Comment Letter: Swan Stream Alteration Project (P24-057)

To: Ketchum Planning & Zoning Commission
From: Project Big Wood
Date: 10/13/2025
Re: Remaining Concerns and Recommendations – Swan Stream Alteration Project (401 Northwood Way)

Purpose

This memorandum outlines remaining technical and ecological concerns with the *Swan Stream Alteration Project (P24-057)*, following review of the *Applicant Narrative (Sept. 25, 2025)* and *Staff Report (Oct. 14, 2025)*, and comparison with our prior *PBW Comments*.

Project Big Wood also partially **funded the "Northwoods Concept Design"**—a reach-scale river restoration assessment prepared to guide sustainable, river-friendly solutions along this reach of the Big Wood River. We strongly support this concept and urge both the City of Ketchum and the property owner to incorporate its principles into the current proposal.

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1. River-Friendly Restoration and Reach-Scale Coordination

The applicant's narrative remains narrowly focused on protecting one property rather than restoring the river reach as an integrated system.
The **Northwoods Concept** demonstrates that this section of the Big Wood can be stabilized more effectively through **coordinated, process-based actions** that reconnect floodplains, reduce erosive energy, and enhance riparian habitat without heavy armoring.

Key points from the Northwoods Concept include:

- Using **large wood, floodplain benches, and vegetated roughness** instead of rock to dissipate energy.
- Promoting **side-channel connectivity** and flow exchange between multiple braids to balance sediment transport.
- Restoring **native riparian vegetation corridors** and long-term channel resilience through natural succession.
- Encouraging **collaborative implementation** among adjacent landowners, the City, and local nonprofits, such as Trout Unlimited Hemingway Chapter (TU) and Project Big Wood (PBW), for reach-scale benefits.

By contrast, the current Swan design—focused on local gravel removal, geogrid mats, and buried rock toe protection—remains a property-level intervention inconsistent with this broader, ecologically sound framework.

Recommendation:

Integrate the *Northwoods Concept* as the guiding framework for this reach.
The City may want to consider conditioning permit approval on **coordination with the Northwoods reach plan** and on development of a **multi-property restoration implementation strategy** rather than an isolated project. TU and PBW remain committed and available to assist the owner and design team with this project.

2. Bank Stabilization: Transition from Hard Armoring to Bioengineering

Although the applicant states there is no intent to "create any semblance of a riprapped bank," the proposed use of **toe rock, buried rock backstops, and geogrid materials** still constitutes hard armoring.
These features will continue to reflect energy, limit natural migration, and reduce habitat complexity.

Recommendation:

- Replace all buried rock and synthetic geogrid with **bioengineered alternatives**: rootwad revetments, live cribwalls, willow lifts, or vegetated terraces.
- Utilize **large woody material structures** consistent with the Northwoods Concept instead of toe rock or sills.
- Require a demonstration that full bioengineering can achieve stability while maintaining floodplain connectivity.

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3. Riparian Planting and Floodplain Vegetation

The planting plan relies heavily on **non-native turf species (Scottish Links fescue)** and sparse shrub density. Both PBW and staff have identified the need for more robust, native planting consistent with local riparian ecology.

Recommendation:

- Revise the planting plan to fully adopt the **Blaine County Wetland and Riparian Plant List**.
- Increase planting density (≥10 shrubs per 1,000 sq ft; ≥5 native trees per zone).
- Include **two staggered willow rows** along the bank toe and slope.
- Require **three years of irrigation, protection, and adaptive replanting** to ensure establishment.

The Northwoods Concept provides an excellent model for this approach—showing how multi-layered vegetation (willows, dogwoods, cottonwoods) can stabilize banks naturally and improve habitat.

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4. East Channel and Inlet Treatment

The East Channel design proposes a **buried rock sill** to stabilize the inlet. This contradicts river-friendly practice and the reach-scale recommendations in the Northwoods Concept, which favor **woody deflector jams or engineered log sills** that mimic natural channel processes.

Recommendation:
Replace the proposed rock sill with a **rootwad or large-wood deflector jam**, designed per the Northwoods Concept guidelines to balance flow distribution while promoting sediment deposition and habitat diversity.

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5. Monitoring and Adaptive Management

The current proposal lacks a plan for long-term monitoring and adaptive management.
Consistent with reach-scale restoration best practices and the Northwoods Concept, the project should track **vegetation survival, sediment transport, and hydraulic performance** to guide future adjustments.

Recommendation:

Require a **5-year monitoring program** with measurable performance standards and annual reporting to the City and stakeholders.

6. Summary of Requested Revisions and Conditions

Category	Key Recommendations
River-Friendly Framework	Integrate *Northwoods Concept* principles and coordinate reach-scale restoration
Bank Stabilization	Remove all rock and geogrid; replace with bioengineered wood-based stabilization
Planting Plan	Revise to native species, higher density, and multi-layer vegetation
East Channel Treatment	Replace rock sill with large-wood or rootwad deflector jam
Monitoring	Require 5-year adaptive management and success metrics

Conclusion

Project Big Wood appreciates the City's commitment to improving the ecological health and stability of the Big Wood River.

However, we urge the City and the property owner to **fully embrace the Northwoods Concept** as the appropriate, science-based path forward. This reach-scale approach aligns with both FEMA floodplain management goals and community expectations for river-friendly, habitat-enhancing design.

Integrating these principles will not only improve project outcomes at the Swan property but will contribute to the long-term resilience of the entire Northwood reach.

Again, we thank you for the opportunity to participate and thank you for showing up for our home water, the Big Wood River, the centerpiece of our treasured community.

With Gratitude,

Amanda Bauman & the team at Project Big Wood

Executive Director

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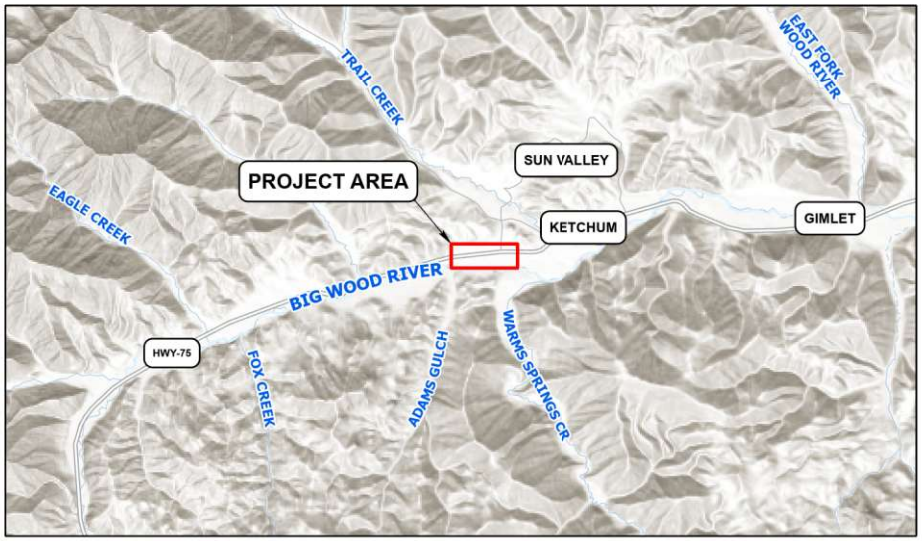
BIG WOOD RIVER - NORTHWOODS REACH

CONCEPTUAL DESIGN PLANS



SHEET LIST:

SHEET NUMBER	SHEET NAME
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3	SITE PLAN AND EXECUTIVE SUMMARY
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PREPARED FOR:

TROUT UNLIMITED HEMINGWAY CHAPTER

TROUT UNLIMITED

PREPARED BY:

ENVIRONMENTAL SCIENCE ASSOCIATES (ESA)
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PROJECT ENGINEER: GREG WOLOVEKE, PE

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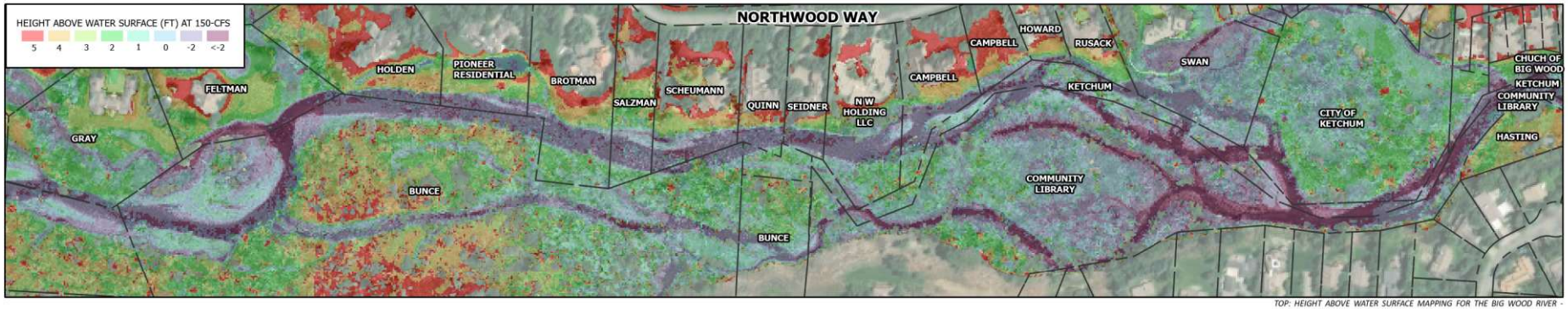
TROUT UNLIMITED

PROJECT DIRECTOR: JON AMBROSE, MS
ENGINEER: GREG WOLOVEKE, PE
CLIENT: TROUT UNLIMITED
DATE: 10/13/2021

BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
COVER PAGE



TOP: HEIGHT ABOVE WATER SURFACE MAPPING FOR THE BIG WOOD RIVER - NORTHWOODS REACH. TAX LOTS AND OWNERSHIP SHOWN FOR REFERENCE.

PROJECT BACKGROUND

The 1.8-mile Northwoods Reach of the Big Wood River runs from Adams Gulch to Warm Springs through the northern portion of the City Ketchum.

The Big Wood River Atlas (Cardno and Ecosystem Sciences 2020) characterizes this reach (identified as Reach 5 in the Atlas) as containing high value floodplain in a highly developed area. The Atlas recommends actions to protect and maintain existing floodplain function and restoration priorities to expand floodplain utilization, including actions to restore natural channel process where historic channel occupation is observed. In particular, the Atlas identifies the western floodplain occupied in part by the Community Library as a unique and high priority opportunity to restore floodplain connectivity and stream channel processes in a reach that has been widely impacted by the presence of bank hardening along the eastern bank.

Reach Project Potential

The western floodplain through the upper sections of this reach are currently undeveloped and subject to some protection in the Northwood Natural Area. These areas serve a high value in floodplain function upstream of a highly developed zone. Efforts should be made to maintain and expand protected status, as well as restore channel processes in areas of prior channel occupation.

Excerpt from Big Wood River Atlas for Reach 5 regarding floodplain reconnection in the Northwoods Reach (Cardno / Ecosystem Sciences 2020)

Homes along the southeastern limits of the reach have experienced bank erosion associated with both historic tree removal and then channel migration experienced during the 2017 flood event. Channel changes in the reach resulted in bed aggradation, elevated surface water, and groundwater levels that are affecting riverside properties.

PROJECT GOALS AND OBJECTIVES

The overall goal for the Northwoods Conceptual Design is to provide a reach-scale approach to activate the western floodplain with the intent of reducing flooding and hydraulic forces along the eastern streambank and reduce the need for non-deformable erosion and scour protection (ie. rock). Increasing streamflow in the western floodplain not only helps protect nearby property owners, but promotes natural river processes, off-channel habitat complexity and supports secondary objectives such as improved groundwater infiltration, stream temperature regulation, and provides fish cover from predation. Actions are intended to work together to restore natural channel process and meet project objectives.

Reach-Scale and Site-Specific design objectives include the following:

1. Increase connectivity to the western floodplain to reduce velocity and erosive forces in the main channel.
2. Promote physical habitat complexity and evolution of off-channel aquatic habitats throughout the project reach.
3. Increase shallow groundwater infiltration (aquifer recharge) through greater floodplain inundation and improved flood storage.
4. Reduce flood extents, stream velocities, and erosive forces adjacent to properties along the eastern streambank.
5. Relocate riprap at the Hasting property to expand hydraulic conveyance and reduce velocities along the western streambank upstream of Warm Springs Bridge. Add wood along river edge to improve local fish habitat.

The project provides a balanced cut-fill approach that reuses excavated materials and minimizes the need to haul and dispose of materials off-site.

METHODS

The Northwoods Reach Conceptual Design builds upon the geomorphic assessment documented in the 2020 Big Wood Atlas to meet reach-scale goals and objectives in support of on-going river management and restoration strategies in the Big Wood watershed. The conceptual design supports this vision through a comprehensive review of opportunities and constraints identified within the reach. Recommended restoration actions are supported by development of a detailed terrain model, on-site field reconnaissance to confirm site conditions and assess constructability, and 2-Dimensional hydraulic modeling to evaluate the effectiveness and expected hydraulic response of proposed actions. Specific steps completed by ESA in support of the concept design include the following:

TERRAIN DEVELOPMENT

In May 2021, ESA contracted with NS Consulting to collect orthophotogramic imagery via drone overflight and develop a digital surface model (DSM). The resolution of the survey is adequate for analyzing and depicting reach-scale hydraulic patterns, but site-scale features such as deep pools and elevations beneath dense tree canopy may not be fully captured by this process. Therefore, targeted ground-based topographic and bathymetric survey may be needed to advance the design.

CHARACTERIZE EXISTING REACH HYDRAULICS

The DSM was used to develop a 2-Dimensional HEC-RAS Hydraulic Model of the project reach. The intent of the existing conditions model was to simulate a range of flows between summer low-flow and flood-flow conditions to identify primary and secondary overflow pathways. The variability and patterns of reach-scale and site-scale hydraulics is used as the basis of restoration actions and recommendations. Calibration of the hydraulic model was completed to simulate conditions observed during the drone flight. Using the date of the drone flight and the downstream USGS stream gage at Ketchum, it was determined the streamflow at the time of survey represented a low summer flow of approximately 150 cubic feet per second.

FIELD RECONAISSANCE

Field reconnaissance was performed to ground-truth current conditions and support design recommendations to improve floodplain process and create habitat where opportunities were observed from an initial desktop evaluation of data. Field observations were made to document conditions such as sediment composition, flood indicators, bed and bank erosion, large wood presence, and overflow pathways.

DESIGN ELEMENTS & PROJECTED RIVER RESPONSE

Restoration actions are identified to meet project objectives based on an evaluation of hydraulic modeling results and our field investigation. Actions include:

1. Engineered Log Jams (ELJs) to split flow into the primary side channel near the western valley wall;
2. Targeted grading to activate the western floodplain more frequently;
3. Floodplain Roughness Jams to maintain flow along the western valley:
4. Beaver dam analogs (BDAs) to retain water and sediment in off-channel floodplain and improve groundwater infiltration.
5. Biorevetment and berm to protect the Swam property from bank erosion and flooding;
6. Biorevetment and floodplain bench to improve habitat and reduce velocity at Hastings property.

To analyze the effectiveness of the design, restoration actions were built into the hydraulic model and results compared to the no-project alternative. These results are provided as part of this plan to demonstrate the projects potential to activate the western floodplain, support aquatic habitat objectives, and reduce the magnitude of hydraulic forces action upon the east streambank. The wood structures described in this concept design are intended to a have a lifespan of approximately +/- 50 years and support a long-term shift in river process that sustains benefits and restoration trajectory.

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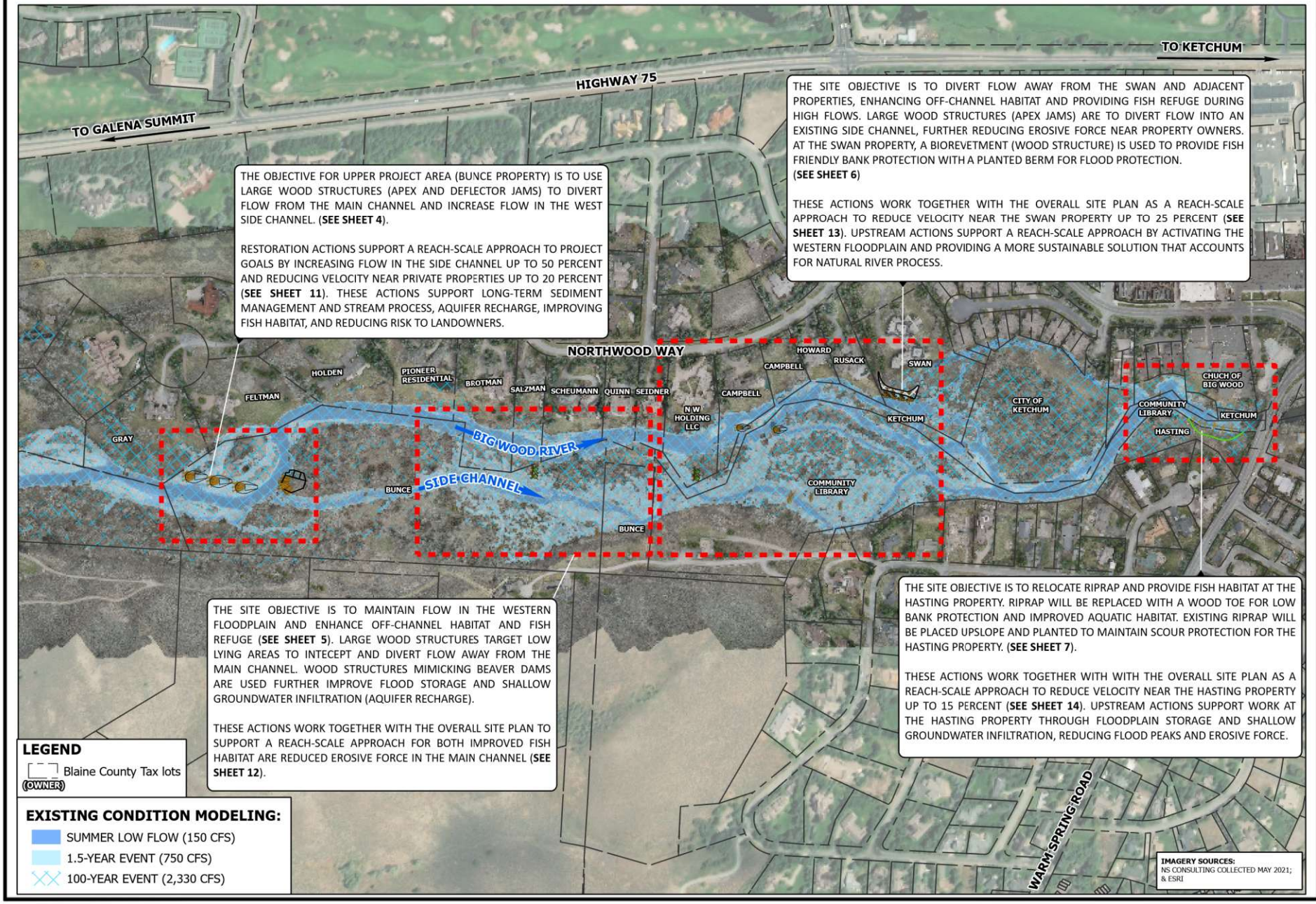
0 300 FT

BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
BACKGROUND, GOALS, AND METHODS



THE OBJECTIVE FOR UPPER PROJECT AREA (BUNCE PROPERTY) IS TO USE LARGE WOOD STRUCTURES (APEX AND DEFLECTOR JAMS) TO DIVERT FLOW FROM THE MAIN CHANNEL AND INCREASE FLOW IN THE WEST SIDE CHANNEL. (**SEE SHEET 4**).

RESTORATION ACTIONS SUPPORT A REACH-SCALE APPROACH TO PROJECT GOALS BY INCREASING FLOW IN THE SIDE CHANNEL UP TO 50 PERCENT AND REDUCING VELOCITY NEAR PRIVATE PROPERTIES UP TO 20 PERCENT (**SEE SHEET 11**). THESE ACTIONS SUPPORT LONG-TERM SEDIMENT MANAGEMENT AND STREAM PROCESS, AQUIFER RECHARGE, IMPROVING FISH HABITAT, AND REDUCING RISK TO LANDOWNERS.

THE SITE OBJECTIVE IS TO DIVERT FLOW AWAY FROM THE SWAN AND ADJACENT PROPERTIES, ENHANCING OFF-CHANNEL HABITAT AND PROVIDING FISH REFUGE DURING HIGH FLOWS. LARGE WOOD STRUCTURES (APEX JAMS) ARE TO DIVERT FLOW INTO AN EXISTING SIDE CHANNEL, FURTHER REDUCING EROSIVE FORCE NEAR PROPERTY OWNERS. AT THE SWAN PROPERTY, A BIOREVETMENT (WOOD STRUCTURE) IS USED TO PROVIDE FISH FRIENDLY BANK PROTECTION WITH A PLANTED BERM FOR FLOOD PROTECTION. (**SEE SHEET 6**)

THESE ACTIONS WORK TOGETHER WITH THE OVERALL SITE PLAN AS A REACH-SCALE APPROACH TO REDUCE VELOCITY NEAR THE SWAN PROPERTY UP TO 25 PERCENT (**SEE SHEET 13**). UPSTREAM ACTIONS SUPPORT A REACH-SCALE APPROACH BY ACTIVATING THE WESTERN FLOODPLAIN AND PROVIDING A MORE SUSTAINABLE SOLUTION THAT ACCOUNTS FOR NATURAL RIVER PROCESS.

THE SITE OBJECTIVE IS TO MAINTAIN FLOW IN THE WESTERN FLOODPLAIN AND ENHANCE OFF-CHANNEL HABITAT AND FISH REFUGE (**SEE SHEET 5**). LARGE WOOD STRUCTURES TARGET LOW LYING AREAS TO INTECEPT AND DIVERT FLOW AWAY FROM THE MAIN CHANNEL. WOOD STRUCTURES MIMICKING BEAVER DAMS ARE USED FURTHER IMPROVE FLOOD STORAGE AND SHALLOW GROUNDWATER INFILTRATION (AQUIFER RECHARGE).

THESE ACTIONS WORK TOGETHER WITH THE OVERALL SITE PLAN TO SUPPORT A REACH-SCALE APPROACH FOR BOTH IMPROVED FISH HABITAT ARE REDUCED EROSIVE FORCE IN THE MAIN CHANNEL (**SEE SHEET 12**).

THE SITE OBJECTIVE IS TO RELOCATE RIPRAP AND PROVIDE FISH HABITAT AT THE HASTING PROPERTY. RIPRAP WILL BE REPLACED WITH A WOOD TOE FOR LOW BANK PROTECTION AND IMPROVED AQUATIC HABITAT. EXISTING RIPRAP WILL BE PLACED UPSLOPE AND PLANTED TO MAINTAIN SCOUR PROTECTION FOR THE HASTING PROPERTY. (**SEE SHEET 7**).

THESE ACTIONS WORK TOGETHER WITH WITH THE OVERALL SITE PLAN AS A REACH-SCALE APPROACH TO REDUCE VELOCITY NEAR THE HASTING PROPERTY UP TO 15 PERCENT (**SEE SHEET 14**). UPSTREAM ACTIONS SUPPORT WORK AT THE HASTING PROPERTY THROUGH FLOODPLAIN STORAGE AND SHALLOW GROUNDWATER INFILTRATION, REDUCING FLOOD PEAKS AND EROSIVE FORCE.

LEGEND

Blaine County Tax lots (OWNER)

EXISTING CONDITION MODELING:

- SUMMER LOW FLOW (150 CFS)
- 1.5-YEAR EVENT (750 CFS)
- 100-YEAR EVENT (2,330 CFS)

IMAGERY SOURCES:
NS CONSULTING COLLECTED MAY 2021; & ESRI

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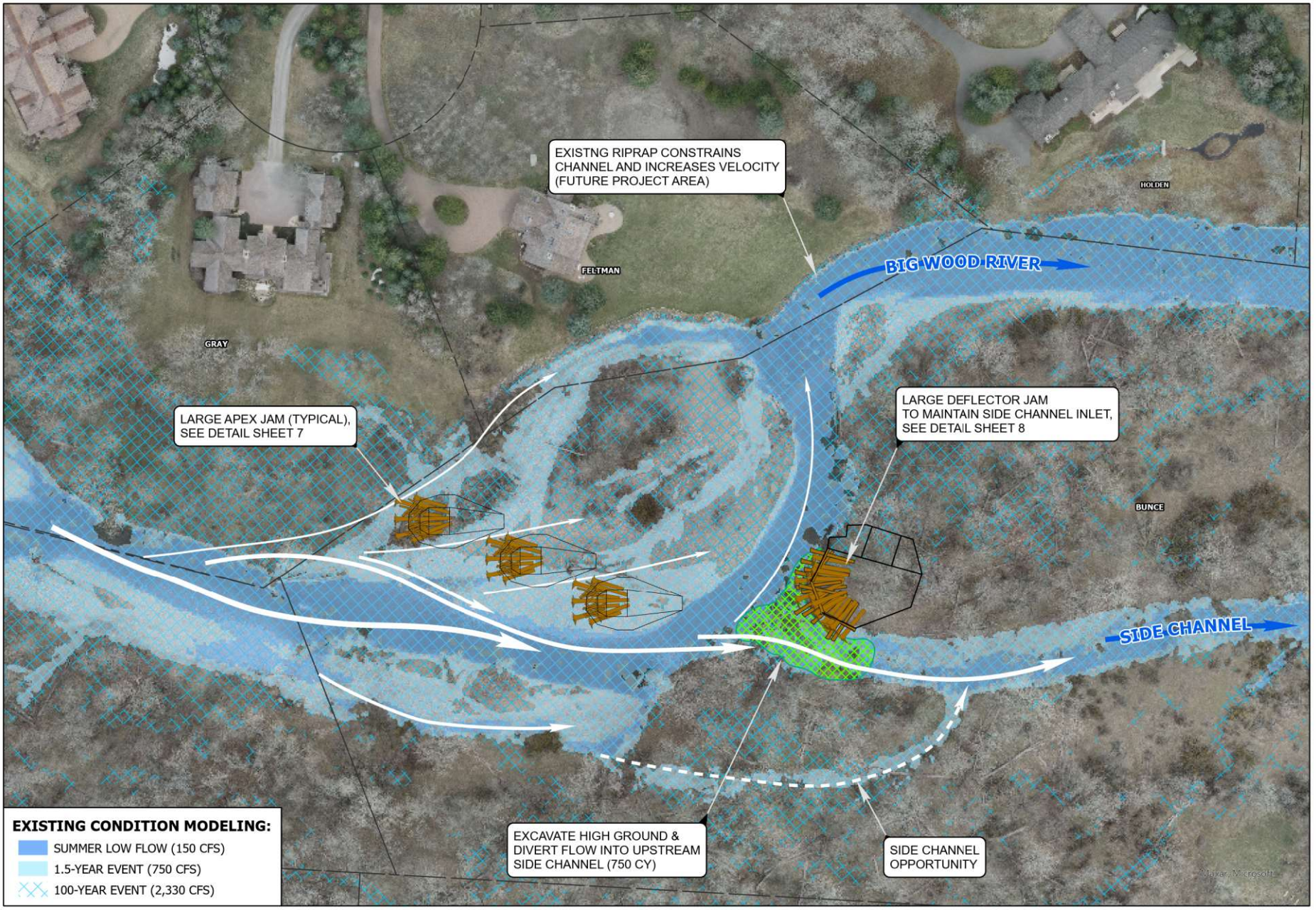
BIG WOOD RIVER - NORTHWOODS REACH CONCEPT DESIGN
SITE PLAN AND EXECUTIVE SUMMARY



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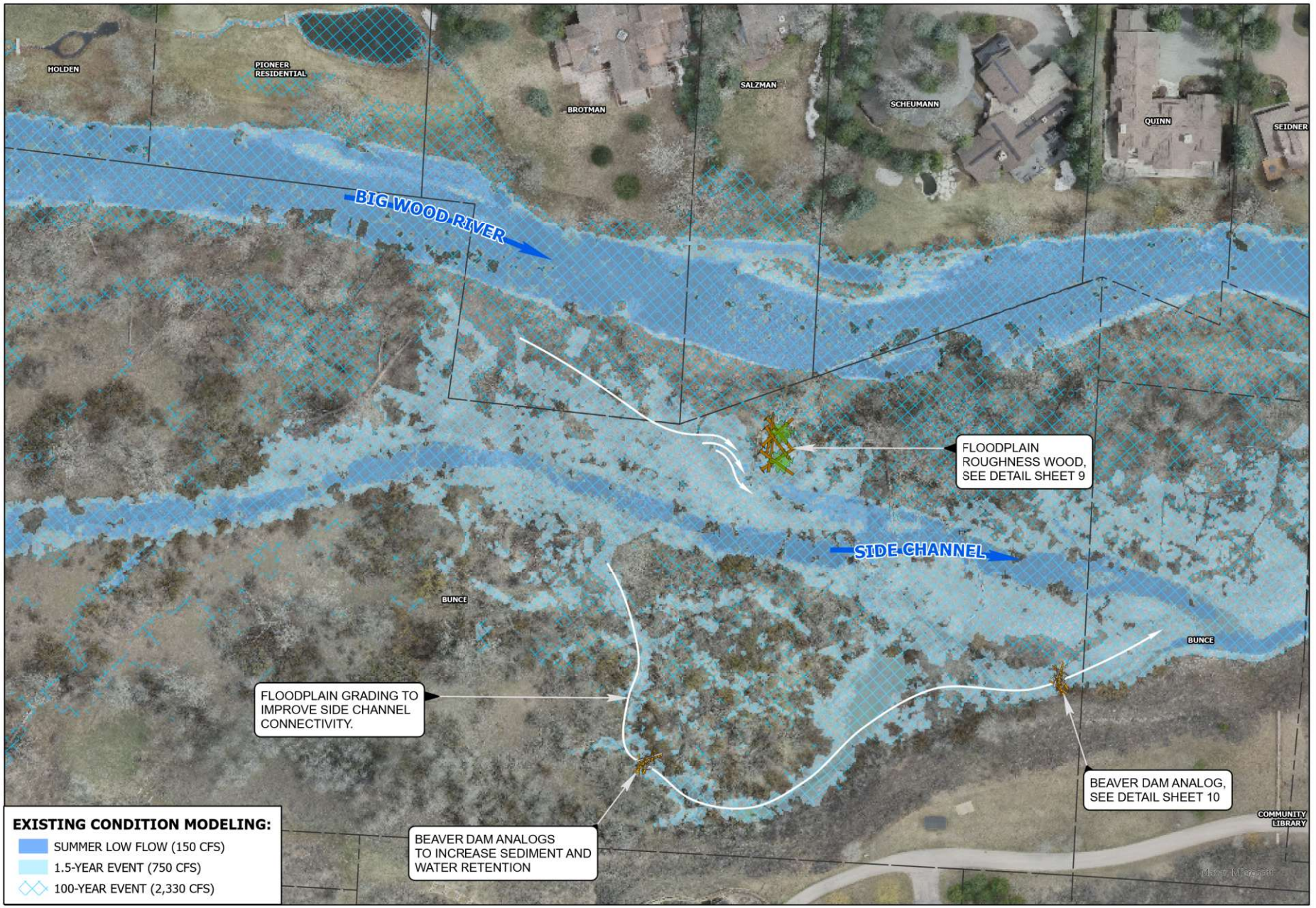
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PLAN VIEW - 1



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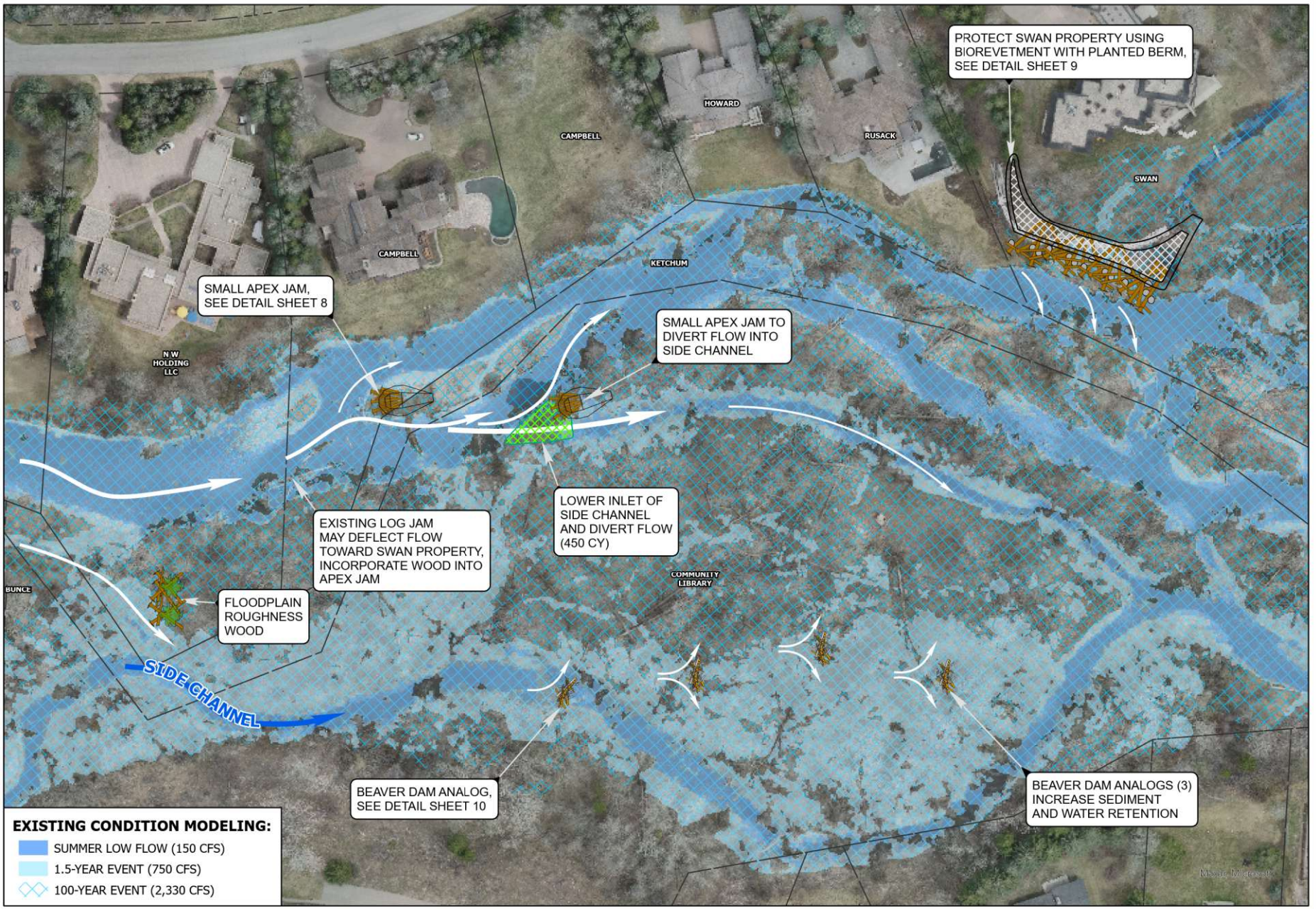
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PLAN VIEW - 2



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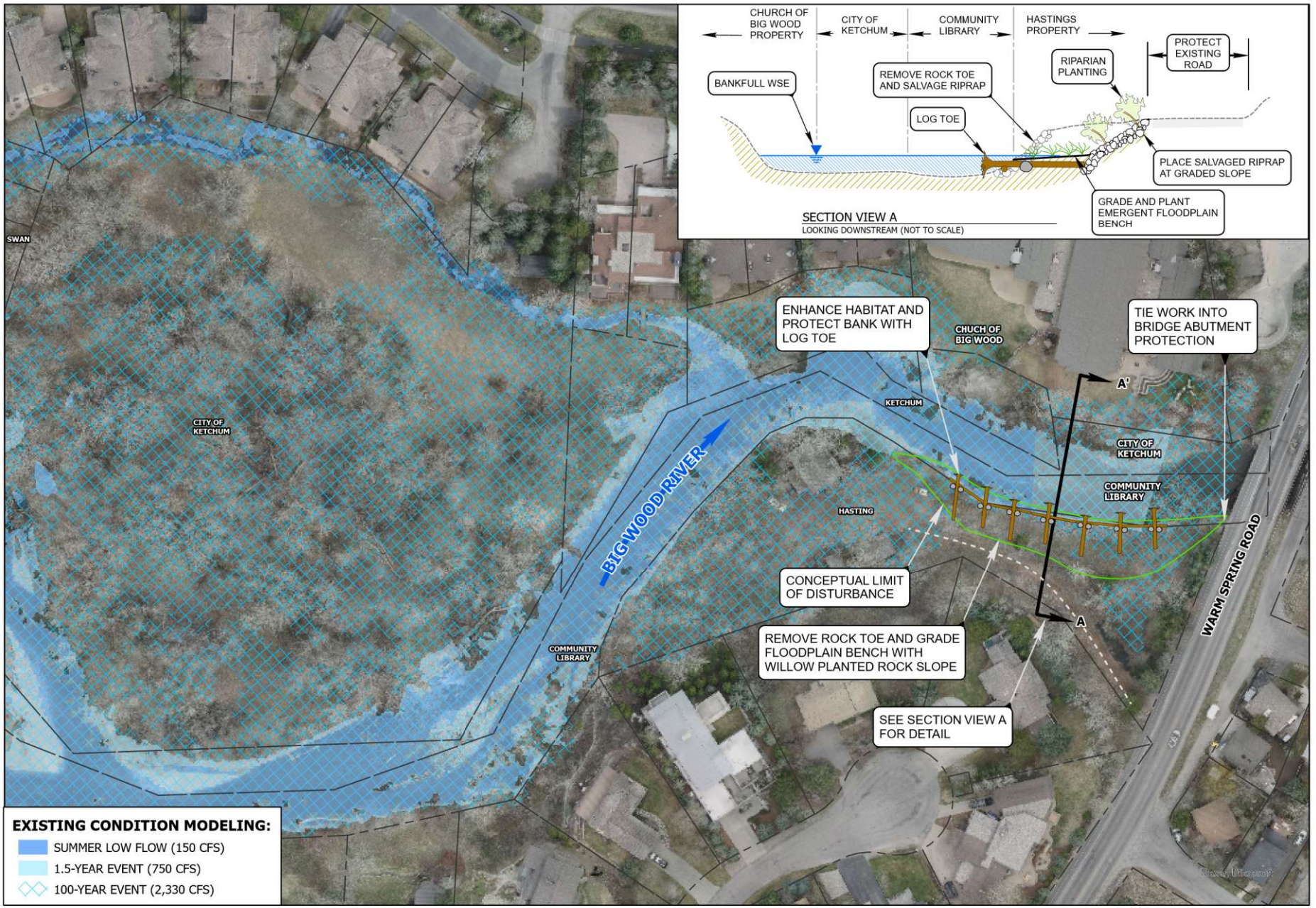
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PLAN VIEW - 3



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BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PLAN VIEW - 4

SHEET
7 OF 14

APEX JAM

PLAN VIEW

DESCRIPTION:

APEX JAMS MIMIC NATURAL WOOD JAMS OFTEN FOUND AT THE UPSTREAM EXTENT OF GRAVEL BARS. THESE STRUCTURES ARE CONCEPTUALLY LOCATED UPSTREAM OF SIDE CHANNELS AND SUPPORT THE REACH-SCALE APPROACH TO DIVERT FLOW INTO THE WESTERN FLOODPLAIN.

HYDRAULIC BENEFITS:

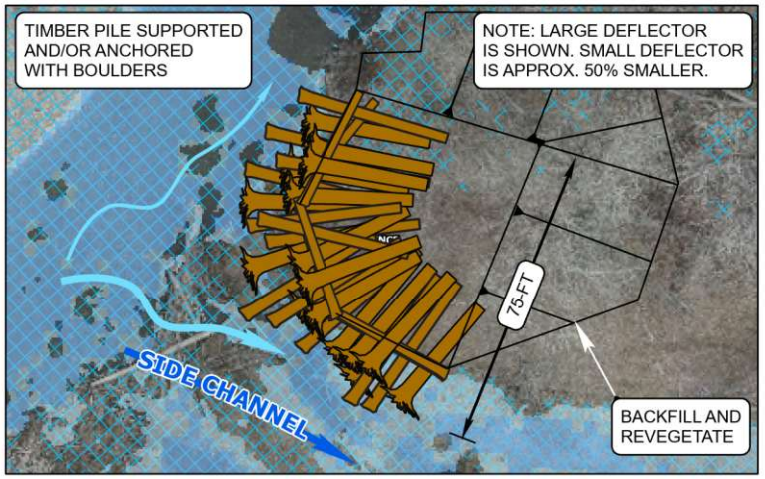
- INFLUENCE PRIMARY FLOW PATH.
- CREATE SCOUR POOL AND SORT SEDIMENT.

HABITAT BENEFITS:

- DEEP POOL FORMATION FOR ADULT HOLDING AND JUVENILE FISH REARING.
- ACCUMULATE WOODY DEBRIS OVER TIME, MAINTAINING STRUCTURE AND MIMICKING NATURAL WOOD JAMS.
- ENHANCE FISH HABITAT AND LOCAL DIVERSITY BY INCREASING OFF-CHANNEL HABITAT AND PROVIDING LOCAL COVER FROM PREDATION.

APEX JAM

REPRESENTATIVE PHOTO



BANK DEFLECTOR STRUCTURE

PLAN VIEW

DESCRIPTION:

A DEFLECTOR JAM IS PLACED TO MIMIC A NATURAL WOOD JAM THAT WOULD FORM AT THE HEAD OF A SIDE CHANNEL. THE STRUCTURE SUPPORTS THE REACH-SCALE APPROACH BY DIVERTING FLOW INTO THE WESTERN FLOODPLAIN AND CREATING LOCALIZED SCOUR THAT MAINTAINS THE SIDE CHANNEL ENTRANCE.

HABITAT BENEFITS:

- ENHANCE FISH HABITAT AND LOCAL DIVERSITY BY INCREASING OFF-CHANNEL HABITAT.
- DEEP POOL FORMATION FOR ADULT HOLDING AND JUVENILE FISH REARING.
- PROVIDES COMPLEX COVER FOR FISH.
- INCREASED ORGANIC INPUTS FOR PRIMARY PRODUCTIVITY.

BANK DEFLECTOR STRUCTURE

REPRESENTATIVE PHOTO

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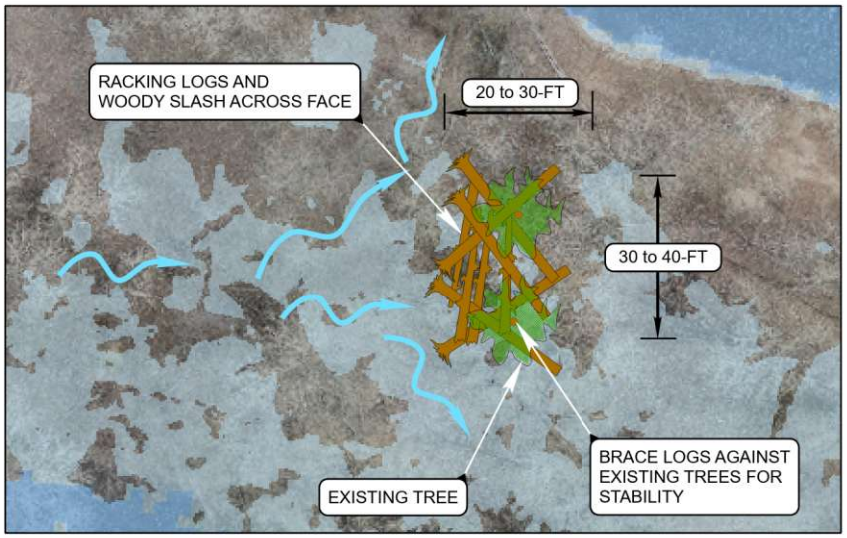
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
WOOD DETAILS - 1



FLOODPLAIN ROUGHNESS WOOD

PLAN VIEW

DESCRIPTION:

FLOODPLAIN ROUGHNESS WOOD MIMICS NATURAL WOOD ACCUMULATIONS DEPOSITED IN FLOODPLAINS DURING FLOOD FLOWS. THESE STRUCTURES WOULD BE BRACED AGAINST EXISTING TREES TO PROVIDE A LOW-TECH DESIGN THAT SUPPORTS THE REACH-SCALE APPROACH, INCREASING FLOW IN THE WESTERN FLOODPLAIN AND REDUCING EROSIVE FORCE ALONG THE EAST STREAMBANK.

HYDRAULIC BENEFITS:

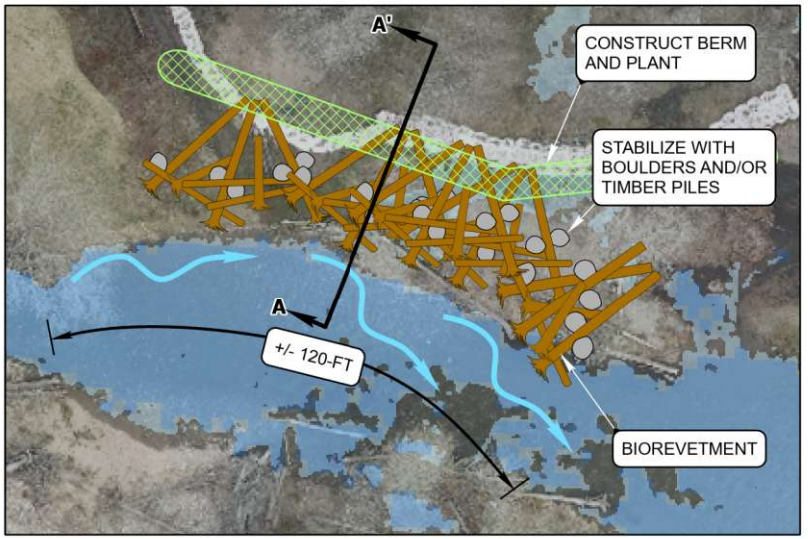
- REDUCE OVERBANK VELOCITY AND INTECEPT FLOOD FLOWS.
- INCREASE HYDRAULIC ROUGHNESS THROUGH COMPLEX FLOW THAT SUPPORTS NATURAL RIVER PROCESS.

HABITAT BENEFITS:

- ACCUMULATE DEBRIS OVER TIME FOR STRUCTURE LONGEVITY.
- PROVIDE HIGH FLOW COVER AND FISH REFUGE.
- CREATES WILDLIFE HABITAT.
- SUPPORTS MAINTENANCE OF RIPARIAN FORESTS.

FLOODPLAIN ROUGHNESS WOOD

REPRESENTATIVE PHOTO



BIOREVETMENT WITH PLANTED BERM

PLAN VIEW

DESCRIPTION:

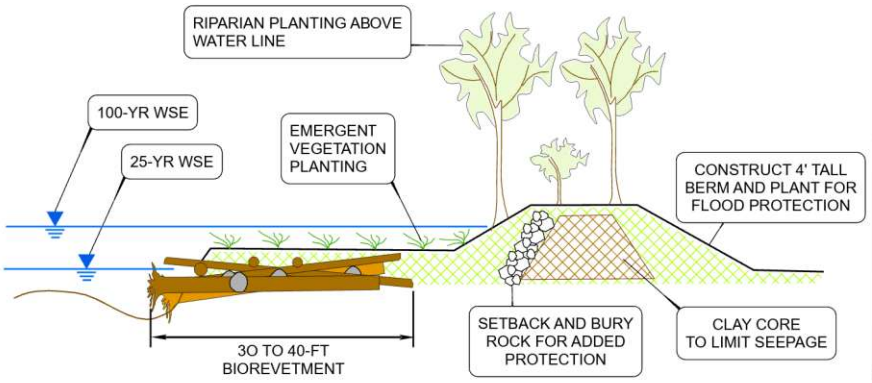
BIOREVETMENT IS RECOMMENDED AT THE SWAN PROPERTY AS A HABITAT FRIENDLY EROSION AND SCOUR PROTECTION STRUCTURE. THE STRUCTURE WILL BE BACKFILLED AND PLANTED WITH EMERGENT VEGETATION. A BERM IS PROPOSED THAT PROVIDES FLOOD PROTECTION.

HYDRAULIC BENEFITS:

- DEFLECT FLOW AWAY FROM BANK.
- CREATE LOCAL SCOUR.
- LIMITS EROSION AND CHANNEL MIGRATION TO THE EAST.

HABITAT BENEFITS:

- PROVIDE FISH COVER AND SHADE.



BIOREVETMENT WITH PLANTED BERM

SECTION VIEW A - LOOKING UPSTREAM - NOT TO SCALE

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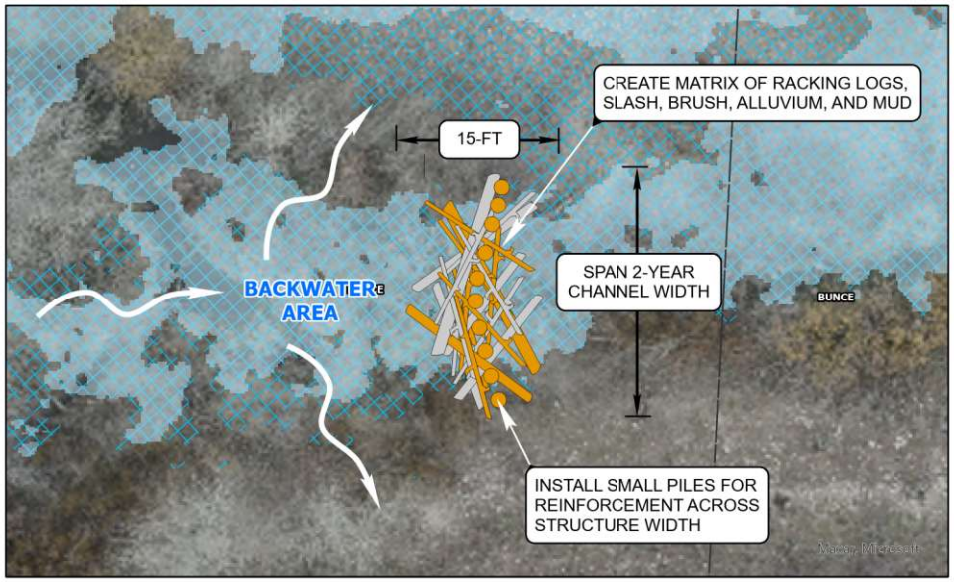
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
WOOD DETAILS - 2



BEAVER DAM ANALOG (BDA)
PLAN VIEW

REPRESENTATIVE PHOTO - 1

DESCRIPTION:
BEAVER DAM ANALOGS PROVIDE A LOW-TECH WOOD STRUCTURE THAT MIMICS THE HYDRAULIC AND GEOMORPHIC FUNCTIONS OF BEAVER DAMS. BDAs SUPPORT THE REACH-SCALE APPORACH BY OBSTRUCTING FLOW AND STORING SEDIMENT, SUPPROTING INCREASED FLOODPLAIN ACTIVATION.

HYDRAULIC BENEFITS:
- ATTENUATE FLOW IN FLOODPLAIN AND RAISE WATER TABLE THROUGH SHALLOW GROUNDWATER INFILTRATION (AQUIFER RECHARGE).
- REDUCE FLOW VELOCITIES IN SIDE CHANNEL AND FLOODPLAINS.
- RETAIN SEDIMENT IN SIDE CHANNELS AND FLOODPLAIN.

HABITAT BENEFITS:
- INCREASE WETTED CHANNEL MARGIN AND INCREASE PHYSICAL HABITAT COMPLEXITY.
- CREATE OFF-CHANNEL REARING HABITAT AND REFUGE FOR FISH.
- SHALLOW GROUNDWATER INFILTRATION SUPPORTS REDUCED WATER TEMPERATURE AND NUTRIENT EXCHANGE.

REPRESENTATIVE PHOTO - 2

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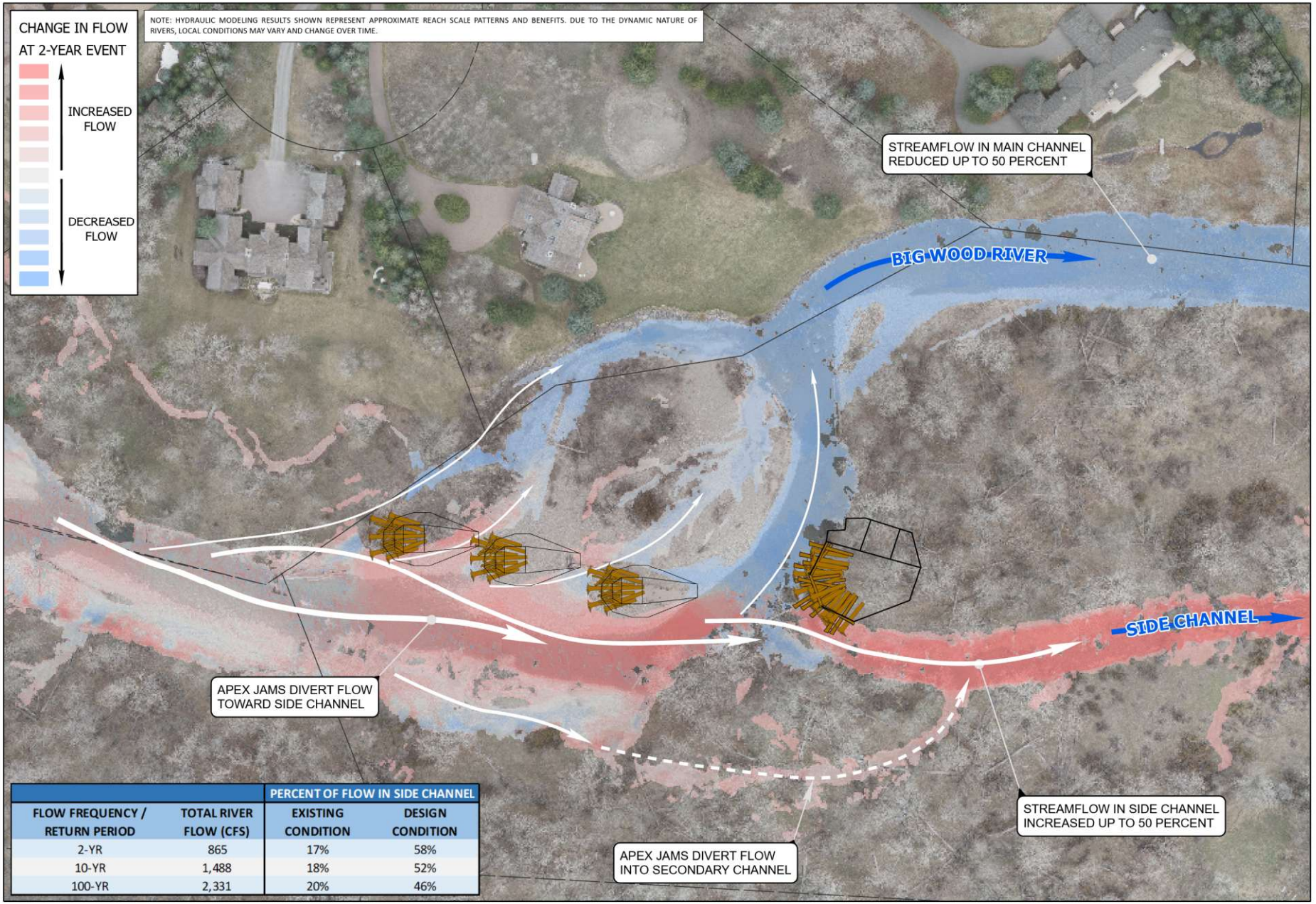
0 20 FT

BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
WOOD DETAILS - 3



		PERCENT OF FLOW IN SIDE CHANNEL	
FLOW FREQUENCY / RETURN PERIOD	TOTAL RIVER FLOW (CFS)	EXISTING CONDITION	DESIGN CONDITION
2-YR	865	17%	58%
10-YR	1,488	18%	52%
100-YR	2,331	20%	46%

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SUITE 200
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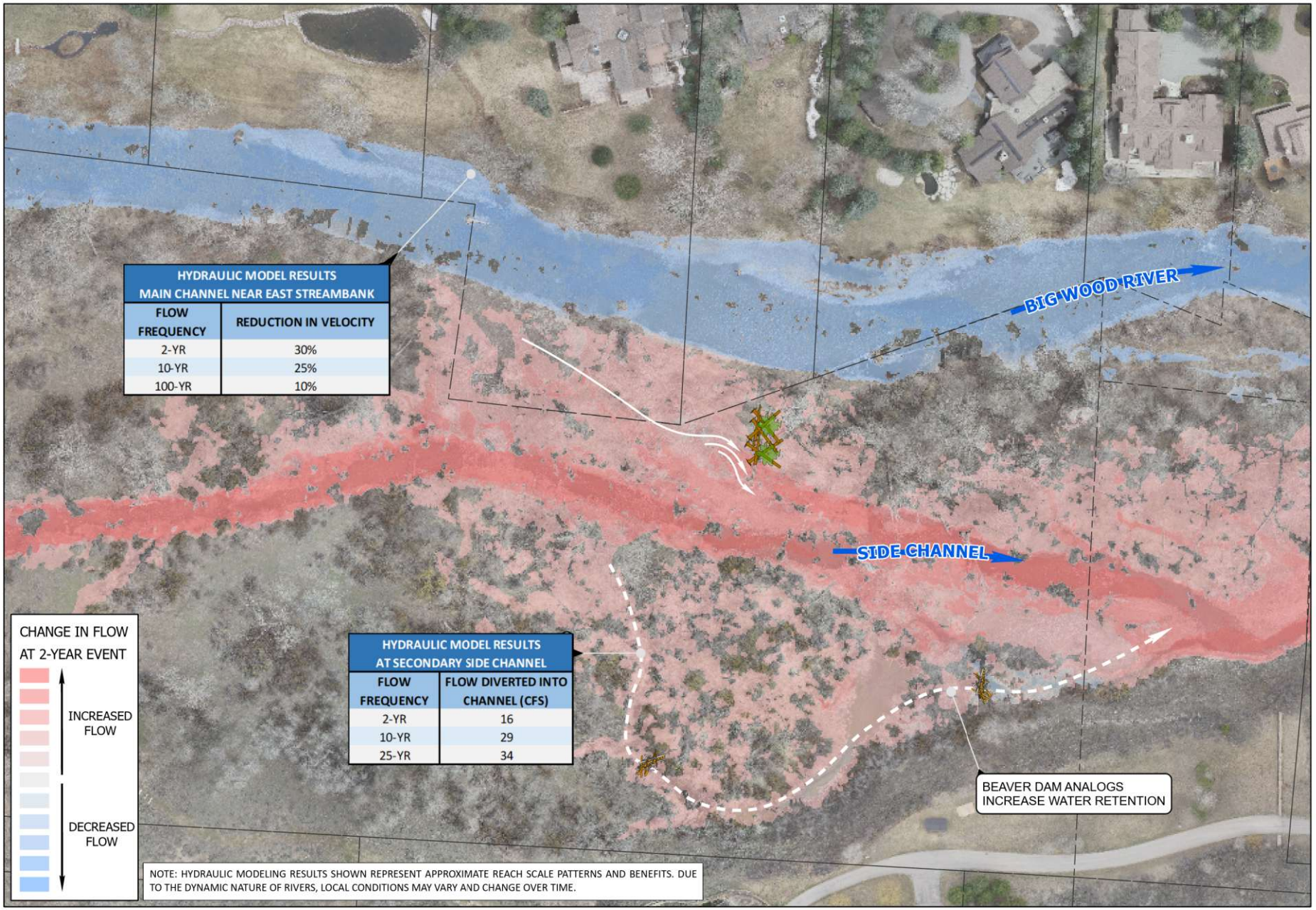
WWW.ESASSOC.COM

TROUT UNLIMITED

0 80 FT

BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PROPOSED HYDRAULIC CONDITIONS - 1



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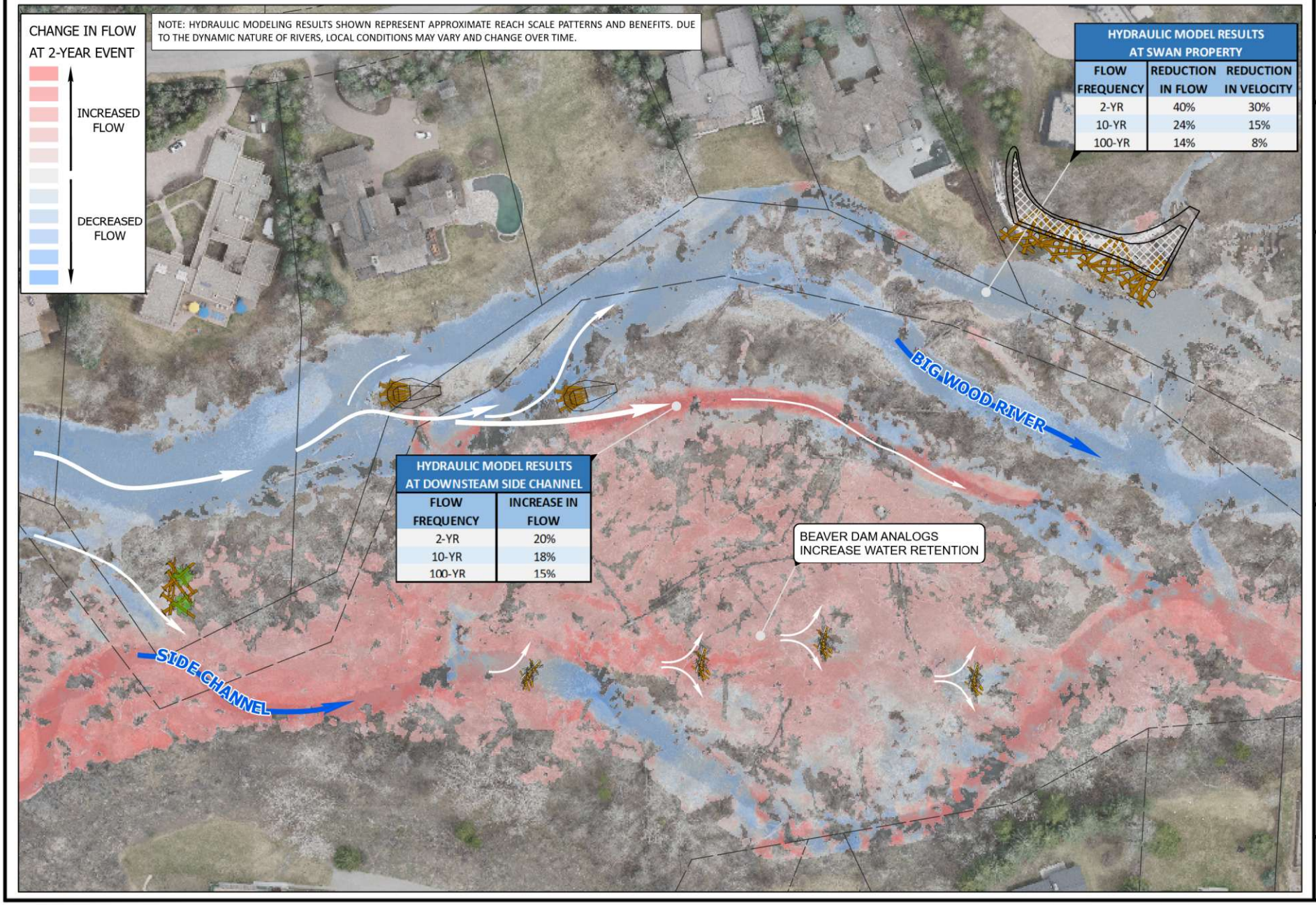
CONCEPT DESIGN
PROPOSED HYDRAULIC CONDITIONS - 2



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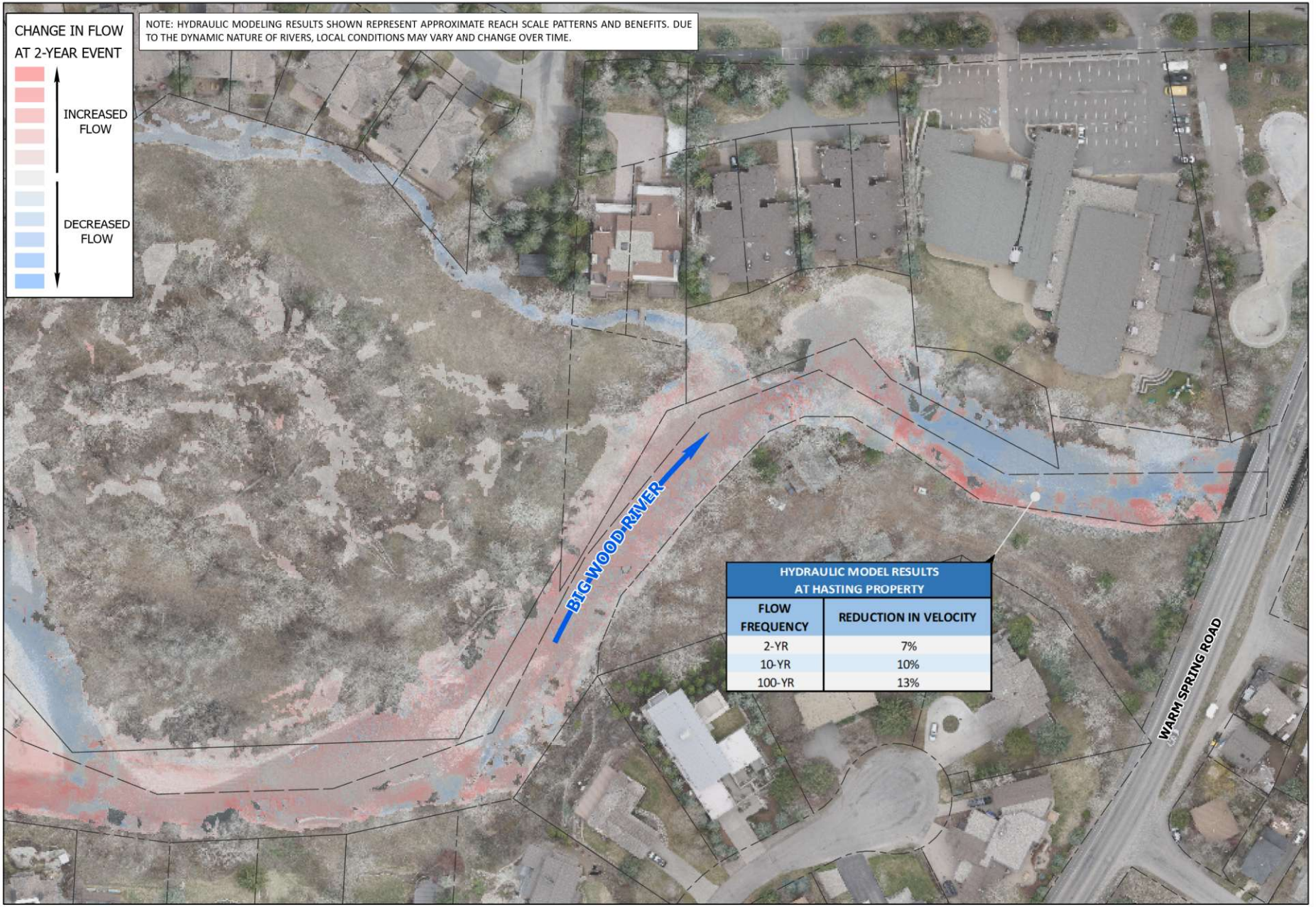
BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PROPOSED HYDRAULIC CONDITIONS - 3



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BIG WOOD RIVER - NORTHWOODS REACH
CONCEPT DESIGN
PROPOSED HYDRAULIC CONDITIONS - 4