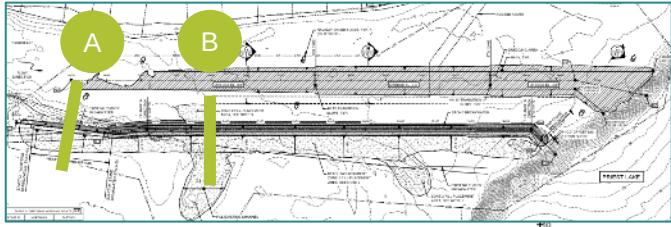
Project Overview – Stream Diversion & Access

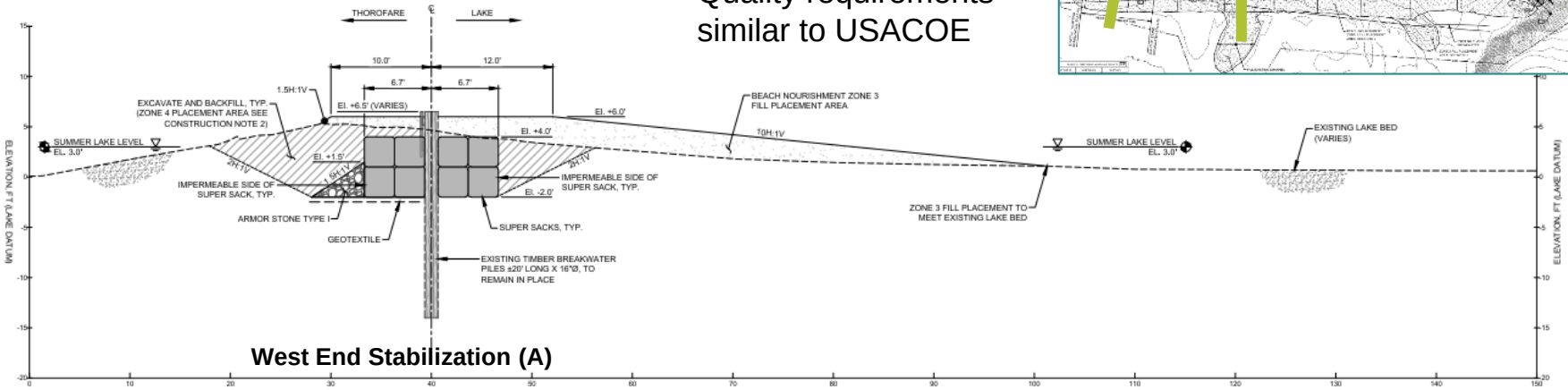
Site Plan


NAVIGATION AID BUOYS, TYP.
DREDGING AREA
NAVIGATION CHANNEL DREDGING
ROCK BREAKWATER
BEDDING LAYER
ROCK BREAKWATER
EXISTING TIMBER WALL
CHANGE IN DIRECTION STA 3+75
CHANGE IN DIRECTION STA 14+75
END ROCK BREAKWATER STA 15+17
START OF GEOBAG AND ROCK SCOUR PROTECTION STA 0+50
GEOBAGS AND ROCK SCOUR PROTECTION
START OF ROCK BREAKWATER STA 2+75
DREDGED SAND (PLACED ON SOUTH SIDE OF BREAKWATER)
EXISTING TIMBER BREAKWATER
FILL EXISTING CHANNEL WITH DREDGED SAND
BEACH FILL – DREDGED MATERIAL
PRIEST LAKE

Breakwater Sections

Stone
- 3 gradations
- Quality requirements similar to USACOE

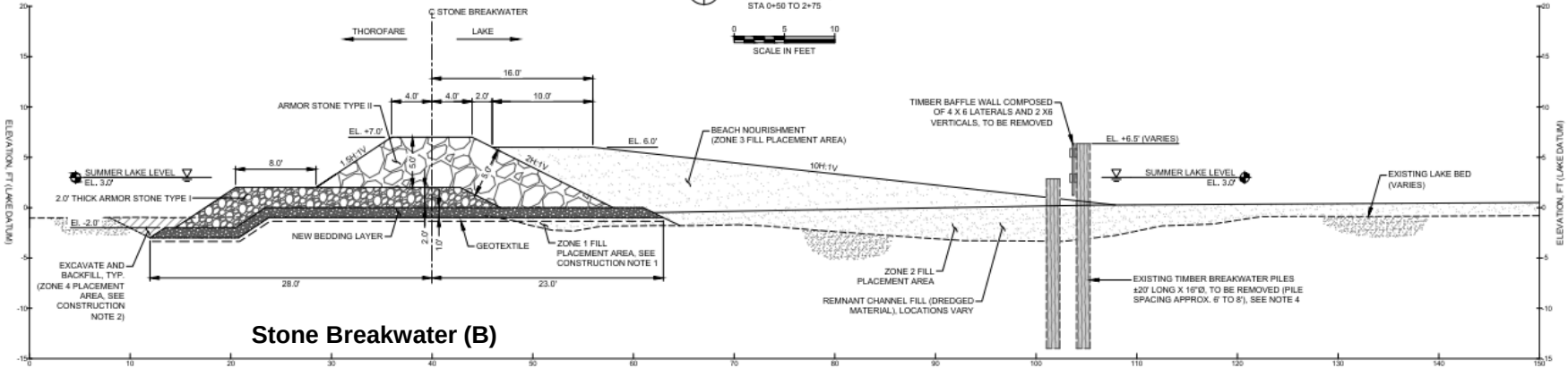




West End Stabilization (A)

A 13 15 SECTION
WEST END STABILIZATION
STA 0+50 TO 2+75

SCALE IN FEET



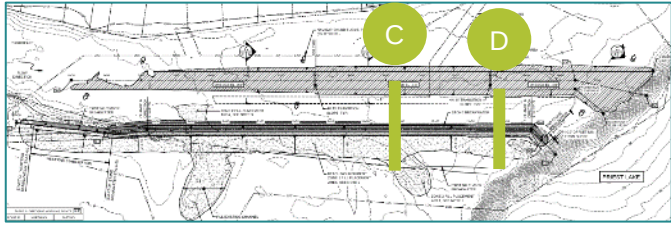
Stone Breakwater (B)

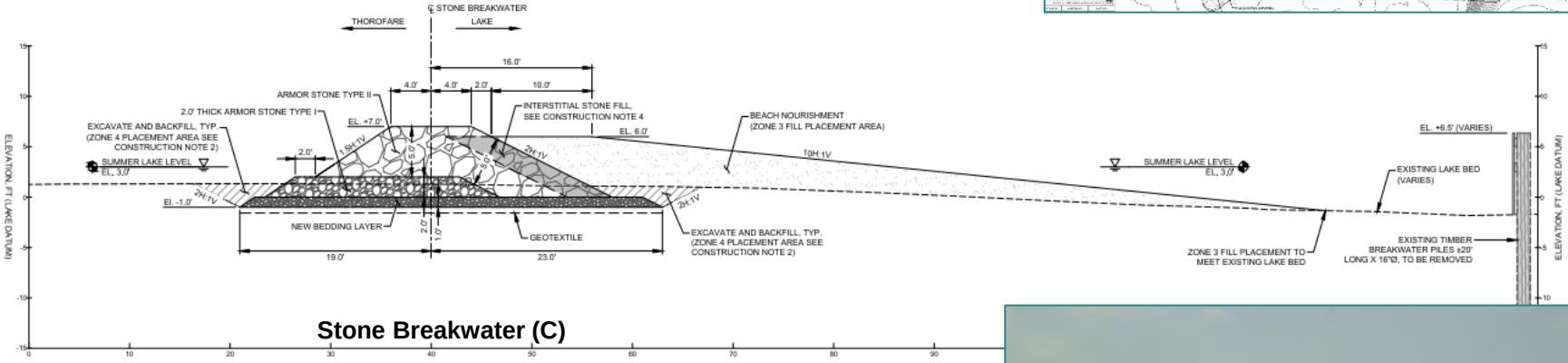
EGEND
BEACH NOURISHMENT

CONSTRUCTION NOTES
1. AREA AND QUANTITY OF ZONE 1 FILL WILL VARY BASED UPON THE DYNAMIC CONDITIONS OF THE SITE. PLACEMENT VOLUME SHALL BE CONFIRMED WITH

B SECTION

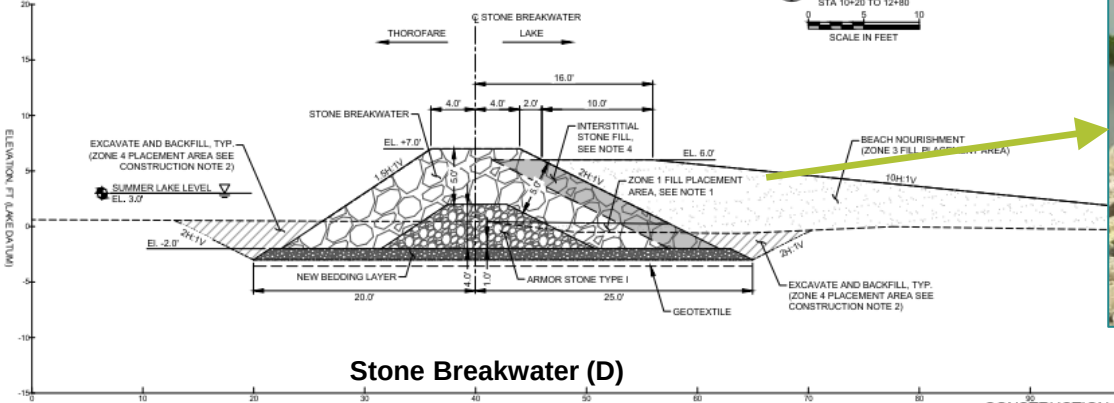
Breakwater Sections





Stone Breakwater (C)

C 14 16 SECTION
STONE BREAKWATER
STA 10+20 TO 12+80
0 5 10
SCALE IN FEET



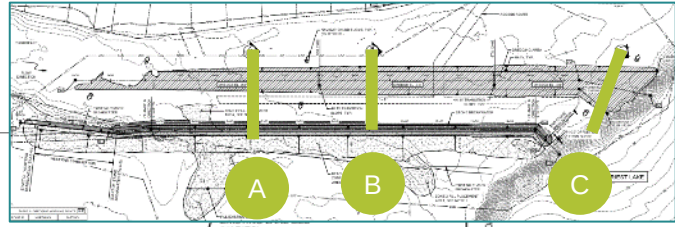
Stone Breakwater (D)

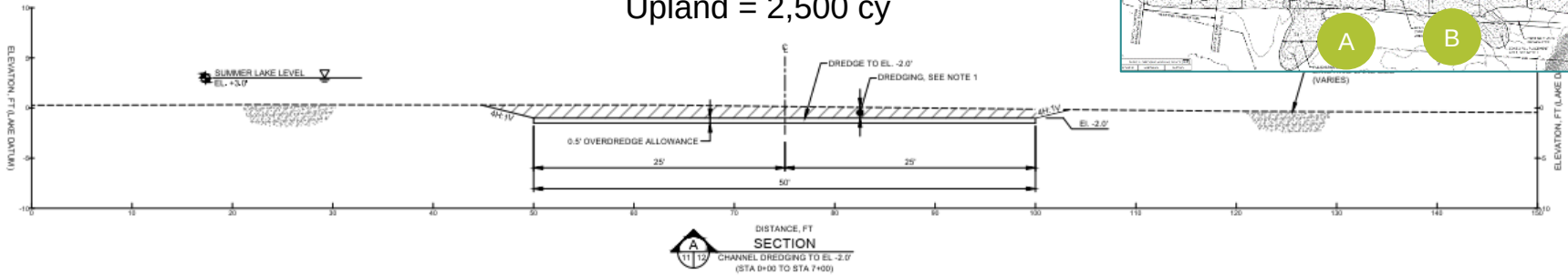
LEGEND

CONSTRUCTION NOTES

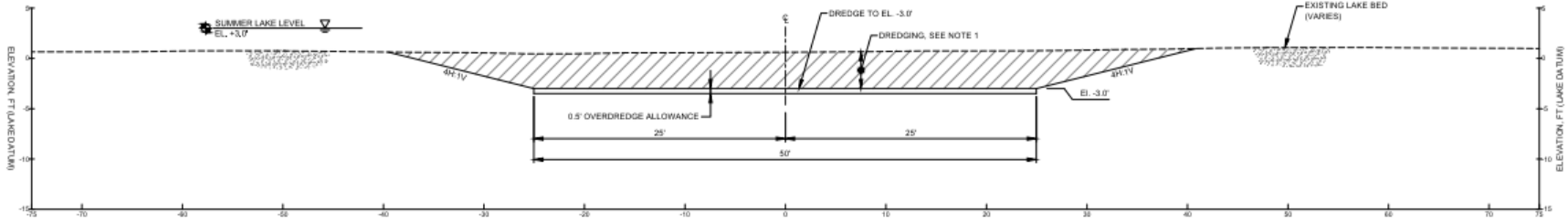
Dredging Sections

Disposal
Aquatic = 9,700 cy
Upland = 2,500 cy

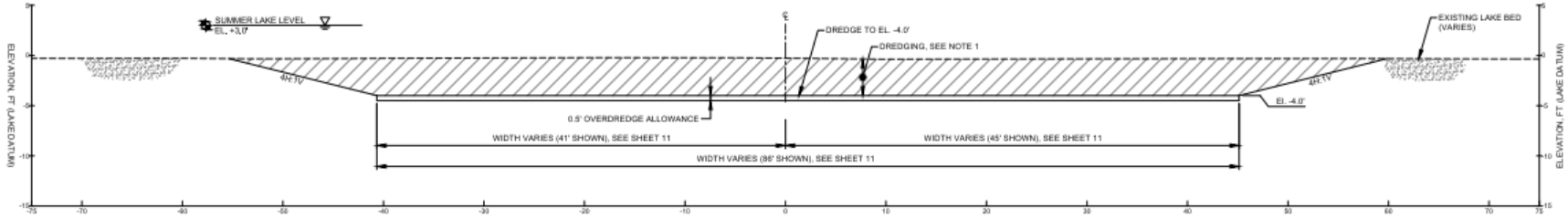




A 11 12 SECTION
CHANNEL DREDGING TO EL -2.0'
(STA 0+00 TO STA 7+00)



B 11 12 SECTION
CHANNEL DREDGING TO EL -3.0'
(STA 7+00 TO STA 12+00)



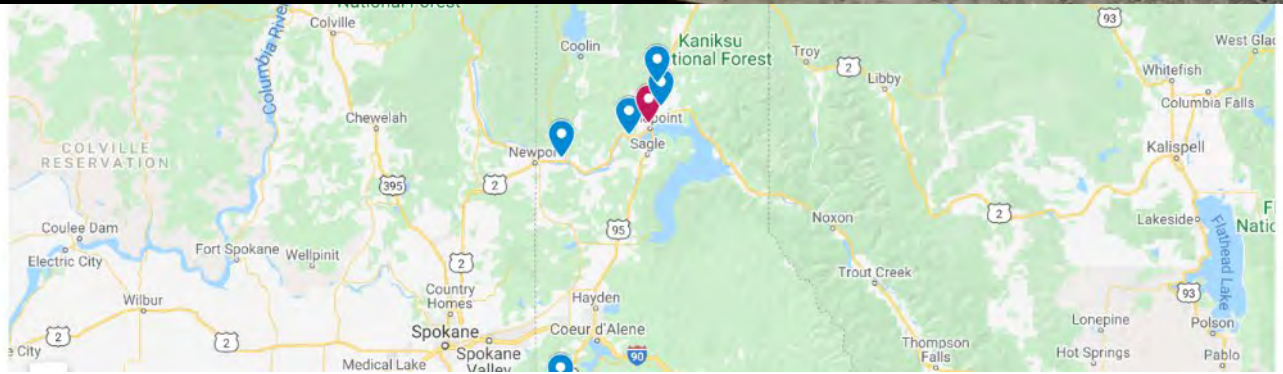
C 11 12 SECTION
CHANNEL DREDGING TO EL -4.0'
(STA 12+00 TO 16+50)

NOTES

1. DREDGE ELEVATION VARIES FROM -2.0' TO -4.0' (SEE SHEET 11). DREDGED MATERIAL SHALL BE PLACED AS FILL WITHIN ZONE 3 - BEACH NOURISHMENT.
2. WATER LEVEL SUBJECT TO DAILY CHANGE BASED ON DRAINAGE BASIN HYDROLOGY

LEGEND

DREDGING


Colville
Coolin
Kaniksu
tional Forest
Troy
Libby
Whitefish
Columbia Falls
Chewelah
COLVILLE
RESERVATION
Newport
Sagle
Kalispell
Coulee Dam
Electric City
Fort Spokane
Wellpinit
Noxon
Lakeside
Trout Creek
Wilbur
Country
Homes
Hayden
Spokane
Coeur d'Alene
Lonepine
Polson
Thompson
Falls
Hot Springs
Pablo
Medical Lake
Spokane
Valley

Stockpiling and Placement Areas

- Huckleberry
  - Up to 800 cy dredged material
- Bear Creek
  - Temporary stone stockpile area
- IDL
  - Temporary Storage for
  - Offroad trucks

Construction

- Construction
- Lessons Learned
- Board and Community Response Post-Construction

Construction Access

Flow Diversion

Demolition

Dredging

- Stair-stepped dredging construction progressed from downstream end to upstream end of the Thorofare in coordination with flow diversion and demolition works
- Hydraulic excavators operated predominately in the dry.
- Material stockpiled via “yo-yo” scheme within the approximate footprint of the beach nourishment

Dredging and Beneficial use

Breakwater Construction

Breakwater Construction

Construction Issues and Resolution

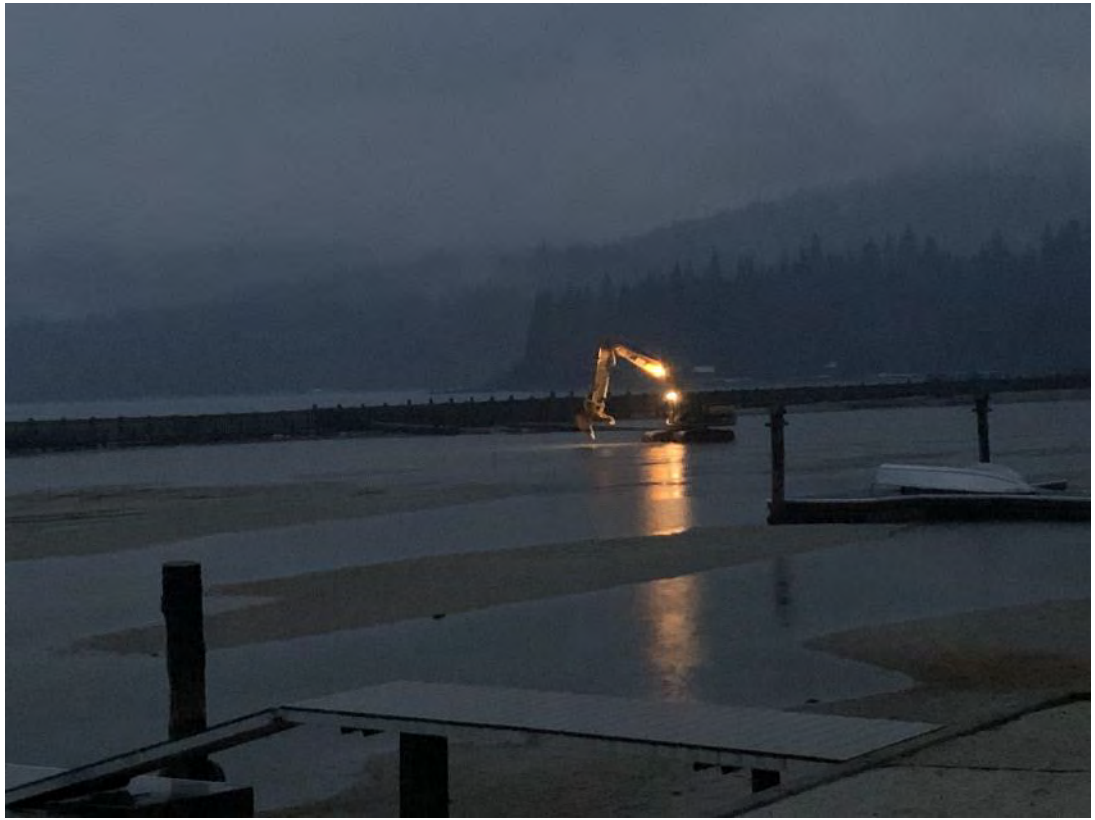
- Weather
- Geomorphology
- Access
- Substantial Completion
- Property Ownership

Breakwater Construction

Breakwater Construction

Key Success Factors

- Active Client and Stakeholder Coordination and Communication
- Attention to detail in all elements of design and project planning.
  - Access
  - Flow diversion
  - Main Project Features
- Unique bidding and procurement scenario
- Coordination with suppliers
- Construction administration and management



Priest Lake Water Management Project

Pacific Chapter WEDA

IDWR

Idaho Water Resource Board

Bonner County Idaho 1907

MOTT MACDONALD

DAVID EVANS AND ASSOCIATES INC.

GeoEngineers
Earth Science + Technology