Congratulations Jaclyn Hancock!
Class 45: AgForestry Leadership

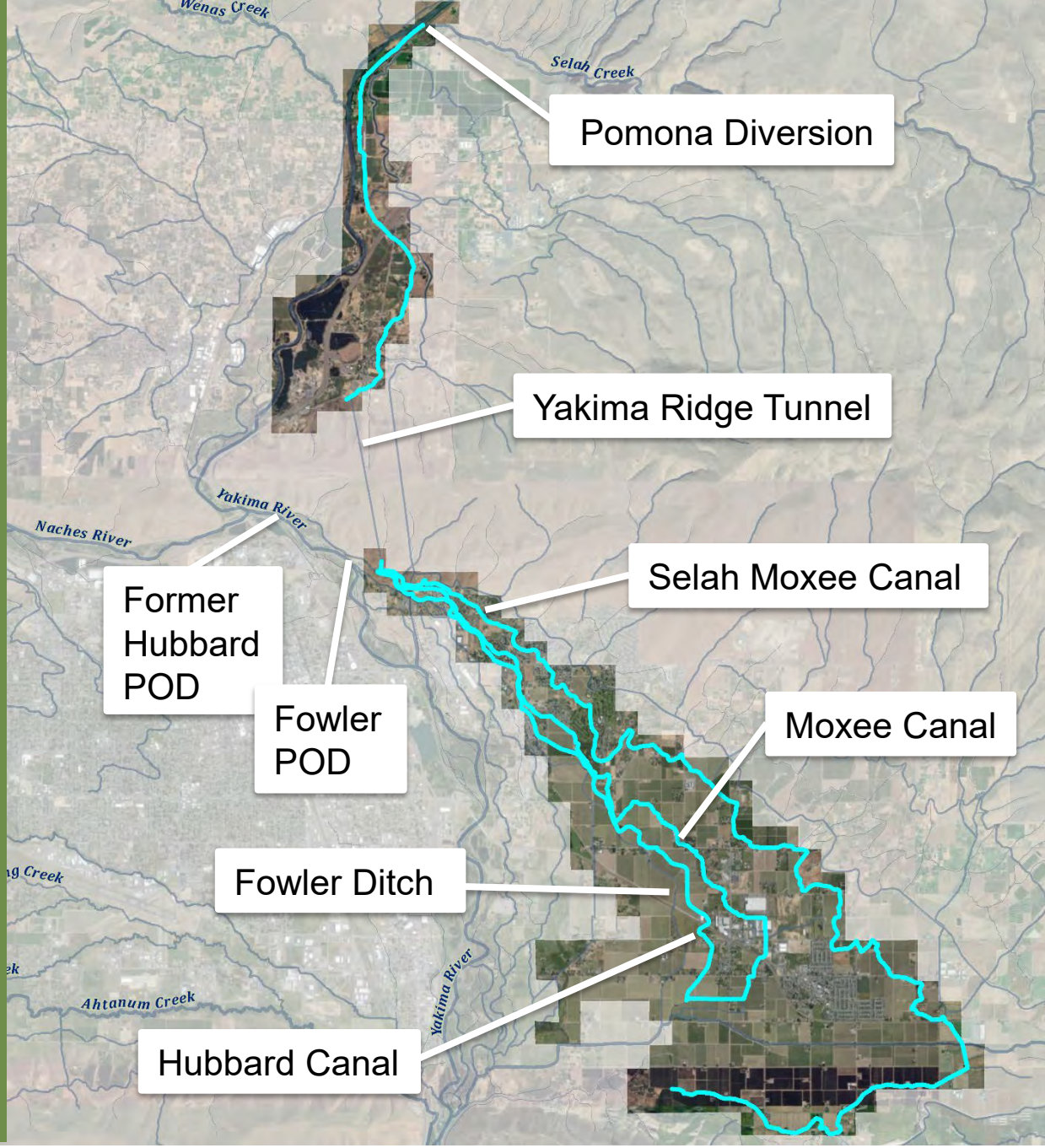
Selah-Moxee Irrigation District Water Conservation Program

March 12, 2025

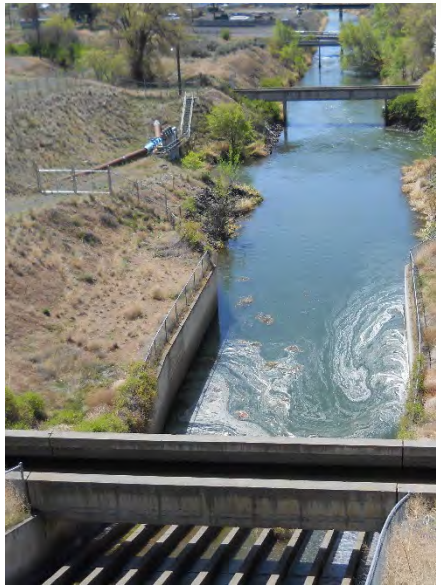
Presented by:

Nathan Draper, SMID Manager

SMID System Overview



Water Conservation Program



- $100 million in necessary infrastructure upgrades
- Canal Lining
- Canal Piping
- Automation

Why Does the District Implement this Program?

- Aging Infrastructure
- Improves canal operations
- Provides reliability for our customers
- Conserves water

Canal Lining

Canal Piping

Enhanced Conservation Program

- $3.5 million in upgrades
- 1,200 AF Conserved Water

Current Funding Souces

- SMID Landowners' through assessments.
- SMID Water Bank

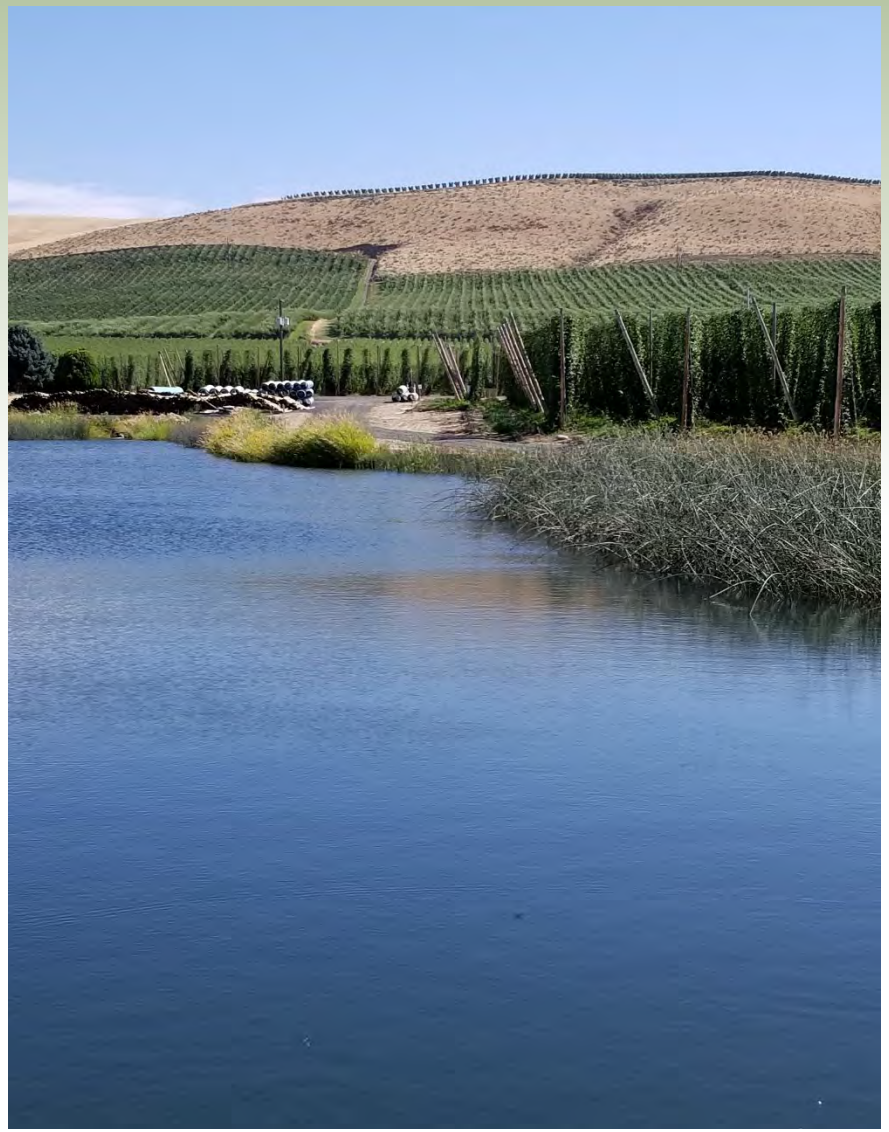
Water Banking: General Bank Structure

- Water bank approved in June 2021
- Wholesale style bank (not retail exempt wells!)
- Typical sales/Leases for medium to large blocks of water (10's to 100's of ac-ft)
- Solving local water supply problems

Project Financing Needs

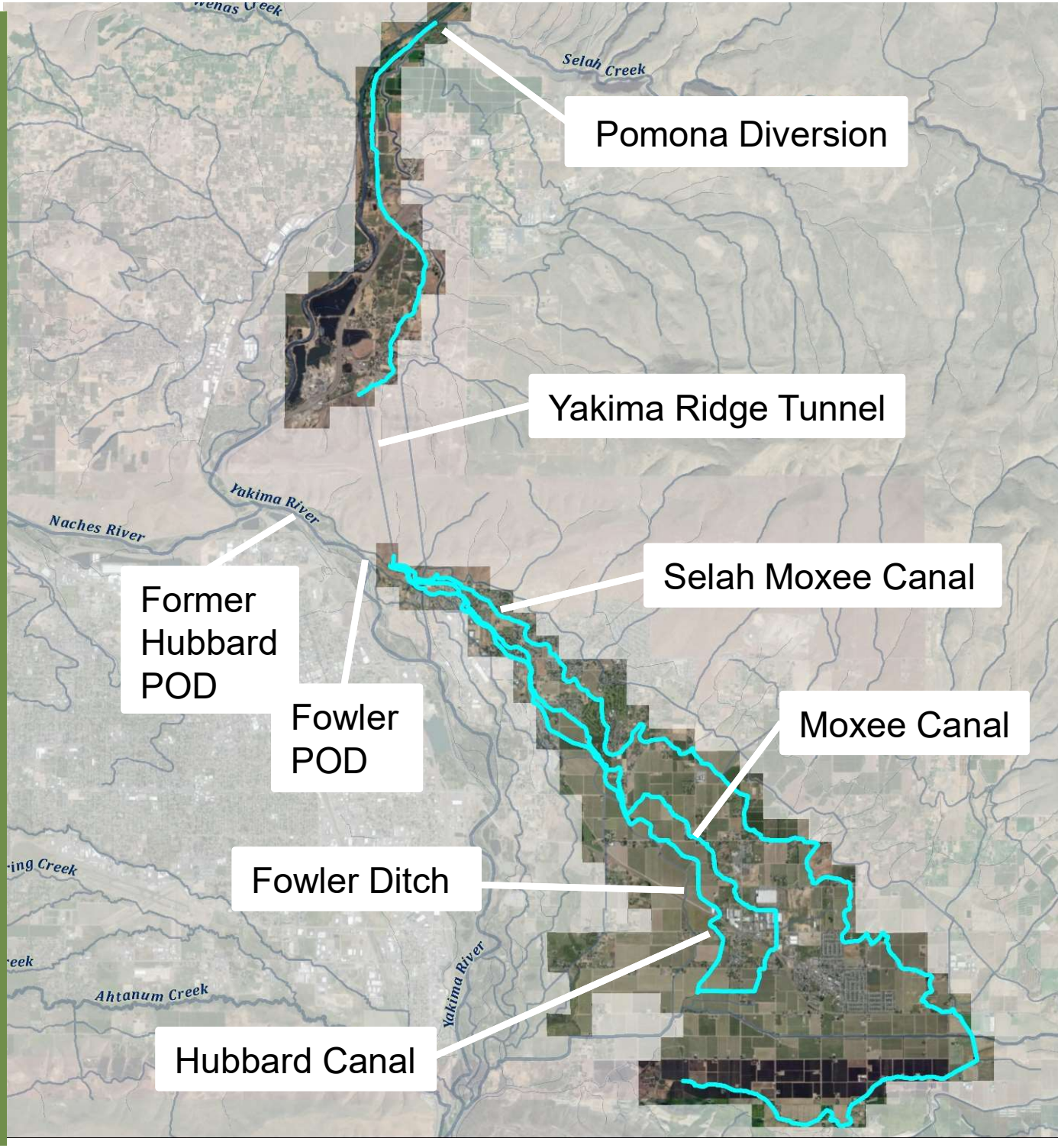
Project Estimates:

- $100 Million to complete the project
- 7,800 AF of Conserved Water



Questions

Nathan Draper, Manager
Selah-Moxee Irrigation District
ndraper@selahmoxee.org
509-469-0449

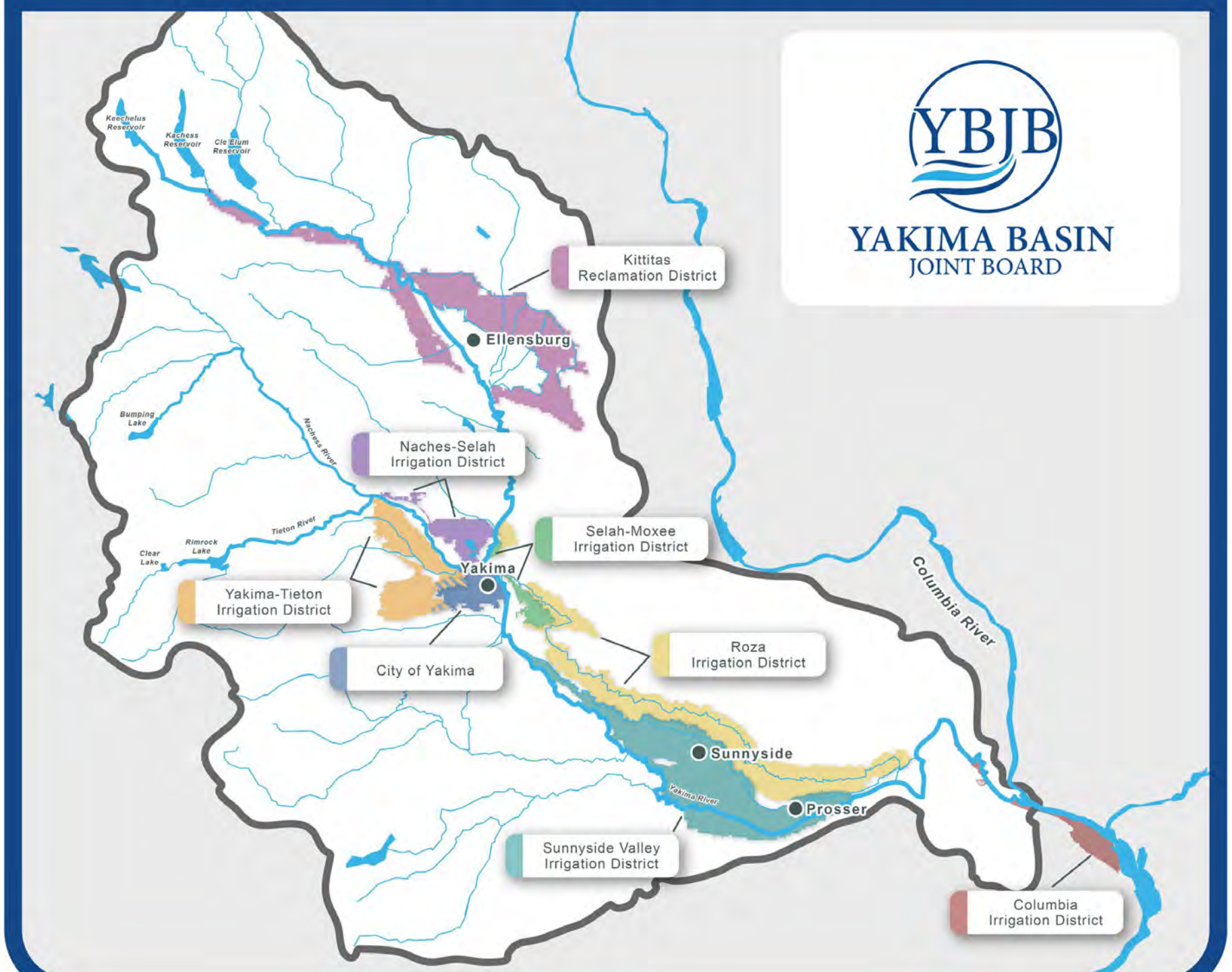


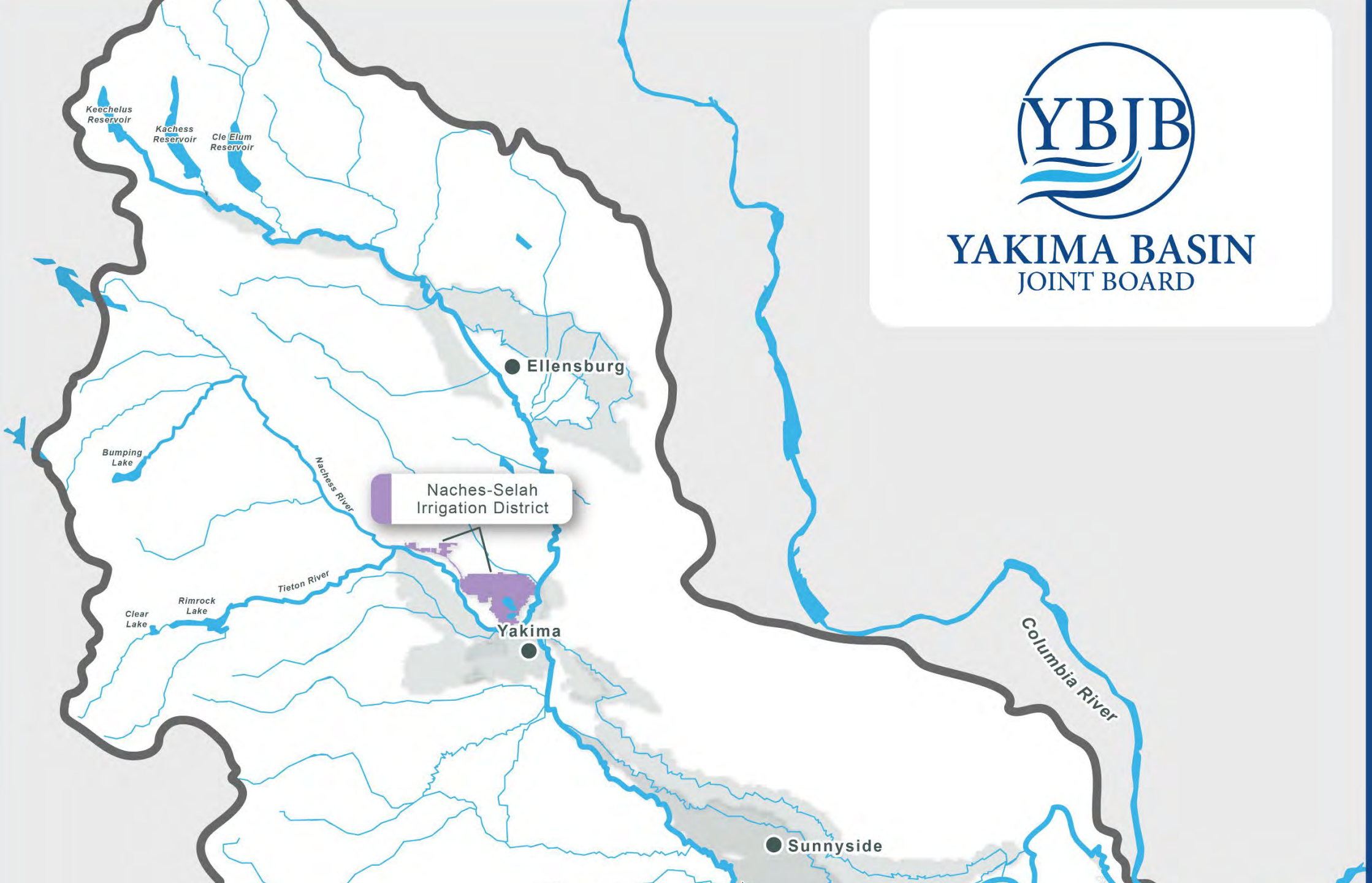
A Story of Modernization

Naches-Selah
Irrigation District
Est. 1916

Justin Harter, Manager

March 12, 2025


YBJB
YAKIMA BASIN
JOINT BOARD
Keechelus Reservoir
Kachess Reservoir
Cle Elum Reservoir
Kittitas Reclamation District
Ellensburg
Bumping Lake
Naches River
Naches-Selah Irrigation District
Tieton River
Rimrock Lake
Clear Lake
Selah-Moxee Irrigation District
Yakima
Yakima-Tieton Irrigation District
City of Yakima
Roza Irrigation District
Columbia River
Sunnyside
Yakima River
Prosser
Sunnyside Valley Irrigation District
Columbia Irrigation District


YBJB
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Naches River
Naches-Selah Irrigation District
Tieton River
Rimrock Lake
Clear Lake
Yakima
Columbia River
Sunnyside


SELAH VALLEY CANAL Mile 9.0
1903

Reconstruction of the Naches-Selah Irrigation Canal

Parts of Old Sidehill Canal in Disrepair Replaced, Under War Conditions, by Concrete-Lined Tunnels, Reinforced-Concrete Flumes, and Canal With Wire-Reinforced Concrete

By Elbert M. Chandler
Chief Engineer, Naches-Selah Irrigation District, Yakima, Wash.

TUNNEL FACE SHOWING USE OF COAL AUGERS

REINFORCED-CONCRETE FLUME BETWEEN TUNNELS

SAND AND GRAVEL PLANT ON RIVER BAR

Fig. 1—Section of Flume Between Tunnels Showing Concrete Arch Built to Obviate Deep Excavation for Footings Across a Draw.

Fig. 2—Section of Flume, Cantilever Type, Between Two Tunnels, Making About a 10° Curve.

Fig. 3—Section of Flume Leading from a Tunnel Into an Open Ditch.

Concrete Flumes for Irrigation Work

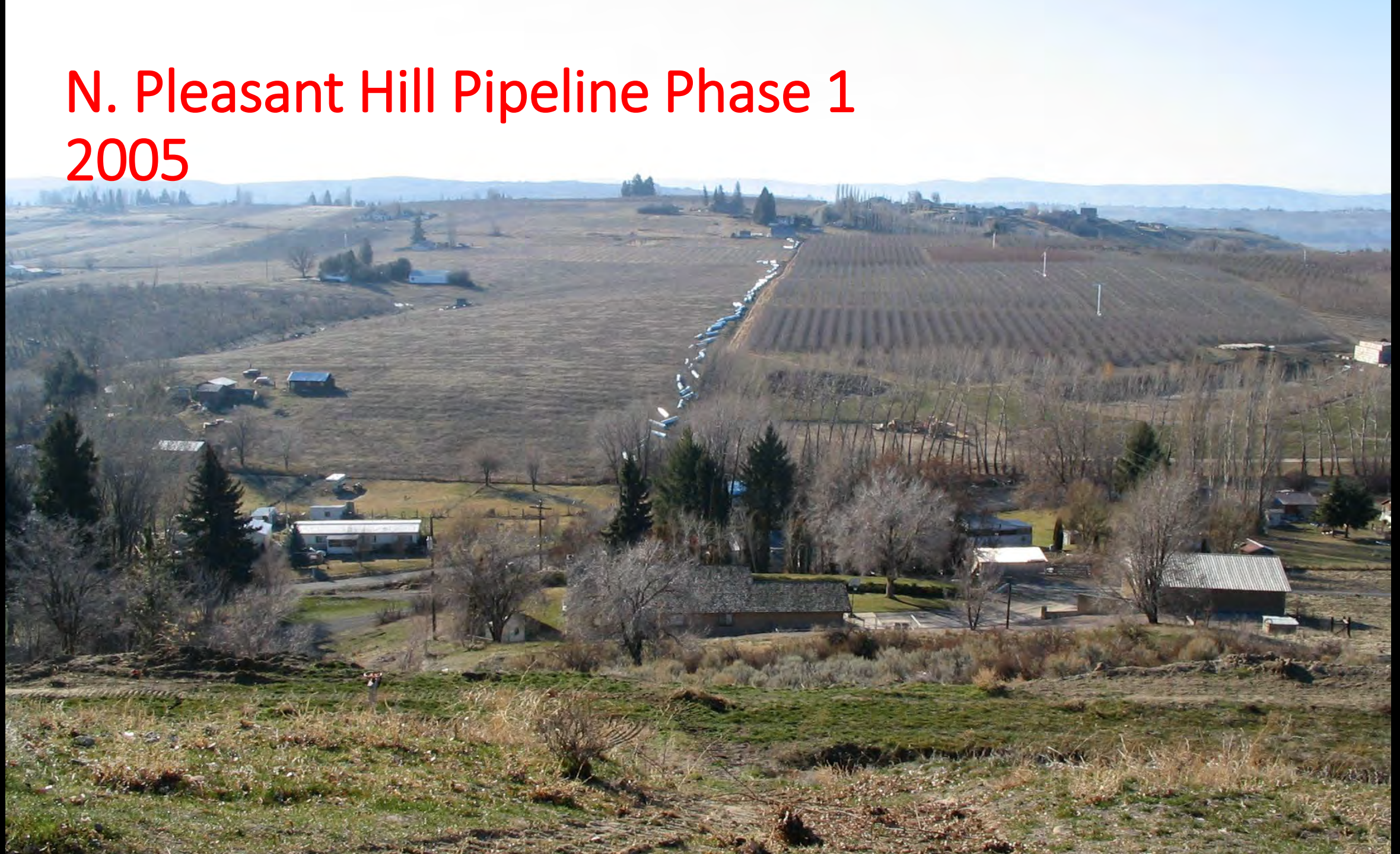
SELAH VALLEY CANAL Mile 9.0

8/21/2023

SELAH VALLEY CANAL MILE 5.7


SELAH VALLEY CANAL MILE 5.7
GROVE
OVERSIZE LOAD
7/1992

N. Pleasant Hill Pipeline Phase 1
2005




No. 1 Lateral--Reservoir Loop Siphon
48 Inch Wood Stave Pipe circa 1919


54 Inch HDPE Fusion Pipe
2007


First Automated Control Gate
Main Canal Mile 9.4
2007


2008 No. 1 Wasteway
18 inch Actuated BFV
Distant Upstream Level Control

SELAH VALLEY CANAL MILE 3.1

10/29/2013

SELAH VALLEY CANAL MILE 3.1


Selah Valley Canal Mile 5.4
2015

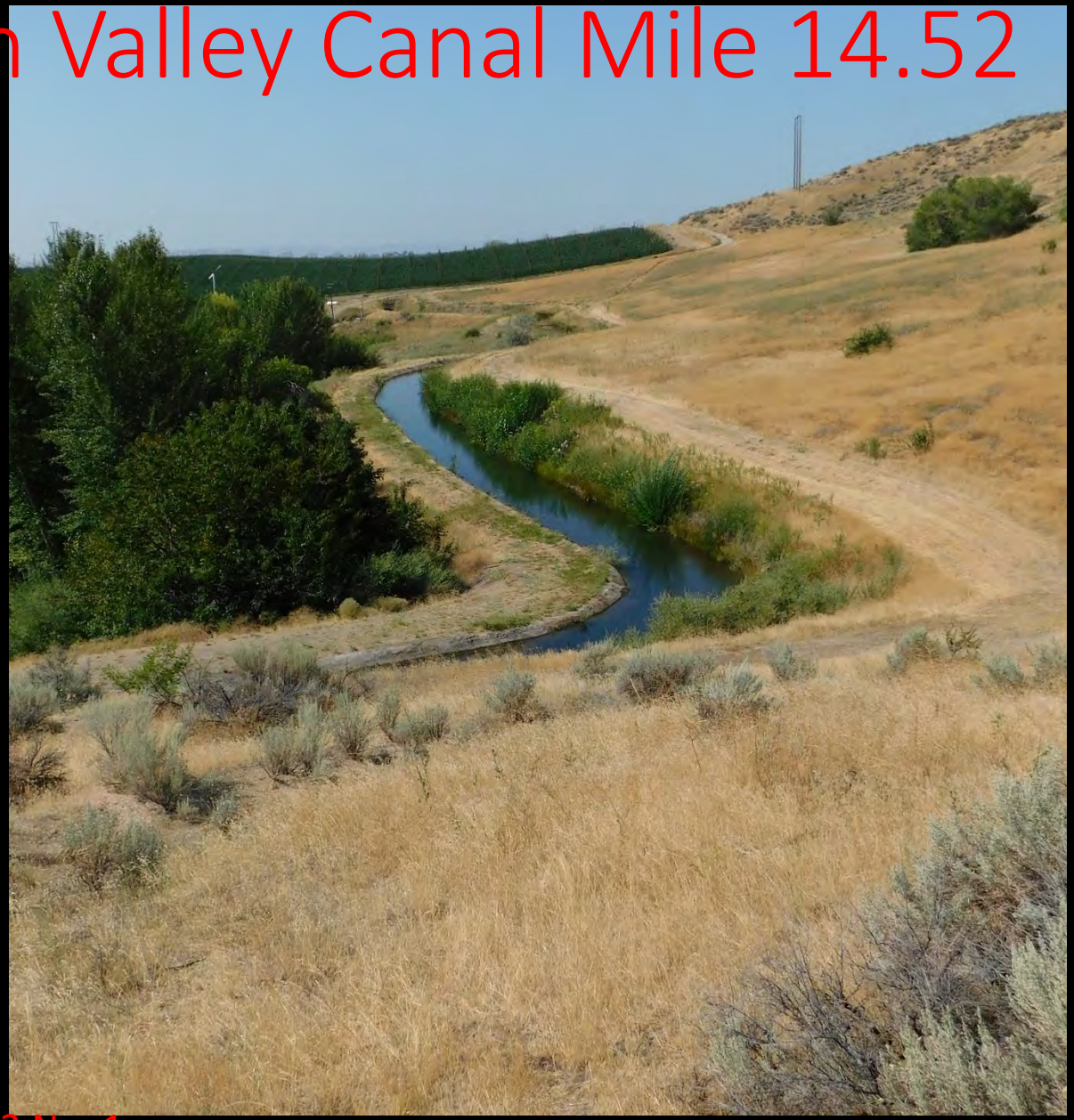

Selah Valley Canal Mile 3.3
2015


SELAH VALLEY CANAL MILE 8.5
Baileys Flume
05/02/2013

Selah Valley Canal Mile 8.5

2015

Selah Valley Canal Mile 14.52



Concrete in Architecture and Engineering February 1919, Vol. 2 No. 1
“Concrete Work on Naches-Selah Irrigation District, Yakima, Wash.”
By W. A. SCOTT

8/5/2019

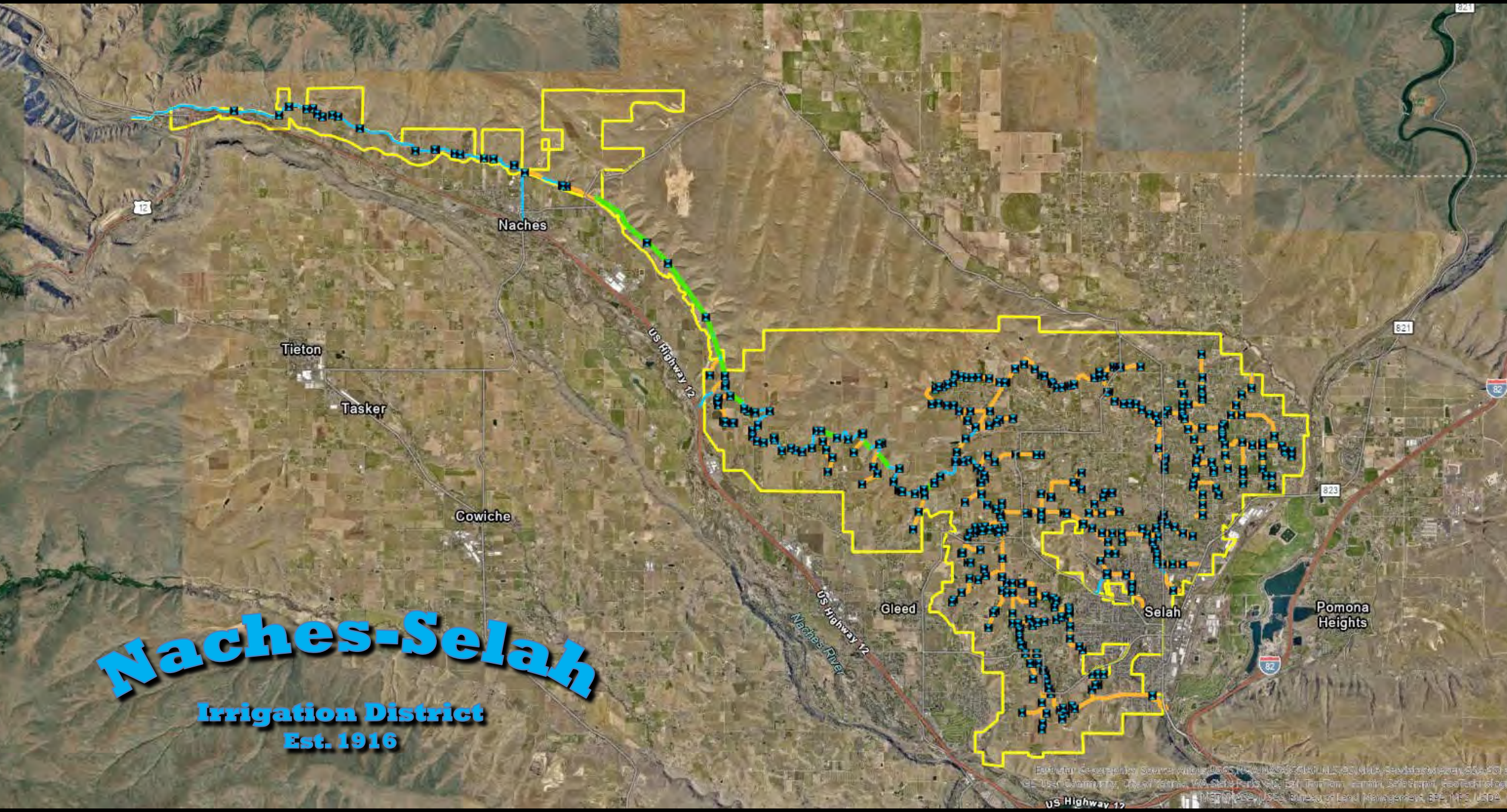

Selah Valley Canal Mile 14.52
5/4/2020


No. 3 Lateral 2.5 Mile


No. 3 Lateral 2.8 Mile

No. 3 Lateral 2.0 Mile


No. 3 Lateral 2.5 Mile


Naches-Selah
Irrigation District
Est. 1916
Naches
Tieton
Tasker
Cowiche
Gleed
Selah
Pomona Heights
US Highway 12
Naches River
12
821
823
82

NSID Statistics

2010

- 1888 Year Project Started
- 10,600 Irrigated Acres
- 1,788 Landowners
- $1.3 Million Revenue
- $1.2 Million 2010 Capital Improvemen
- $131,627 Annual Debt Repayment
- 23 Miles of Canal
- 39 Miles of Pipe
- 8 Fulltime Employees

2024

- 1888 Year Project Started
- 10,600 Irrigated Acres
- 1,874 Landowner
- $2.7 Million Revenue
- $287,000 2024 Capital Improvements
- $1.2 Million Annual Debt Repayment
- 14.5 Miles of Canal
- 47.1 Miles of Pipe
- 7 Fulltime Employees

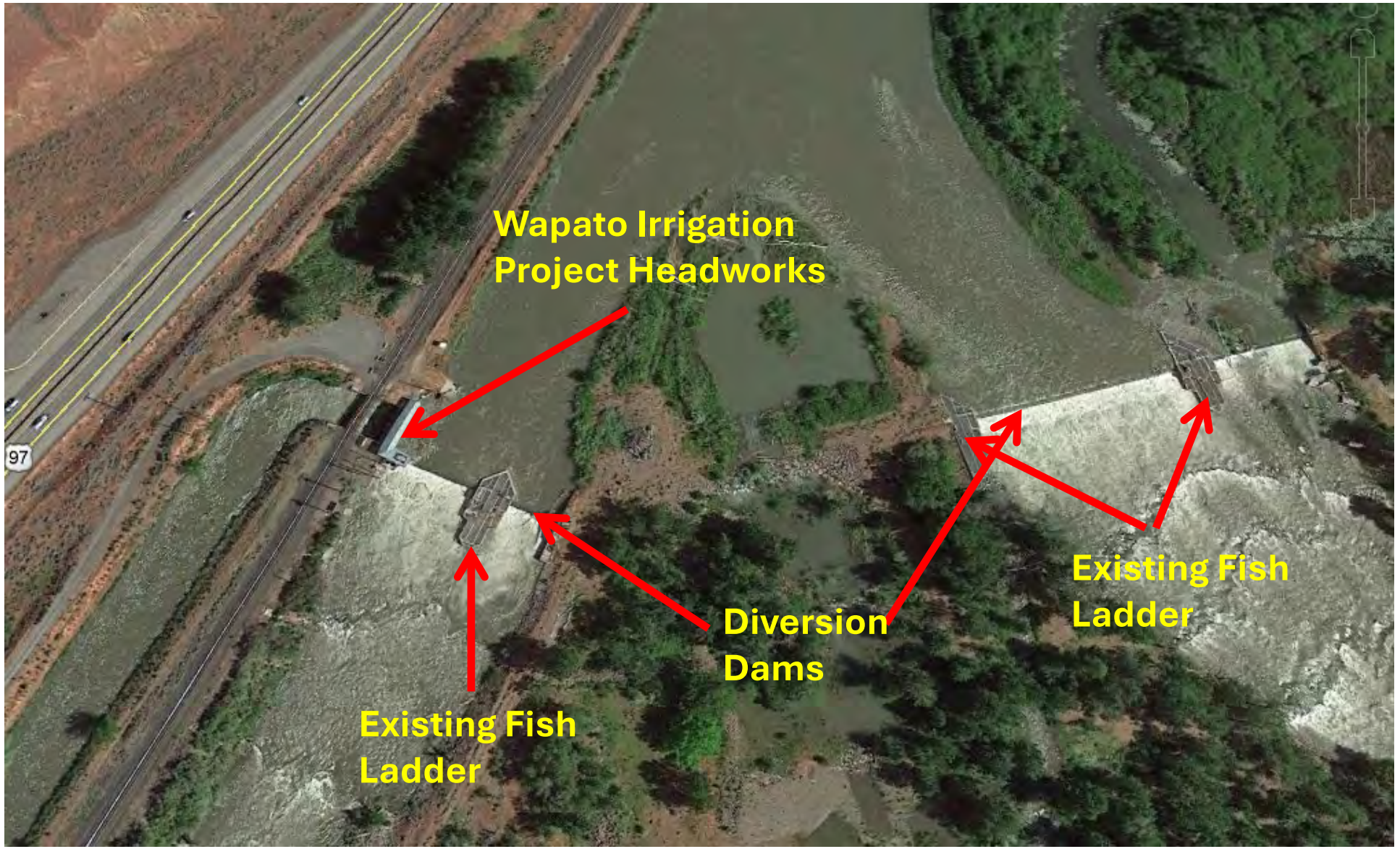

Questions?
Justin Harter justinh@n-sid.org

WAPATO DAM FISH PASSAGE IMPROVEMENTS

Dave Fisher, P.E.
Retired BIA DWP Branch
of Irrigation and Power

Tom Elliott
Yakama Nation

Wapato Main Diversion, Yakima River



Background

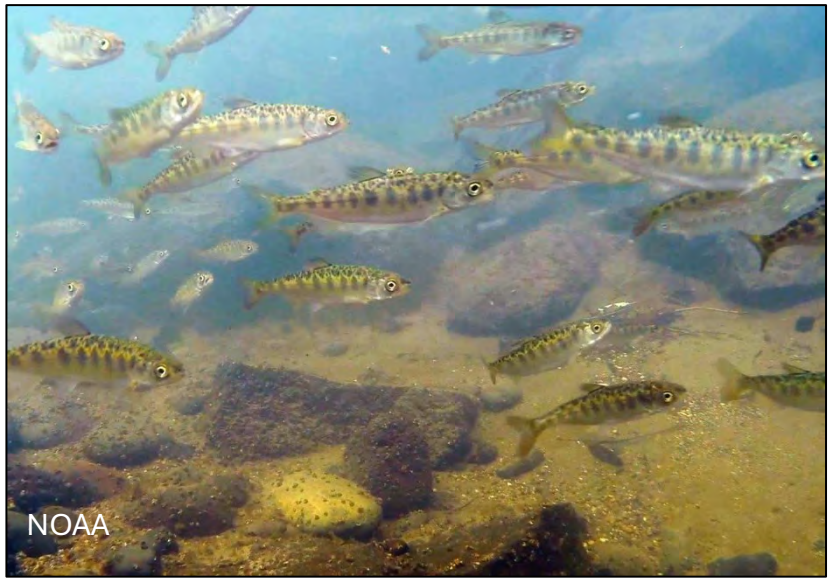
- The Yakama Nation, BIA, USBR, and project partners are planning improvements to the Wapato Diversion

<u>Challenges:</u>

- Dilapidated condition
- Potential to divert less than full water right
- High juvenile fish mortality
- Lack of Tribal harvest opportunity
- Impedes river function (sediment)

<u>Critical to the Wapato Irrigation Project</u>

- 140,000 assessable acres
- Diversion Right = 2,029 cfs
- $500 million in direct agricultural sales



Project Objectives

- Improve Operator Safety
- Address Operational Issues
- Improve Fish Passage by reducing fish mortality and injury
- Improve Sediment Transport through the dam
- Address Flooding Concerns
- Fish Harvest - improve opportunities for Tribal Harvest

Project History Timeline

2023

2024

2025

May 2023

Stakeholder Meeting

The group reviewed design concepts based on the overarching design objective of addressing the smolt entrainment and mortality issues at the existing facility. During this meeting, stakeholders requested the Project team complete a Value Planning Study.

September 2023 - October 2024

Wapato Headworks Rehabilitation Construction Project

The goals of this project were to address short-term operational needs (e.g., repairing gates) and collect data for the long-term design (e.g., geotechnical investigations). The project included a significant emergency repair to address previously unknown deficiencies.

October 2023

Value Planning Study

After considering several alternatives, including those with traditional undershot headworks and in-river screening, Project partners and stakeholders selected a preliminarily-preferred alternative to carry forward to a feasibility-level analysis.

Throughout 2024

Feasibility Study

The Project team looked at the alternative advanced out of the Value Planning Study. The general finding of the Feasibility Study is that this alternative appears to be feasible, pending the results of the forthcoming physical modeling, which will evaluate the effectiveness of the layout in addressing fish mortality and entrainment issues.

December 2024 - February 2025

Alternative Concept Analysis

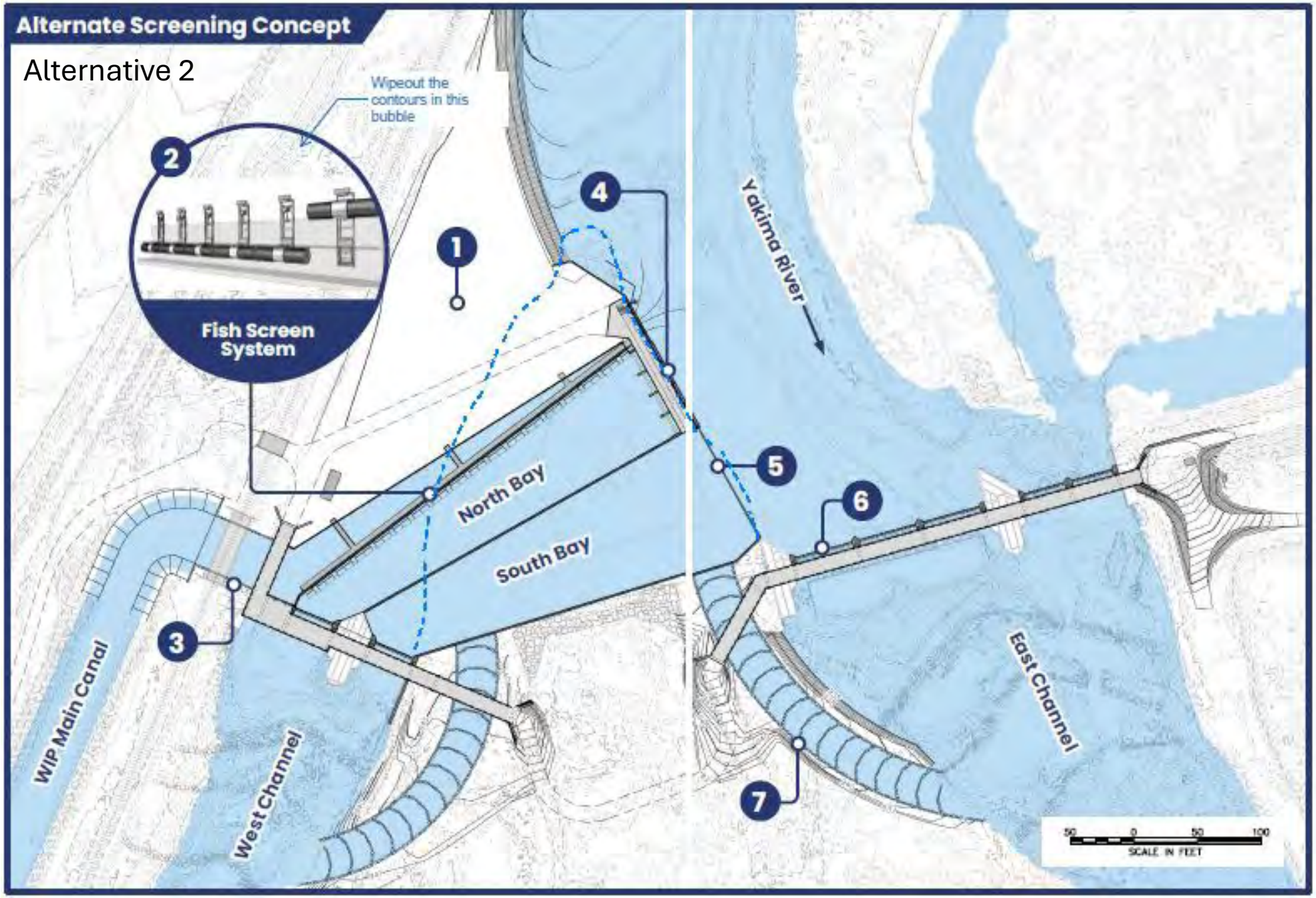
The project team performed a screening-level analysis of additional in-river screening concepts (or concepts with similar objectives) not previously considered during Value Planning. The alternative concept map in this handout presents a hybrid arrangement that incorporates elements of several of these concepts.

February 2025

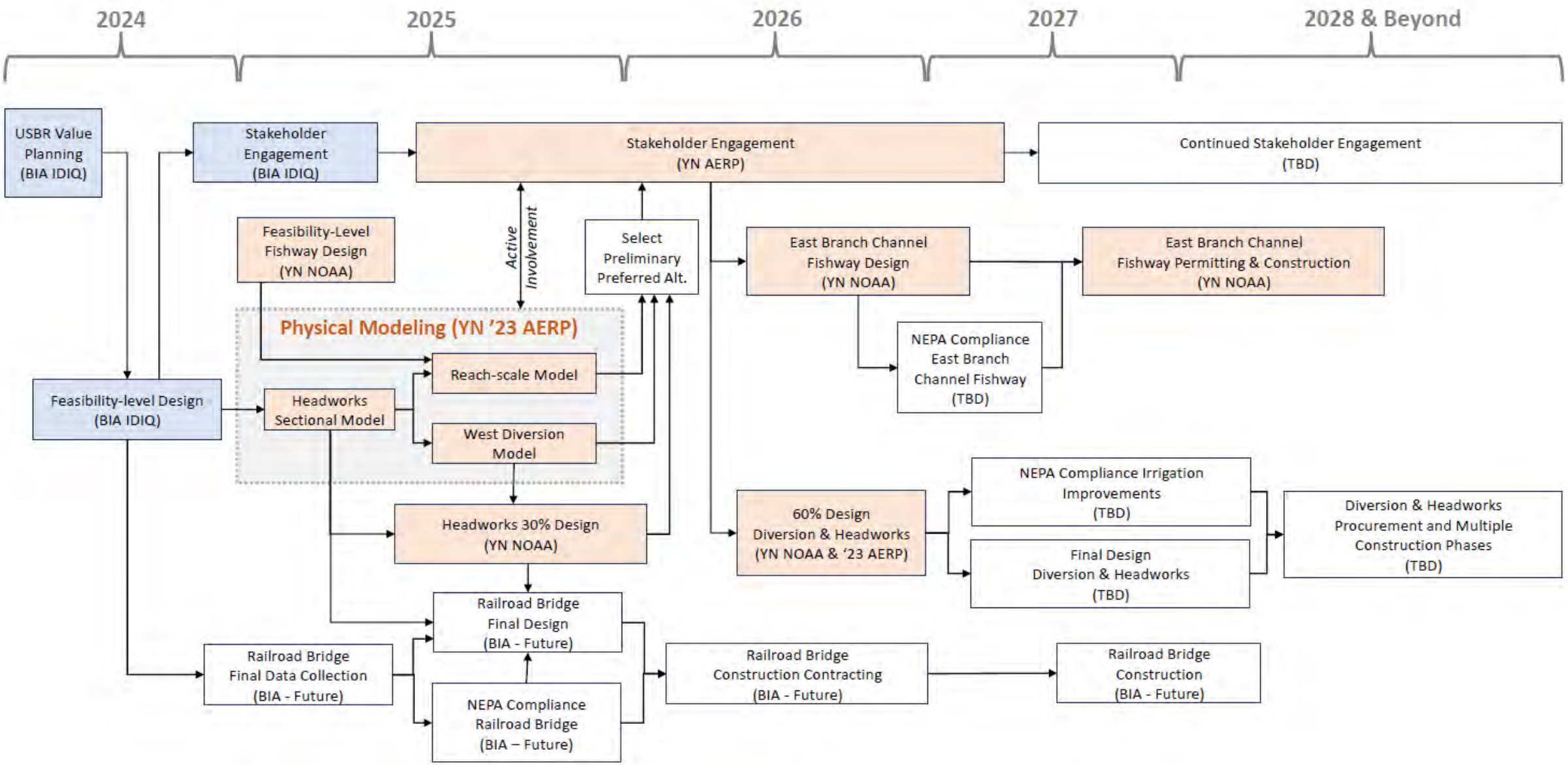
Post-Feasibility Stakeholders Meeting

DOWL will present results of the Feasibility Study and the screening-level analysis of the alternate concept and will collect stakeholder input. Following this meeting, Project partners will select which alternative(s) to carry forward to physical modeling.


PRELIMINARY PREFFERED ALTERNATIVE
Alternative 1
1
Trash Rack
2
3
4
5
6
7
Crest Gates
8
Yakima River
WIP Main Canal
West Channel
East Channel
N
50 0 50 100
SCALE IN FEET


Alternate Screening Concept
Alternative 2
Wipeout the contours in this bubble
2
Fish Screen System
1
4
Yakima River
5
6
North Bay
South Bay
3
WIP Main Canal
West Channel
East Channel
7
50 0 50 100
SCALE IN FEET

PROPOSED WORKFLOW



DRAFT PROJECT MANAGEMENT SCHEDULE (Alternative 1)			
Task	**Estimated Cost ($M)**	**Start Date**	**End Date**
Feasibility-level Design		Jan 2024	Dec 2024
Physical modeling		FY2025	
NEPA		Dec 2025	Dec 2026
Final design		Dec 2025	Jun 2027
Permitting		Dec 2026	Dec 2027
BNSF railroad bridge design and construction	**$5.1**	Dec 2024	Mar 2028
East branch roughened channel fishway D&C	**$14.1**		2028
Phase 1 - East diversion dam construction	**$32.4**	Aug 2028	May 2030
Phase 2 - West diversion dam construction	**$47.3**	Mar 2030	July 2031
Phase 3 - Headworks/sluiceway construction	**$28.0**	Feb 2031	Sep 2032
Total Design Costs (15% of construction)	**$19.0**		
Construction complete	**$145.9**		Sep 2032

BIA ESTIMATED COSTS/OBLIGATIONS TO DATE			
Project Title	**Date**	**Fund Source**	**Amount**
Wapato Yakima River headgate design	FY15	BIA A1128	$100,070
Wapato Yakima River headgate rehabilitation	FY15	BIA A1128	$570,461
Wapato Main Diversion structure engineering	FY18	BIA A1128	$2,144,033
Yakima River headgate rehabilitation	FY18	BIA A1128	$2,000,000
Wapato Diversion construction	FY22	BIL Ai112	$3,900,000
Wapato Diversion construction	FY22	BIA A1128	$1,368,145
Wapato Diversion construction	FY23	BIL Ai112	$3,600,000
Wapato Diversion construction	FY23	WIIN A1163	$694,000
Wapato Diversion construction	FY23	BIA A1128	$87,312
Wapato Diversion Dam rehabilitation and modernization	FY23	BIA A1128	$78,292
Wapato scour hole repair	FY24	BIA A1128	$370,098
Wapato scour hole repair	FY24	BIA A1128	$294,726
Wapato scour hole repair	FY24	BIA A1128	$188,604
Total			$15,395,741

TRIBAL FUNDS/GRANTS			
Project Title	**Date**	**Fund Source**	**Amount**
WaterSmart grant application—Wapato Diversion: Improvements for Anadromous Fish Passage (physical modeling cost)	**FY23**	**BOR-AERP**	**$3,077,000**
WaterSmart grant application - Wapato Diversion: Improvements for Anadromous Fish Passage	**FY24**	**BOR-AERP**	**Not funded**
NOAA 2023	**FY23**	**NOAA Fisheries**	**$7,203,000**
Total			**$10,280,000**

BIA Estimated Future 5-year Plan Costs (Subject to Congressional Funding Appropriations)			
Project Title	**Date**	**Fund Source**	**Amount**
Wapato Diversion Construction	**FY26**	**BIL Ai112**	**$710,000**
Wapato Diversion Construction	**FY26**	**BIA A1128**	**$1,000,000**
Wapato Diversion Construction	**FY26**	**WIIN A1163**	**$1,000,000**
Wapato Diversion Construction	**FY27**	**BIA A1128**	**$1,000,000**
Wapato Diversion Construction	**FY28**	**BIA A1128**	**$1,290,000**
Wapato Diversion Construction	**FY29**	**BIA A1128**	**$3,000,000**
Total			**$8,000,000**

Total BIA support:

$15,395,741(pre-2025) + $8,000,000 (est. future) = $23,395,741

(+ $10,280,000 from Yakama Nation = $33,395,741)

ASK

- BIA APPROPRIATIONS ARE NOT SUFFICIENT FOR IMPLEMENTING THE BEST OVERALL SOLUTION
- FUNDING PARTNERSHIPS WILL ENSURE THE FISH PASSAGE COMPONENTS ARE IMPLEMENTED PROPERLY TO IMPROVE UPSTREAM FISH PASSAGE AND ADDRESS FISH MORTALITY

Additional Information available at:

https://wapatodiversion.com

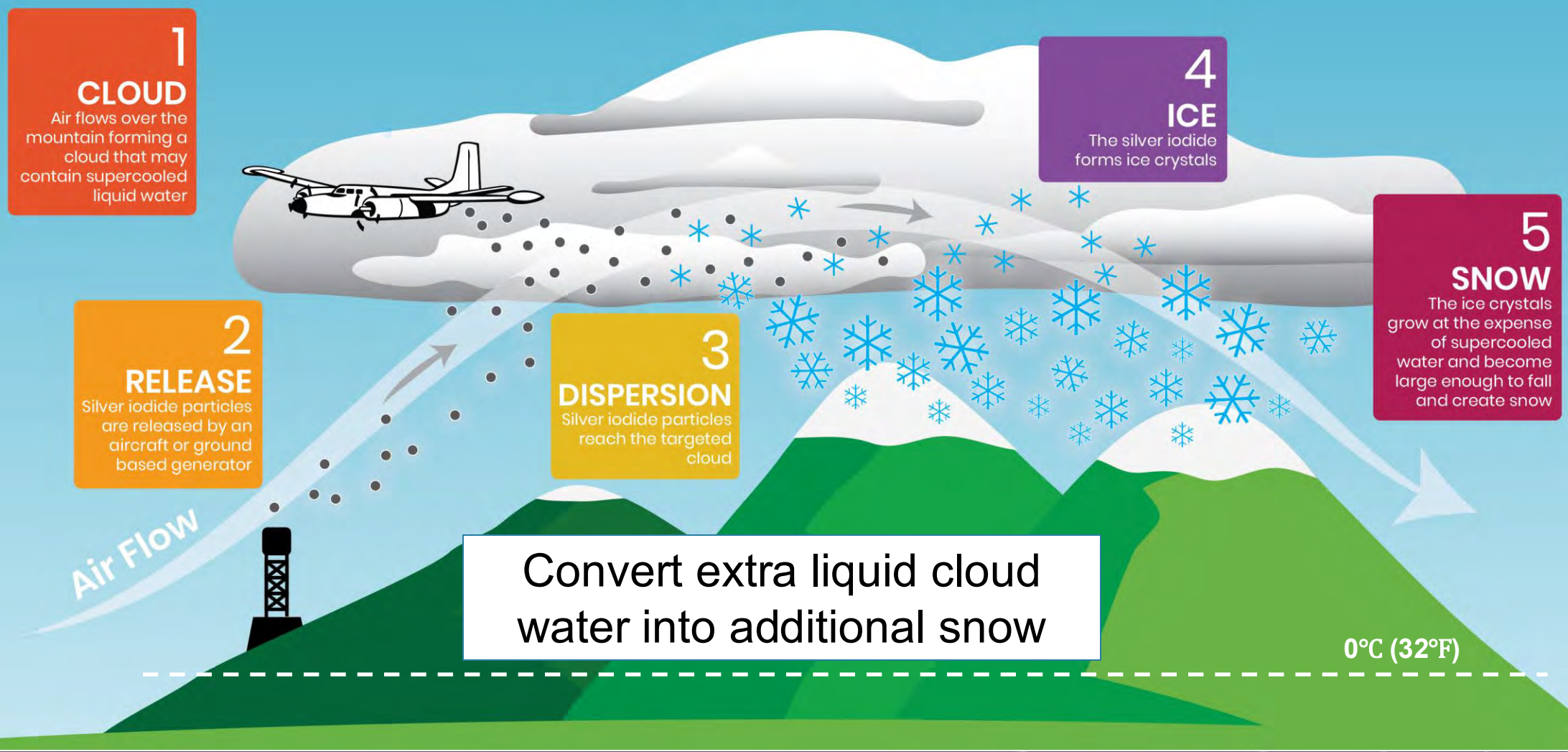
Cloud Seeding to Enhance Precipitation

How it works and common questions

Sarah Tessendorf
Research Applications Laboratory
U.S. National Science Foundation National Center for Atmospheric Research
Boulder, Colorado

March 12, 2025

The goal of winter orographic cloud seeding is to increase snowpack (and subsequent streamflow)



Convert extra liquid cloud water into additional snow

NCAR RAL

The goal of winter orographic cloud seeding is to increase snowpack (and subsequent streamflow)

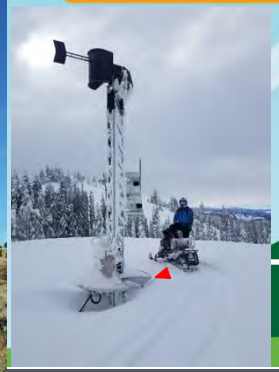
1 CLOUD
Air flows over the mountain forming a cloud that may contain supercooled liquid water

2 RELEASE
Silver iodide particles are released by an aircraft or ground based generator

3 DISPERSION
Silver iodide particles reach the targeted cloud

4 ICE
The silver iodide forms ice crystals

5 SNOW
The ice crystals grow at the expense of supercooled water and become large enough to fall and create snow



Convert extra liquid cloud water into additional snow

0°C (32°F)

NCAR RAL

The Origins of Cloud Seeding

DRY-ICE SEEDING cut race-track pattern into clouds over Rome, N.Y. Dropping dry ice from plane was first successful way of making rain artificially.

New York dry ice seeding 1946 (Life Magazine)

Early work in cloud seeding by Schaefer and Langmuir in 1946

—1946—

Proof of concept that liquid clouds could be seeded to produce ice, which would deplete the liquid cloud

It has taken over 70 years to prove the entire seeding conceptual model

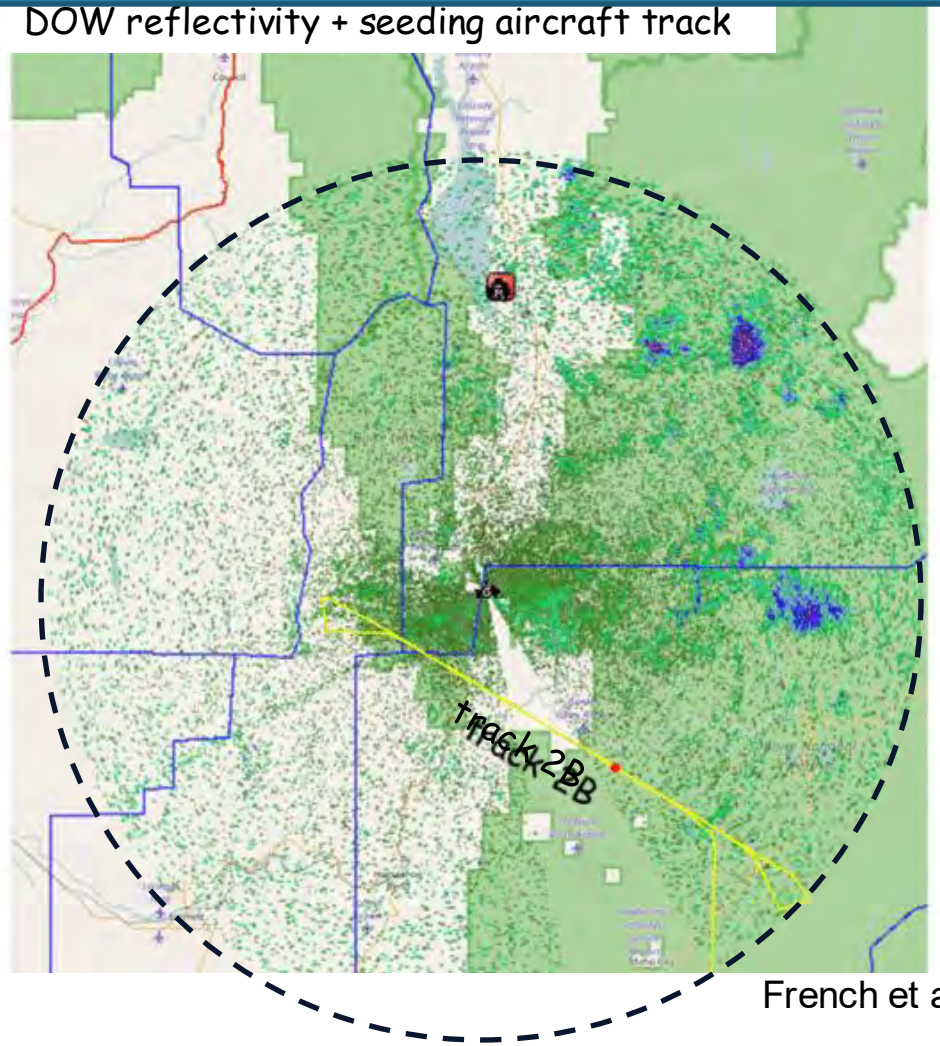
- Challenges with large natural variability of weather made it hard to isolate effects due to seeding
- Limited observations and computer modeling capabilities

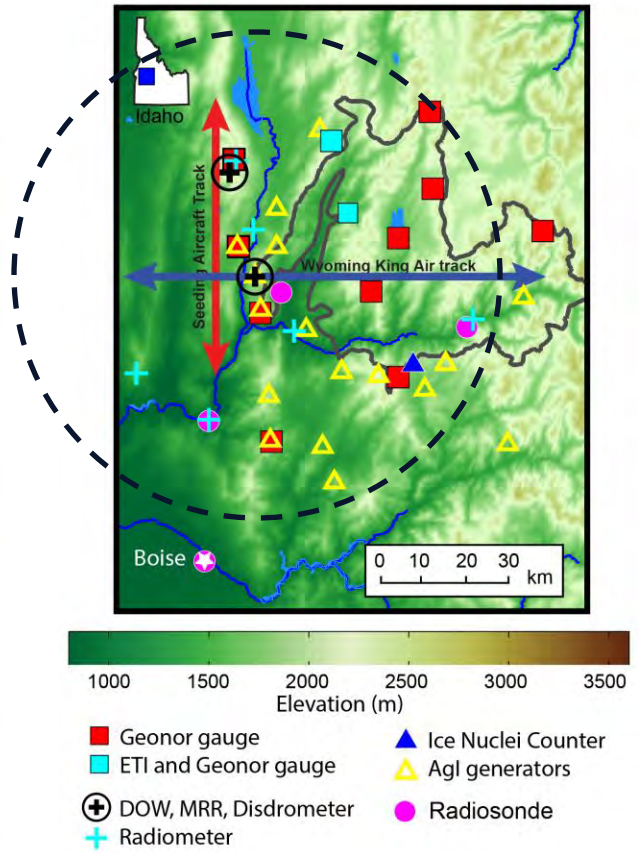
SNOWIE proves cloud seeding produces ice and snow

Seeded and **N**atural **O**rographic **W**intertime clouds: the **I**daho **E**xperiment
January 7–March 17, 2017

- Silver iodide (AgI) produces ice
- Ice grows into snow that falls to the ground

The "zig zag" pattern is an unambiguous seeding signature from airborne seeding

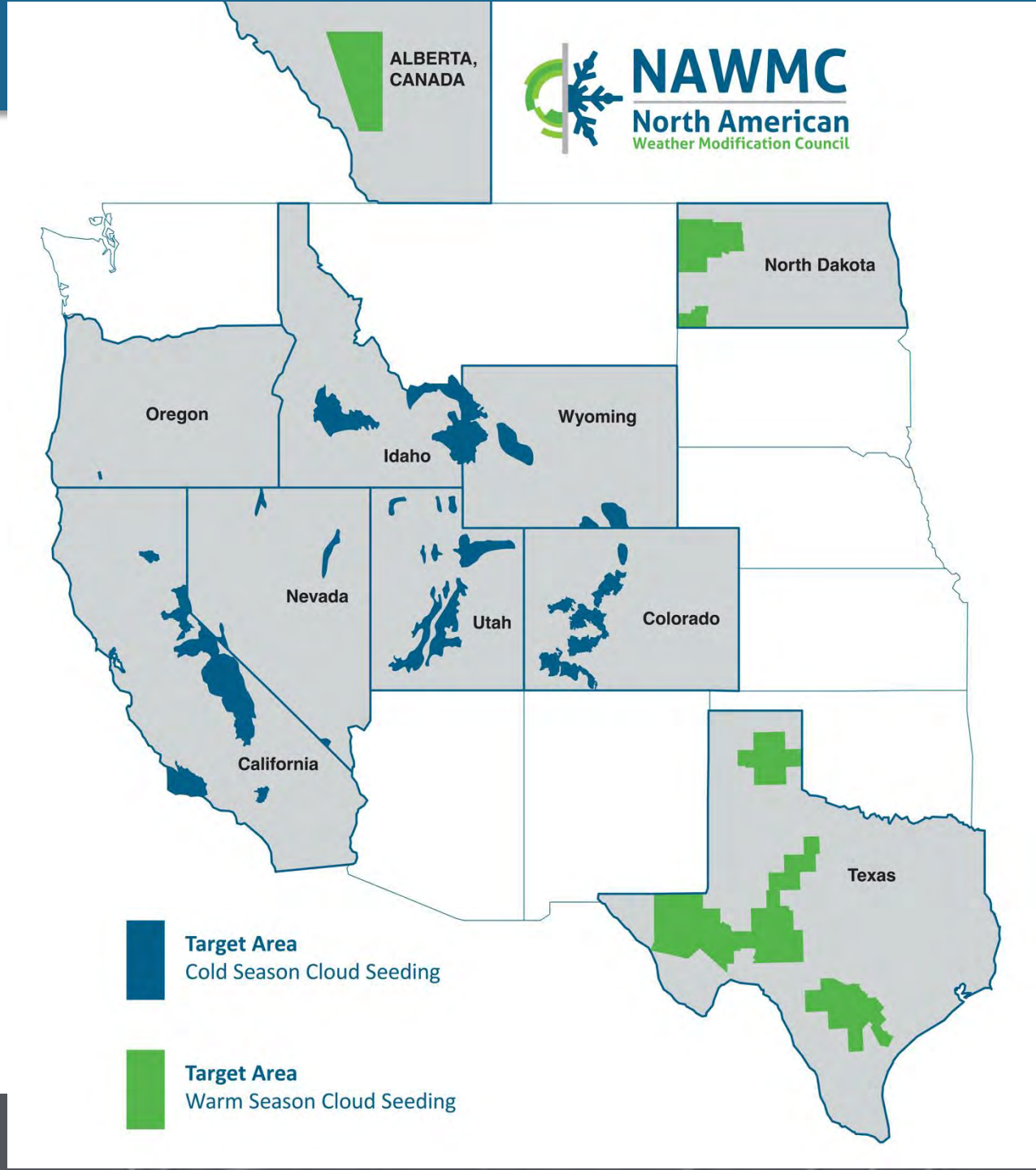




French et al. (2018) PNAS, Tessendorf et al. (2019) BAMS

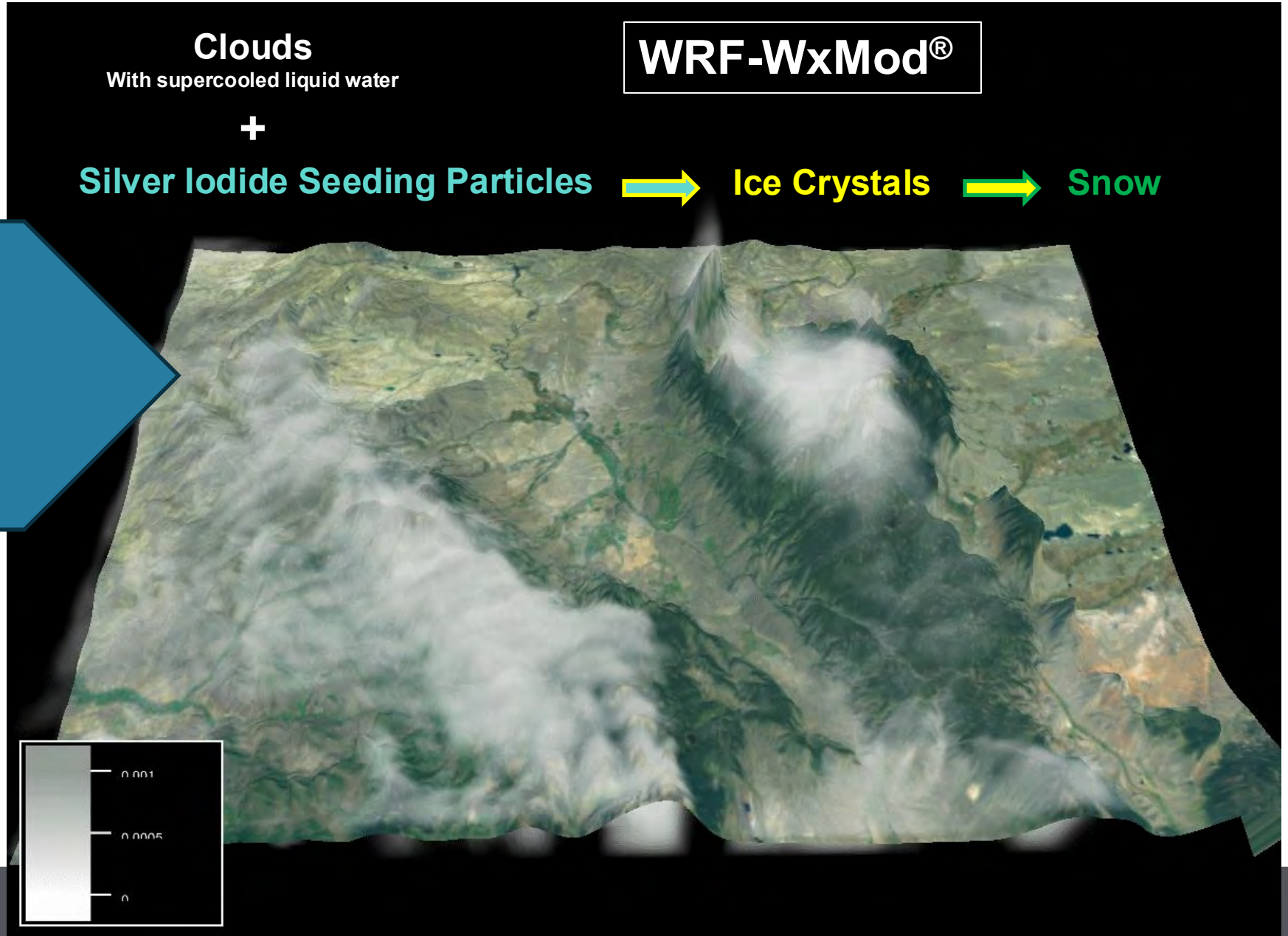
Cloud Seeding in the U.S.

- Cloud Seeding is typically being used to enhance precipitation
  - Other aims include hail mitigation, fog dispersal
- Cloud seeding occurs across the western U.S. and in many countries around the world



Breakthroughs in modeling the impacts of cloud seeding

Developed a **parameterization to simulate cloud seeding** in WRF (WRF-WxMod®) Xue et al. (2013)



Common Questions

- **Extra area effects?**
  - Does cloud seeding remove water from the sky that would have been precipitation elsewhere?

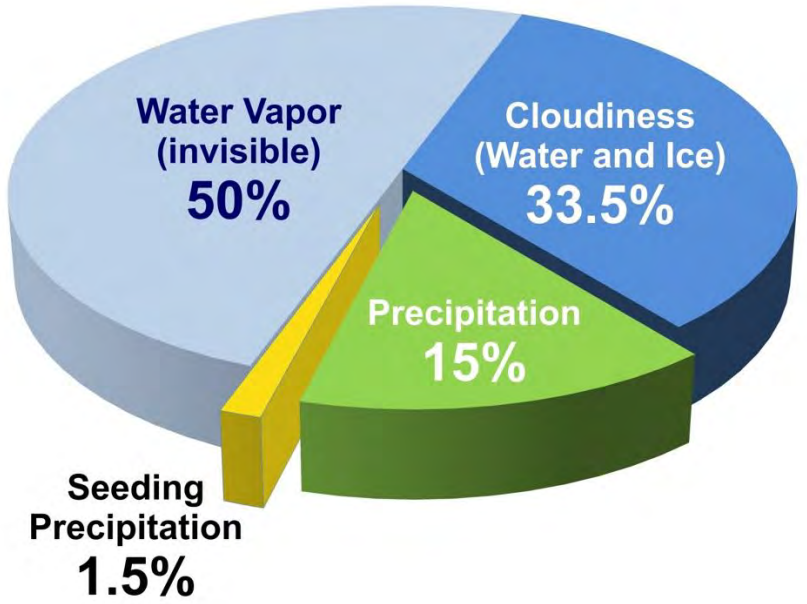
- **Potential environmental impacts?**
  - Does cloud seeding with Silver Iodide lead to dangerous levels of silver in snow and water?

Common Questions

- **Extra area effects?**
  - Does cloud seeding remove water from the sky that would have been precipitation elsewhere?

- Water vapor budget calculations **suggest a very small impact** (<1%)
- Challenging to detect the intended effect, extra area effects may be even more diffuse
- With new modeling capabilities, this needs to be addressed in a more robust way

Water Vapor Budget

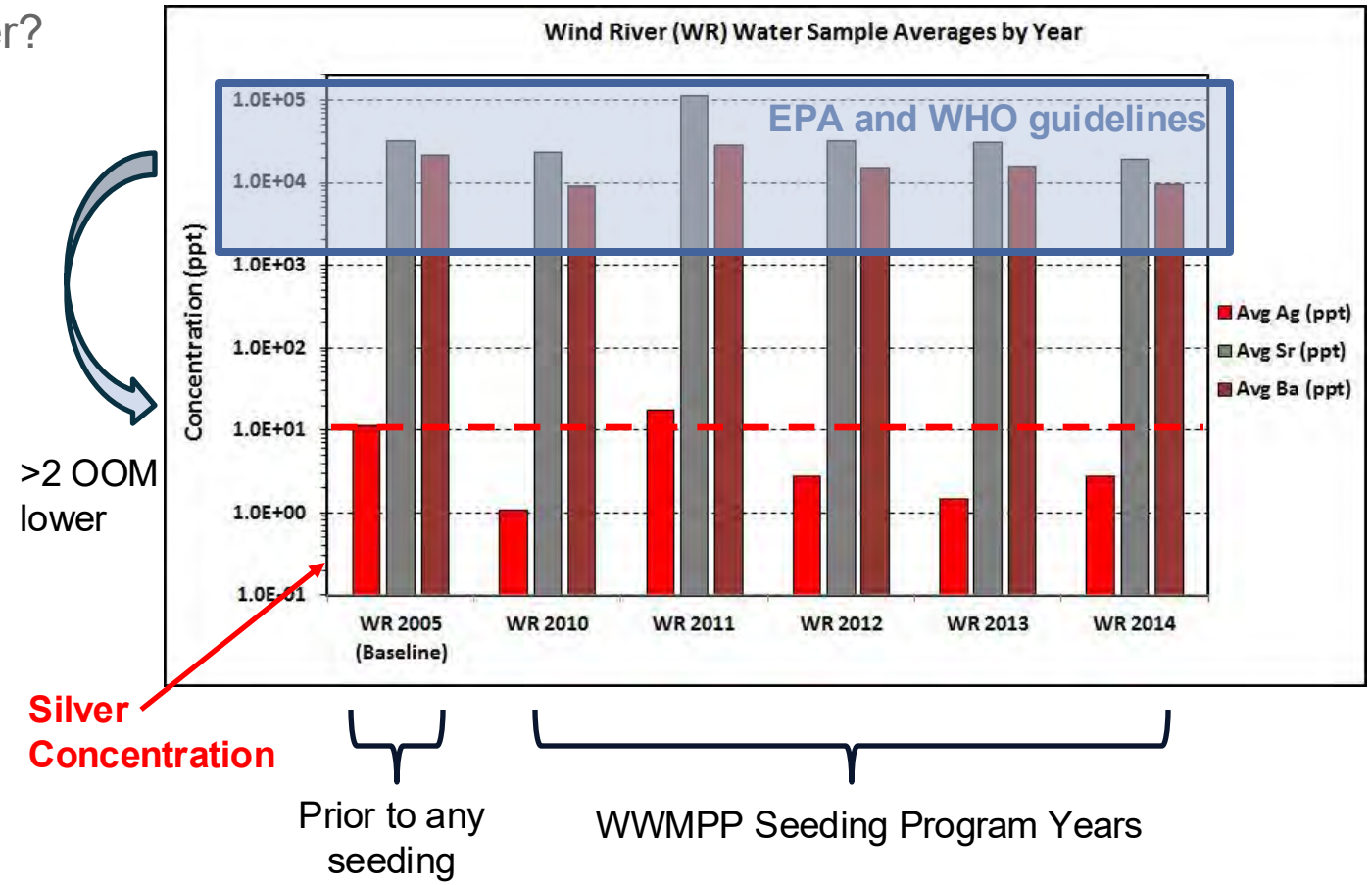


Common Questions

- **Potential environmental impacts?**
  - Does cloud seeding with Silver Iodide lead to dangerous levels of silver in snow and water?

- Trace chemistry analysis of snow indicates silver amounts are low, similar to background (natural) levels without seeding
- **Several orders of magnitude below any levels that might pose health and environmental concerns**

Silver in Water Samples from WWMPP



(From the WWMPP Report)

Key Messages

Cloud Seeding is a weather modification technology that typically aims to enhance precipitation

Recent studies have proven that cloud seeding works to enhance precipitation in winter orographic clouds

Recent advances in computer modeling are enabling improved understanding of cloud seeding impacts

Educational Opportunities

Free Online Training Module:

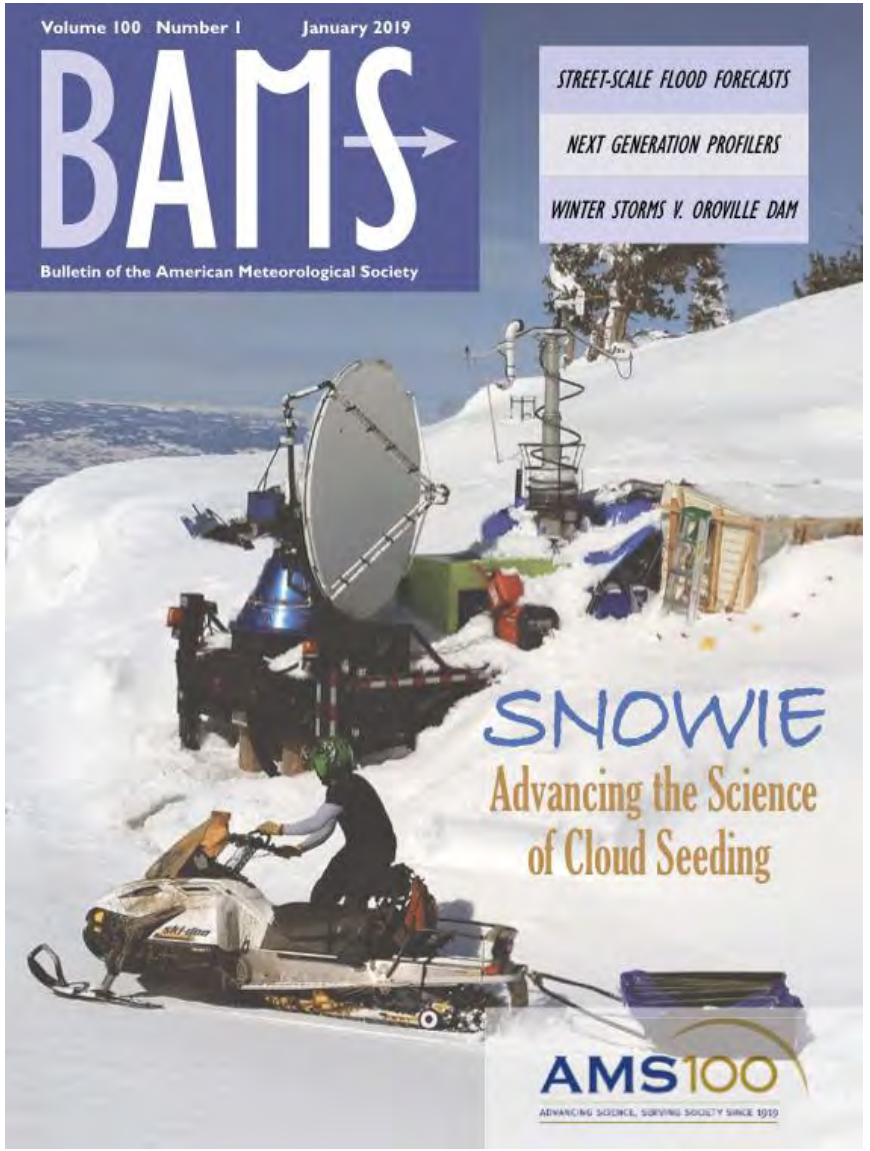
Produced by the COMET Program
https://www.meted.ucar.edu/USBR/cloud_seeding/

You will be asked to create an account to access this training module and any others in the catalog

Thank you!

Questions?

Contact me at saraht@ucar.edu



Tessendorf, S.A., and co-authors, 2019: **A transformational approach to weather modification research: The SNOWIE project**. *Bull. Amer. Meteor. Soc.*, **100**, 71–92, doi: 10.1175/BAMS-D-17-0152.1