

ROYAL RIVER YARMOUTH, MAINE AQUATIC ECOSYSTEM RESTORATION STUDY

CONTINUING AUTHORITIES PROGRAM
SECTION 206

AUGUST 13, 2024

Presenters:

Janet Cote (Project Manager/Planner)

Tom Mhlbachler, Civil Engineer (Hydraulics)

New England District,
U.S. Army Corps of Engineers



U.S. ARMY



US Army Corps
of Engineers®
New England District





MEETING PRESENTERS

US Army Corps of Engineers (USACE) presenters include:

TJ Atwell, Deputy Chief Public Affairs Officer

Janet Cote, Project Manager/Planner

Tom Muhlbachler, Civil Engineer (Hydraulic)

Town of Yarmouth

Scott LaFlamme, Town Manager

Karin Orenstein, Town Councilor



MEETING AGENDA



Meeting Goals

- Provide an update on the Royal River study.
- To present new information about the hydraulic modeling efforts.

Agenda

- Overview of the Section 206 study
- Hydraulic Study Information
 - 'Behavior' of the Royal River – Flow depth, speed & direction the water follows
 - 'Paddle Depth' & 'Normal Flow' Changes
 - Gooch Island
- Study Update
 - Study Schedule
 - Public Review

STUDY UPDATE



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New England District



STUDY UPDATE



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- Developed the Tentatively Selected Plan (TSP).
- Completed the TSP Milestone (Internal to the USACE). Received approval to move forward to completed the draft Detailed Project Report/Environmental Assessment.
- Completed the Draft DPR/EA
- Began the District Quality Control Review. Currently, the study team is addressing the review comments.

Scoping

**Alternative
Evaluation**

**Feasibility
Analysis of
Selected Plan**

**Review &
Approval**



Develop & evaluate a range of alternatives to identify a tentatively selected plan

Refine and optimize the selected plan



TENTATIVELY SELECTED PLAN



Bridge Street Dam

- Removal of the entire Denil-type fish ladder and dam structure (275 linear feet).
- Removal of the entire dam spillway and stop log structures.
- No impact to the penstock.

East Elm Street Dam

- Removal of the entire Denil-type fish ladder.
- Removal of the dam segment on the right descending bank (120 linear feet).

Middle Falls

- Installation of diversion structure at the top of Middle Falls to divert streamflow into the side channel.
- Flow in the side channel will be monitored for capacity to pass fish and additional interventions may be executed as part of an adaptive management plan.



NEW HYDRAULIC STUDY INFORMATION



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New England District



SECTION 206 ROYAL RIVER FISH PASSAGE TSP HEC-RAS RESULTS SUMMARY

- New rock ledges exposed at two locations
 - Upstream of Beth Condon Memorial Pedestrian bridge
 - Upstream of Elm Street Bridge
- Elm Street Dam Impoundment Water levels approx. 4-ft lower; four locations could be less than 1.5-ft deep
- Gooch Island back channel
- During low flow periods, flow levels may be lower than depicted.

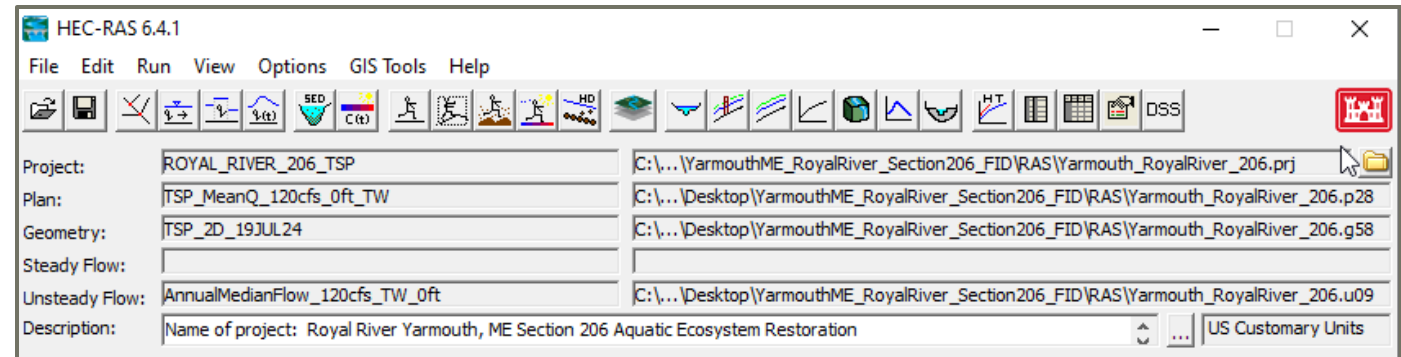


SECTION 206 ROYAL RIVER FISH PASSAGE TSP HEC-RAS RESULTS

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Overview of Results

- Water Surface & Velocity centerline Profiles
- Depth/Inundation Comparisons
- Velocity/Inundation Comparisons
- “Paddle Depth” Comparisons





SECTION 206 ROYAL RIVER FISH PASSAGE - FLOWS

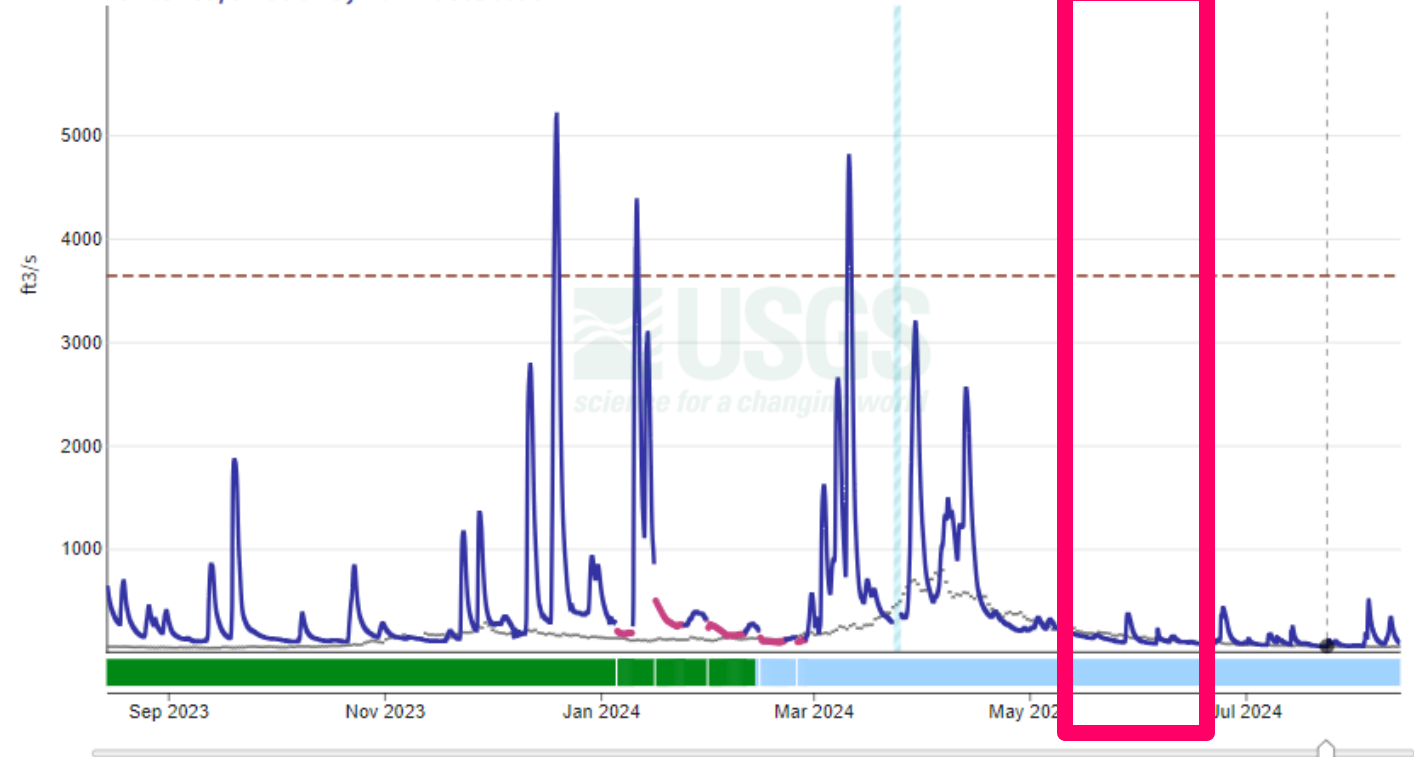
Royal River at Yarmouth, Maine - 01060000

August 14, 2023 - August 13, 2024

Discharge, cubic feet per second

57.8 ft³/s - Jul 23, 2024 09:30:00 PM EDT

- Fish Passage - Upriver Peak Migration
 - 95% flow percentile (62 cfs)
 - 5% flow percentile (641 cfs)
- “Drought”
 - 7Q10 (25 cfs)
- “Normal”
 - Annual median average daily flow (120 cfs)
- Storms
 - 2-yr Flood (50% AEP) (3,643 cfs)
 - 10-yr Flood (10% AEP) (6,480 cfs)
 - 100-yr Flood (1% AEP) (10,419 cfs)
- 10-22DEC2019 storm (validation)



Discharge, cubic feet per second

— Recorded

— Estimated

Ice Affected

Median: — 1950 - 2023

Data approval period

Approved

Provisional

— 2 Year Peak Flow *: 3640 ft³/s

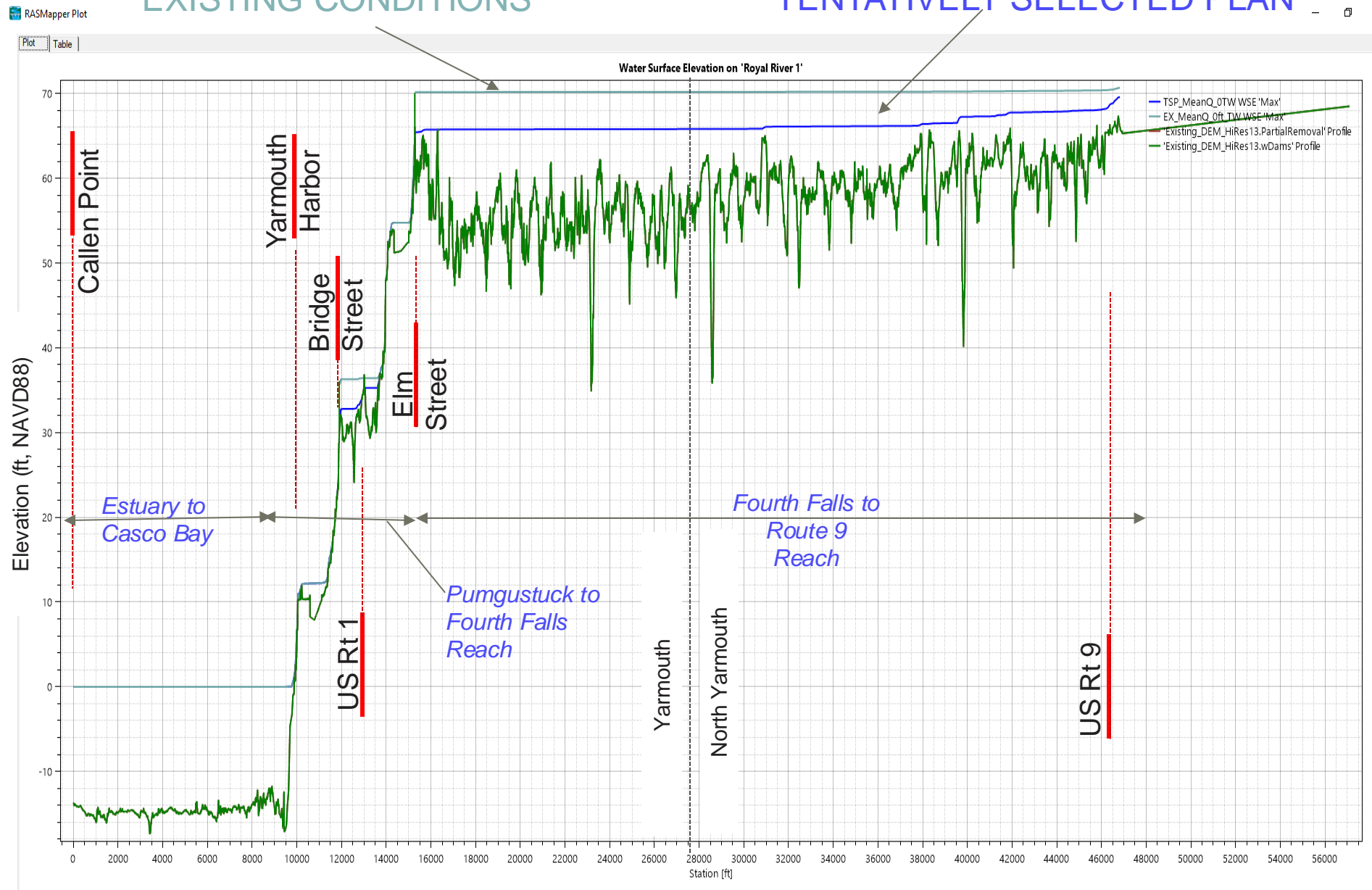
IMPORTANT Data may be [provisional](#)



WATER SURFACE PROFILE COMPARISON ANNUAL MEDIAN AVERAGE DAILY FLOW

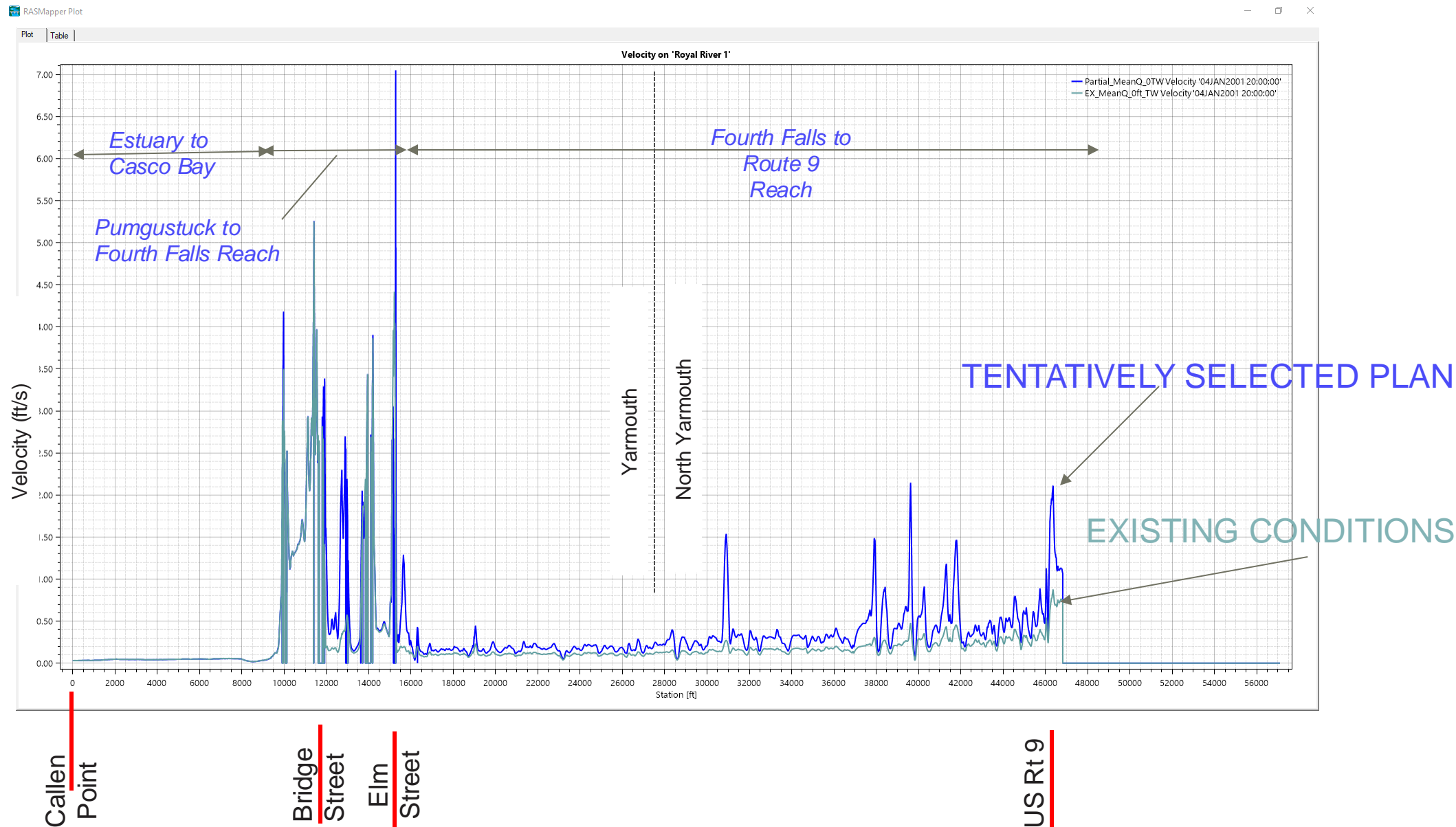
EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN





VELOCITY PROFILE COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW





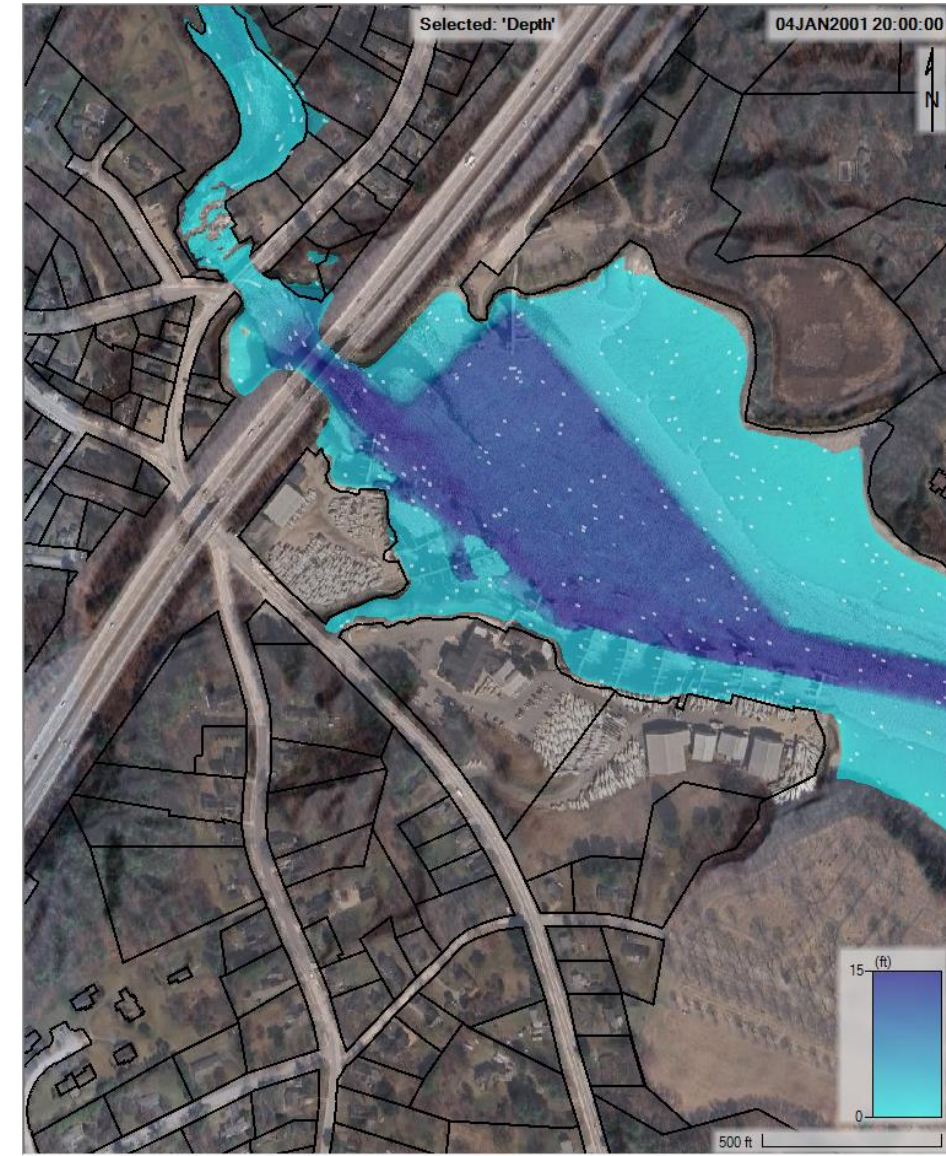
DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

HARBOR TO LOWER FALLS OVERVIEW

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN

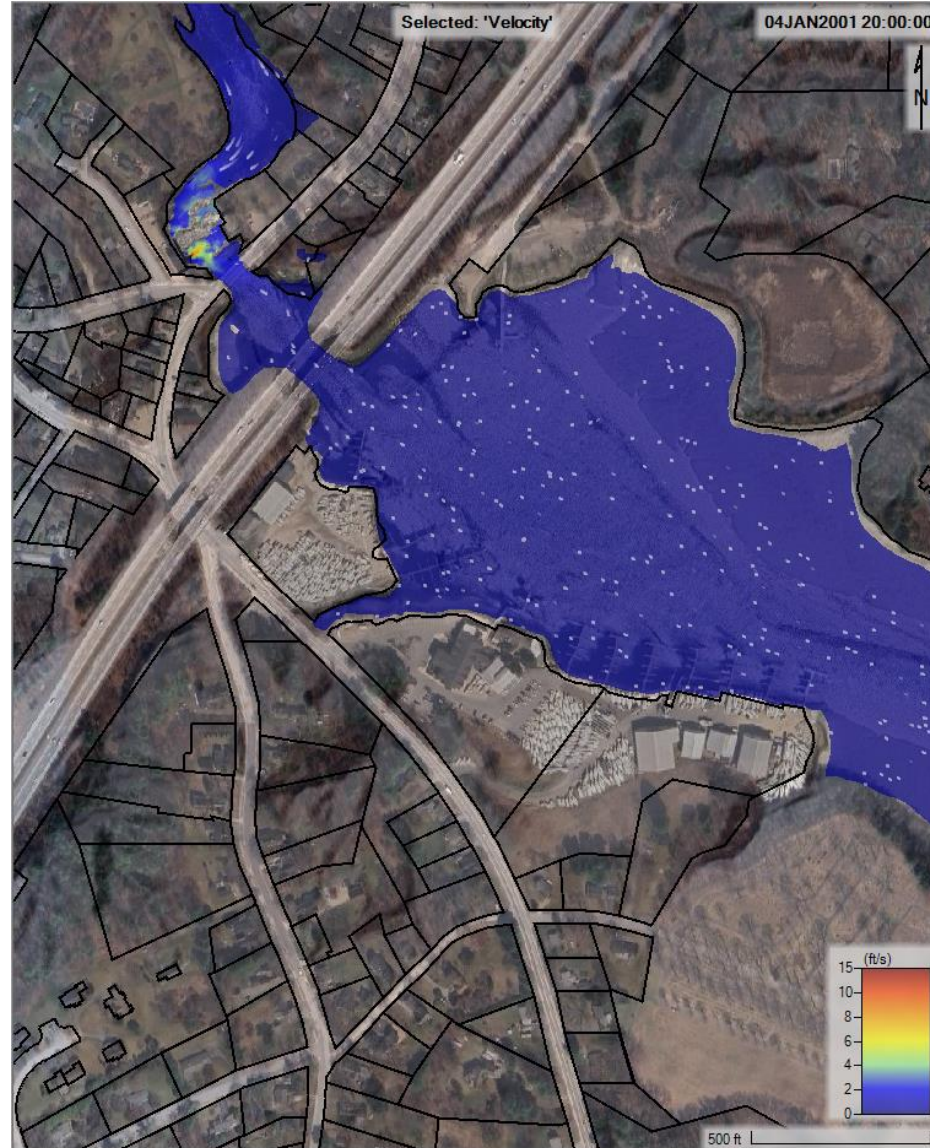




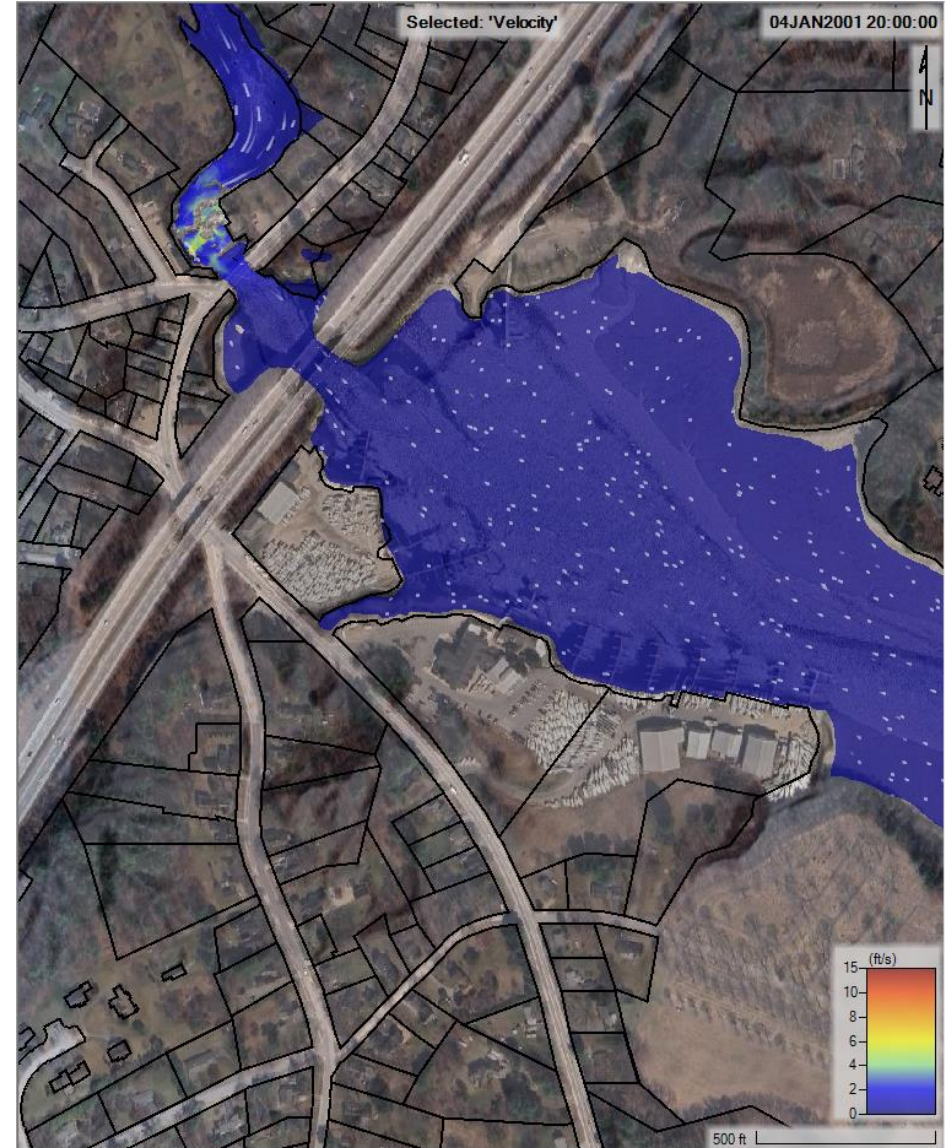
VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW HARBOR TO LOWER FALLS OVERVIEW

14

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN





DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

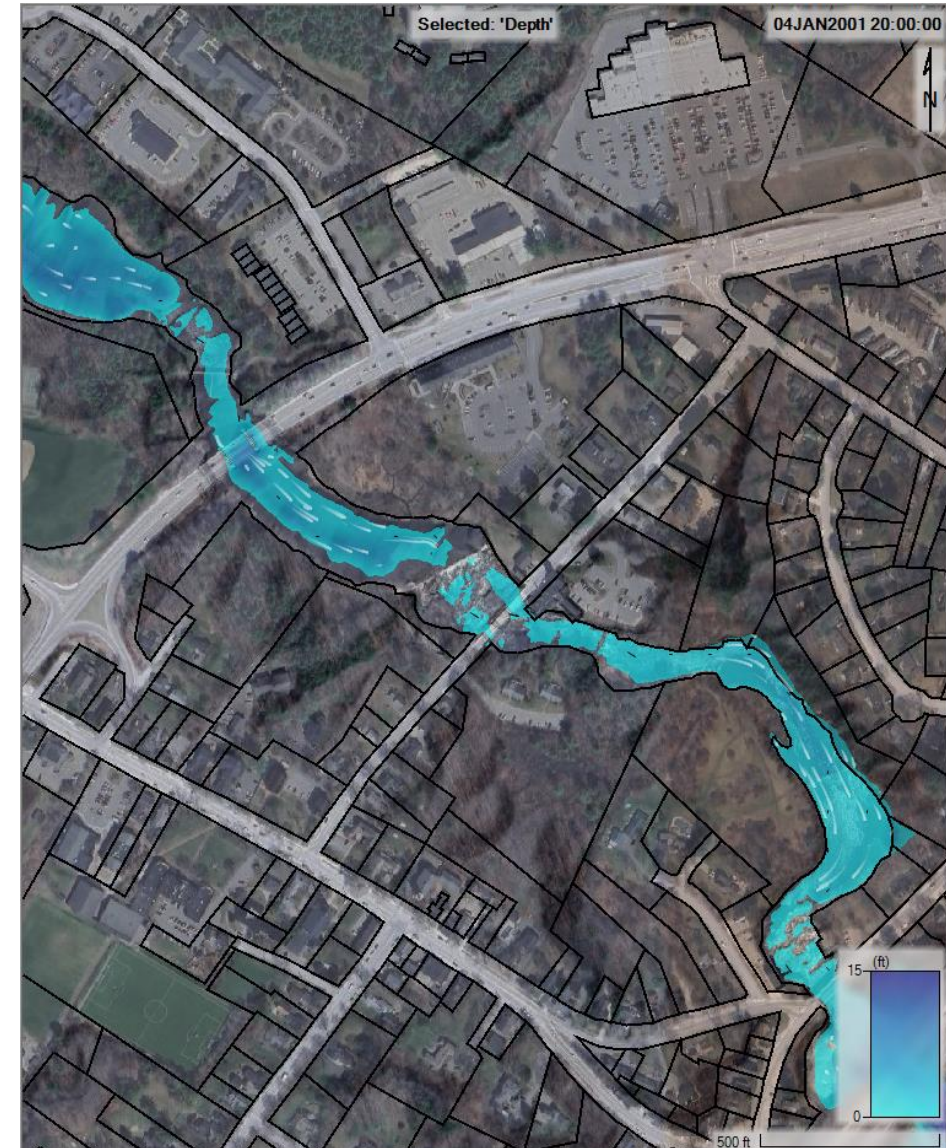
15

LOWER FALLS TO MIDDLE FALLS OVERVIEW

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN

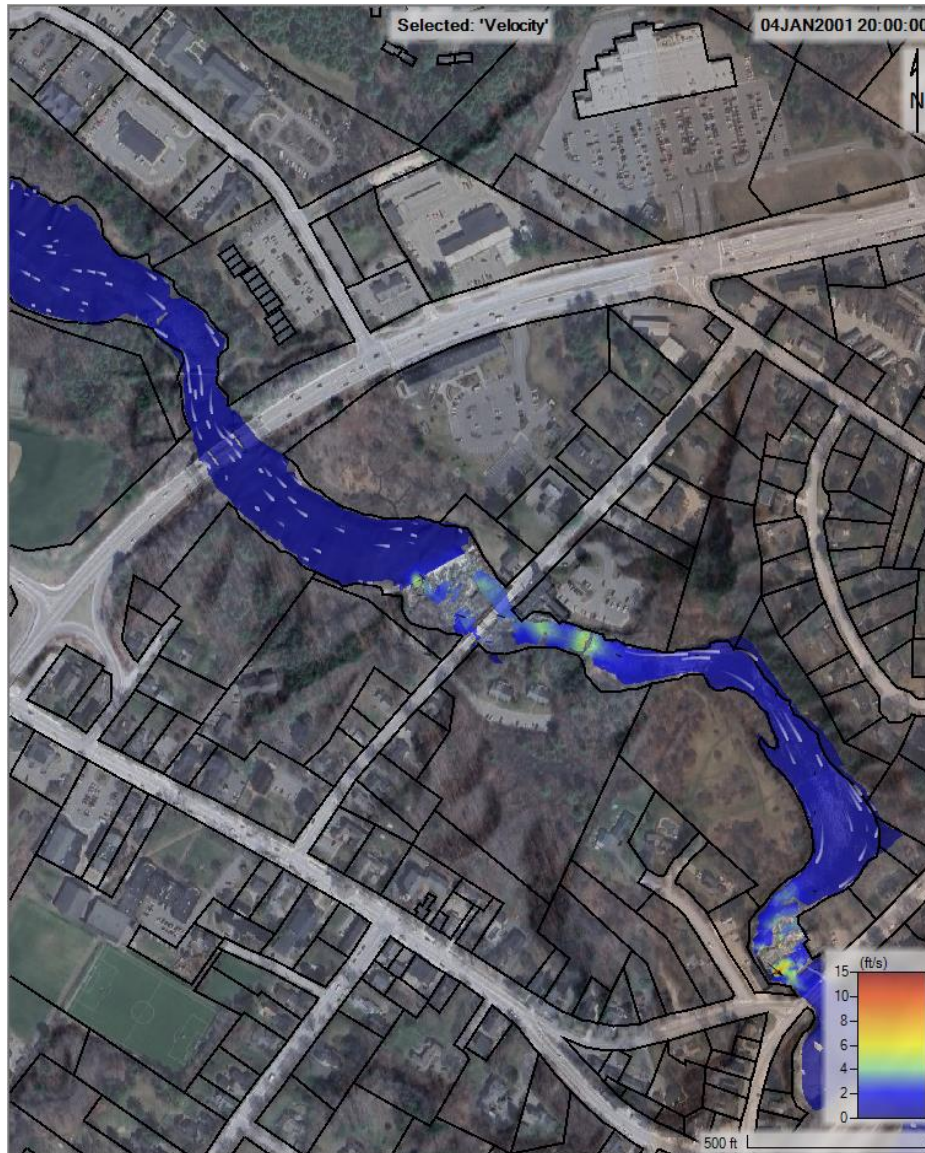




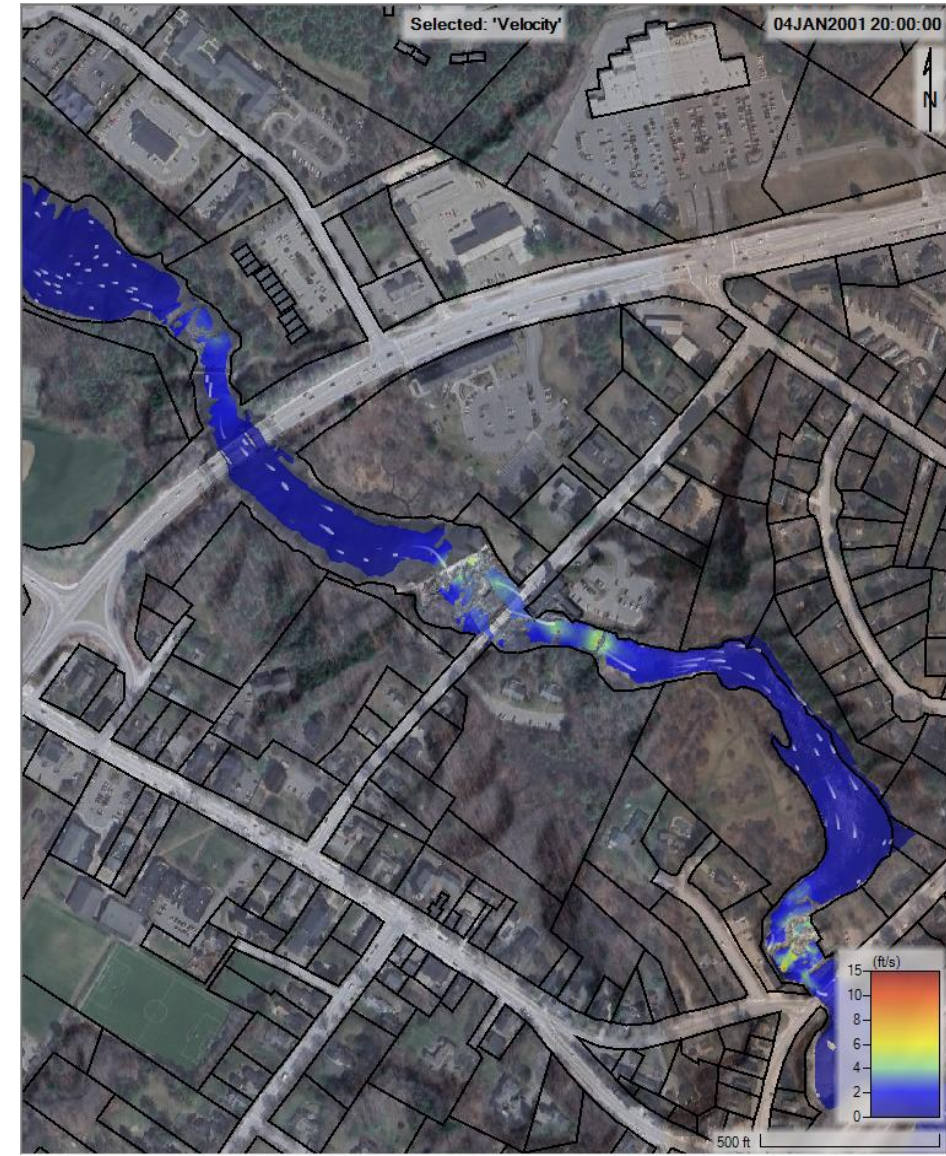
VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

LOWER FALLS TO MIDDLE FALLS OVERVIEW

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN

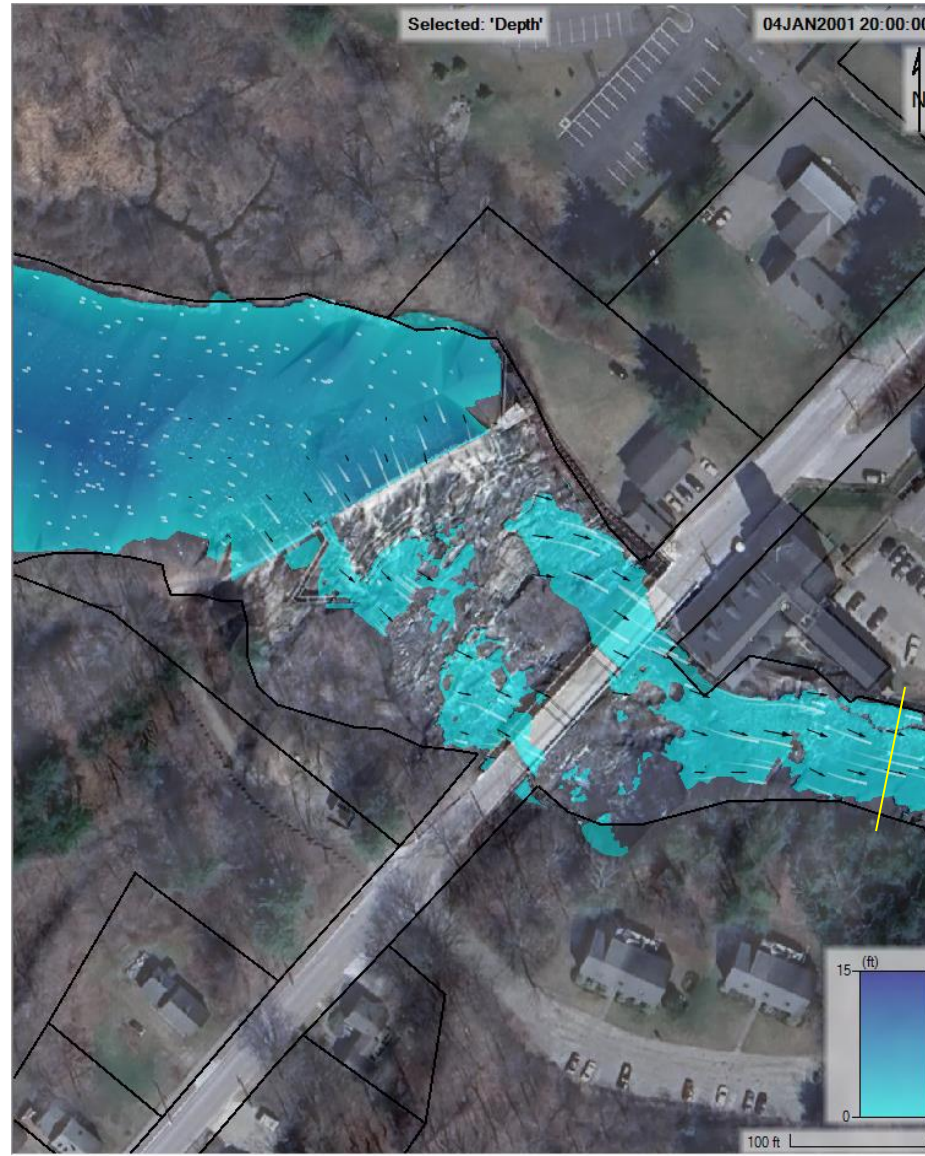




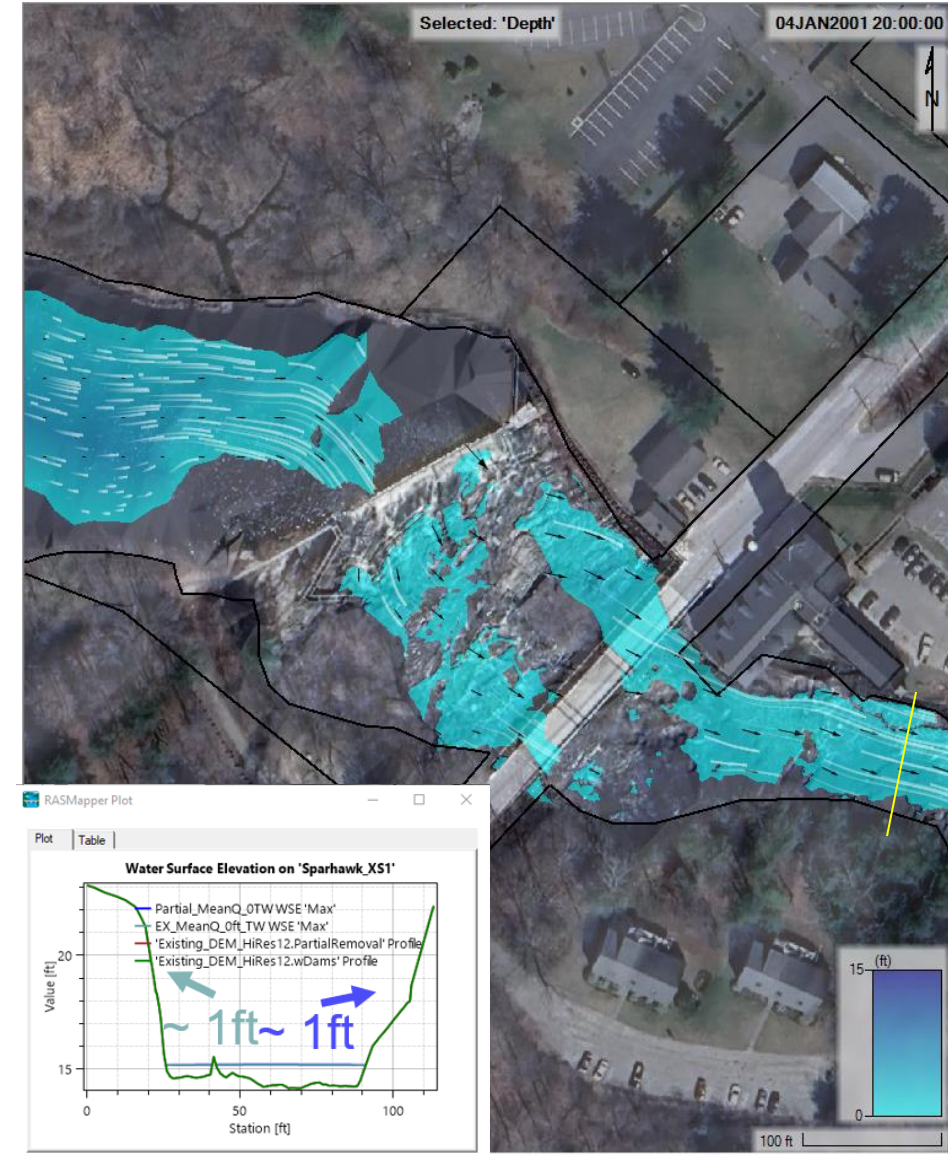
DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

BRIDGE STREET DAM

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN

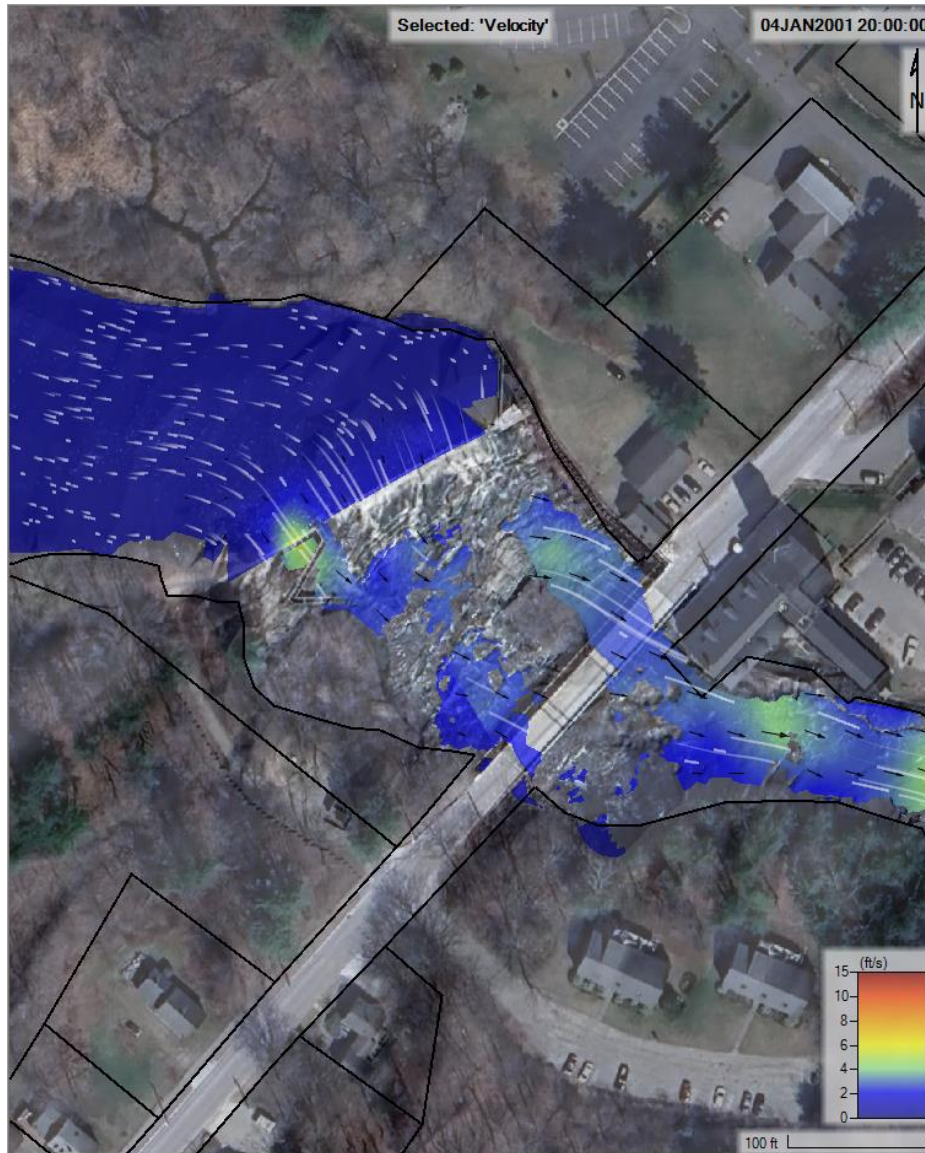




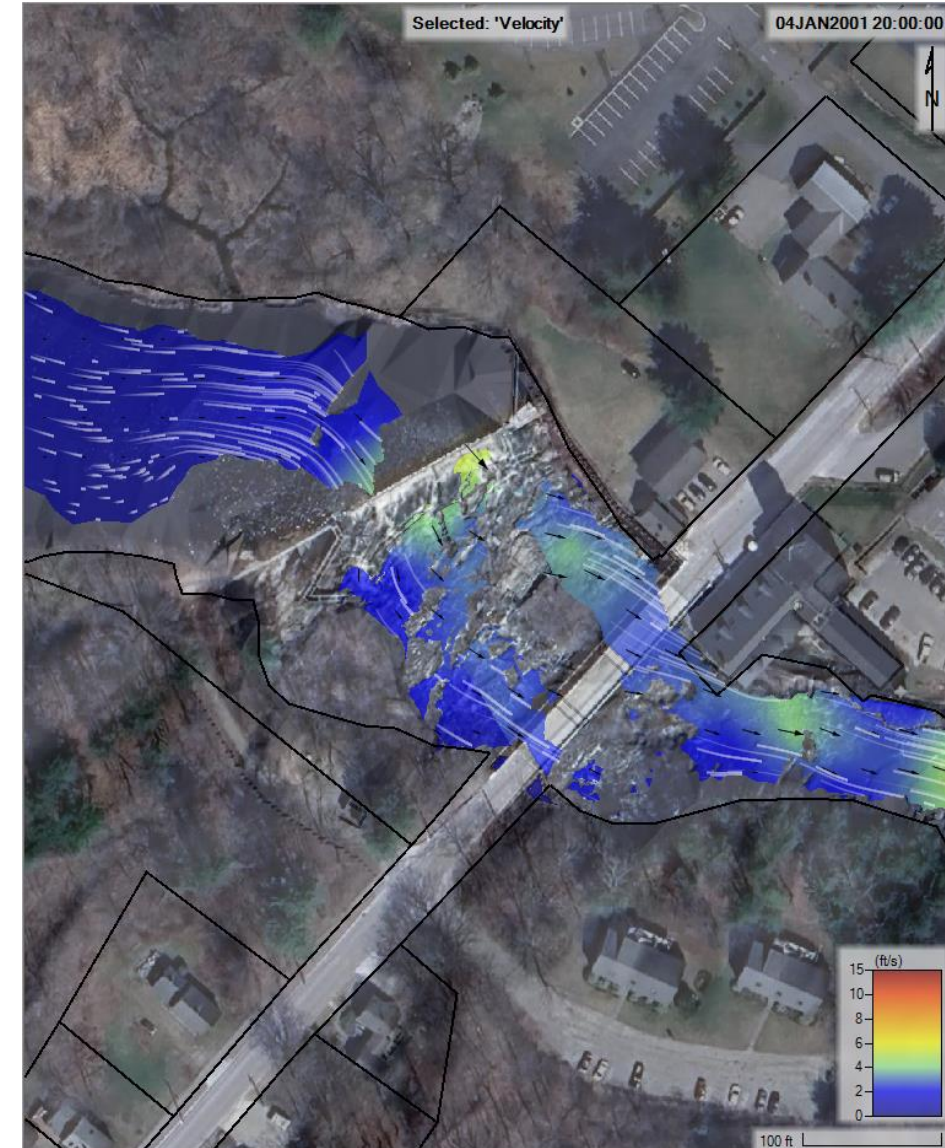
VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW BRIDGE STREET DAM

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EXISTING CONDITIONS



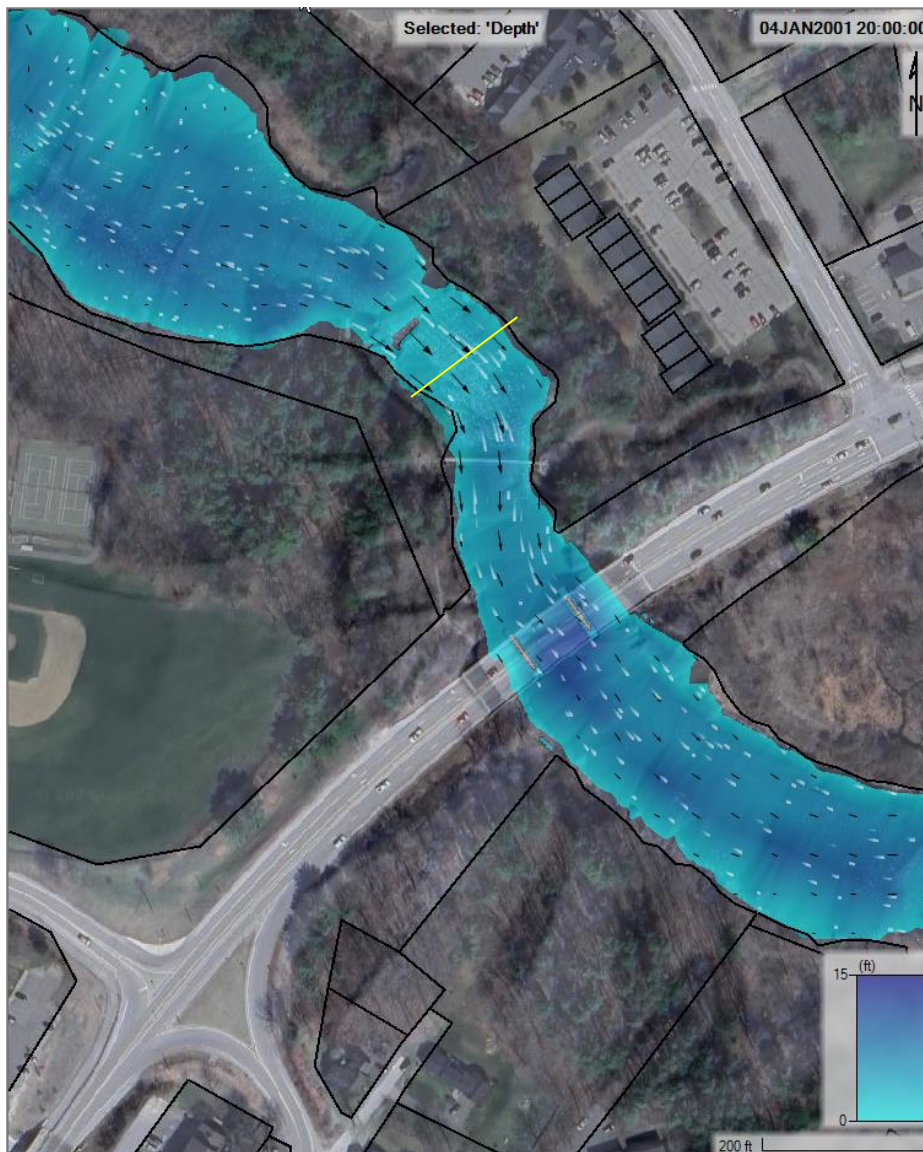
TENTATIVELY SELECTED PLAN



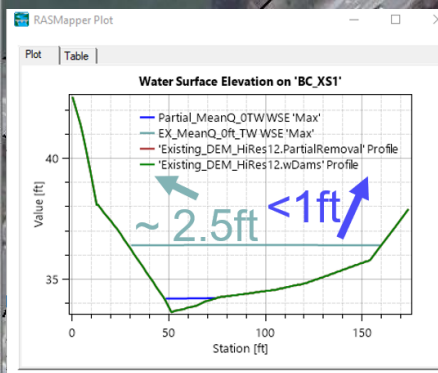
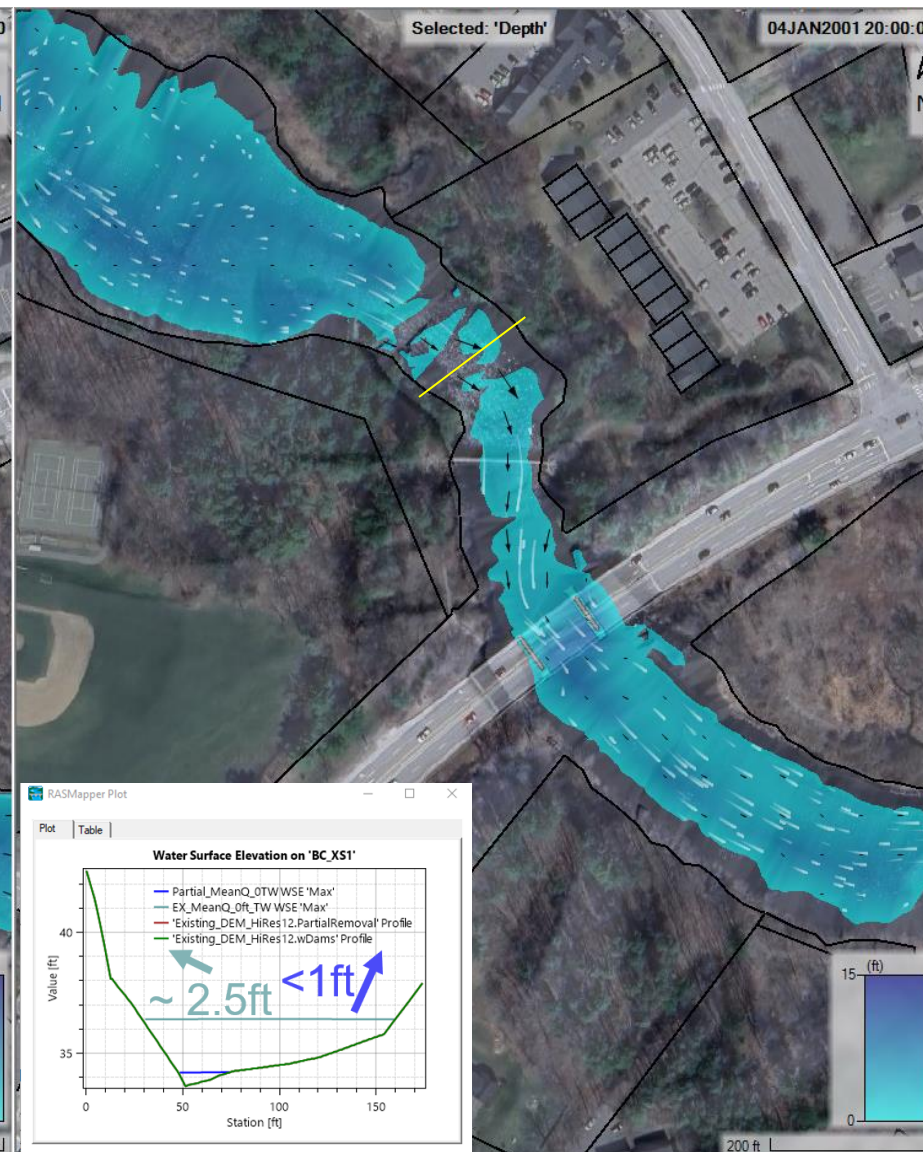


DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW US ROUTE 1 & BETH CONDON FOOTBRIDGE

EXISTING CONDITIONS



TENTATIVELY SELECTED PLAN

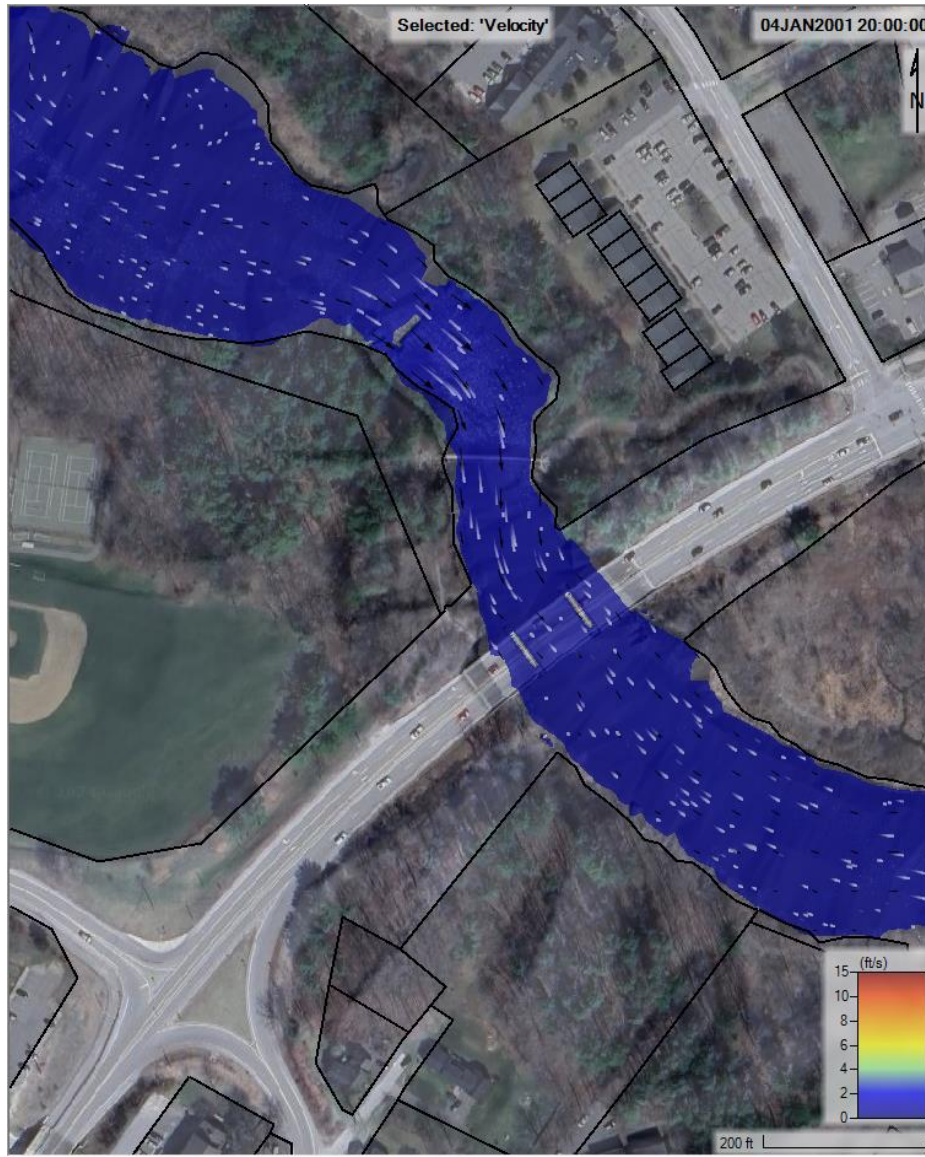




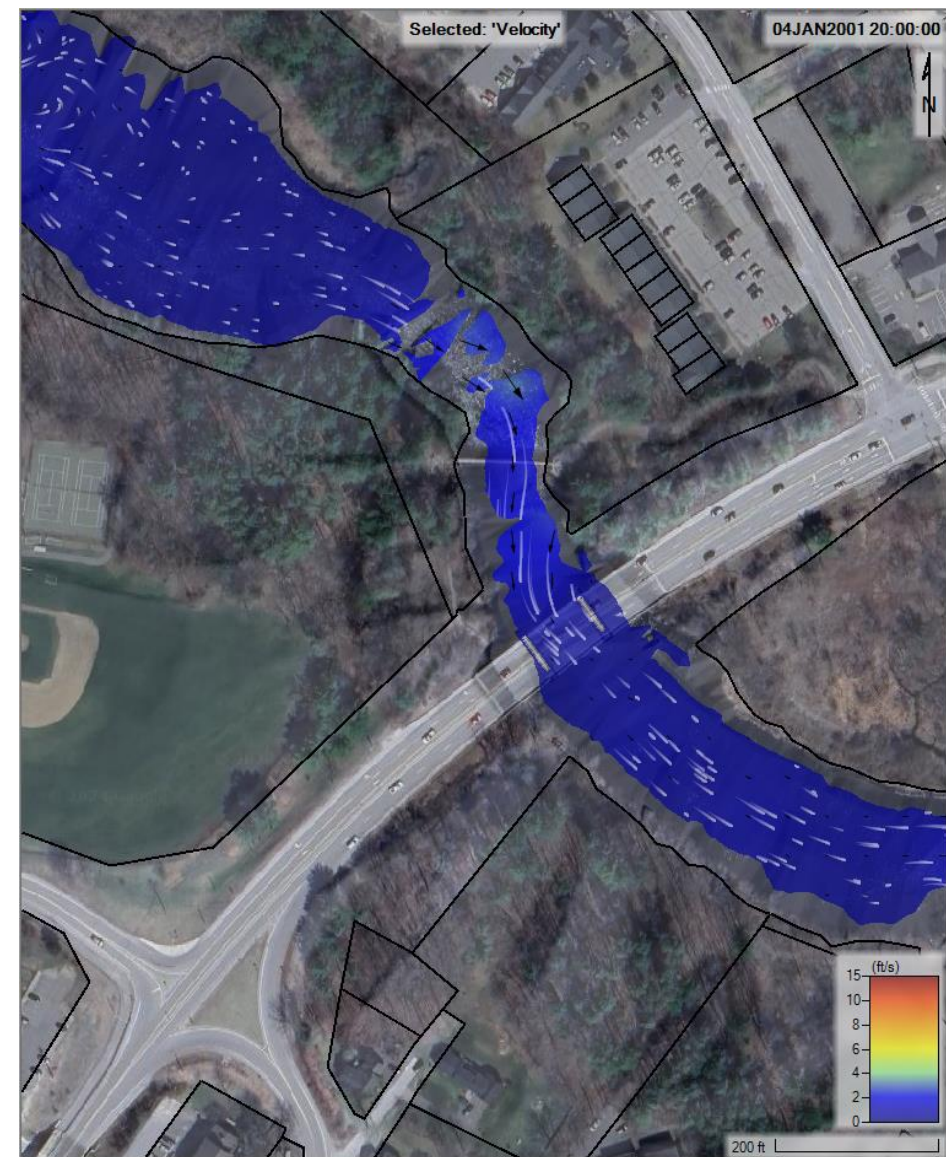
VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW US ROUTE 1 & BETH CONDON FOOTBRIDGE

20

EXISTING CONDITIONS

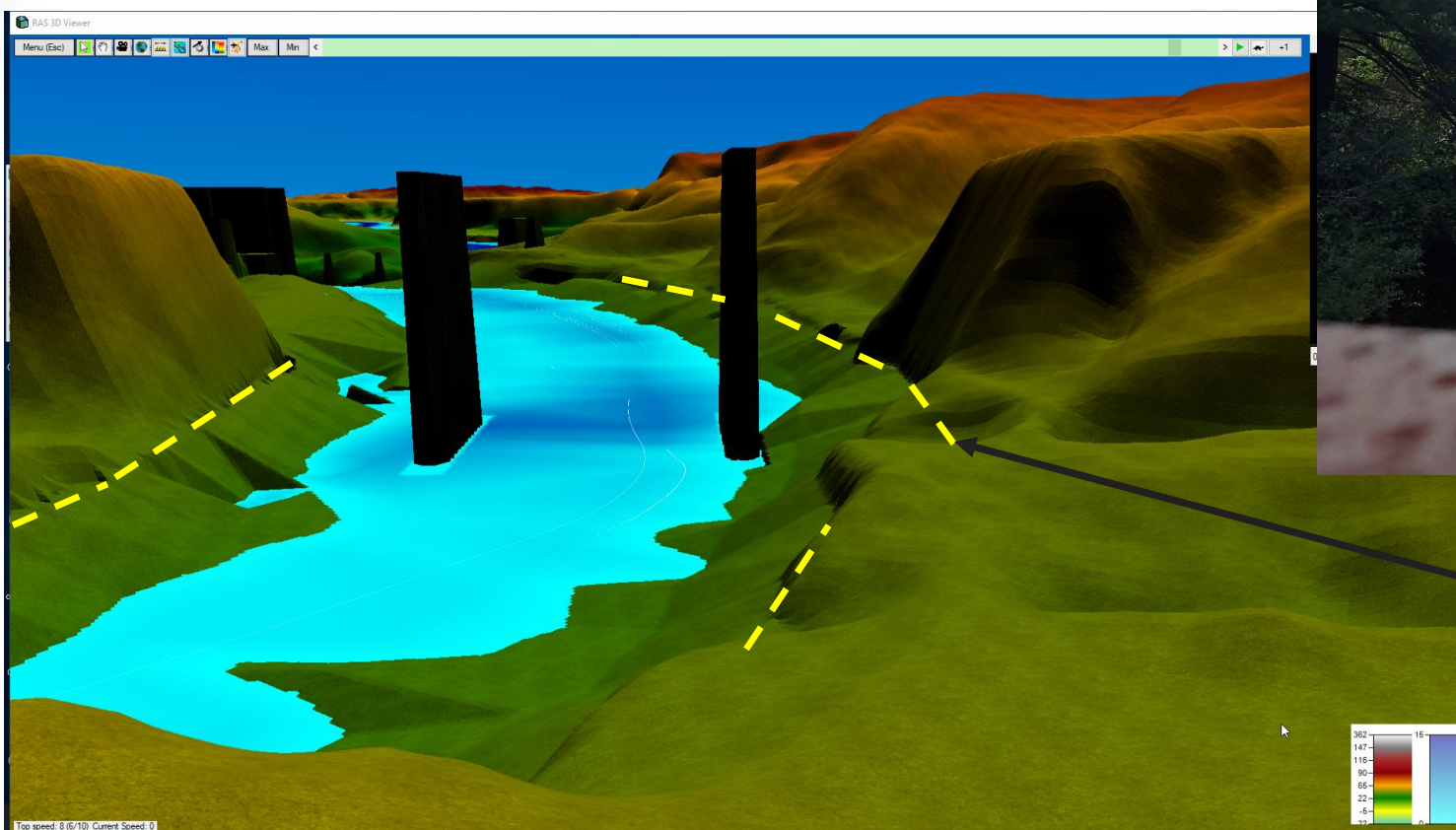


TENTATIVELY SELECTED PLAN





ROYAL RIVER TSP - LOOKING DOWNSTREAM FROM BETH CONDON MEMORIAL PEDESTRIAN BRIDGE

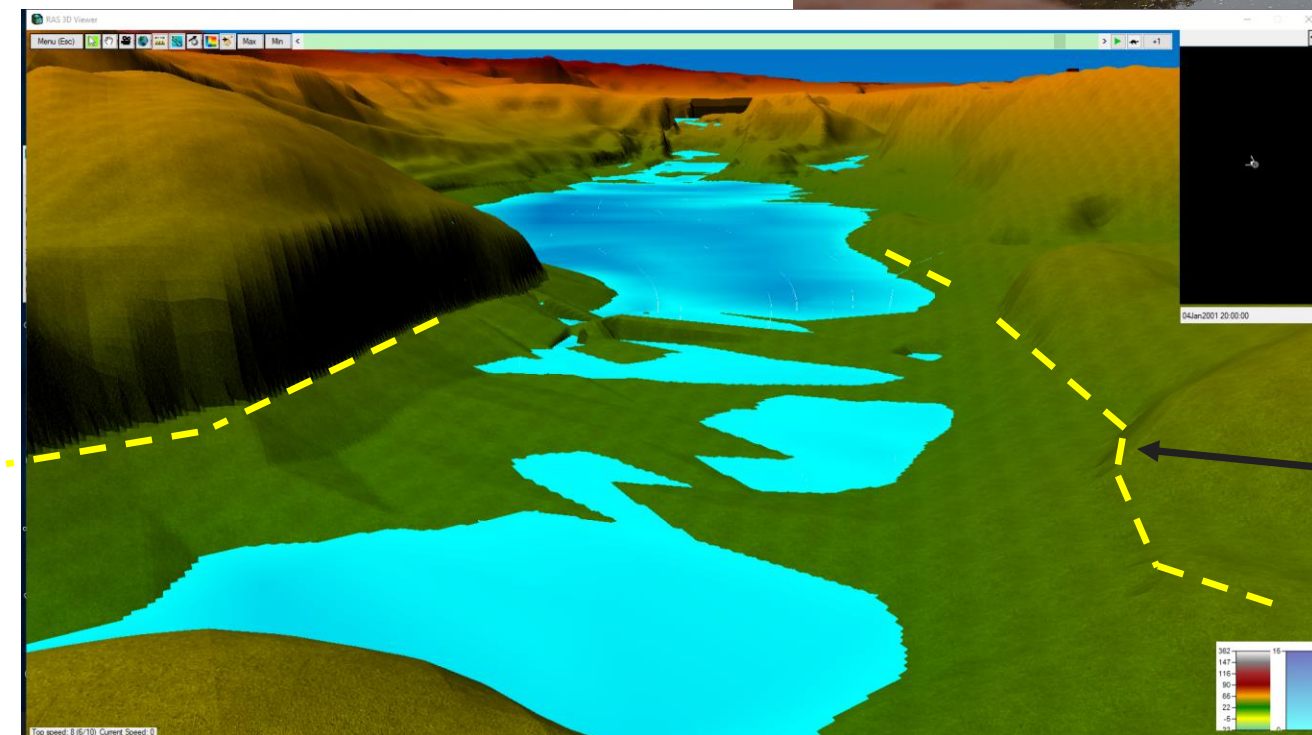
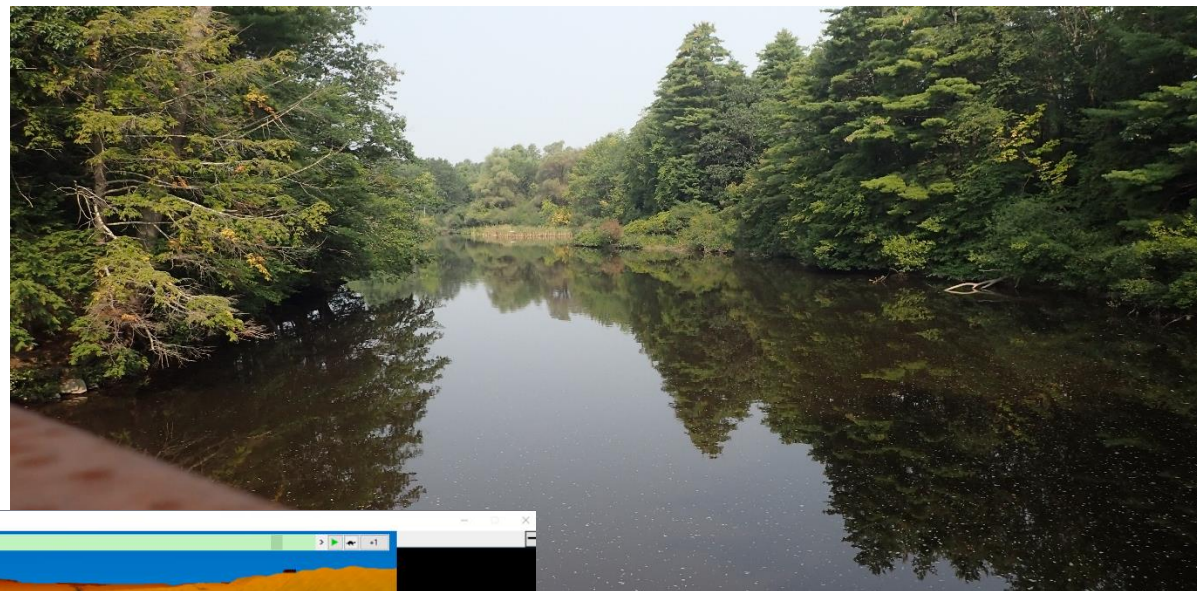


APPROX.
EXISTING WATER
LEVEL

MODEL HEIGHTS EXAGGERATED X3



ROYAL RIVER TSP - LOOKING UPSTREAM FROM BETH CONDON MEMORIAL PEDESTRIAN BRIDGE



APPROX.
EXISTING WATER
LEVEL

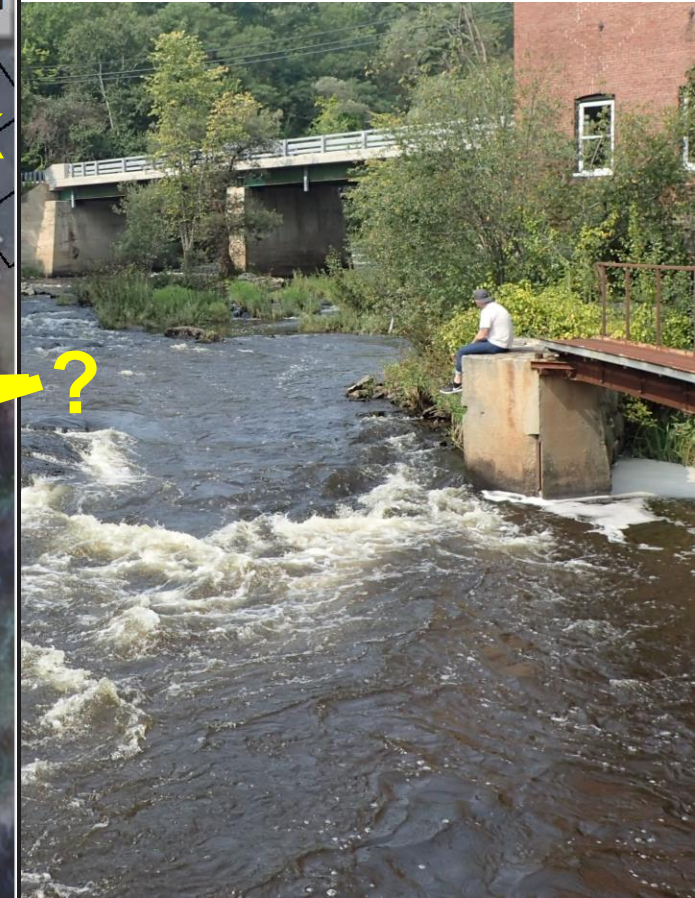
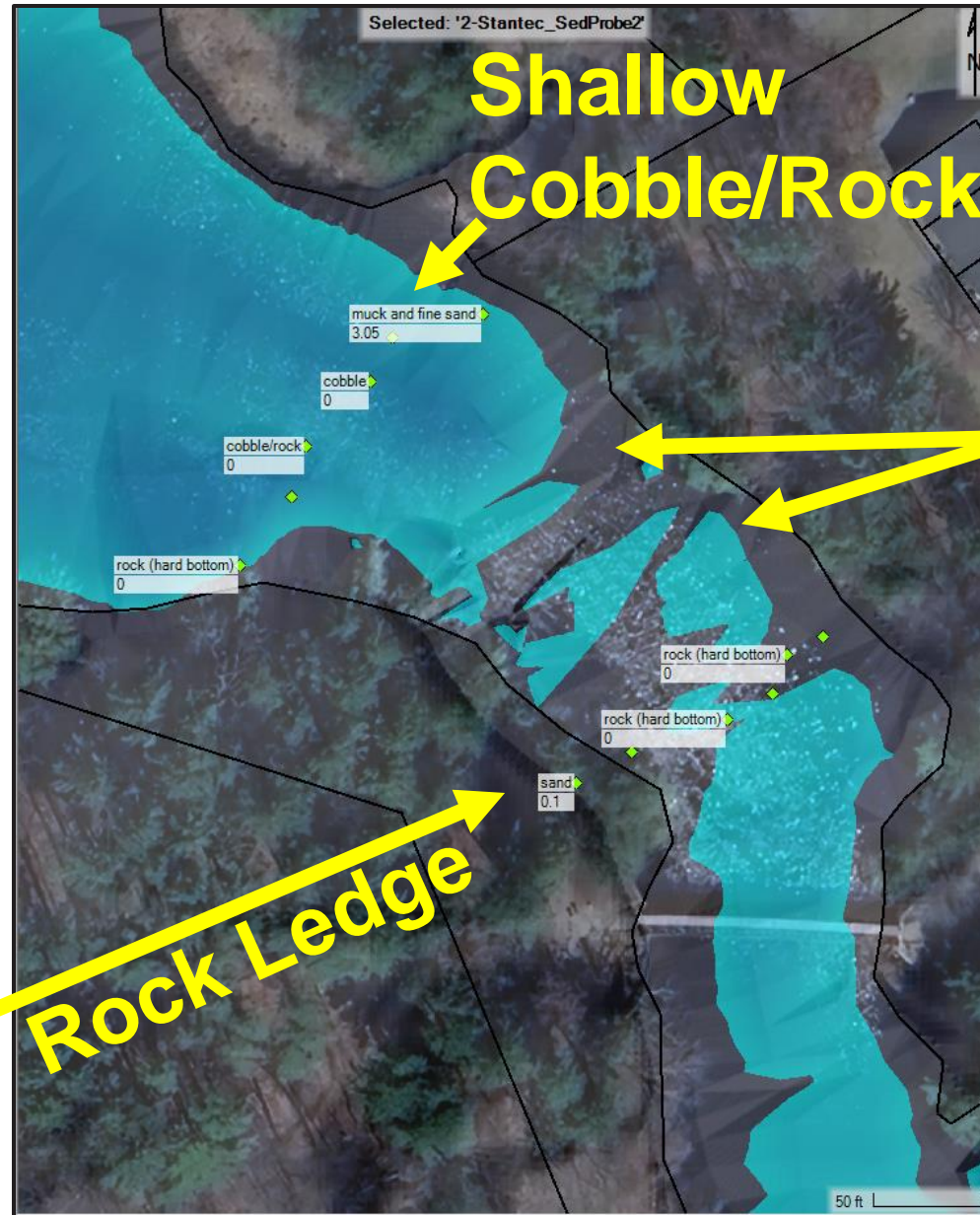
MODEL HEIGHTS EXAGGERATED
X3



ROCK LEDGE UPSTREAM OF PEDESTRIAN BRIDGE

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SEDIMENT PROBE DATA

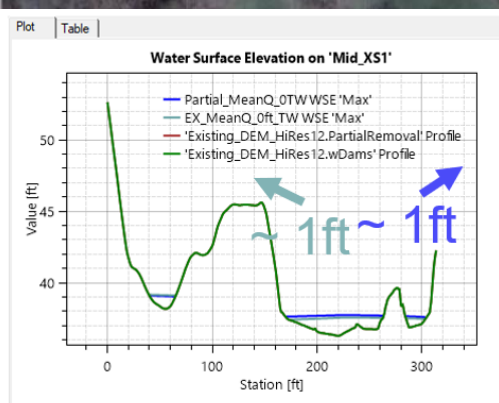
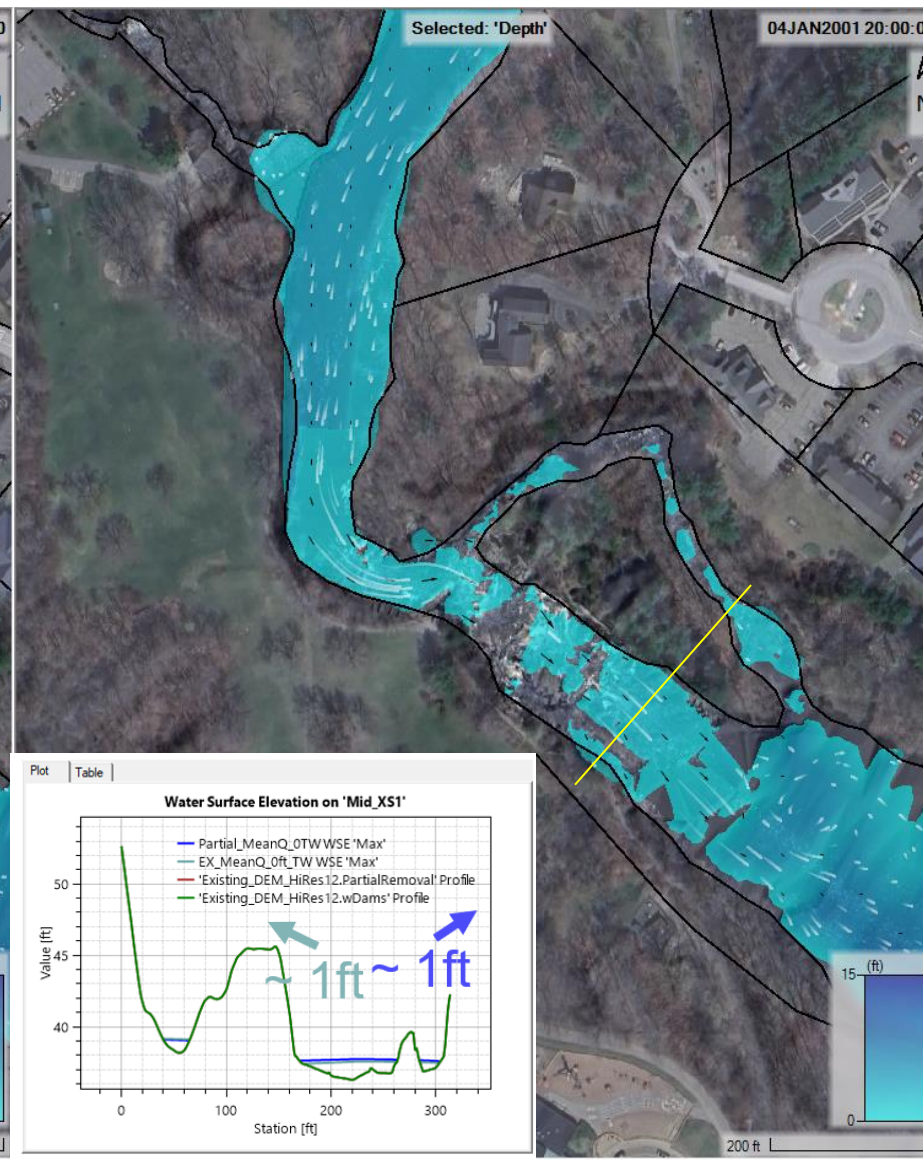




DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW MIDDLE FALLS

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

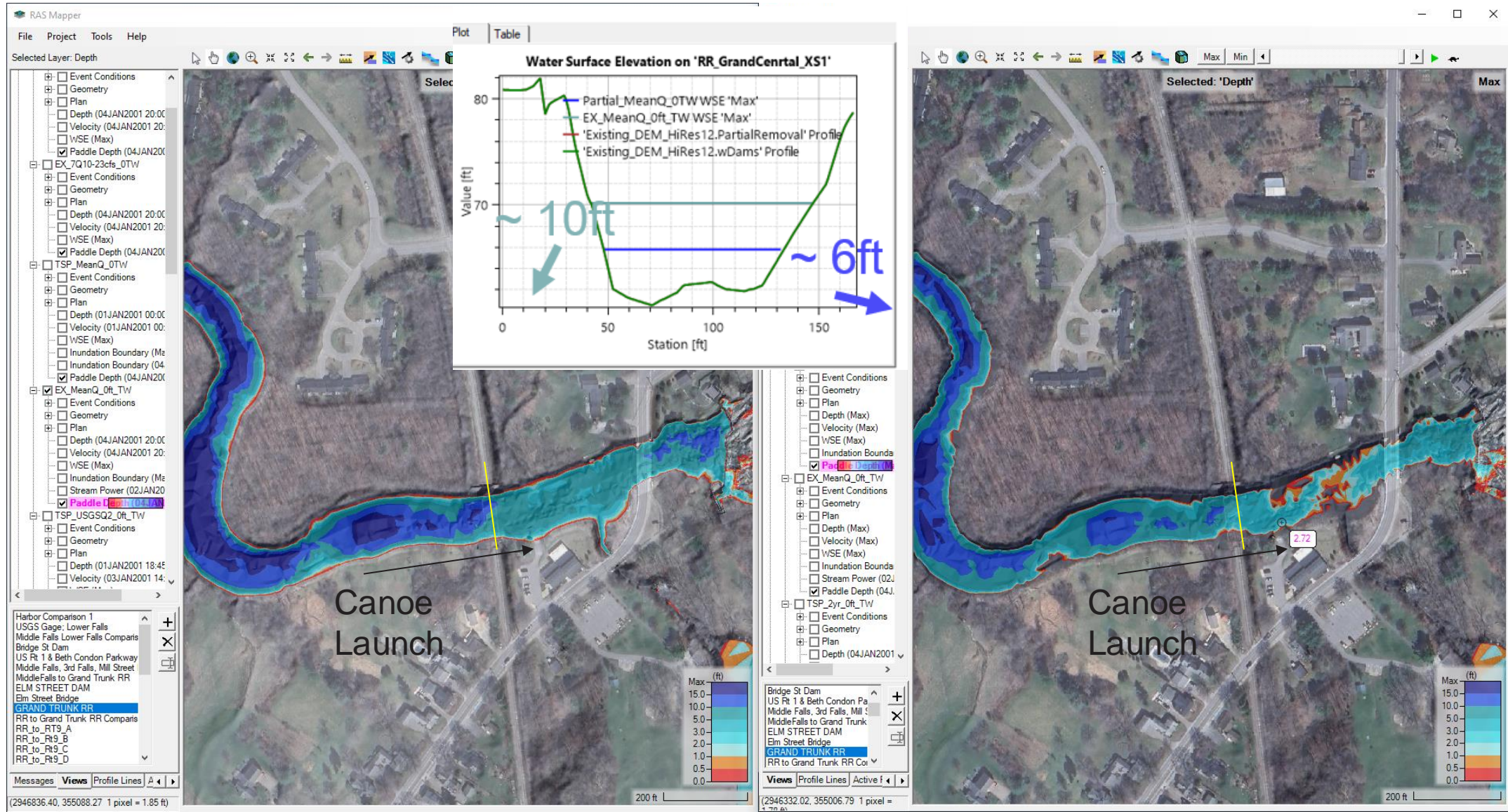


**'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE
DAILY FLOW**

ROYAL RIVER PARK CANOE LAUNCH

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



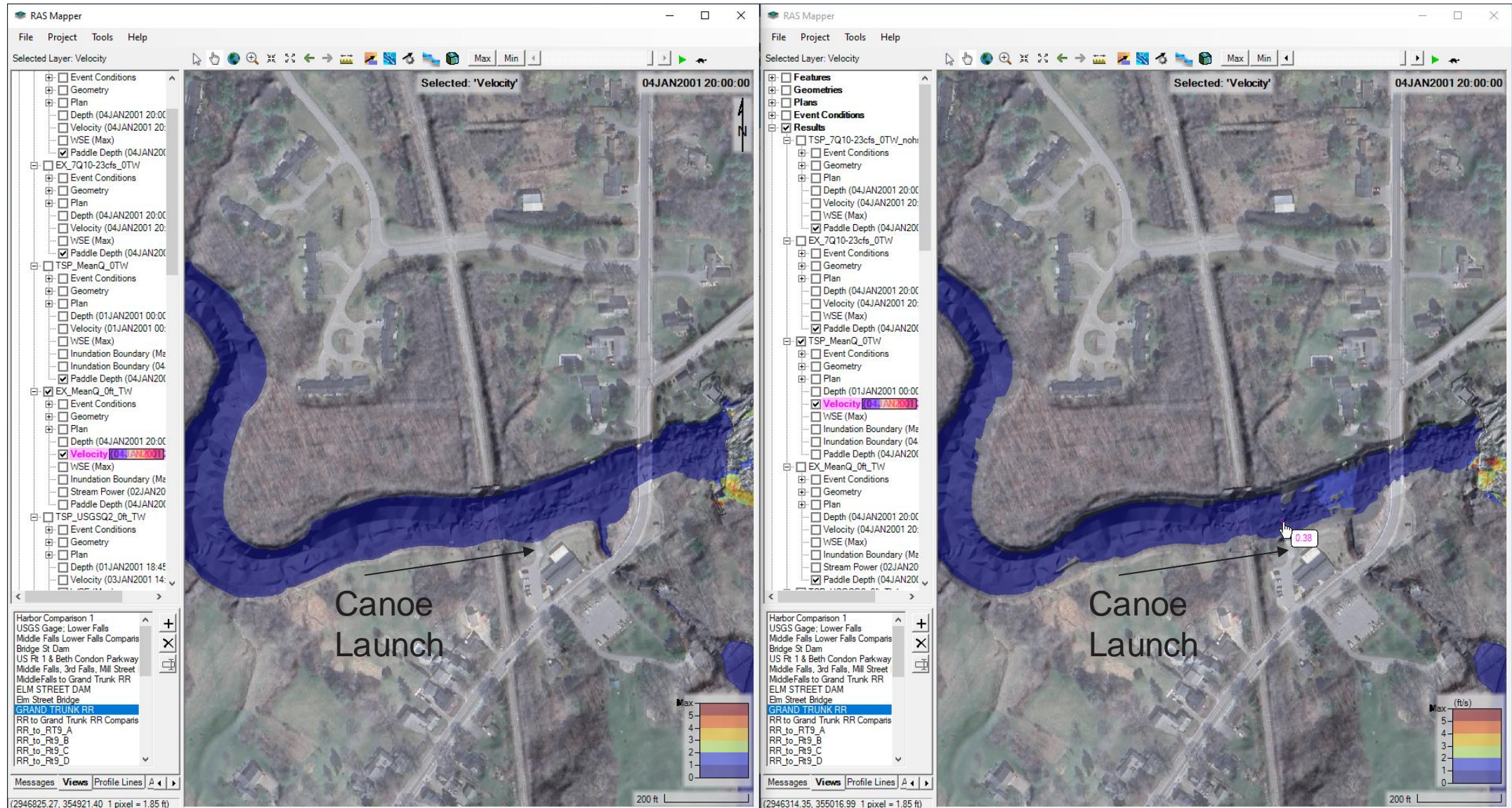


VELOCITY COMPARISON– ANNUAL MEDIAN AVERAGE DAILY FLOW

ROYAL RIVER PARK CANOE LAUNCH

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN





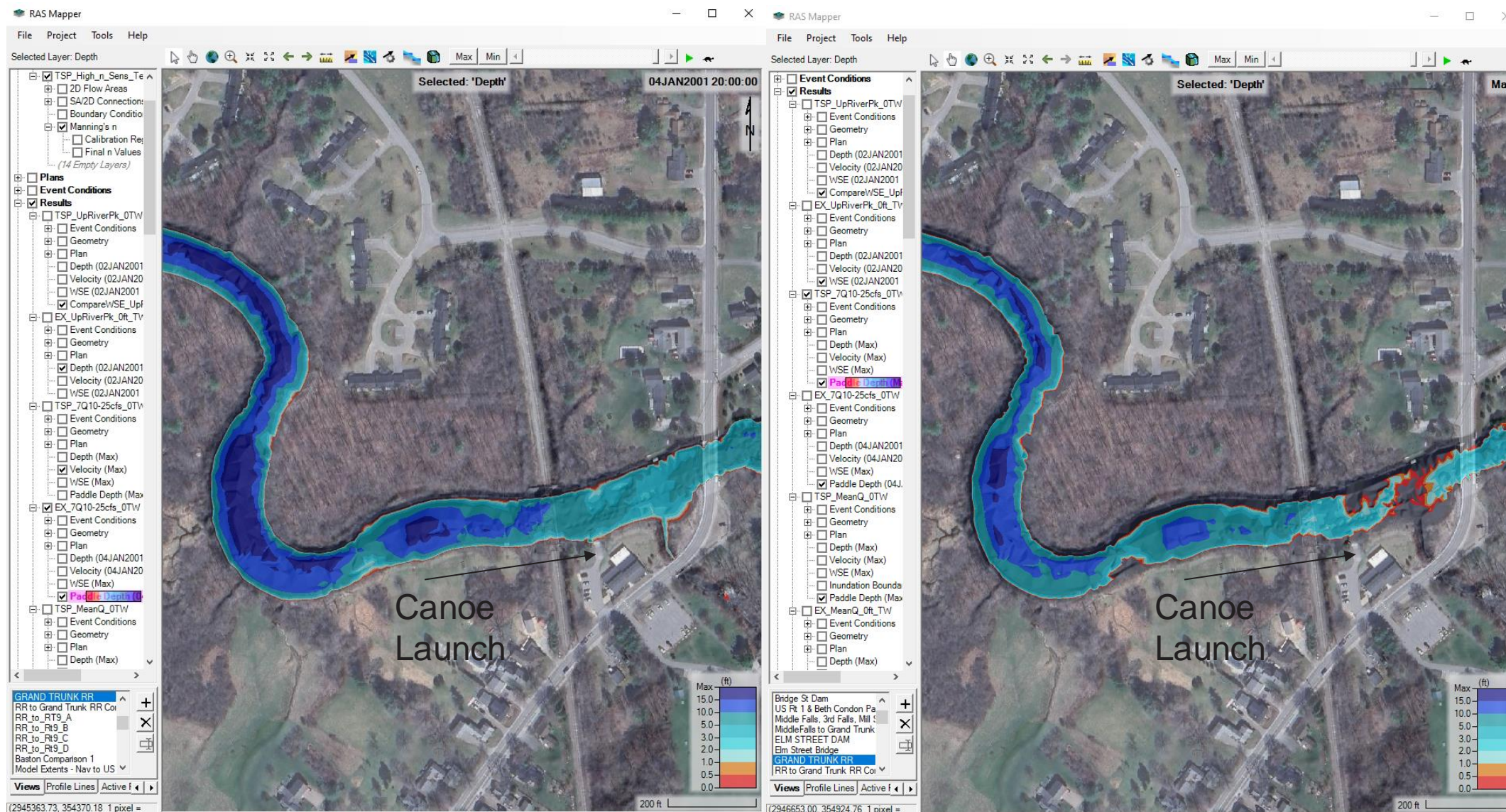
'PADDLE' DEPTH COMPARISON – 7Q10 LOW FLOW

27

ROYAL RIVER PARK CANOE LAUNCH

EXISTING CONDITIONS

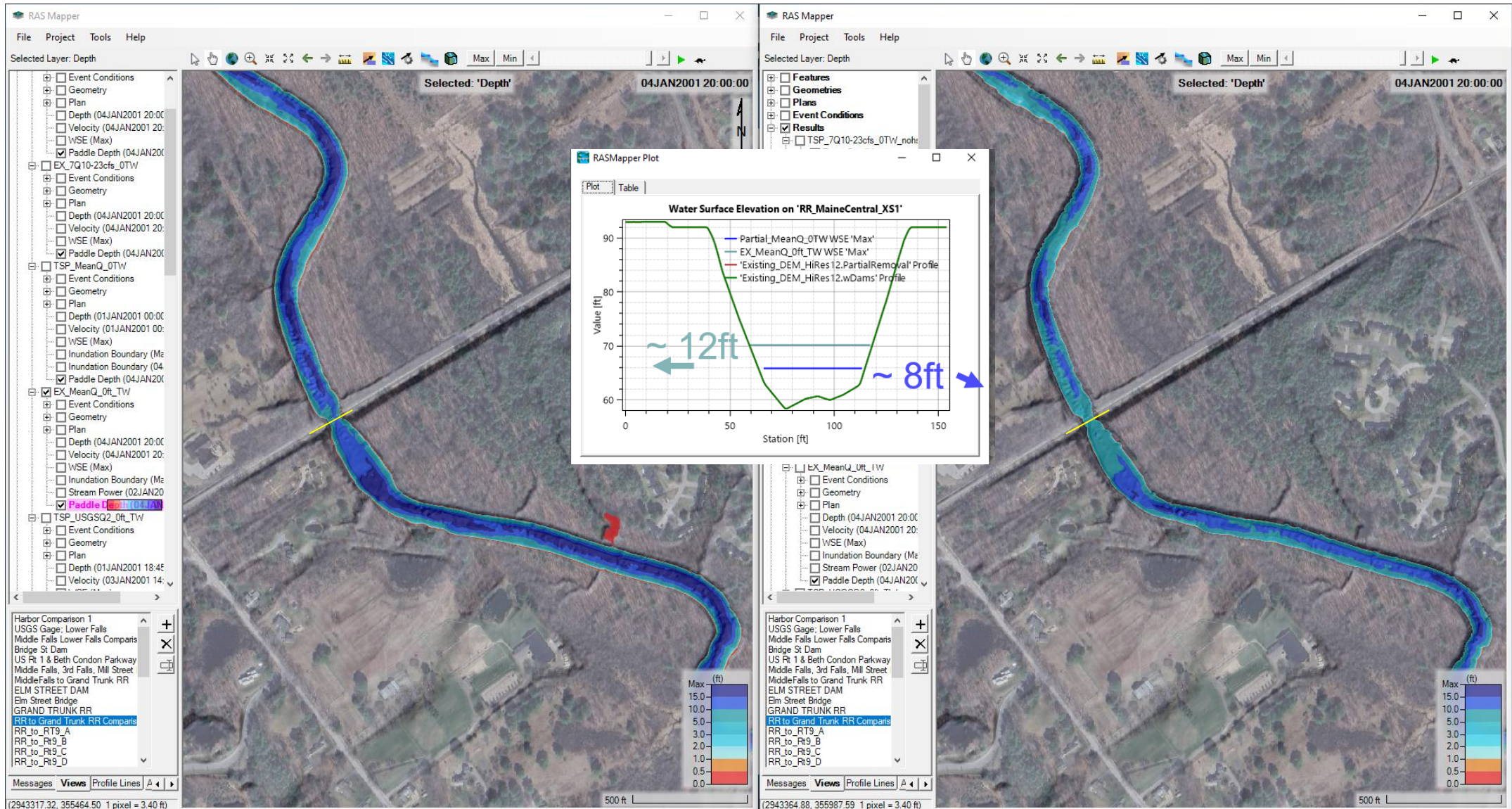
TENTATIVELY SELECTED PLAN





'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW MAINE CENTRAL RR EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

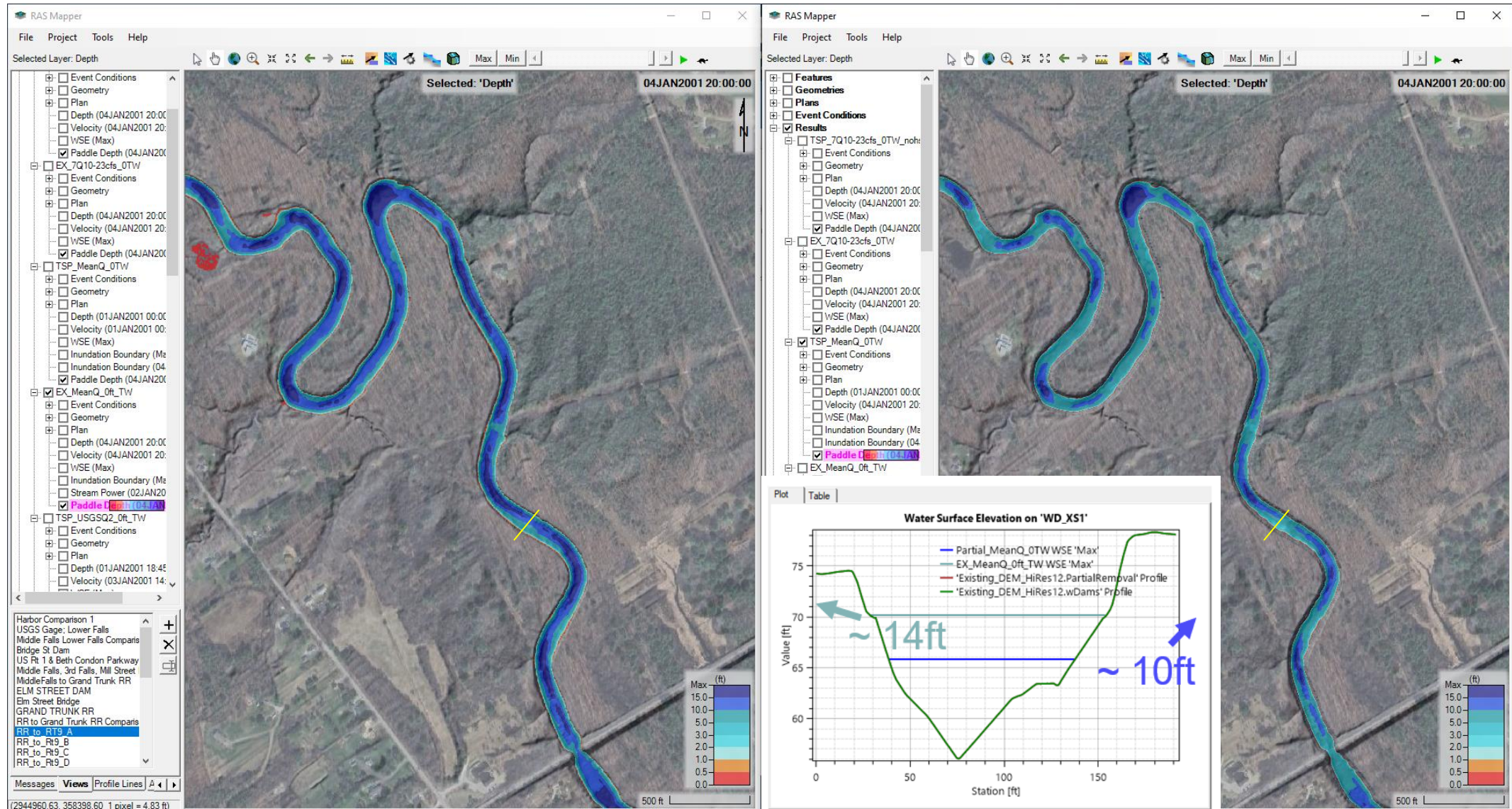




'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW UPSTREAM OF MAINE CENTRAL RR (1)

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

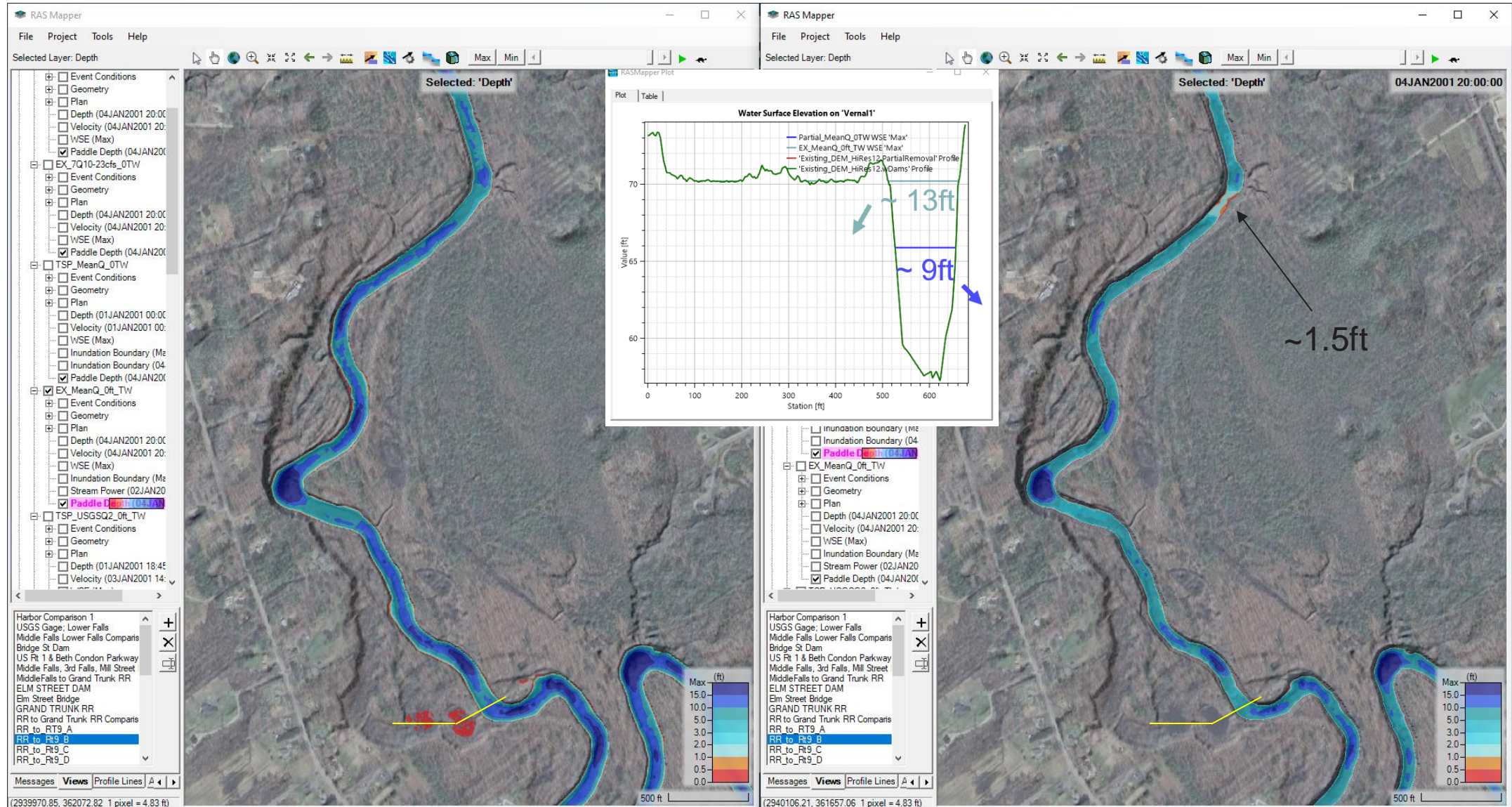




'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW UPSTREAM OF MAINE CENTRAL RR (2)

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

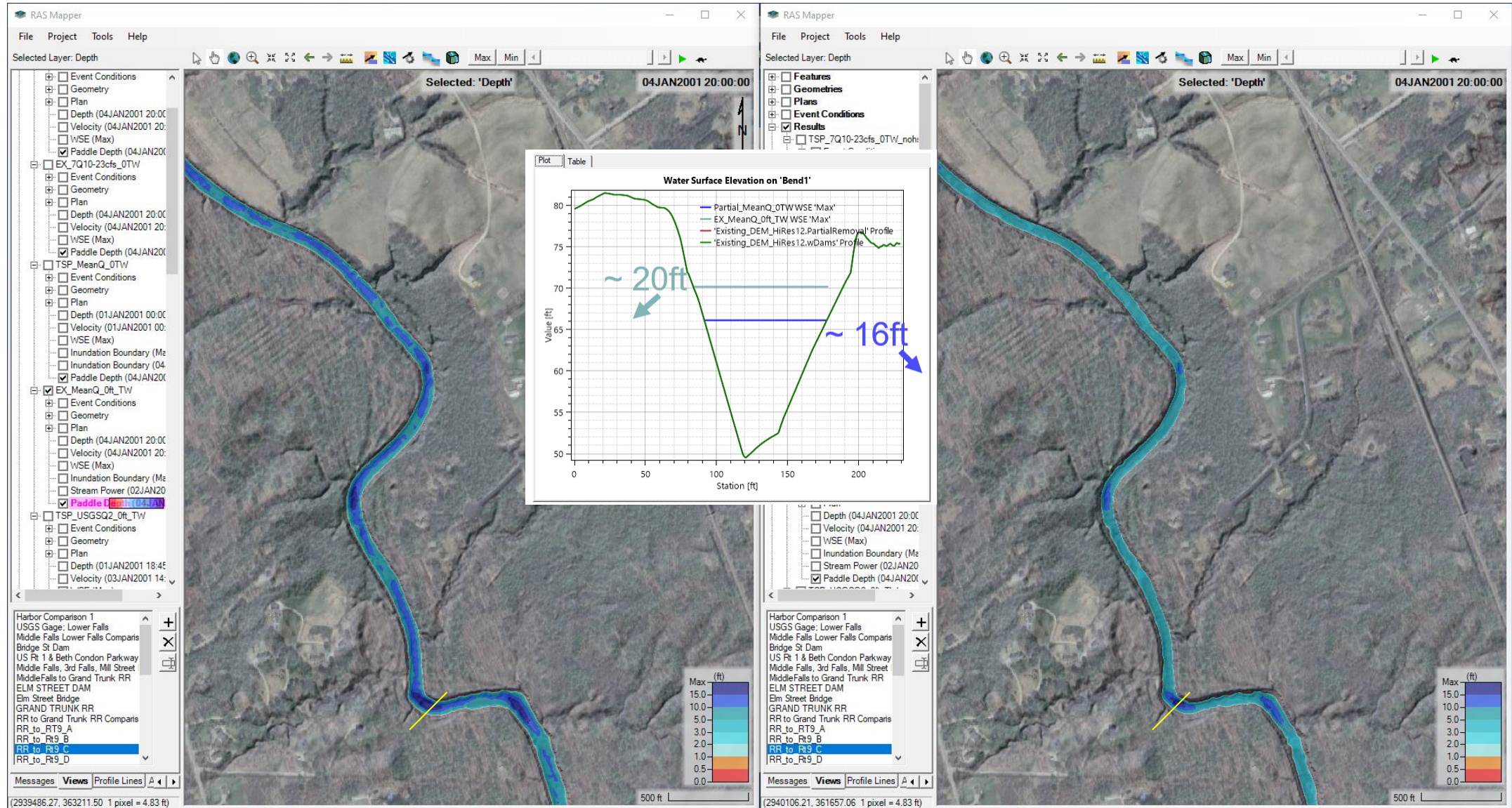




'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW UPSTREAM OF MAINE CENTRAL RR (3)

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

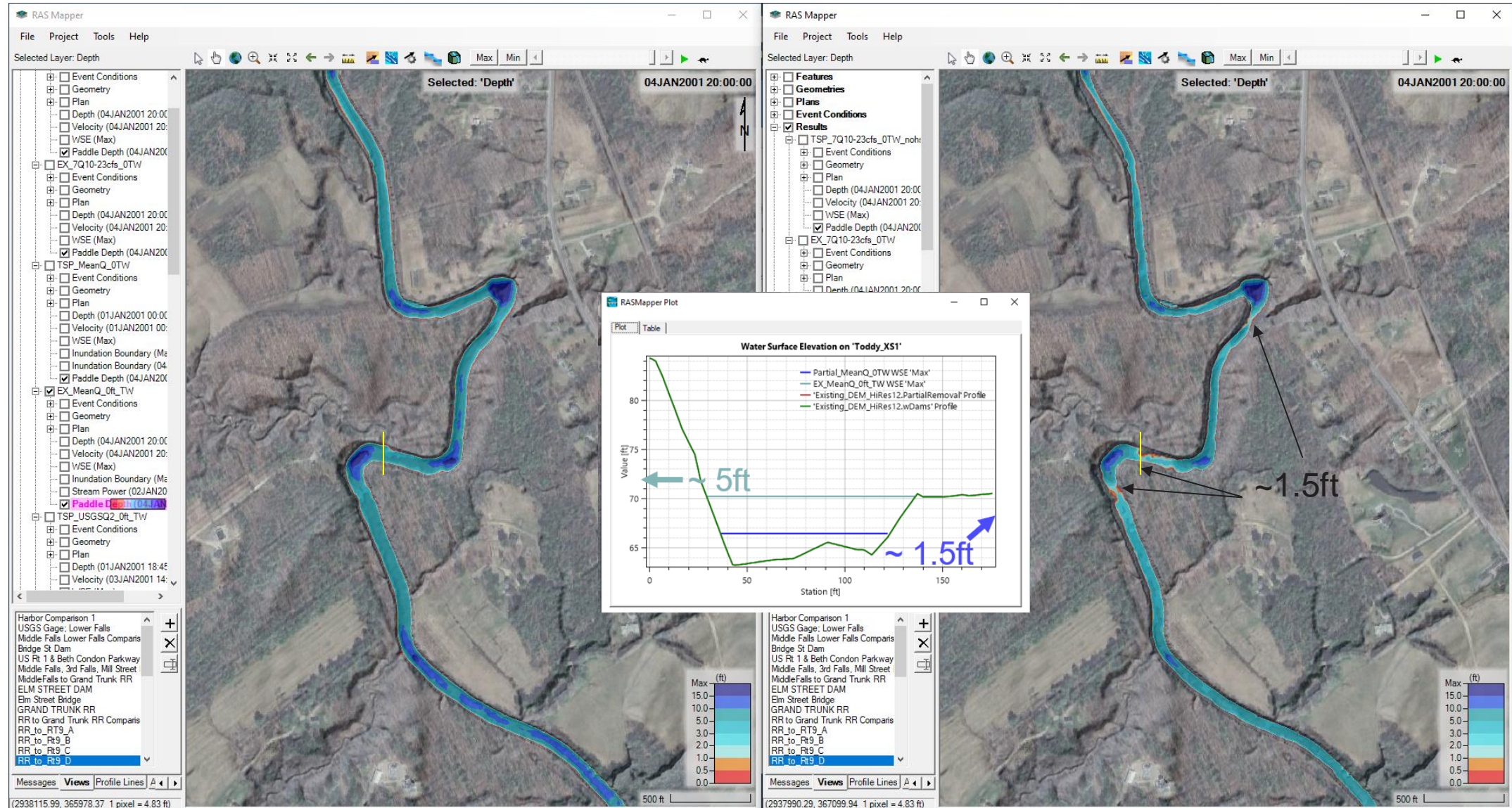




'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW NEAR TODDY BROOK

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



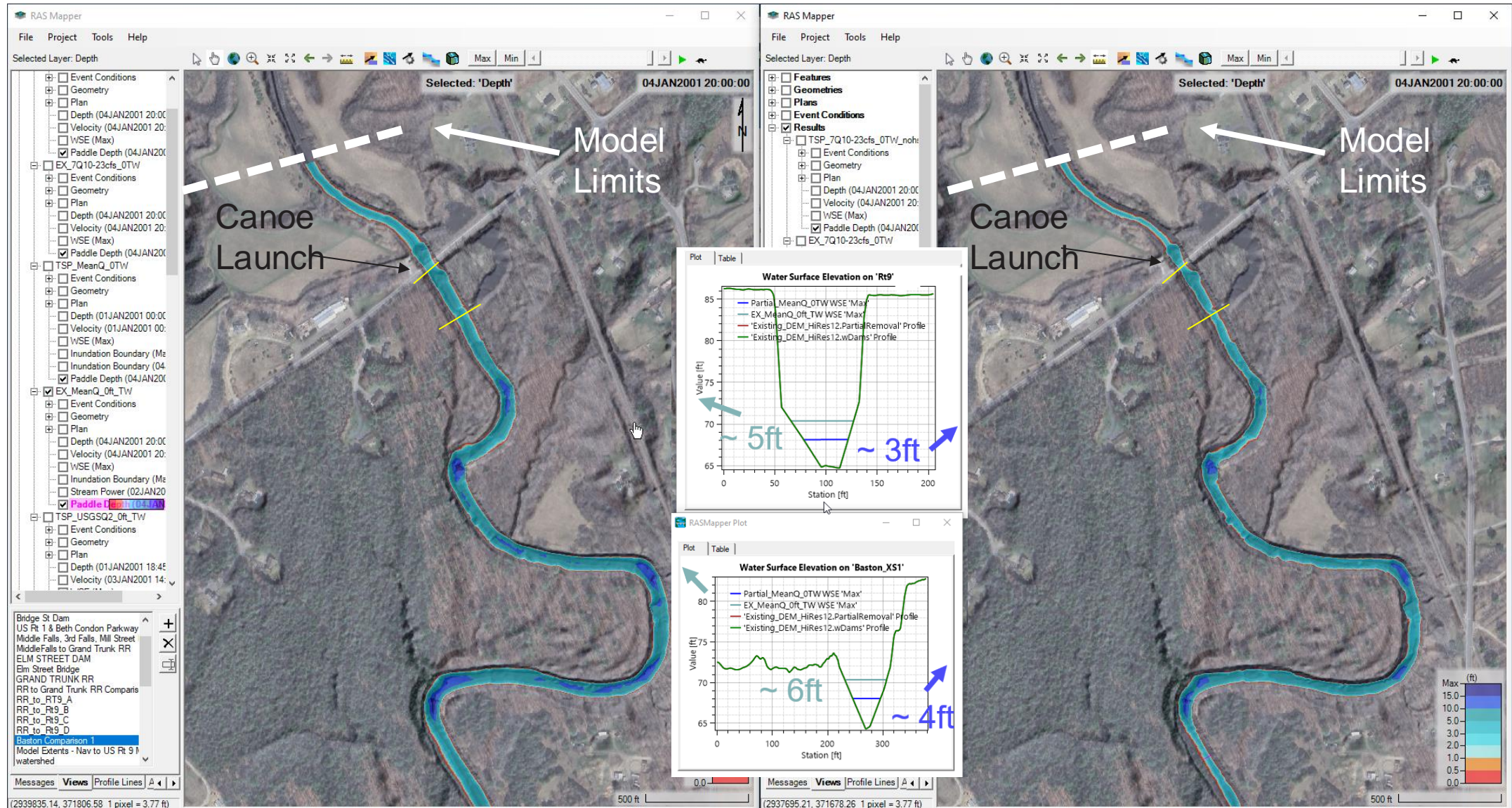


'PADDLE' DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

BASTON PARK / US ROUTE 9

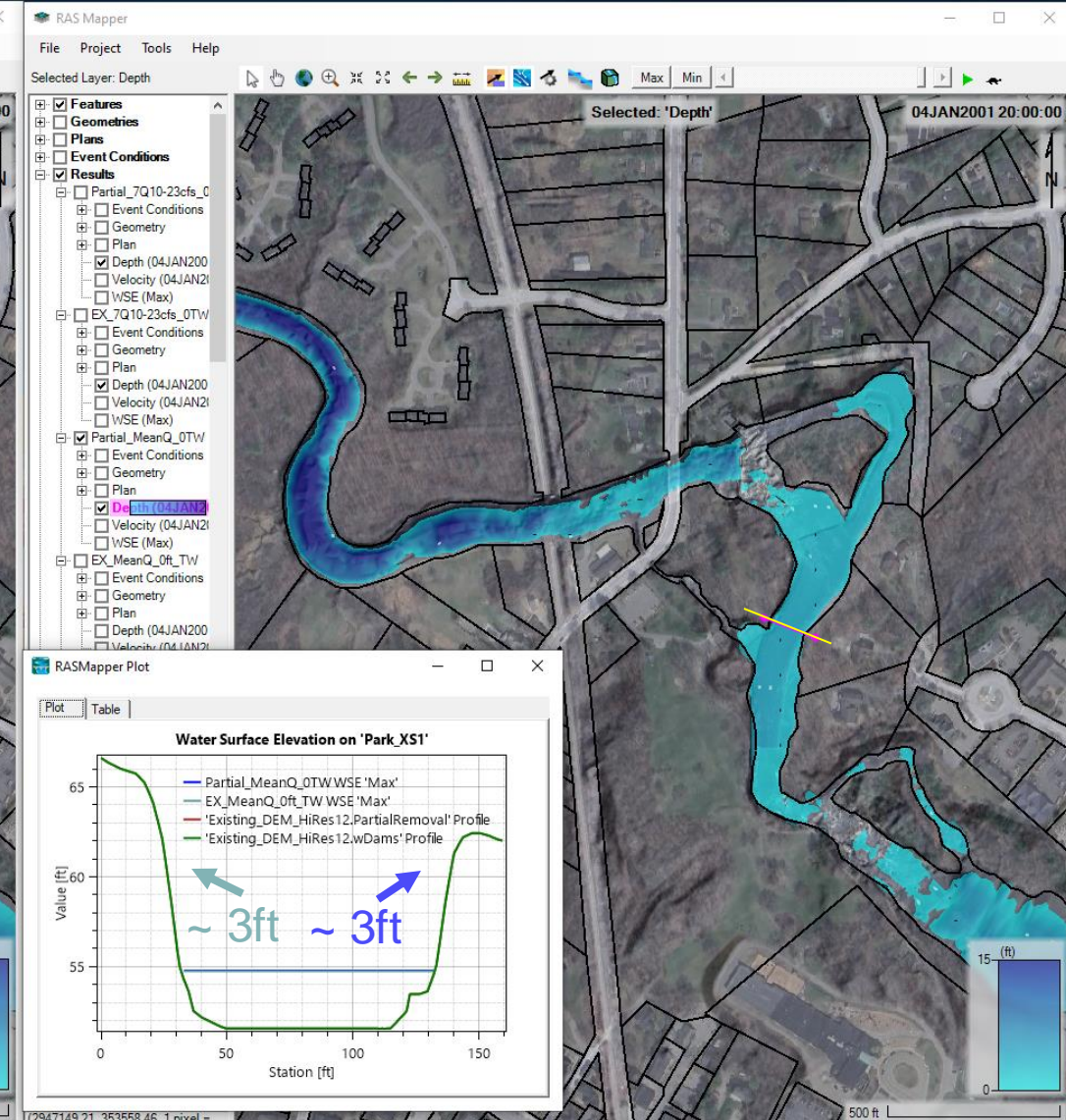
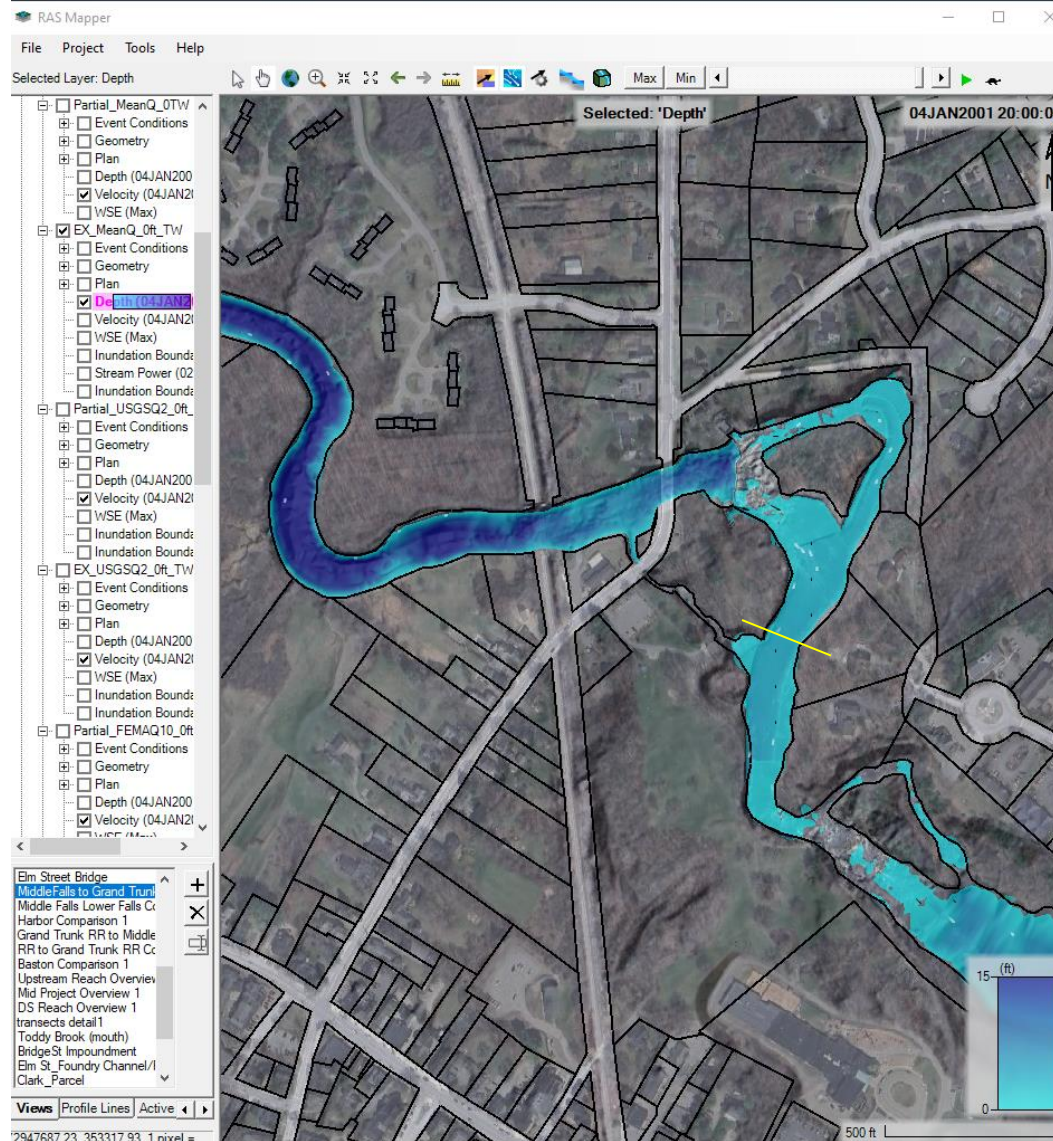
EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

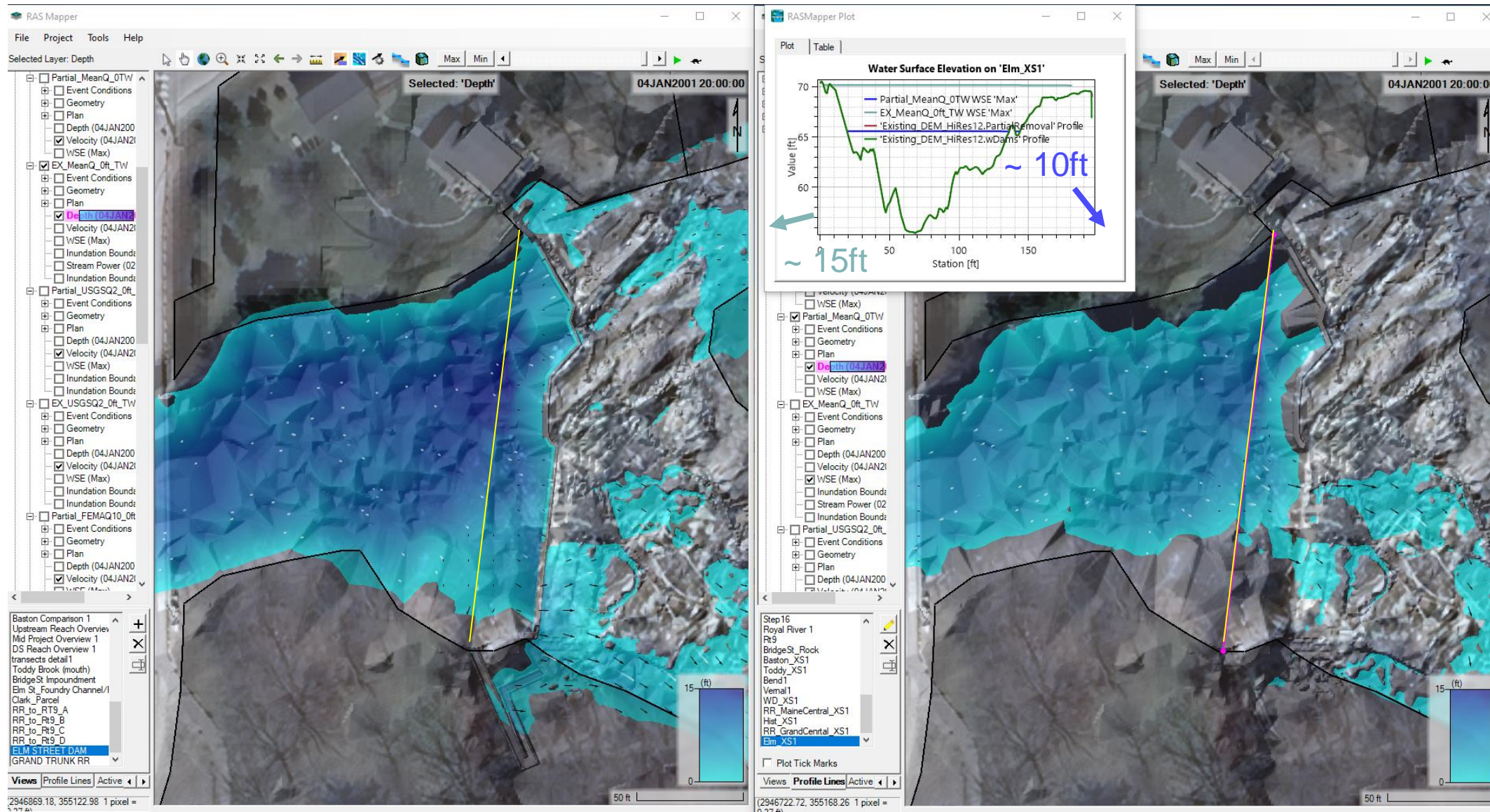




DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW ELM STREET DAM

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

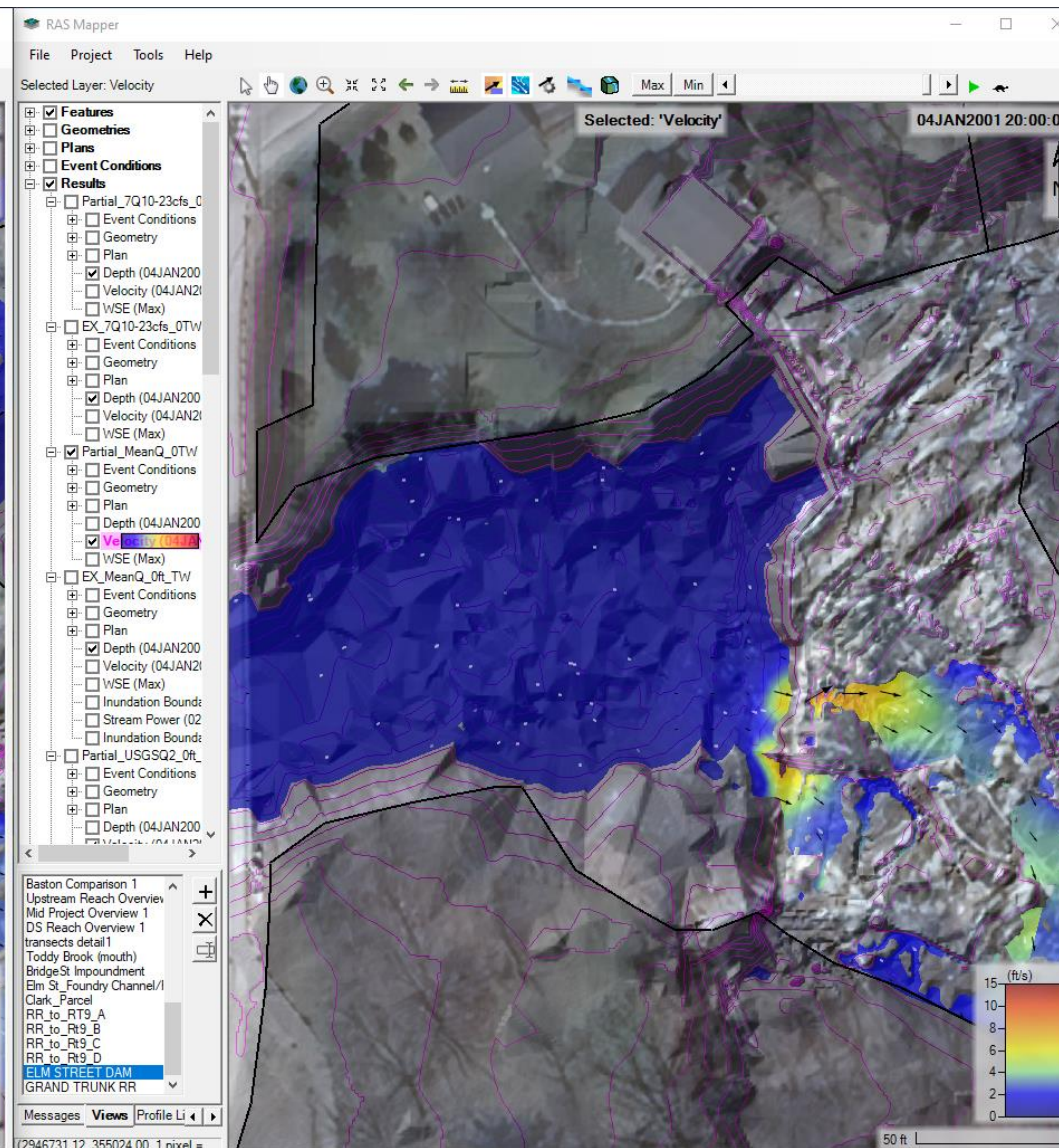
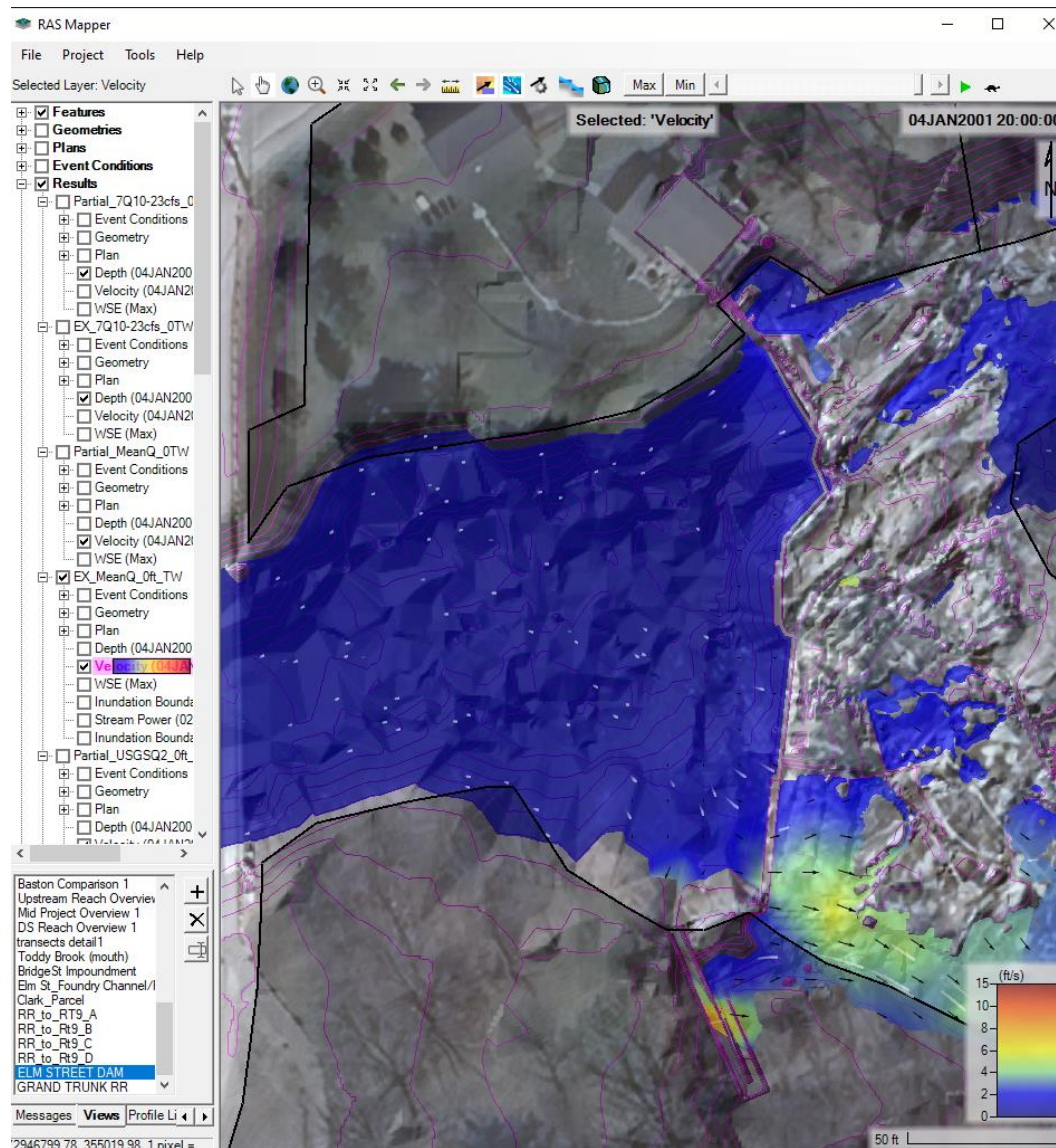




VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW ELM STREET DAM

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



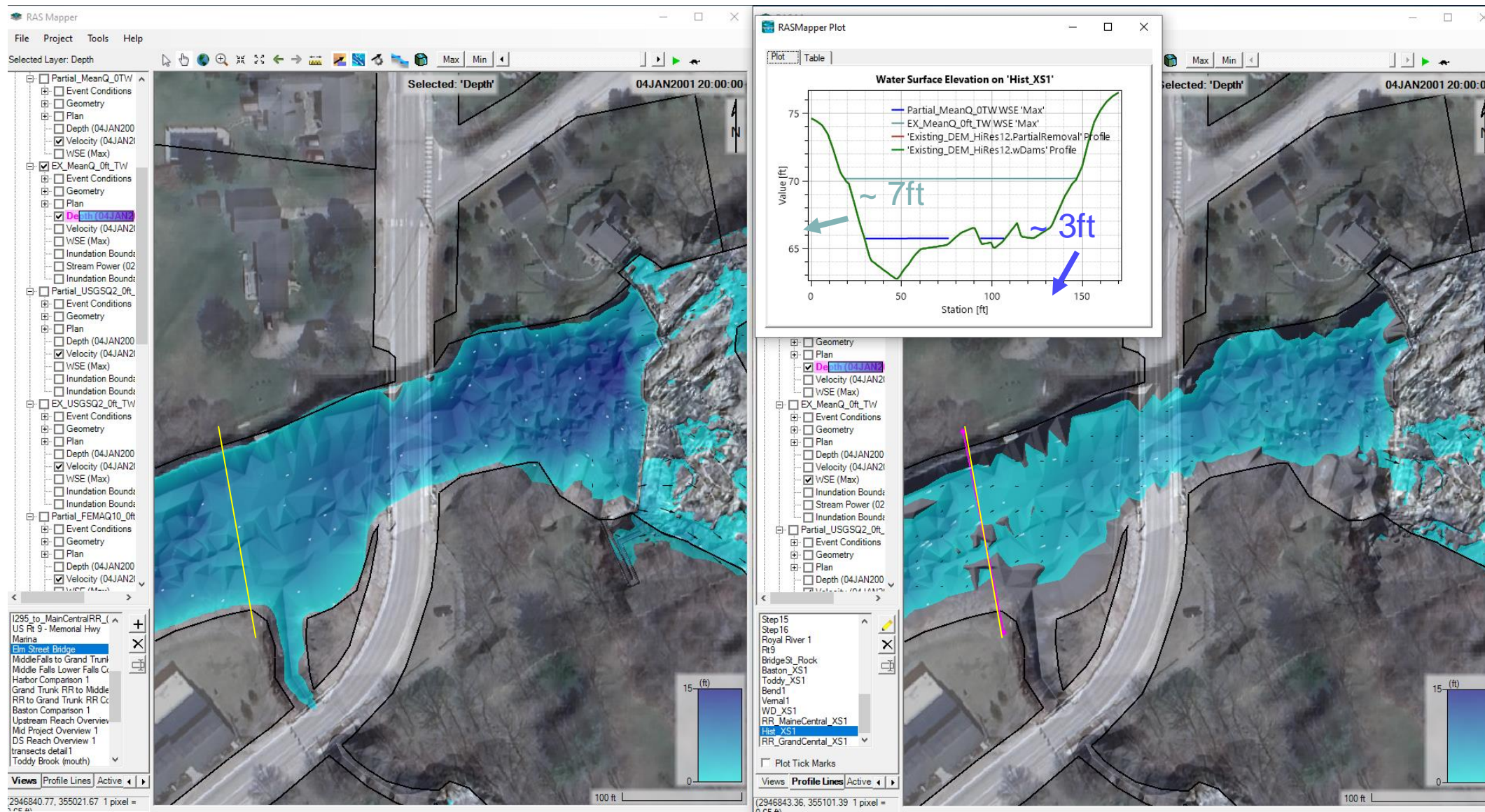


DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

EAST ELM STREET

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



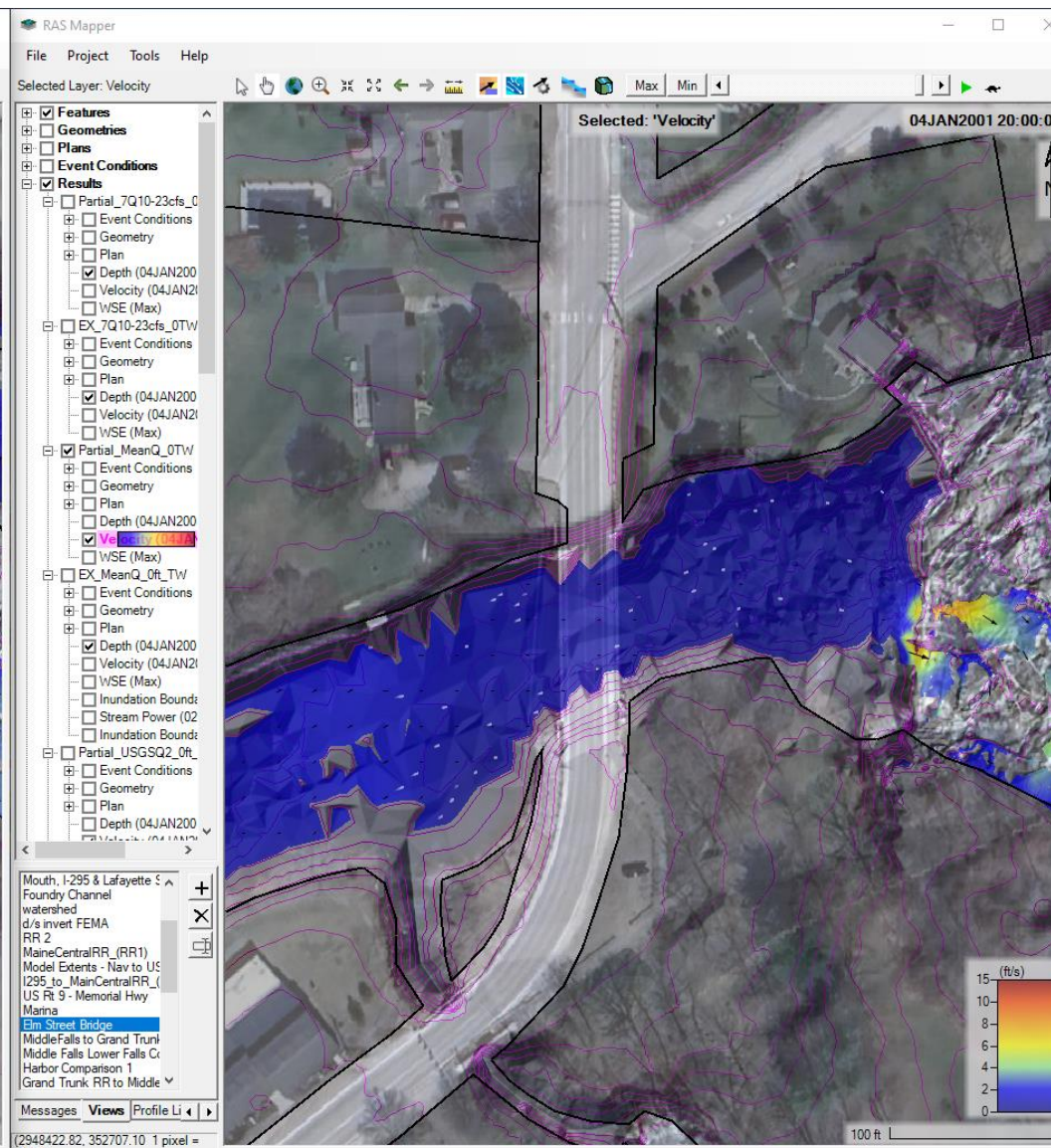
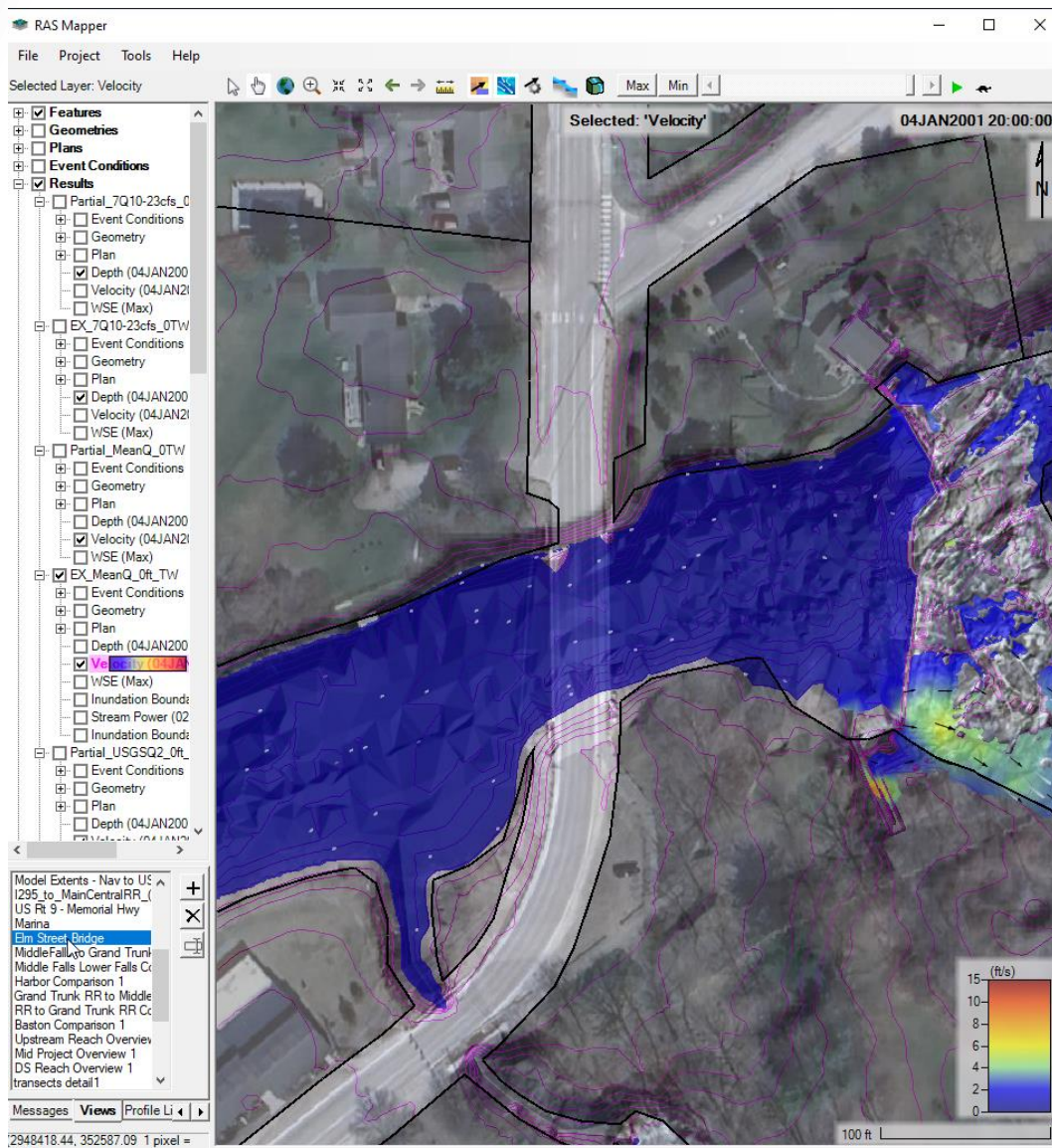


VELOCITY/INUNDATION COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

EAST ELM STREET

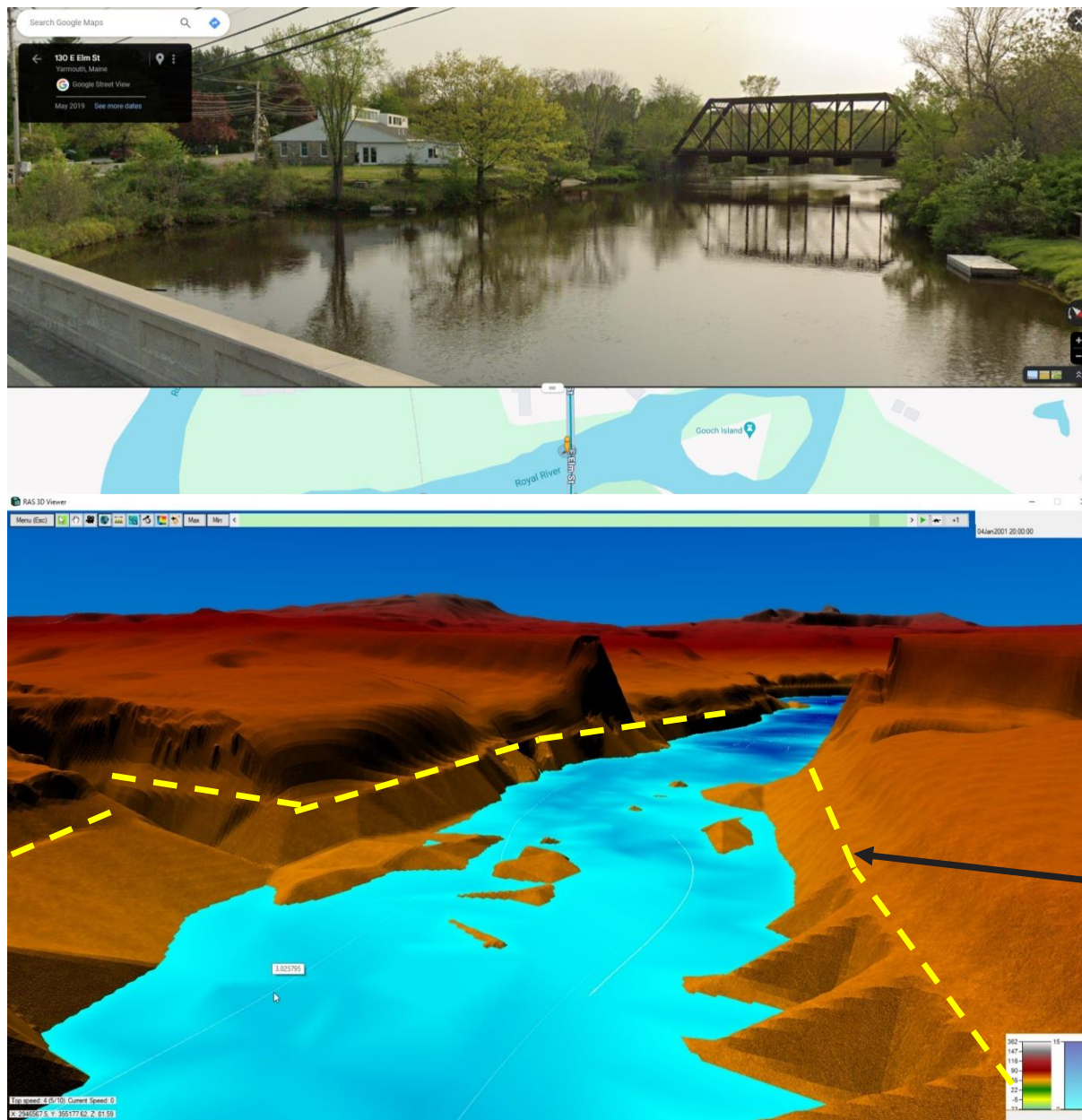
EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN





ROYAL RIVER TSP - LOOKING UPSTREAM FROM EAST ELM STREET BRIDGE

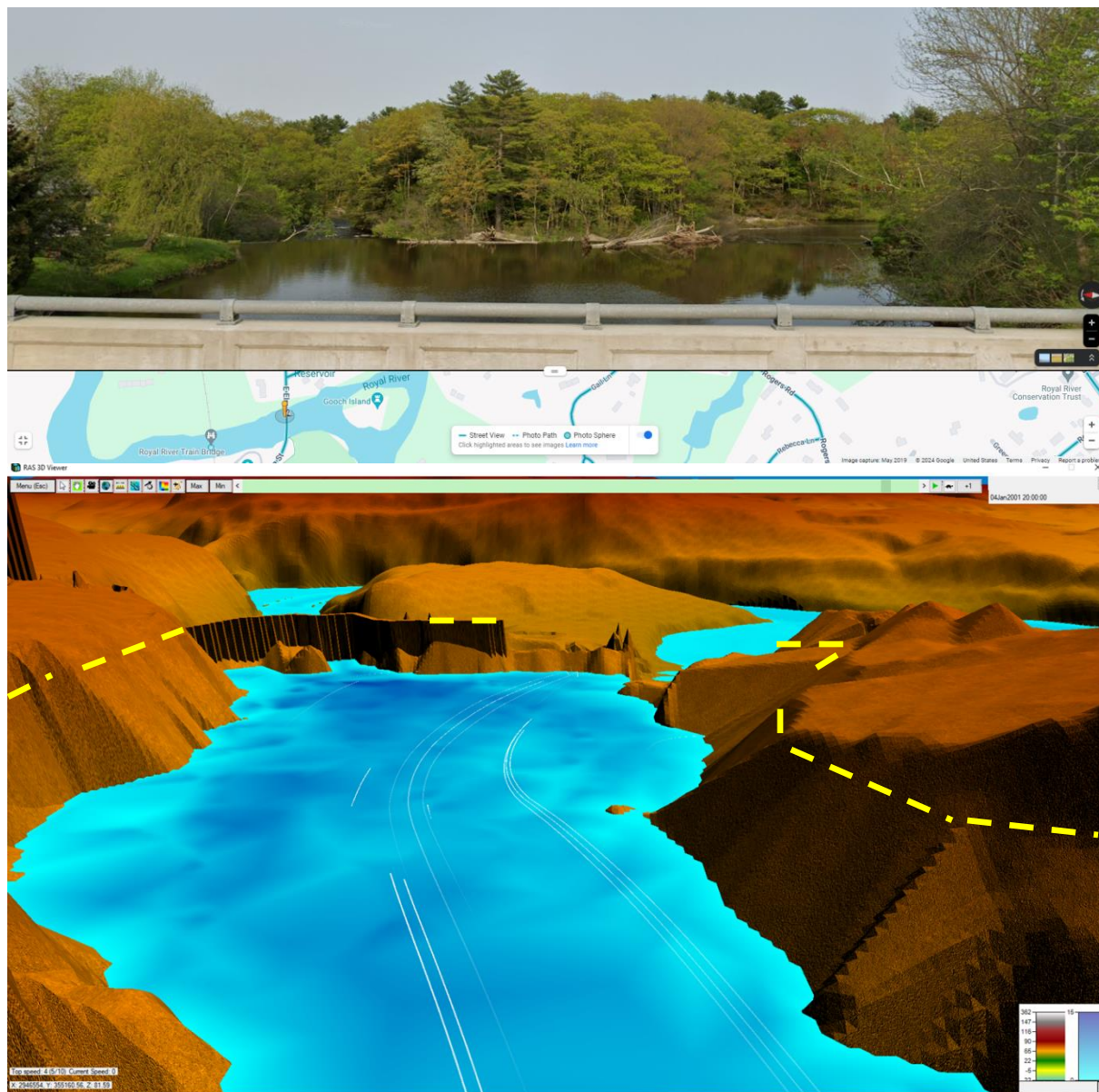


APPROX.
CURRENT WATER
LEVEL

MODEL HEIGHTS
EXAGGERATED
X3



ROYAL RIVER - LOOKING DOWNSTREAM FROM THE ELM STREET BRIDGE



APPROX.
CURRENT WATER
LEVEL



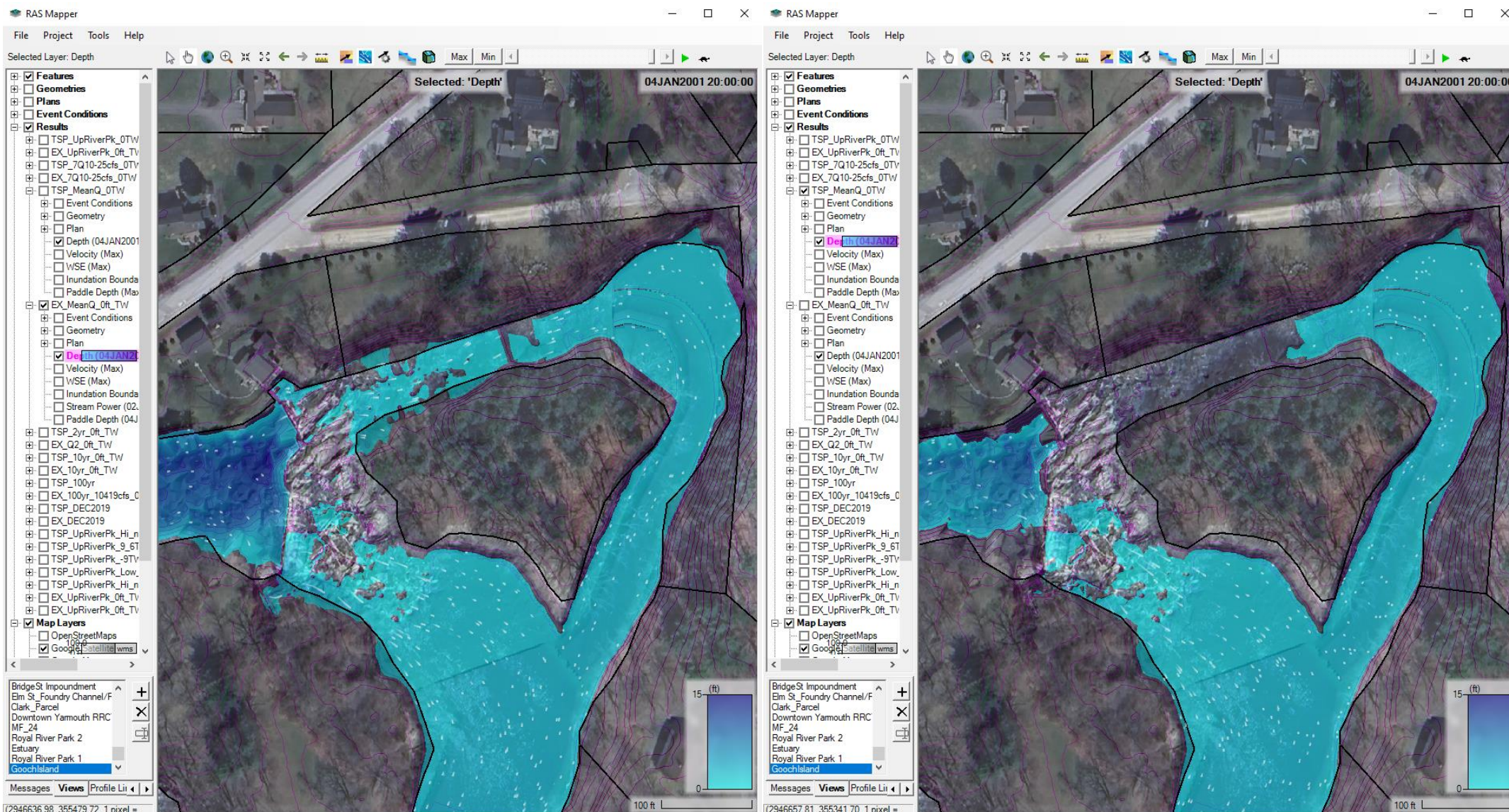
MODEL HEIGHTS
EXAGGERATED
X3



DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW

GOOCH ISLAND

EXISTING CONDITIONS
TENTATIVELY SELECTED PLAN

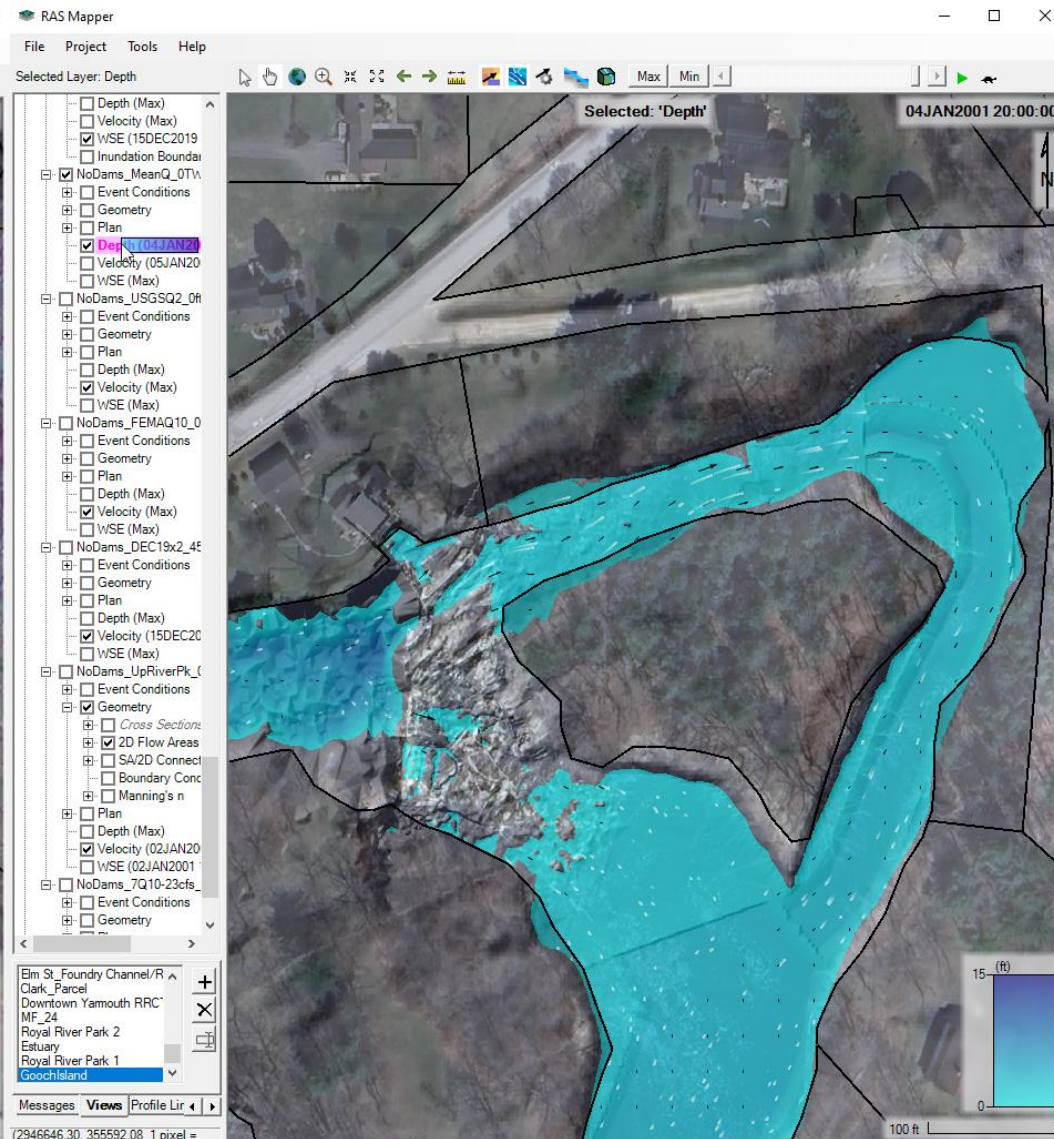
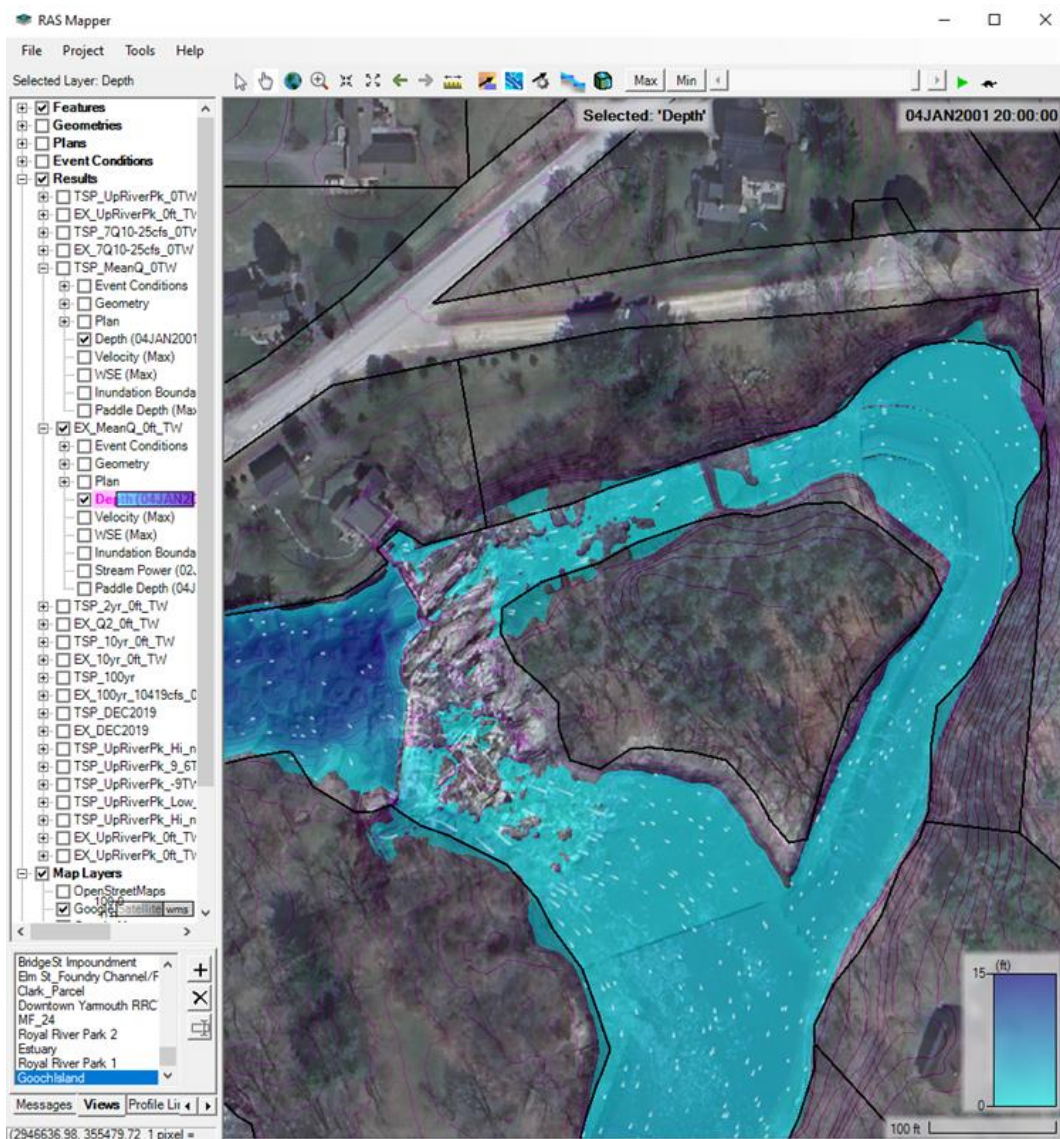




DEPTH COMPARISON – ANNUAL MEDIAN AVERAGE DAILY FLOW GOOCH ISLAND

EXISTING CONDITIONS

FULL REMOVAL



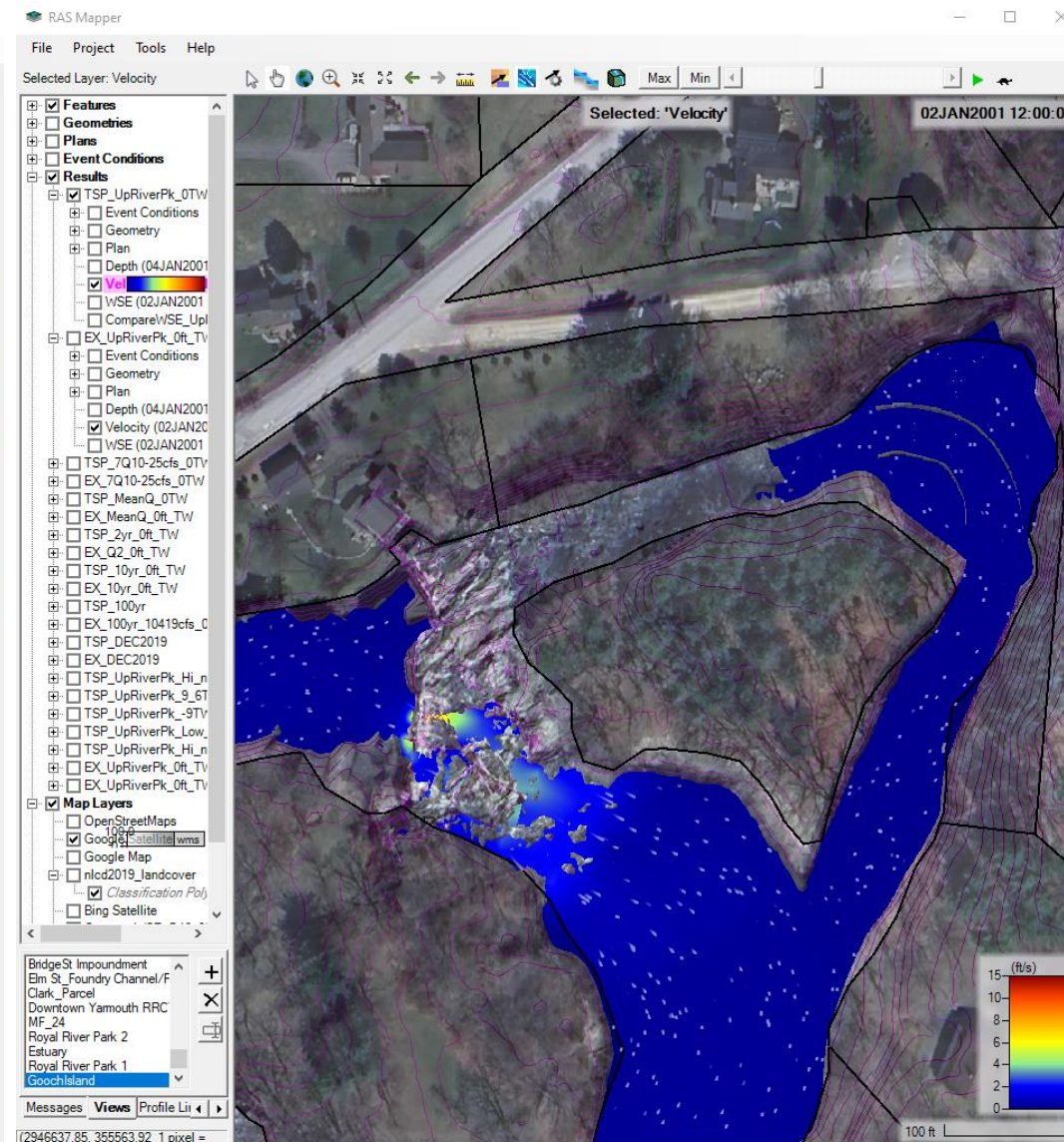
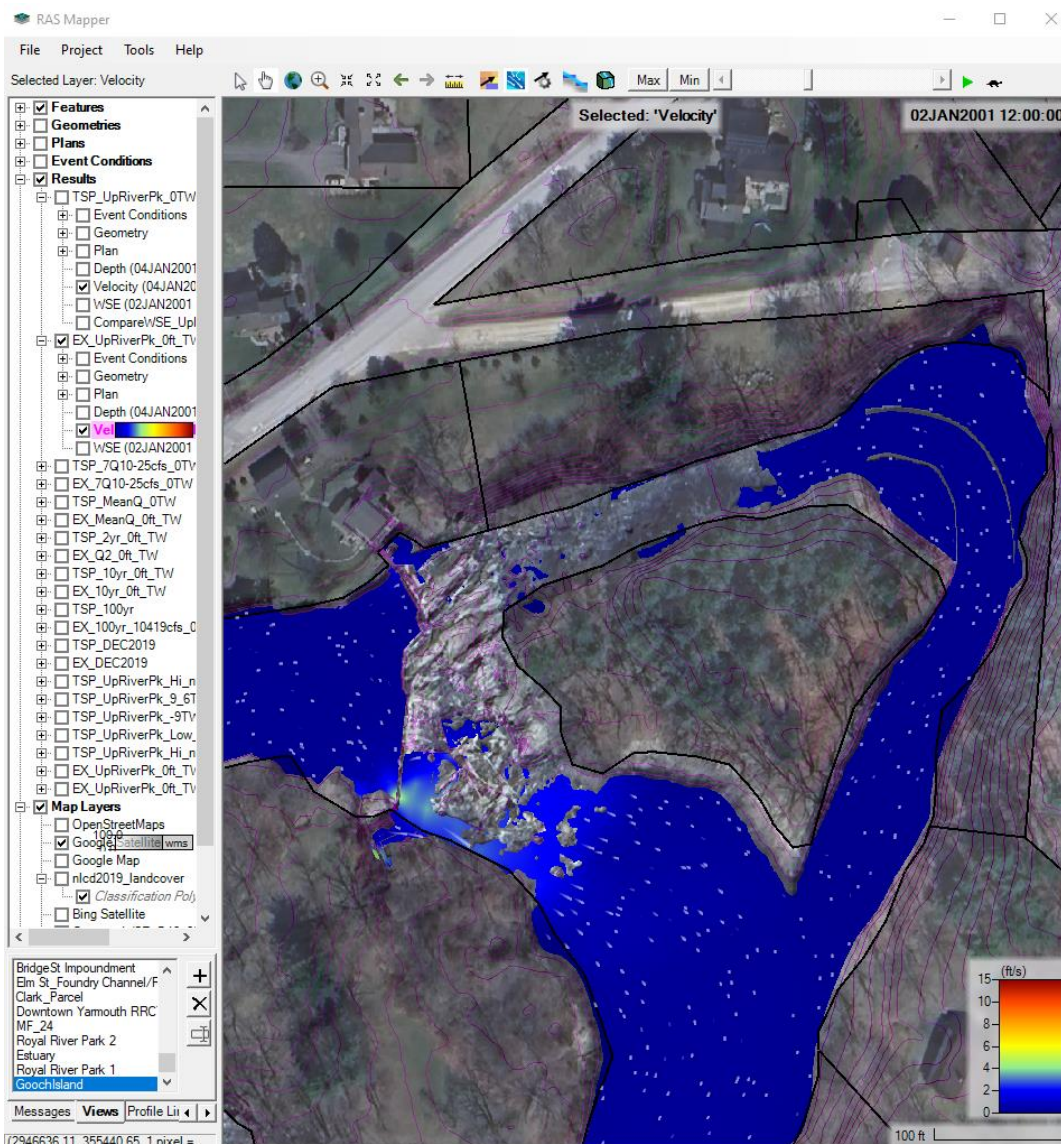


VELOCITY COMPARISON – UPRIVER PEAK MIGRATION 95% FLOW EXCEEDANCE

GOOCH ISLAND

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN



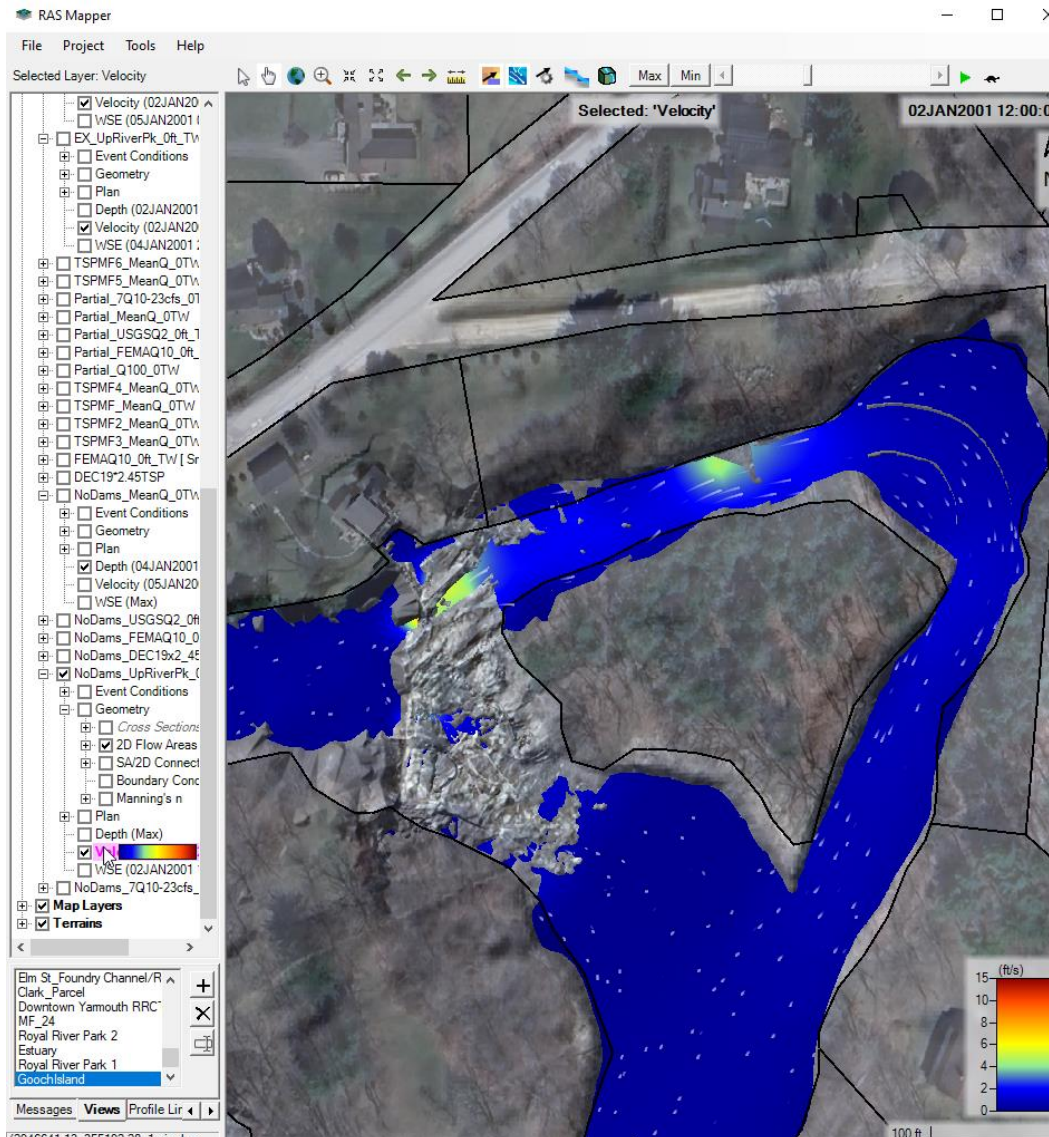
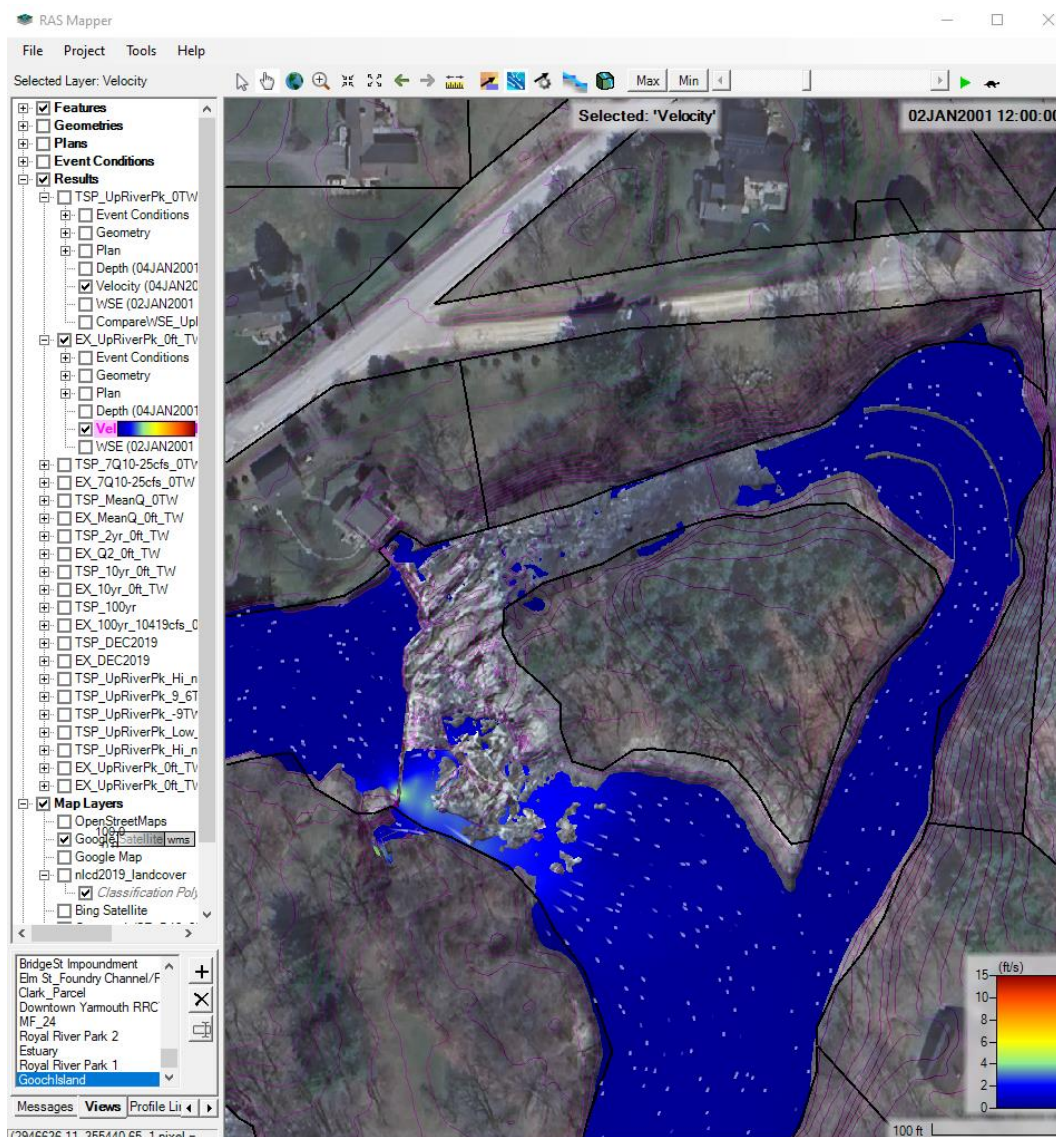


VELOCITY COMPARISON – UPRIVER PEAK MIGRATION 95% FLOW EXCEEDANCE

GOOCH ISLAND

EXISTING CONDITIONS

FULL REMOVAL



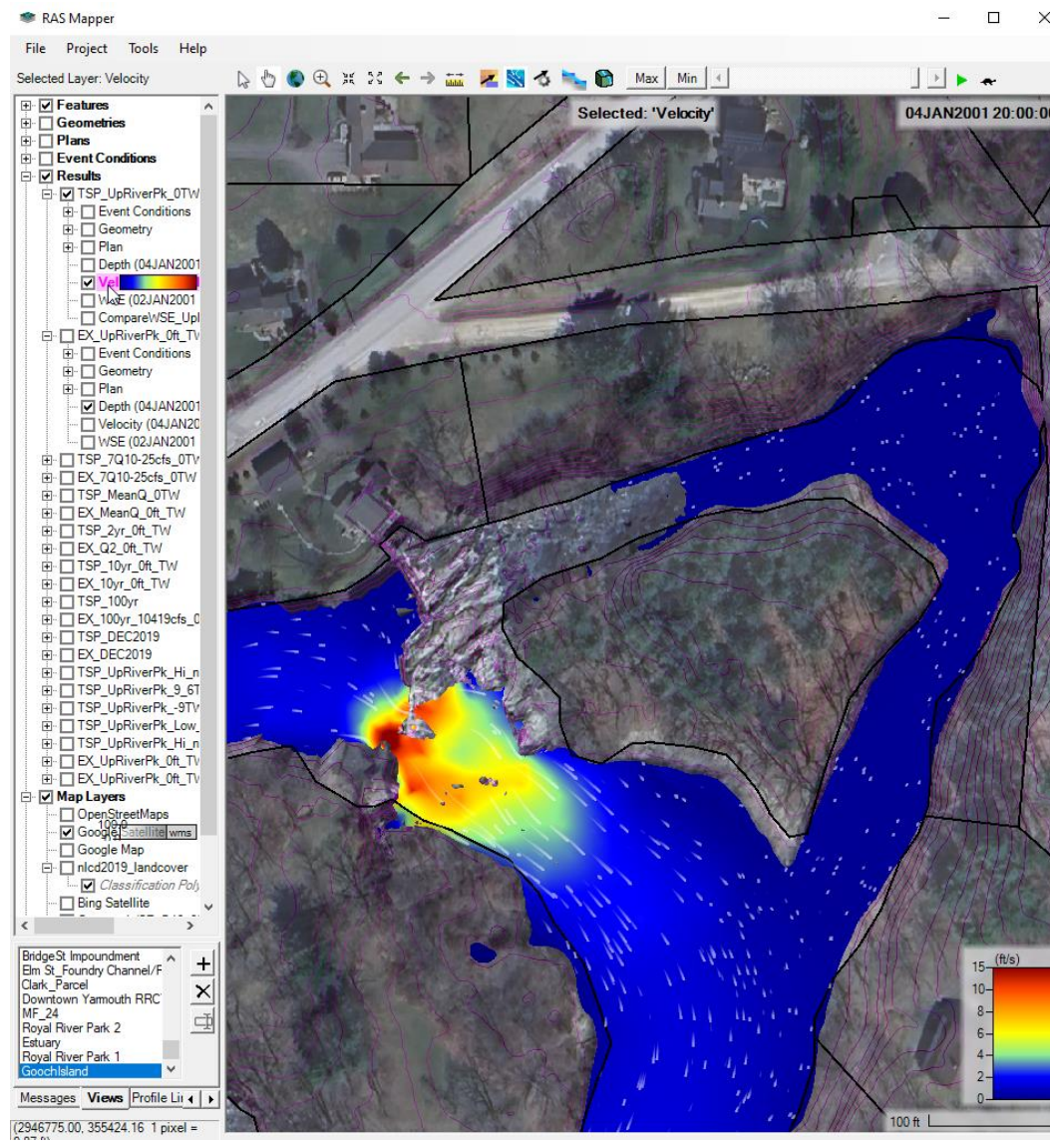
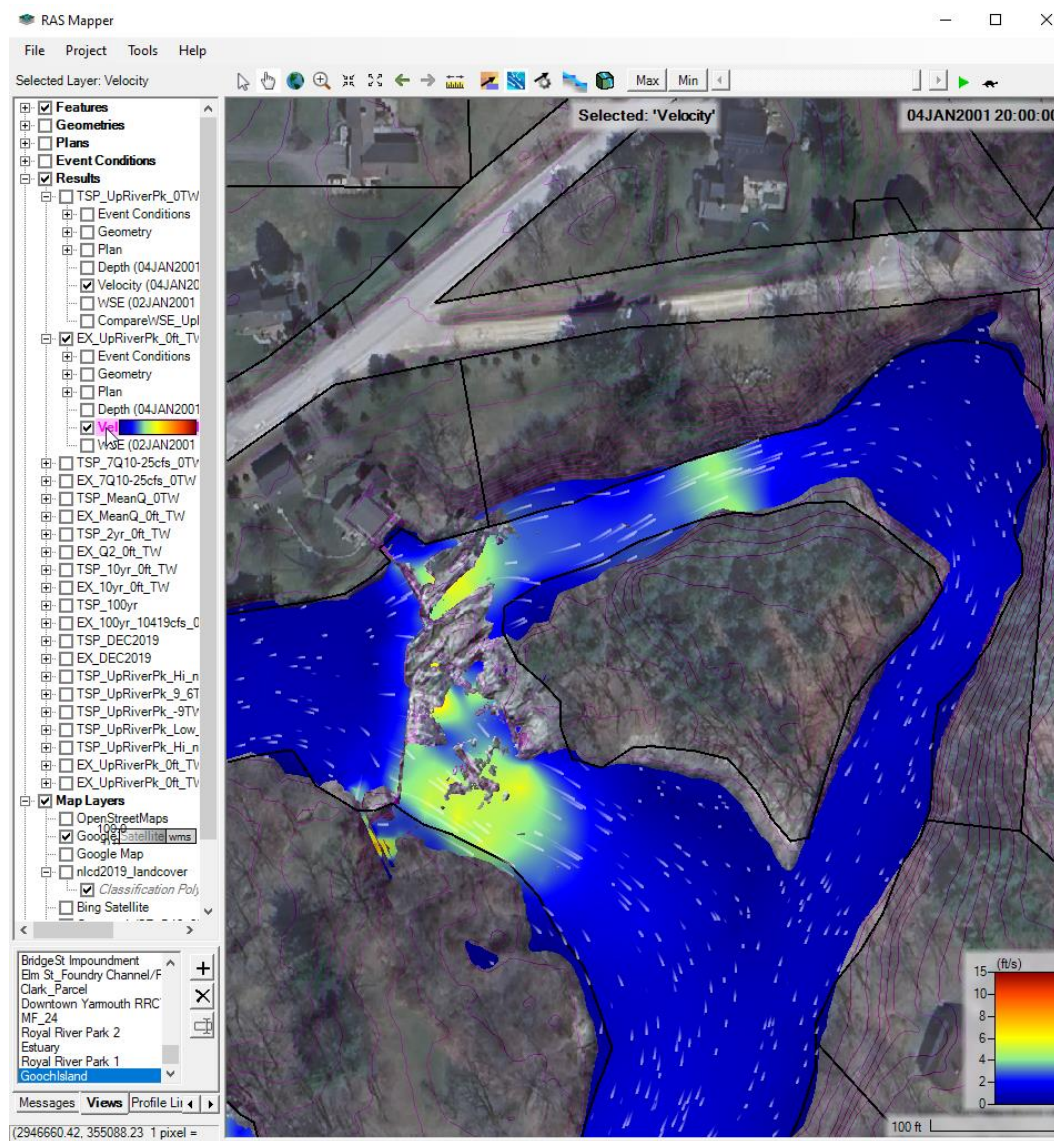


VELOCITY COMPARISON – UPRIVER PEAK MIGRATION 5% FLOW EXCEEDANCE

GOOCH ISLAND

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

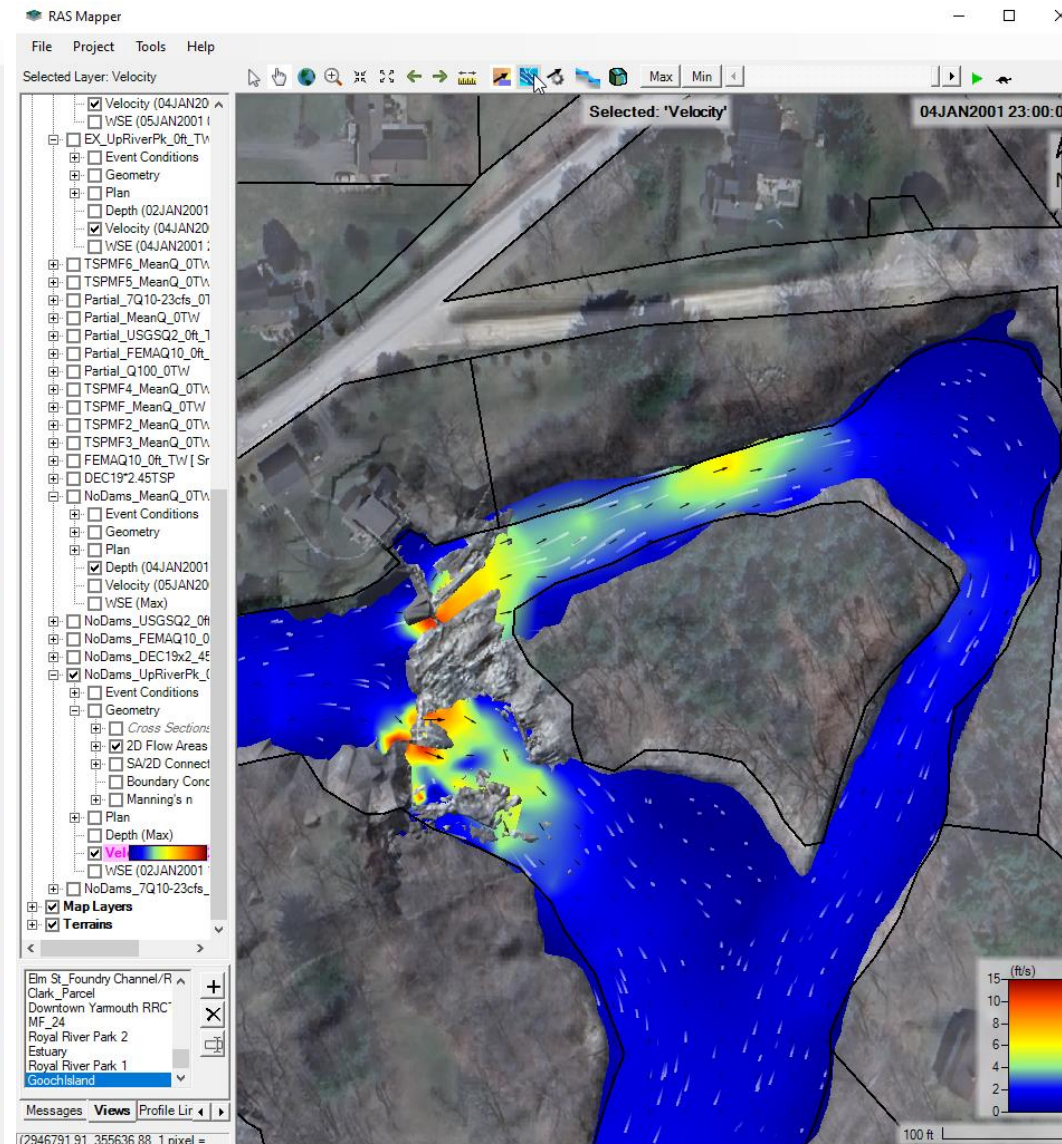
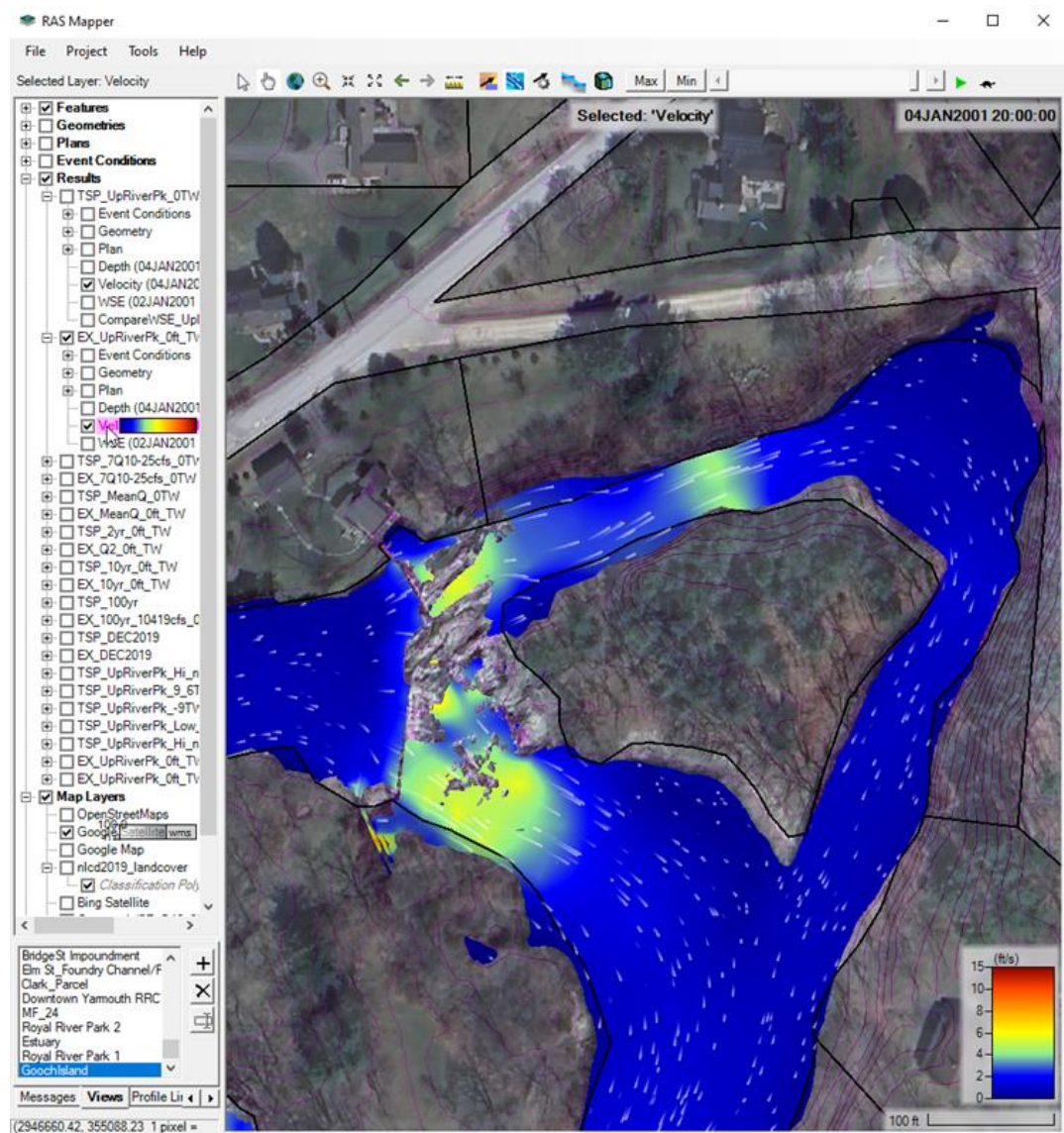




VELOCITY COMPARISON – UPRIVER PEAK MIGRATION 5% FLOW EXCEEDANCE GOOCH ISLAND

EXISTING CONDITIONS

FULL REMOVAL





PORTLAND PRESS HERALD



The Royal River in Yarmouth overflows its banks Sunday, endangering the Thomas Trainor home.

Spring comes in like a roaring lion

From Staff and Wire Reports

Mainers splashed their way into spring at 11:39 p.m. Sunday facing the prospect of more rain today.

Mainers splashed their way into spring at 11:39 p.m. Sunday facing the prospect of more rain today.

"Right now, it looks like we could get another inch or so," said meteorologist Charlie Foley of the National Weather Service's Portland office. "This could be another good soaking."

Foley said this month already is the 10th wettest March since records were first kept in 1862.

Southern Maine experienced flooded roads and basements Saturday night and Sunday after about 2.3 inches of rain fell Saturday on already saturated ground.

In East Sebago, about five families at the mouth of the Northwest River were evacuated early Sunday when high water threatened to collapse a concrete, cut-stone and earthen dam.

ated early Sunday when high water threatened to collapse a concrete, cut-stone and earthen dam.

"About four o'clock, she (water level) was going down," and the families returned to their residences, said Sebago Fire Chief Richard Fox.

In Yarmouth, about 40 volunteer firefighters and local residents packed sandbags alongside the Royal River to protect a house at the water's edge from flood damage.

Thomas Brown, a tenant of the house, said he cannot remember the river overflowing after a single day's rainstorm. The river was running about 8 feet higher than normal, officials said.

Part of the Royal River Parkway, a walkway along the river, was lost to erosion. In North Yarmouth, a Pownal man in a motorized dory rescued a 28-year-old canoeist who had been sucked under the Dunn's

Yarmouth authorities stretched a rope across the river near East Elm Street as a protection for the dory from the falls.

See RAIN
Page 11

Rain

North Yarmouth Rescue would not disclose the identity of the men and did not know who made the rescue.

The man sucked under Dunn's front fender.

day was Sunday, left her Benton home around 9:30 Saturday night but never reached the variety store and did not return home, her husband, Ronald, told police.

The man sucked under Dunn's Depot Bridge was treated at Mercy Hospital for hypothermia and released.

Authorities were to resume searching today for a woman they believe may have been swept into

Authorities were to resume searching today for a woman they believe may have been swept into the swollen Sebasticook River in Benton, a community three miles northwest of Waterville.

The water softened the ground over a culvert in Manchester, and it

The water softened the ground over a culvert in Manchester, and it caved in as Todd Webb, 17, was

driving over it early Sunday morning. Police said Webb only suffered a bumped head but that the car frame was damaged.

Riverside Street in Portland was closed for most of Sunday because of flooding.

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Five roads in Gorham were closed Saturday night but reopened Sunday. "Some of the roads had lined the cellar" up to the fuse box," a local official said.

The 2.3 inches that fell Saturday was a record for the day, surpassing the previous mark of .9 inches on March 19, 1907, the weather service said.

Five roads in Gorham were closed Saturday night but reopened Sunday. "Some of the roads have washed out a bit," but there was no major damage, said a police dispatcher.

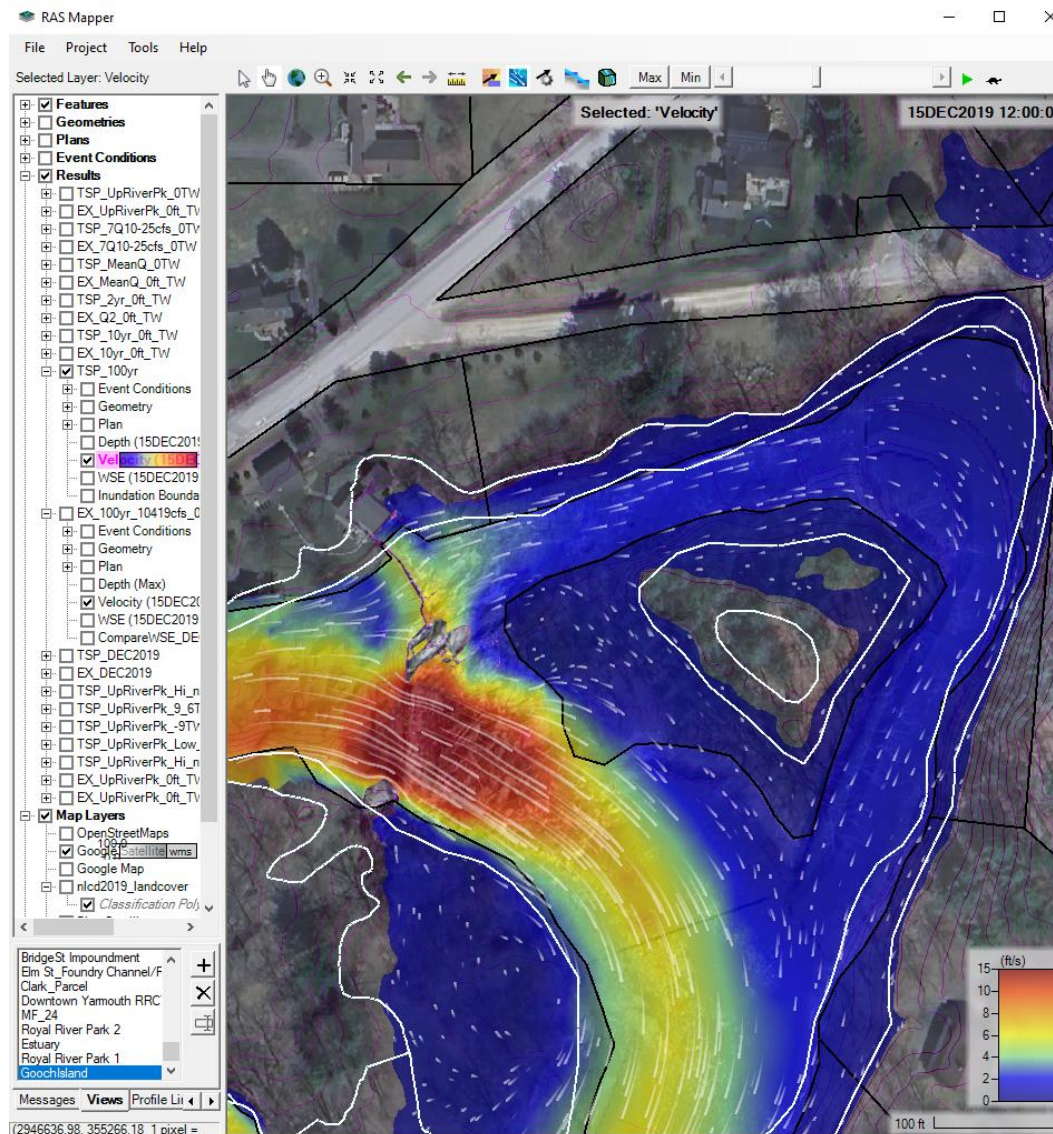
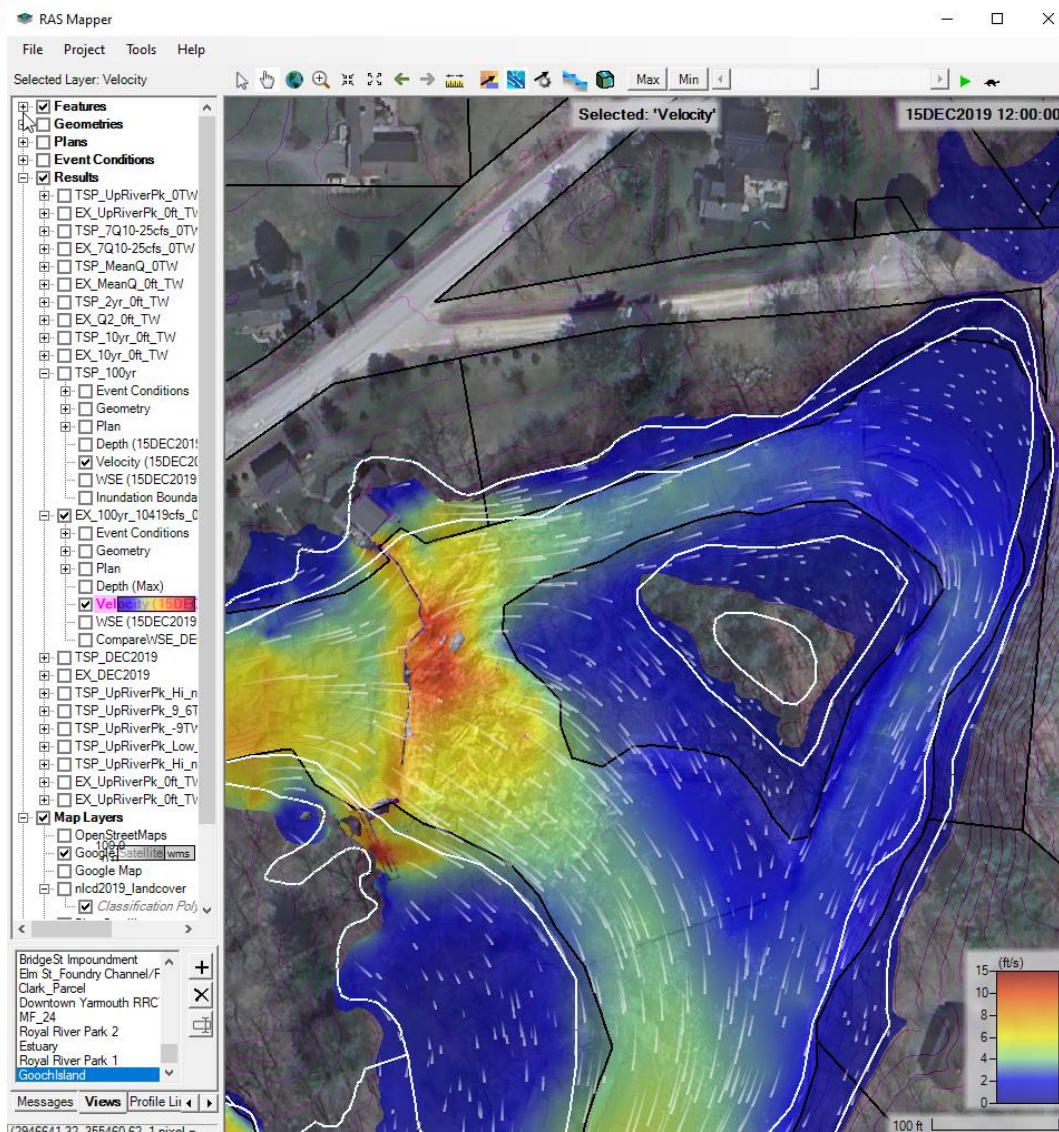
Sunday. "Some of the roads have washed out a bit," but there was no major damage, said a police dispatcher. "If it rains (Monday), it might be different."



VELOCITY COMPARISON –1% AEP (100-YR) FLOW GOOCH ISLAND

EXISTING CONDITIONS

TENTATIVELY SELECTED PLAN

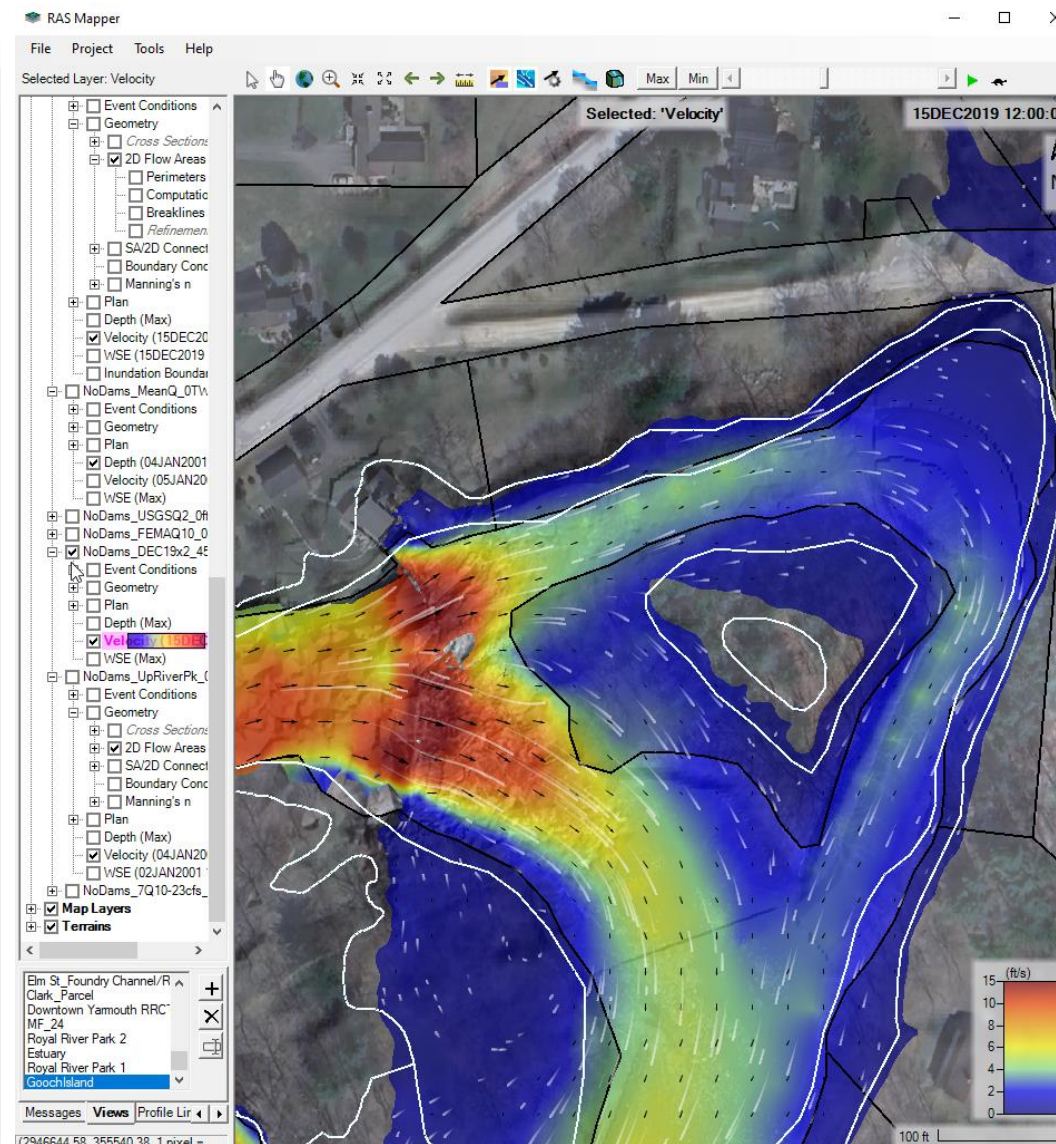
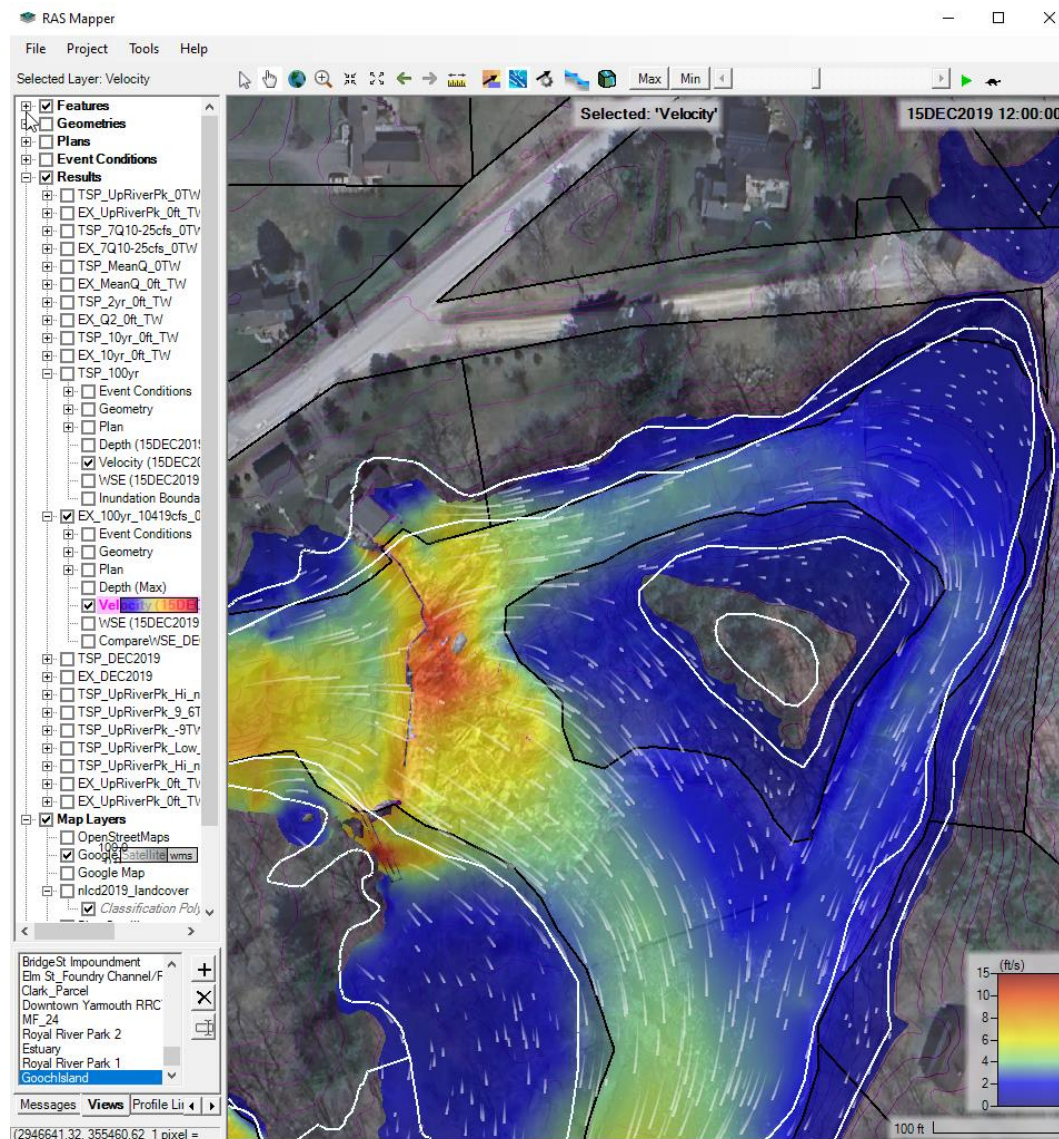




VELOCITY COMPARISON –1% AEP (100-YR) FLOW GOOCH ISLAND

EXISTING CONDITIONS

FULL REMOVAL



STUDY SCHEDULE



U.S. ARMY



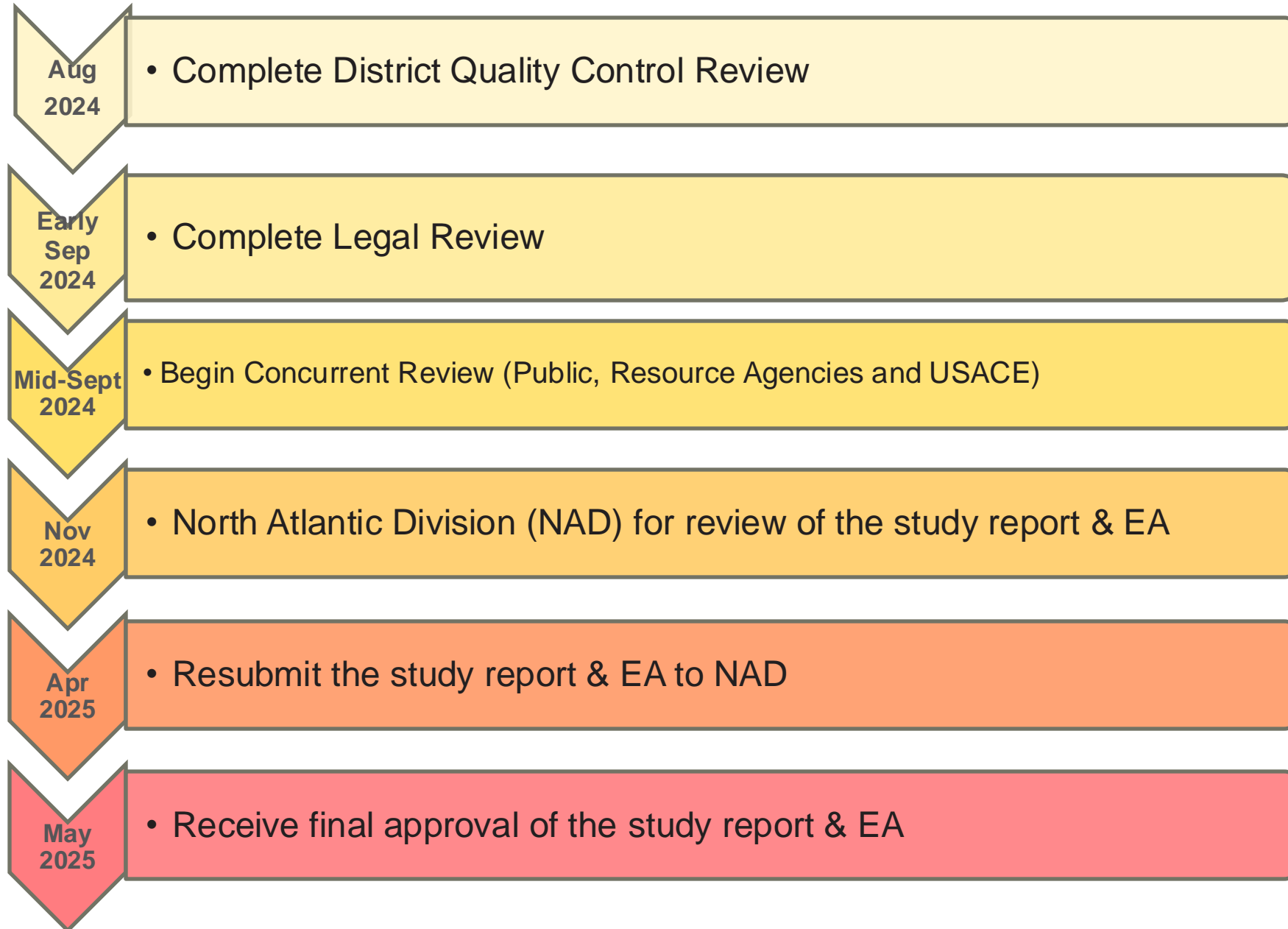
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WHAT'S NEXT?



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PUBLIC REVIEW – SEPTEMBER 2024



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Draft Detail Project Report & Environmental Assessment – The draft study report & EA will be completed and made available to the public, resource agencies and stakeholders.

Public Review Period – Is required by the National Environmental Policy Act (NEPA). A minimum 30-day comment period is required. During that time, interested parties will be able to provide comments. Comments received verbally during the public meeting or in writing will be included in the Responsiveness Summary section of the Record of Decision.

Public Meeting – Another public meeting will be held at the start of the Public review period. The meeting will focus on the tentatively selected plan and how it was developed.



QUESTIONS

CONTACT INFORMATION

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WEBSITE: <https://www.nae.usace.army.mil/missions/projects-topics/royal-river-aquatic-ecosystem-restoration-study/>



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BACKGROUND SLIDES



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SECTION 206 ROYAL RIVER FISH PASSAGE

TSP HEC-RAS ASSUMPTIONS

- Hydraulic model results are assumed to be generally representative for feasibility-level aquatic organism passage considerations. At the falls and other locations within the model domain, localized depths, velocities, vertical accelerations, turbulence, and other hydraulic phenomena may affect target species behavior at a scale that is impractical or impossible for 2D hydraulic modeling to accurately predict.
- Due to unknowns regarding dam construction methods in this study area, there is uncertainty regarding the stream bed under the dams. While it is known that the dams were built upon bedrock formations, the extent to which the bedrock may have been modified is unknown. Additionally, bathymetric data immediately upstream of the dams was not collected due to safe access constraints. For purposes of this study, the underlying stream bed was assumed to have a smooth linear slope between nearest available bathymetric data points.
- The bathymetric surface is assumed to be a fixed bed (non-erodible sediment) for model simplification. While there is significant uncertainty regarding depth to bedrock below the bathymetric surface in some areas, especially immediately upstream of the dams, available sediment probes indicate surficial deposits are relatively shallow.



SECTION 206 ROYAL RIVER FISH PASSAGE

TSP HEC-RAS ASSUMPTIONS

- Ice effects are not considered in this study. Ice is assumed not to affect river hydraulics during the upriver migration period.
- Accumulation of floating debris and its effects on hydraulics were not considered in this feasibility study.
- Groundwater was not explicitly modeled and any drawdown effects in the potentiometric groundwater surface related to dam removal surface water drawdowns are assumed to be localized.
- Any portions of dams not removed in partial removal measures are assumed to remain in place and be properly maintained.
- Explicit sediment transport modeling was not performed for this study, however there is an assumption of significant sediment transport capacity in the Royal River to the estuary during flood flows, based on hydraulic results and field observation.