

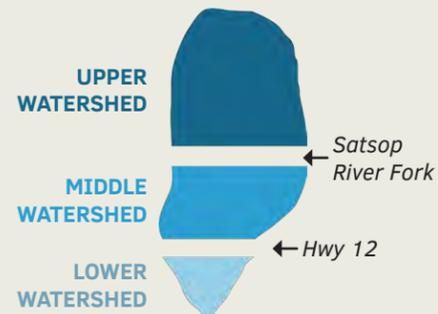
# UNDERSTANDING THE POSSIBLE SOLUTIONS

## SATSOP RIVER SOLUTIONS PROJECT

### How to Use this Handout

WATERSHED

The different parts of the watershed have differing river dynamics that impact the local area and the downstream river system. Certain solutions will be more effective in different parts of the watershed based on the effect it will have in the river and further downriver. This icon indicates whether the solution is anticipated to be most effective in the upper, middle, or lower watershed.



#### NAME OF THE PROPOSED SOLUTION

General description, purpose, and anticipated outcome of the proposed solution.

Flood	Habitat	Erosion
2.5	2.2	2.2

SCORES

These scores are the combined average of scores given to the projects by members of the Advisory Committee. Scores were on a scale of 1 to 3, from low to high. The score categories answer the following questions:

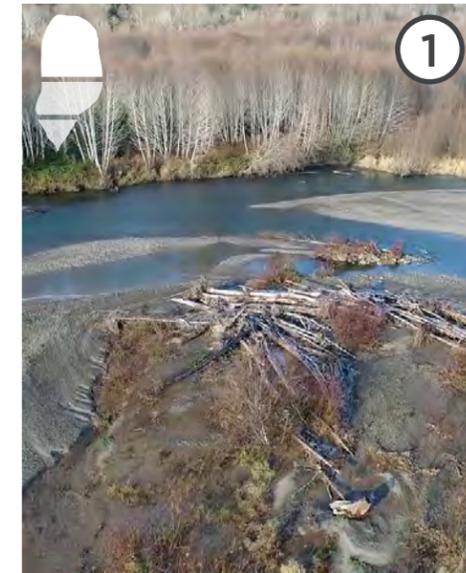
Flood- to what extent would this solution prevent flooding?

Habitat- to what extent would this solution enhance habitat in the river?

Erosion- to what extent would this solution prevent erosion?

### POTENTIAL SOLUTIONS

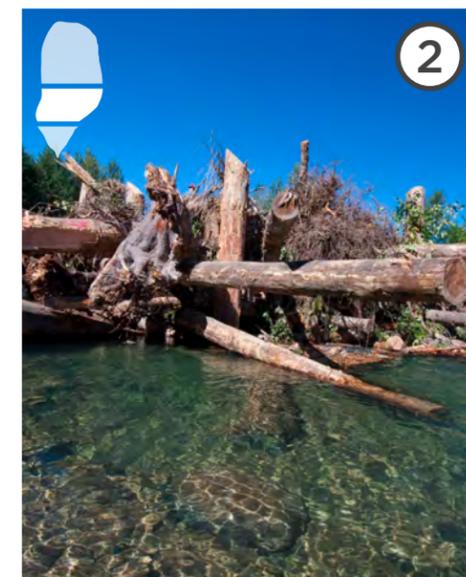
1. Conservation Practices on Working Forest Lands
2. Engineered Log Jams
3. Flood Easements and Conservation Easements
4. Keys Road - Hard Armoring
5. Keys Road - Soft Armoring
6. Keys Road - Relocation
7. In-Stream Gravel Management Study
8. Pilot Channel
9. Property Acquisition from Willing Sellers
10. Reconnecting Historic Side Channels
11. Restoration of Gravel Ponds on WDFW Property
12. Small-Scale Large Woody Debris Projects



#### 1 CONSERVATION PRACTICES ON WORKING FOREST LANDS

Collaborate with working forest managers to ensure that best practices are being met. Additionally, explore opportunities to increase riparian buffer widths, selectively harvest, or increase harvest rotation intervals. Implementation of conservation practices in the headwaters of the Satsop River has the potential to decrease runoff, erosion, and sediment transport in the system.

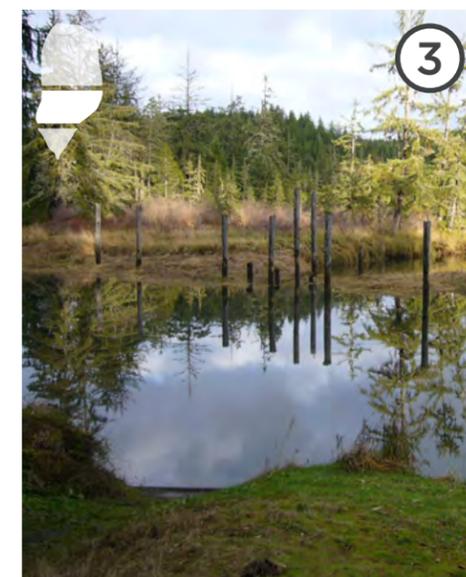
Flood	Habitat	Erosion
2.2	2.3	2.2



#### 2 ENGINEERED LOG JAMS

Place engineered complexes of large wood pieces in strategic locations in stream channels. Engineered log jams would be used to slow bank erosion, promote formation of side channels, increase channel roughness to slow velocity and encourage high flows to spread into the floodplain. Large wood plays a key role in stream morphology. They can promote formation of pools, gravel bars, and side channels. They can stabilize river banks and increase floodplain connectivity.

Flood	Habitat	Erosion
2.0	2.9	2.7



#### 3 FLOOD EASEMENTS AND CONSERVATION EASEMENTS

Collaborate with willing private property owners to obtain easements for flood storage and habitat conservation on private property. Under a flood easement, the owner would be restricted from building structures in the dedicated area and would manage that land proactively. Provides land area for flood storage and channel migration without impacting infrastructure and structures. Increased roughness and diversity of structure in the floodplain also serves to slow flood velocities.

Flood	Habitat	Erosion
2.6	2.4	2.3

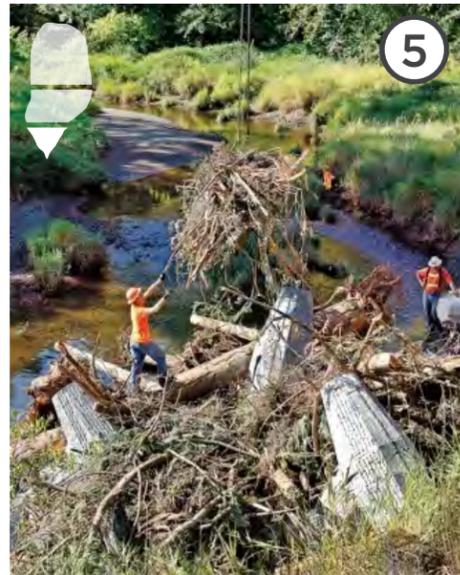


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### KEYS ROAD - HARD ARMORING

The current alignment of Keys Road would be maintained and protected using traditional techniques such as sheet pile wall. Protect Keys Road as a transportation corridor that connects Satsop Business Park and residences to State Route 12. Maintaining the existing alignment also provides erosion protection to farmland east of the road.

Flood	Habitat	Erosion
1.4	1.0	2.7



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### KEYS ROAD - SOFT ARMORING

The current alignment of Keys Road would be maintained and protected using bio-engineering techniques such as rip rap and large woody debris. Protect Keys Road as a transportation corridor that connects Satsop Business Park and residences to State Route 12. Maintaining the existing alignment also provides erosion protection to farmland east of the road.

Flood	Habitat	Erosion
1.4	2.0	2.7

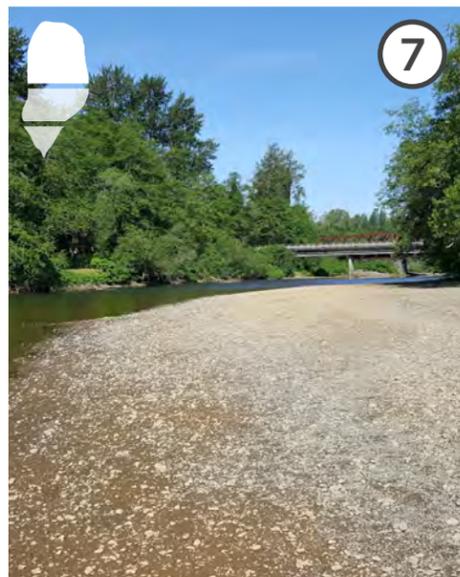


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### KEYS ROAD - RELOCATION

Keys Road and the natural gas line that runs in its right-of-way could be relocated to the east or west, closer to its historical alignment or along higher ground. These options would allow the Satsop River to migrate more freely to the east within its historical alluvial fan. Allowing the river to migrate to the east should reduce bank erosion on the west side. This would allow flood water to spread more broadly across the floodplain.

Flood	Habitat	Erosion
2.5	2.3	2.4



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### IN-STREAM GRAVEL MANAGEMENT STUDY

In coordination with an ELJ project or bank stabilization project, relocate gravel within the limits of the top of bank of the river. The movement of gravel could promote adjustments of the channel that the ELJ or bank stabilization project is designed to achieve.

Flood	Habitat	Erosion
1.9	1.8	2.6

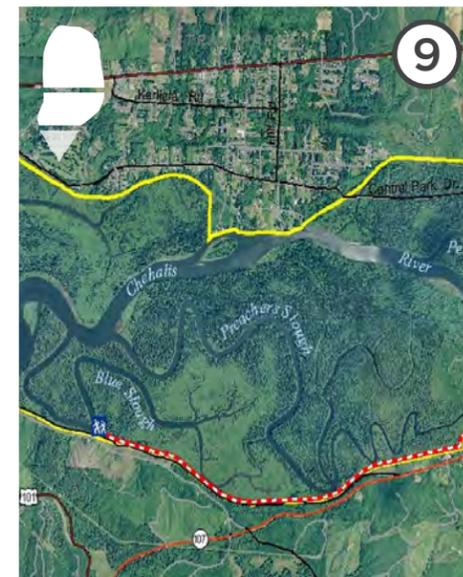


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### PILOT CHANNEL

A pilot channel is created by excavating in a low lying area, anticipating the eventual direction of the river, and creating an avulsion that redirects river flows into the pilot channel and away from eroding banks. Pilot channels can reduce the meandering of the river which can result in reduced bank erosion and loss of property within the floodplain. Pilot channels also have the potential to increase storage in the floodplain as the old channel becomes a backwater or oxbow habitat area.

Flood	Habitat	Erosion
1.4	1.7	2.1

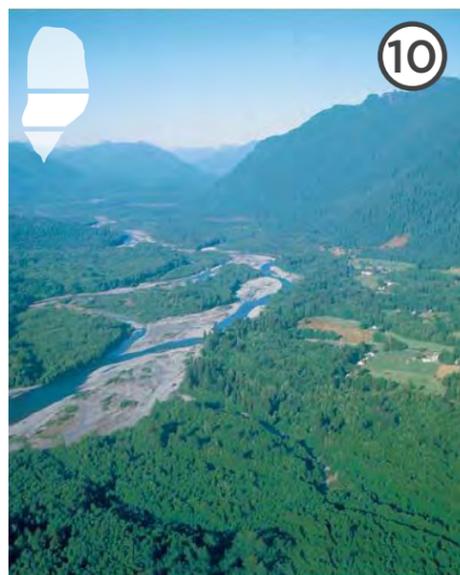


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### PROPERTY ACQUISITION FROM WILLING SELLERS

Purchase land from willing private property owners. These properties would then be managed to allow for periodic flooding and channel migration. The lands could be proactively planted with native trees and shrubs to stabilize river bank, increase floodplain roughness, and increase habitat structure and diversity.

Flood	Habitat	Erosion
2.1	2.0	2.3



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### RECONNECTING HISTORIC SIDE CHANNELS

Encourage the river to flow more broadly across its floodplain in strategic locations to slow velocities, increase storage in the floodplain, and increase habitat diversity. Side channels distribute and attenuate high river flows by encouraging the river flow to split between the main channel and side channels, the velocity of the water can be slowed and the volume of water that can be stored during flood events can be increased.

Flood	Habitat	Erosion
2.3	2.4	2.3

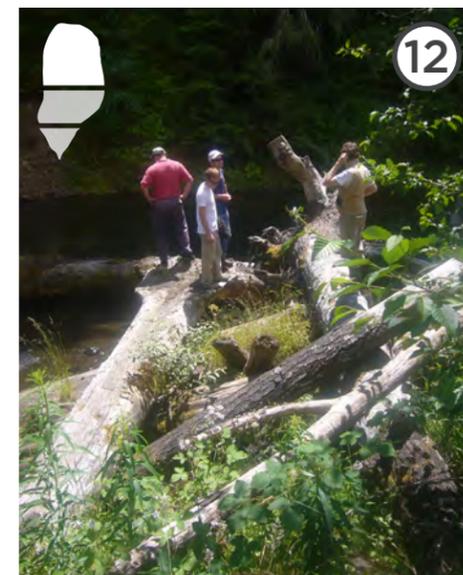


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### RESTORATION OF GRAVEL PONDS ON WDFW PROPERTY

Floodplain restoration through removal of approximately 164,000 cubic yards of spoils from the floodplain and using some of the material to partially fill former gravel pits to create shallow water habitat. Hydraulic and hydrologic modeling of the project indicate that it will have a small reduction in flood elevation and erosion risk, but the effect is primarily limited to the WDFW property itself.

Flood	Habitat	Erosion
1.7	2.4	1.6



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### SMALL-SCALE LARGE WOODY DEBRIS PROJECTS

Place large wood in discrete locations in stream channels. The large wood could range from single pieces to multiple pieces configured as a log jam. The large wood could be anchored or not depending on location, design, and risks. Large wood can provide protection against stream bank erosion. The ability of large wood to trap sediment, decrease flow velocity, and spread flood flows in a reach can reduce erosion and flood risk in downstream reaches.

Flood	Habitat	Erosion
2.0	3.0	2.6

**12** Small-Scale Large Woody Debris Projects

**\$100**

Flood	Habitat	Erosion
2.2	3.0	2.5

**1** Conservation Practices on Forestry Lands

**\$500**

Flood	Habitat	Erosion
2.2	2.4	2.2

**2** Engineered Log Jams

**\$500**

Flood	Habitat	Erosion
2.2	2.8	2.7

**10** Reconnecting Historic Side Channels

**\$1,000**

Flood	Habitat	Erosion
2.3	2.5	2.3

**7** In-Stream Gravel Management Study

**\$1,000**

*must pair with ELGs or Pilot Channel*

Flood	Habitat	Erosion
1.8	1.8	2.7

**11** Restore Gravel Ponds on WDFW Property

**\$2,500**

Flood	Habitat	Erosion
1.7	2.7	1.5

**4** Keys Road - Hard Armoring

**\$2,500**

Flood	Habitat	Erosion
1.3	1.0	2.7

**8** Pilot Channel

**\$1,000**

Flood	Habitat	Erosion
1.3	1.7	2.2

**6** Keys Road - Relocation

**\$5,000**

Flood	Habitat	Erosion
2.4	2.3	2.3

**3** Flood & Conservation Easements

**\$100**

Flood	Habitat	Erosion
2.5	2.5	2.2

**9** Property Acquisition from Willing Sellers

**\$500**

Flood	Habitat	Erosion
2.0	2.0	2.2

**5** Keys Road - Soft Armoring

**\$2,500**

Flood	Habitat	Erosion
1.3	2.0	2.7

# CALCULATING YOUR PRIORITIES

## SATSOP RIVER SOLUTIONS PROJECT

Potential Solution	Cost	Number of Projects	Total
Flood Easements and Conservation Easements	\$100	_____	_____
Small-Scale Large Woody Debris Projects	\$100	_____	_____
Conservation Practices on Working Forest Lands	\$500	_____	_____
Engineered Log Jams	\$500	_____	_____
Property Acquisition from Willing Sellers	\$500	_____	_____
In-Stream Gravel Management	\$1,000	_____	_____
Pilot Channel	\$1,000	_____	_____
Reconnecting Historic Side Channels	\$1,000	_____	_____
Keys Road - Hard Armoring	\$2,500	_____	_____
Keys Road - Soft Armoring	\$2,500	_____	_____
Restoration of Gravel Ponds on WDFW Property	\$2,500	_____	_____
Keys Road Relocation	\$5,000	_____	_____
<b>TOTAL</b>			<b>\$5,000 MAX</b>