

Fan Extent

Near Term Erosion Risk

Keys Road

A1 - No Action

Assumes no work is done in project area with this funding. Individual landowners would be responsible for future flood or erosion protection measures.

Risks:

- Continued erosion of right bank
- Continued erosion at well
- Continued erosion at WDFW & Scott properties
- Continued presence of 160,000 yards of spoils in floodplain

Benefit:

- Low cost
- No construction impact

Order of Magnitude Cost Estimate:

None

Satsop River Alternative A1

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Grays Harbor County, WA



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SCALE: 1" = 1,000'

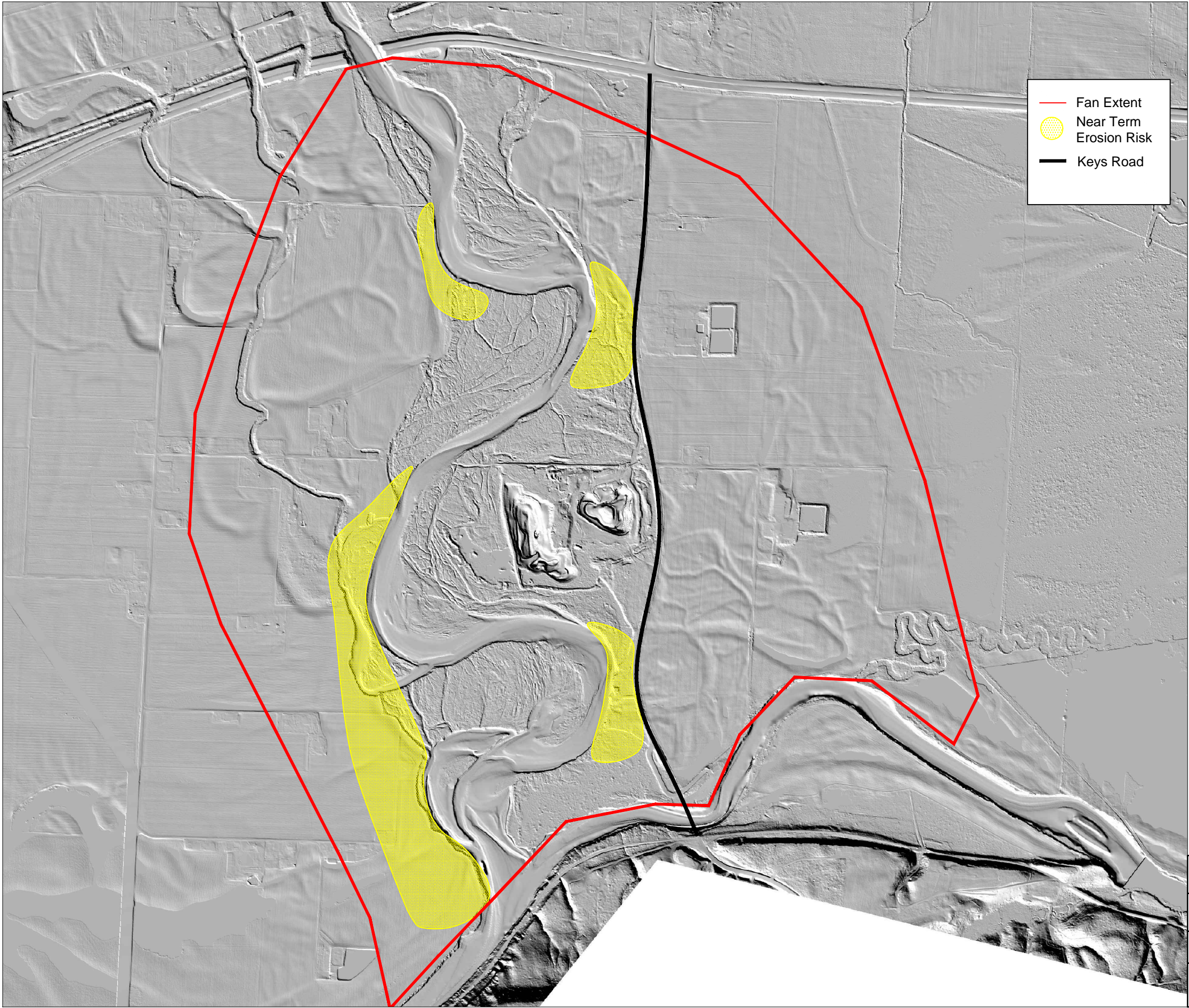
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JOB NO: 14-004

PLATE

1





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Erosion Risk

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Order of Magnitude Cost Estimate:

None

Satsop River Alternative A1

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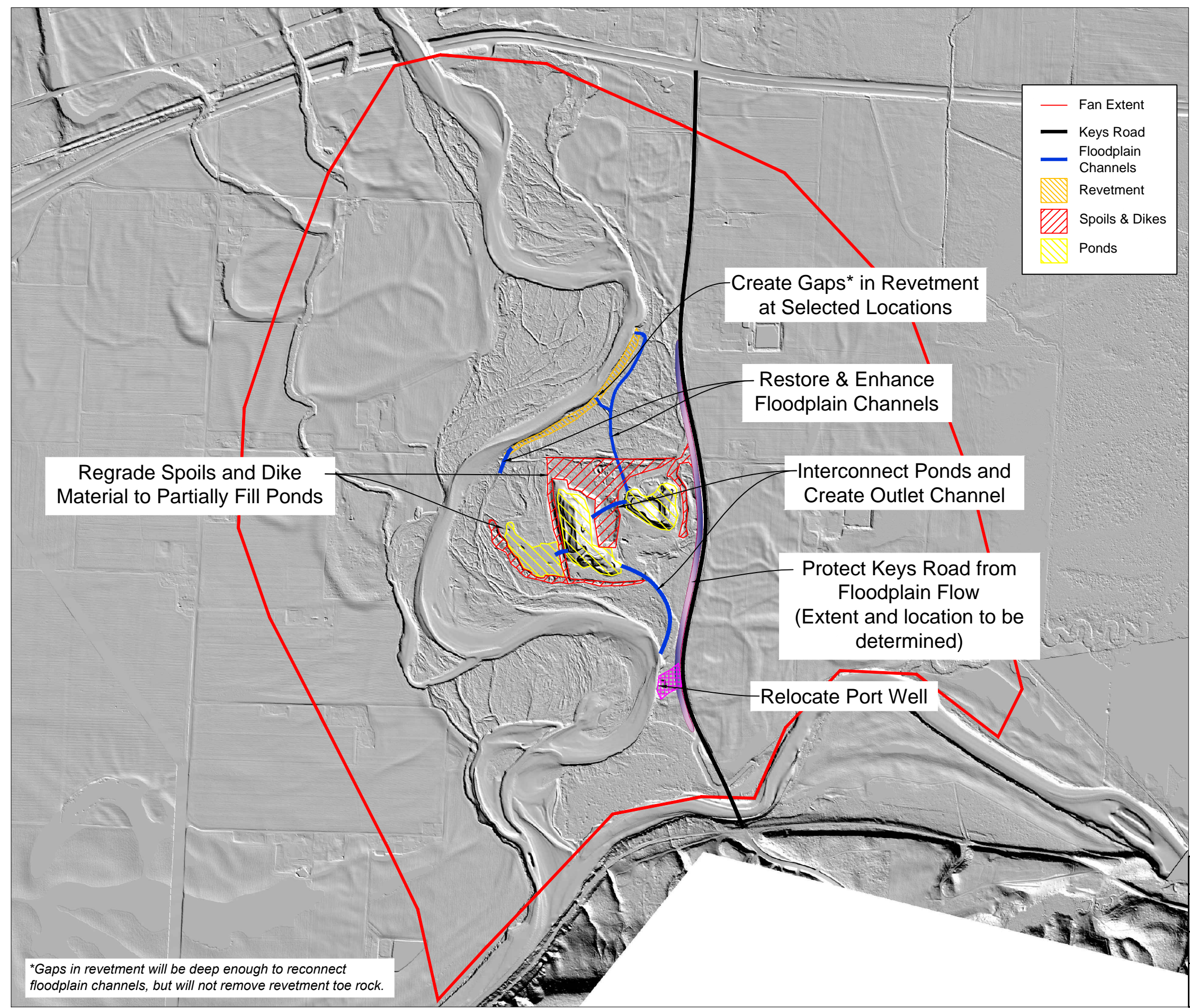
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PLATE
1





# A2-A - Spoils & Dikes Removal with Flood Channel Reconnection

Removal of spoils and dikes on WDFW property and restoration of floodplain channels

**Elements include:**

- Move spoils piles & dikes to partially fill ponds (approx. 1/3 full) & create safer sideslopes
- Excavate gaps in revetment to reconnect floodplain channels
- Restore & enhance floodplain channels
- Interconnect ponds and restore outlet channel
- Protect Keys Road from overbank and floodplain channel flow
- Revegetate disturbed areas
- Relocate Port well

**Risks:**

- Continued erosion of right bank
- Continued erosion at well
- Continued erosion at WDFW & Scott properties


**Order of Magnitude Cost Estimate:**

- Regrade spoils:  
160,000 CY \$1,780,000
- Excavate gaps in revetment  
500 LF \$200,000
- Floodplain channels (3,000 feet):  
10,000 CY \$160,000
- Revegetation  
14 Acres \$250,000
- Keys Road protection  
Lump Sum \$200,000
- Port well relocation  
WDFW contribution \$500,000

**Total \$3,100,000**

Satsop River Alternative A2-A

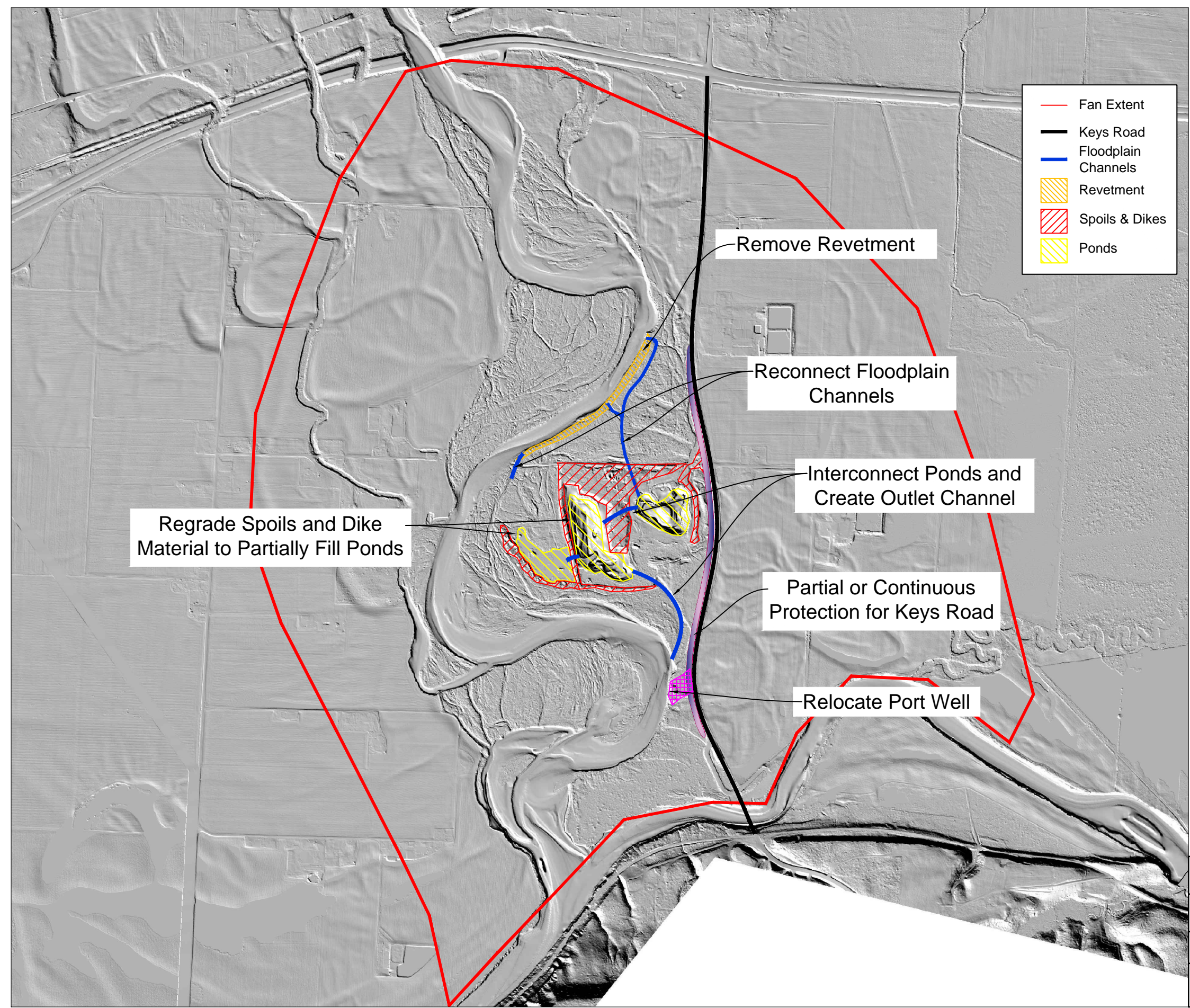
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PLATE  
**2A**





# A2-B - Spoils, Dikes & Revetment Removal

Removal of spoils, dikes & revetment on WDFW property. Revetment removal would require protection for Keys Road

Elements include:

- Remove revetment
- Protect Keys Road against full flow of Satsop (Rock or LWD)
- Move spoils piles & dikes to partially fill ponds (approx. 1/3 full) & create safer sideslopes
- Restore & enhance floodplain channels
- Interconnect ponds and restore outlet channel
- Revegetate disturbed areas
- Relocate Port well

Risks:

- Continued erosion of right bank
- Increased erosion risk to Keys Road & well property

Order of Magnitude Cost Estimate:

- Regrade spoils:  
160,000 CY \$1,780,000
- Remove revetment  
2,200 LF \$890,000
- Floodplain channels (3,000 feet):  
10,000 CY \$160,000
- Revegetation  
14 Acres \$250,000
- Keys Road protection – Full Flow  
3,700 LF (LWD) \$2,000,000  
to  
3,700 LF (Rock) \$6,000,000
- Port well relocation  
WDFW contribution \$500,000

Total \$5,600,000 to \$9,600,000

Satsop River Alternative A2-B

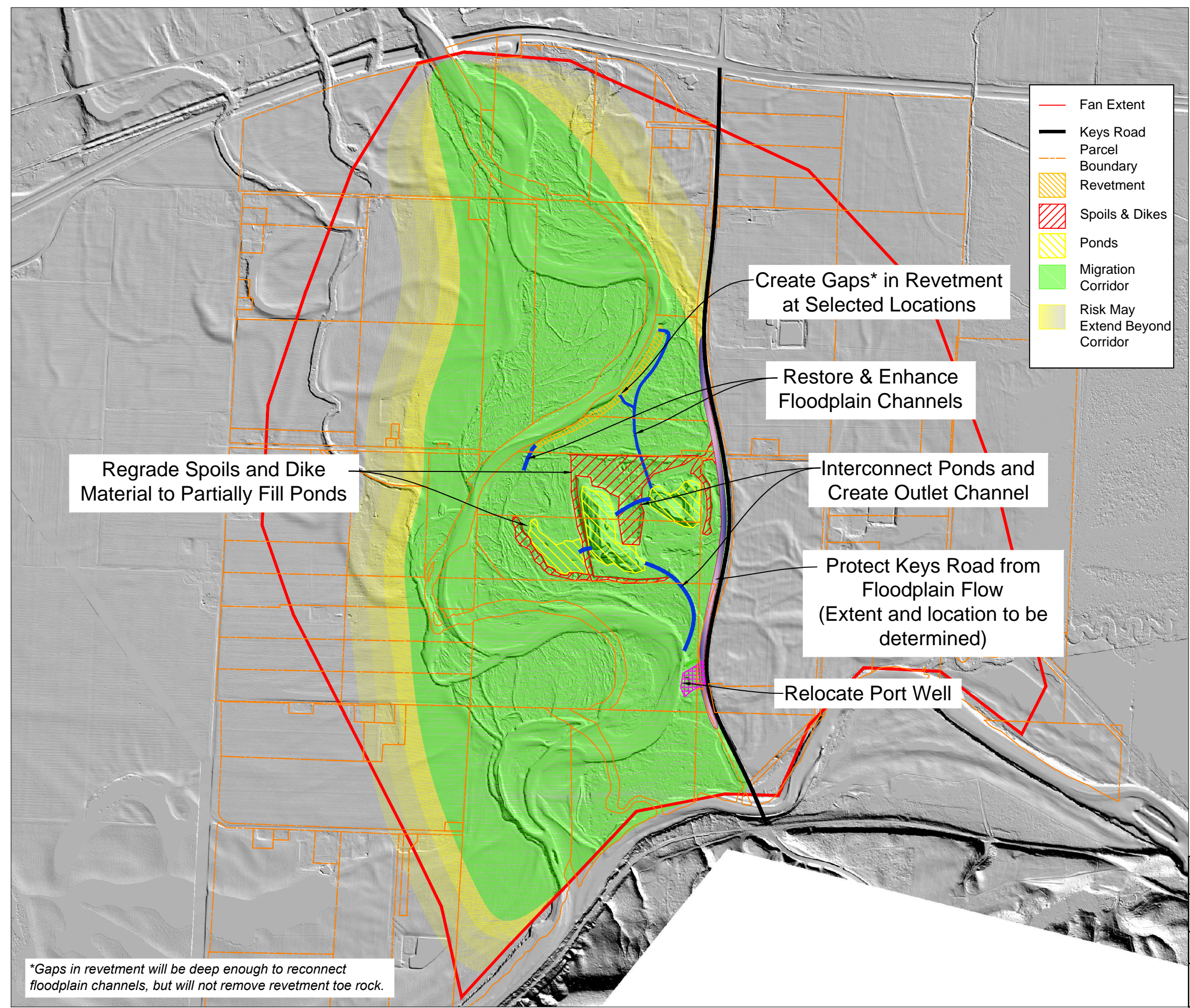
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PLATE  
2B





# A3-A - Lateral Migration Corridor

Assumes channel is allowed to migrate within a defined corridor and that WDFW will support actions to reduce migration outside of the corridor.

## Elements include:

- Prioritized acquisition of easements from willing landowners in migration corridor
- All A2-A Elements:
  - ♦ Move spoils and dikes into ponds
  - ♦ Excavate gaps in revetment
  - ♦ Restore & enhance floodplain channels
  - ♦ Overbank flow protection for Keys Road
  - ♦ Revegetate disturbed areas
  - ♦ Relocate Port well

## Risks:

- Continued erosion of right bank
- Continued erosion at WDFW & Scott properties

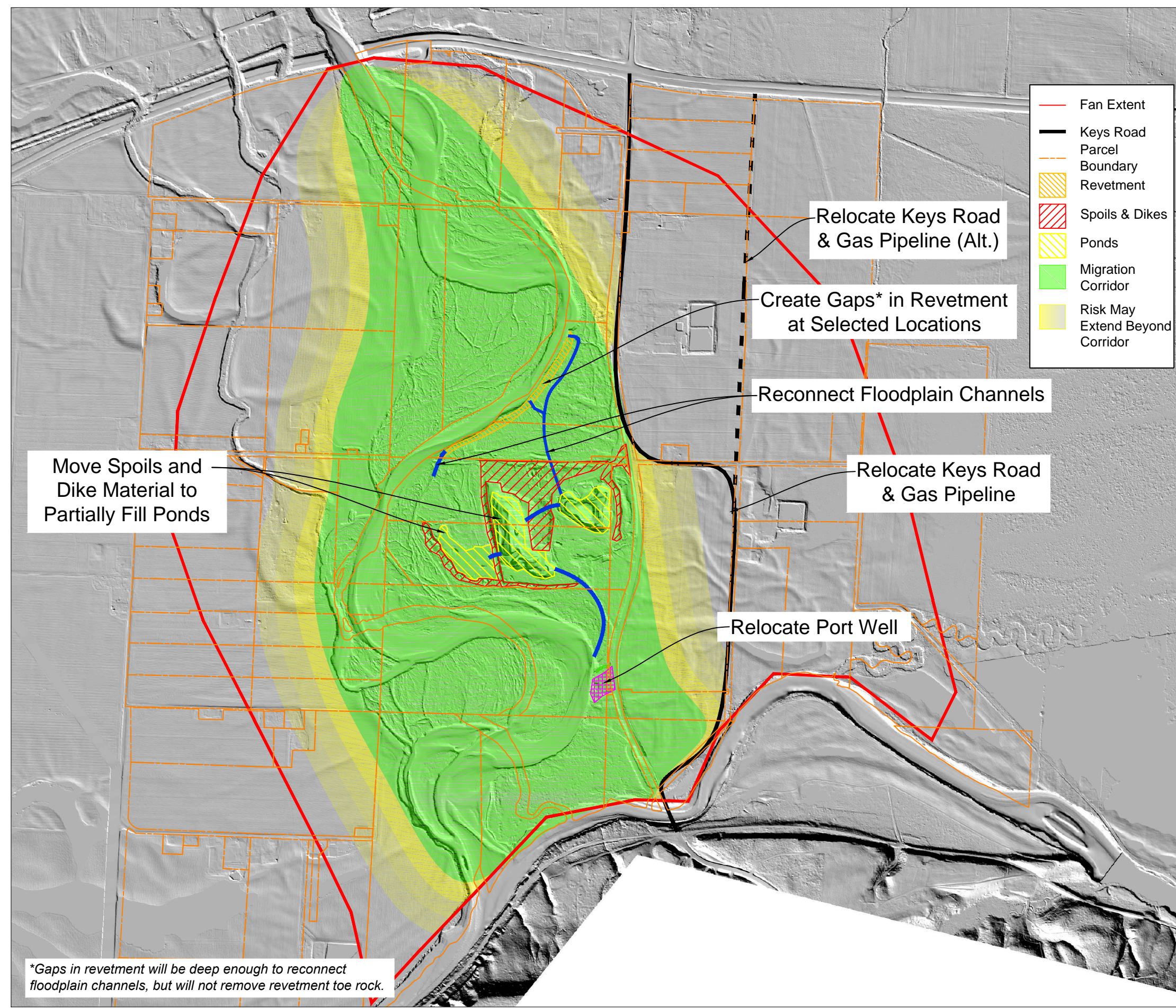
## Order of Magnitude Cost Estimate:

- Alternative A2-A elements:
  - All Elements \$3,100,000
- Acquisition (Assessors value)
  - Up to 220 acres \$565,000

**Total \$3,700,000**

\*Gaps in revetment will be deep enough to reconnect floodplain channels, but will not remove revetment toe rock.





# A3-B - Lateral Migration Corridor with Keys Road Relocation

Assumes channel is allowed to migrate within a defined corridor and that WDFW will support actions to reduce migration outside of the corridor.

- Elements include:**
- Prioritized acquisition of easements from willing landowners in migration corridor
  - Relocating Keys Road
  - All A2-A Elements:
    - ♦ Move spoils and dikes into ponds
    - ♦ Excavate gaps in revetment
    - ♦ Restore & enhance floodplain channels
    - ♦ Overbank flow protection for Keys Road
    - ♦ Revegetate disturbed areas
    - ♦ Relocate Port well

- Risks:**
- Continued erosion of right bank
  - Continued erosion at WDFW & Scott properties

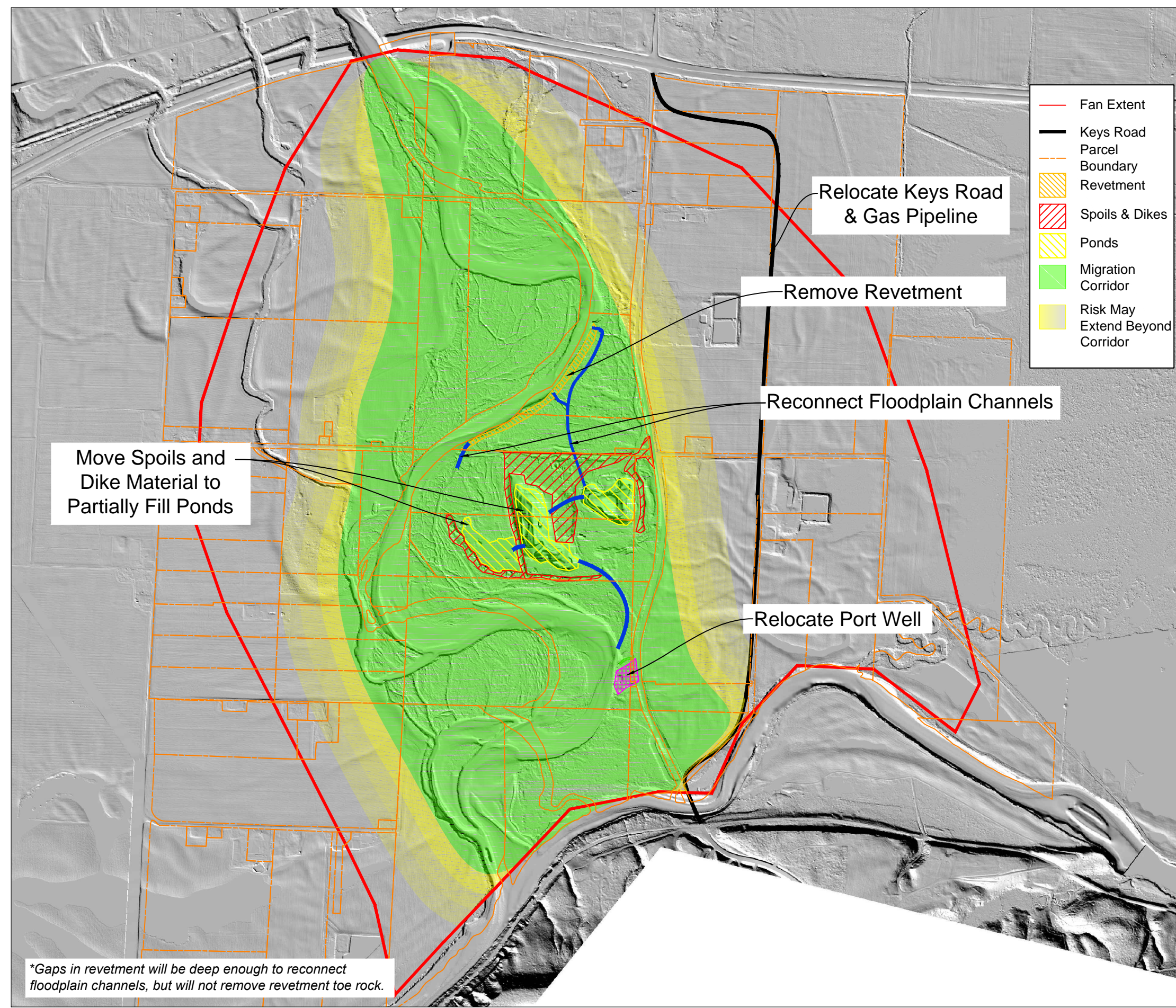
**Order of Magnitude Cost Estimate:**

• Alternative A2-A elements:	
All Elements	\$3,100,000
• Acquisition (Assessors value)	
Up to 215 acres	\$390,000
• Keys Road & gas line relocation	
5,700 - 7,600 LF	\$9,900,000
	to \$13,200,000
<b>Total</b>	<b>\$13,400,000</b>
	<b>to \$16,700,000</b>

\*Gaps in revetment will be deep enough to reconnect floodplain channels, but will not remove revetment toe rock.

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# A3-C - Lateral Migration Corridor with Revetment Removal and Keys Road Relcoation

Assumes channel is allowed to migrate within a defined corridor and that WDFW will support actions to reduce migration outside of the corridor.

- Elements include:**
- Prioritized acquisition of easements from willing landowners in migration corridor
  - Relocating Keys Road
  - A2-B Elements, except Keys Road protection:
    - ♦ Remove revetment
    - ♦ Move spoils and dikes into ponds
    - ♦ Restore & enhance floodplain channels
    - ♦ Revegetate disturbed areas
    - ♦ Relocate Port well

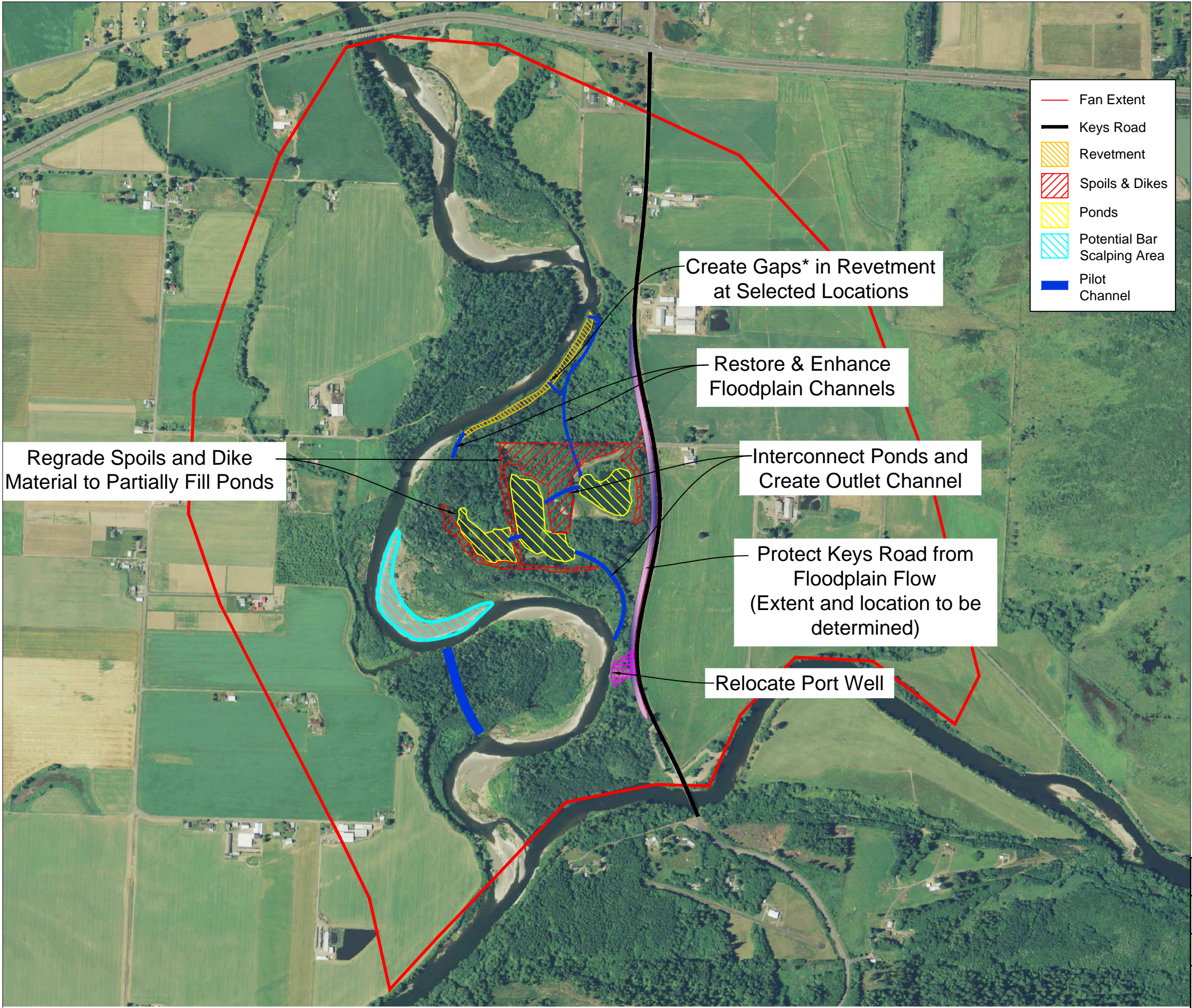
- Risks:**
- Continued erosion of right bank
  - Continued erosion at WDFW & Scott properties

**Order of Magnitude Cost Estimate:**

• A2-B elements:	
Included elements	\$3,600,000
• Acquisition (Assessors value)	
Up to 215 acres	\$390,000
• Keys Road & gas line relocation	
7,600 LF	\$13,200,000
<b>Total</b>	<b>\$17,200,000</b>

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# A4 - Channel Maintenance

Remove gravel and create pilot channels to reduce sediment volume and channel migration impacts.

**Elements include:**

- Bar scalping
- Creation of pilot channel(s)
- Ongoing maintenance
- All A2-A Elements:
  - ♦ Move spoils and dikes into ponds
  - ♦ Excavate gaps in revetment
  - ♦ Restore & enhance floodplain channels
  - ♦ Overbank flow protection for Keys Road
  - ♦ Revegetate disturbed areas
  - ♦ Relocate Port well

**Risks:**

- Experimental; may have limited benefit
- Removes mature riparian forest
- Difficult to obtain permits / variance
- Requires ongoing maintenance
  - Bar scalping every 1-3 years
  - Pilot channel every 10-15 years

**Order of Magnitude Cost Estimate:**

- Alternative A2-A Elements:
  - All Elements \$3,100,000
- Bar Scalping
  - 58,000 CY \$350,000
- Pilot Channels
  - 1,000 LF \$120,000

**Total \$3,600,000**

**Annual Maintenance**

- Bar scalping (annual replenishment)
  - 10,000 CY \$150,000
- Pilot channels (annualized)
  - @1,000 LF/decade \$12,000

**Total Annual Cost \$160,000**

Satsop River Alternative A4

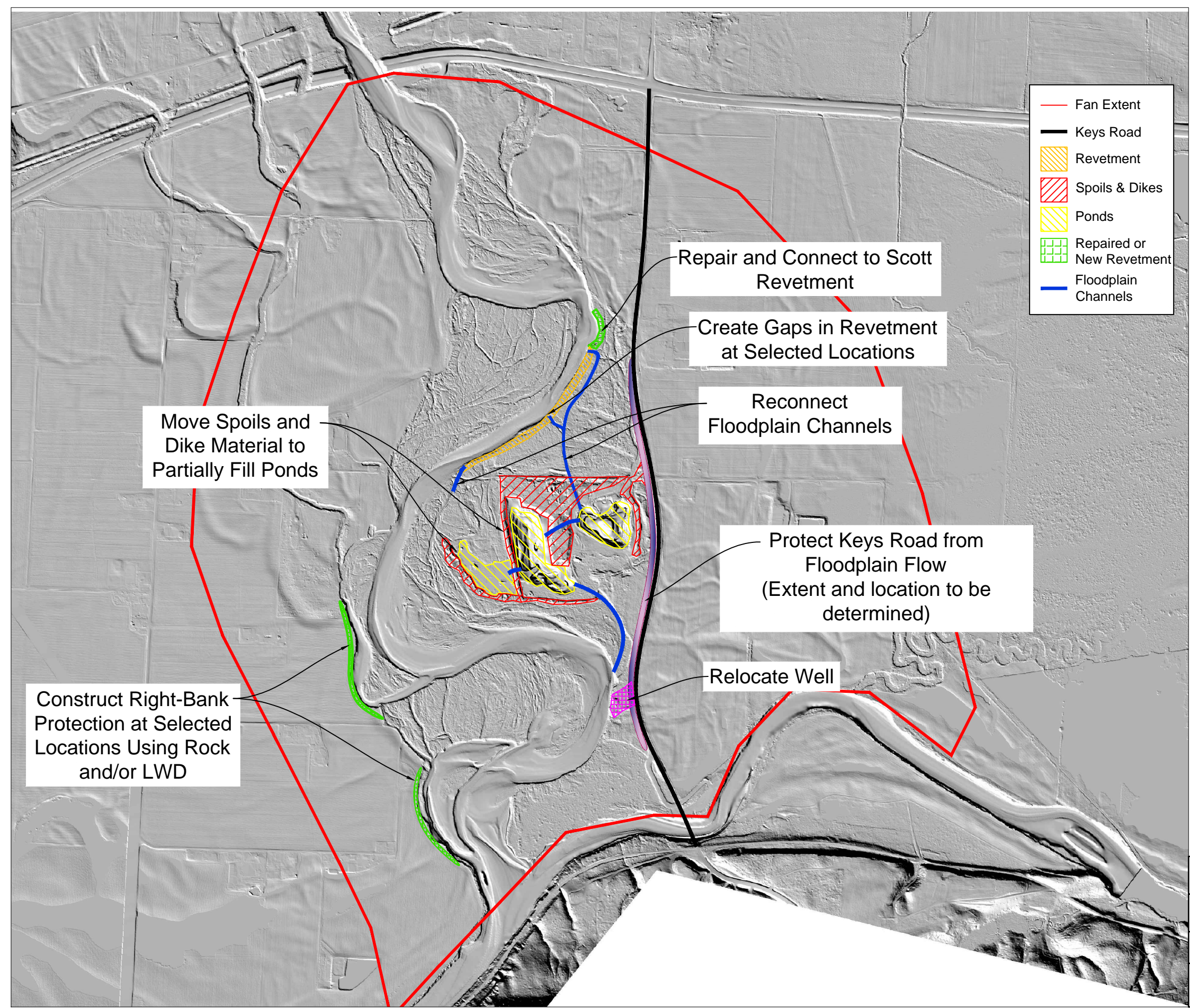
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PLATE  
**4**





# A5-A - New Bank Protection - Targeted

WDFW restoration elements plus targeted bank protection for infrastructure and agricultural land.

**Elements include:**

- Repair or reconnection of WDFW revetment to Scott revetment
- Targeted protection of right bank (rock and/or LWD)
- All A2-A Elements:
  - ♦ Move spoils and dikes into ponds
  - ♦ Excavate gaps in revetment
  - ♦ Restore & enhance floodplain channels
  - ♦ Overbank flow protection for Keys Road
  - ♦ Revegetate disturbed areas
  - ♦ Relocate Port well

**Risks:**

- Reduction in habitat processes
- Future maintenance of bank protection

**Order of Magnitude Cost Estimate:**

- Alternative A2-A elements:
  - All Elements \$3,100,000
- Targeted right bank protection
  - Up to 2,600 LF \$3,900,000
- Repair WDFW/Scott revetment
  - 500 LF \$800,000

**Total \$7,800,000**

Satsop River Alternative A5-A

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PLATE  
**5A**



A5-B - Targeted Bank Protection with WDFW Revetment Removal

Elements include:

- Construction of right bank revetment and/or LWD structures to protect agricultural land
- All A2-B elements
  - ♦ Remove WDFW revetment
  - ♦ Protect Keys Road (Rock or LWD)
  - ♦ Move spoils and dikes into ponds
  - ♦ Restore & enhance floodplain channels
  - ♦ Relocate Port well
  - ♦ Revegetate disturbed areas

Risks:

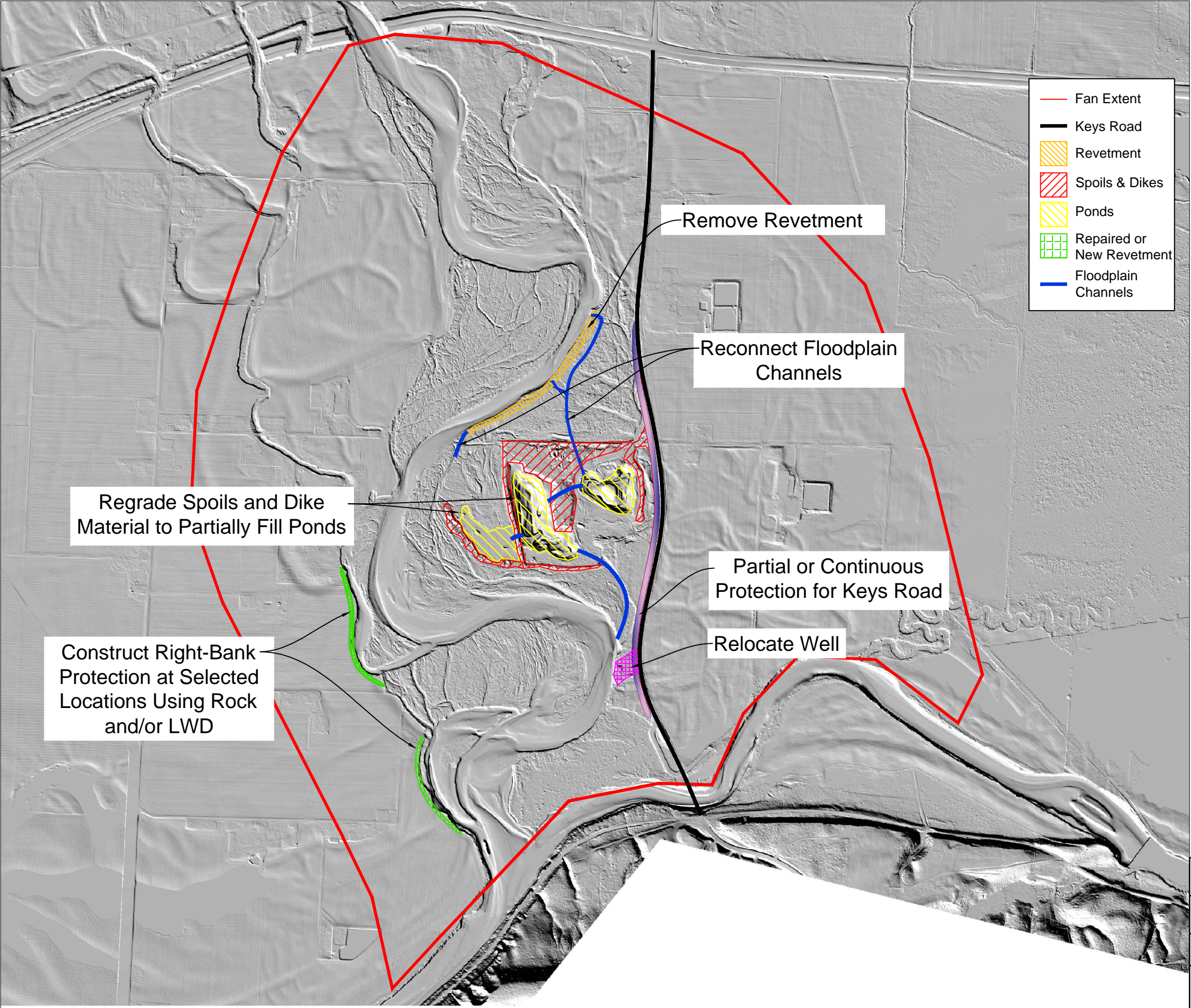
- Reduction in habitat processes
- Future maintenance of bank protection

Order of Magnitude Cost Estimate:

- Alternative A2-B elements:

All Elements	\$6,200,000
	to \$9,200,000
- Targeted right bank protection  
2,600 LF \$3,900,000

**Total** \$10,100,000 to \$13,100,000



Satsop River Alternative A5-B

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5B