



— BUREAU OF —
RECLAMATION

Yakima Project Fish Passage Program: Past, Present, Future

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YFO Fish Program

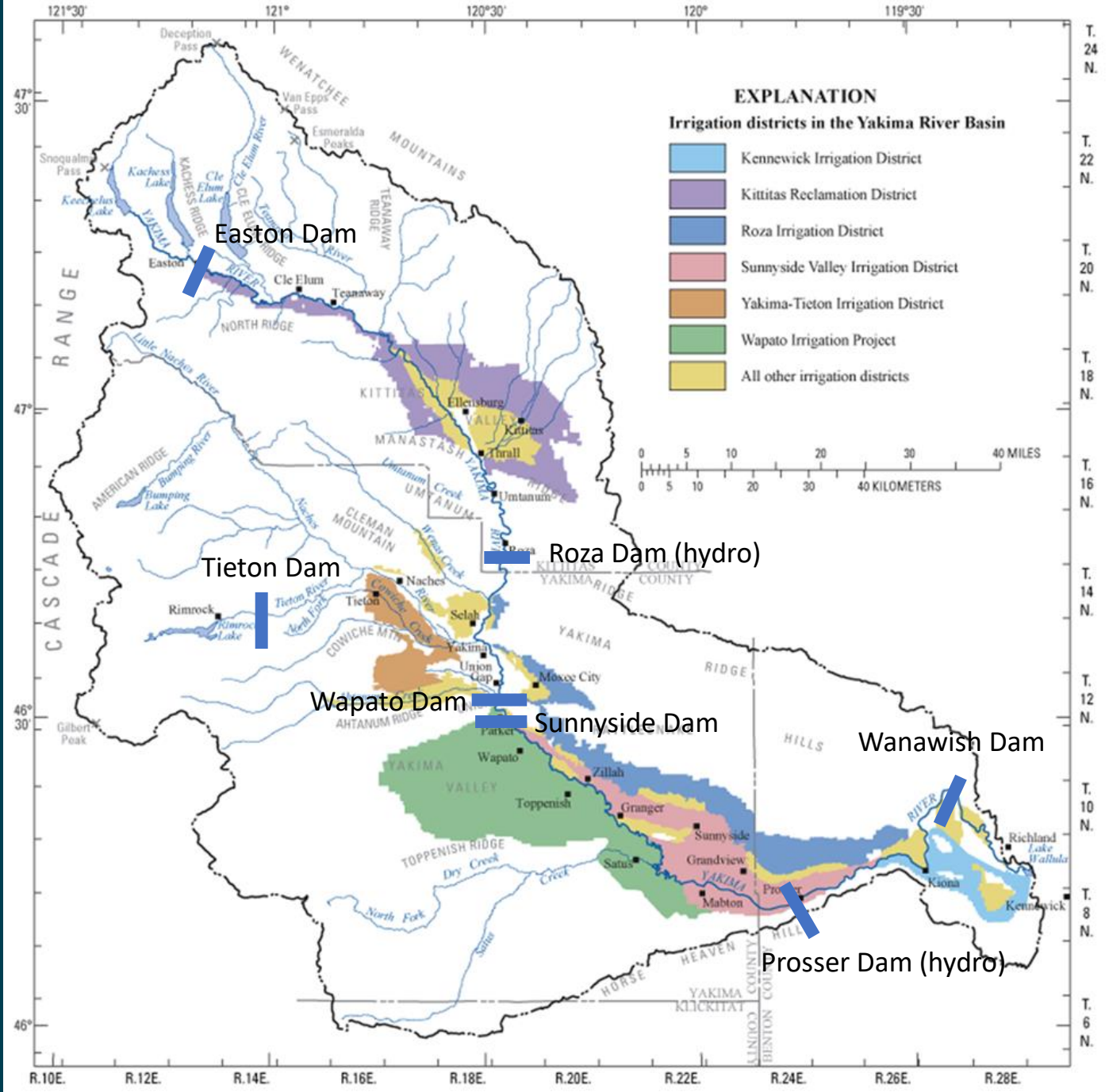
- O&M major fish passage facilities in the basin-largest program in USBR
- Ensure Reclamation has “properly functioning fish passage facilities”
- Studies to evaluate fish survival at projects
- Coordination of System Operations Advisory Committee (SOAC) and environmental flow releases



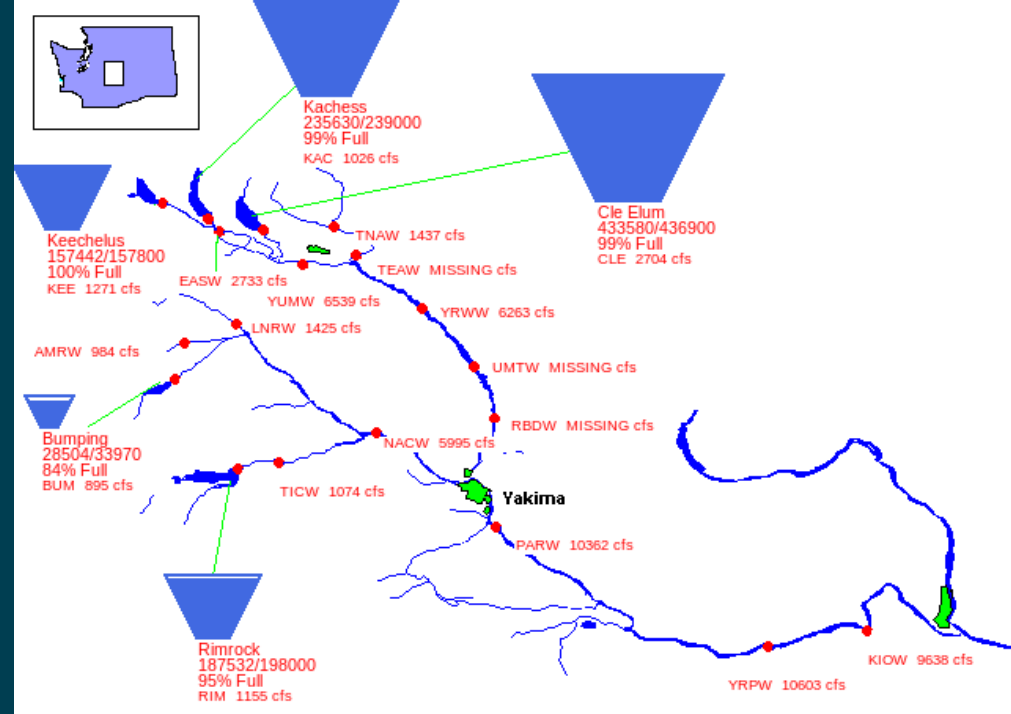
Background

- Basin area is over 6,100 sq. miles
- 3.4 million acre-ft annual runoff, 2.3 maf annual irrigation demand, 1.1 maf reservoir storage
- 460,000 acres irrigated agriculture, April-October, roughly half of the acreage is senior water rights, half junior
- Over allocation in drought years leads to pro-rationed water supplies
- Annual precipitation ranges from 160" in Cascade Mtns to 9" in east



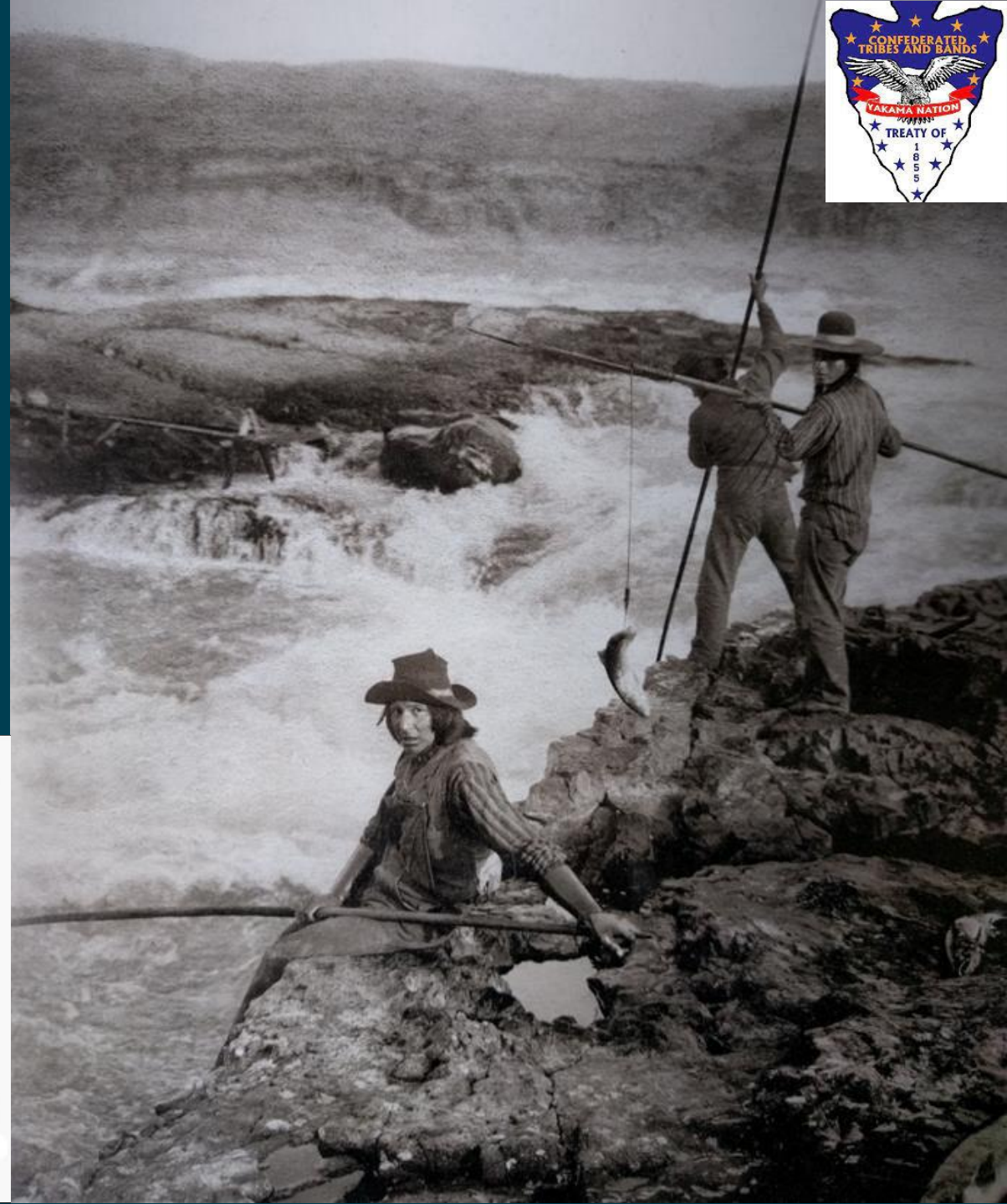


06/05/2022



Background

- Yakama Nation Treaty of 1855: to avoid war tribes ceded territory to U.S. in exchange for certain rights
- > 600,000 salmon estimated to return to Yakima River
- Irrigation from Yakima River for crop production started as early as 1860's
- Washington Statehood 1889

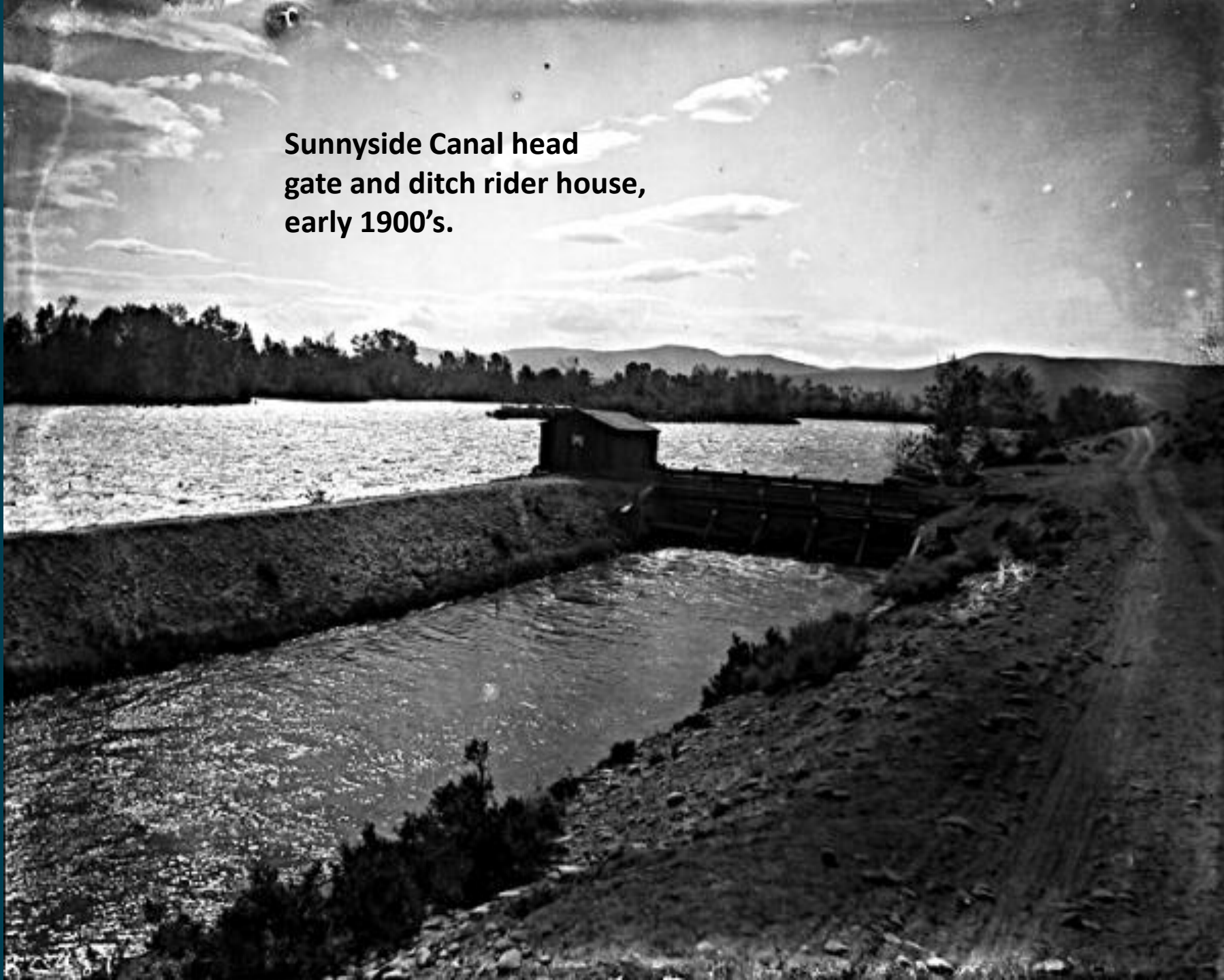




- By 1905 all of the Yakima River low flow had been appropriated and diverted for irrigation
- Petition for Federal management of water storage and distribution system: reservoirs constructed 1910-1930's
- Salmon and steelhead runs were decimated (11,000 fish by 1920)
- WA Fish Screening Statute in 1905 for "streams with state fish hatcheries" (expanded 1949 to include all salmon bearing streams)



**Sunnyside Canal head
gate and ditch rider house,
early 1900's.**



E.L. Brannon, 1929: Yakima Screen Report



Picture of 57 fish caught June 16, 1929, out of the Wapato Ditches. Two steelhead and 10 salmon caught out of lateral A and 45 salmon caught out of upper lateral 371.

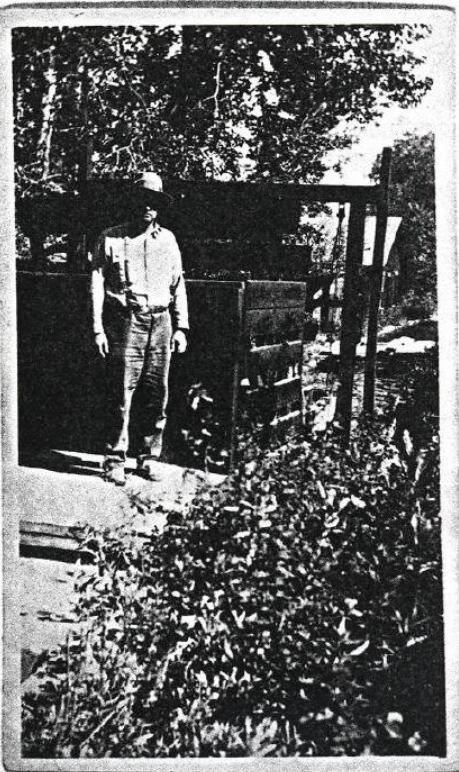


Three steelhead and 101 salmon caught June 19, 1929, out of lower lateral 371. Wapato Ditch.



Three cutthroat, 2 steelhead and 55 young salmon taken Sept. 30, 1929, between the last tunnel and dam No. 1, with hook and line out of the Tieton ditch above Tieton City.





Charlie Cobb on Congdon Screen,
Circa 1928

Cobb invented the first rotary drum fish screen in use in the Yakima Valley in 1926. The screen on the Congdon Canal was refurbished and operational until the 1990's. 50 cfs, 3000 acres.



- In 1930 WA Dept F&G directed chief engineer Milo C. Bell to simplify the design, Bell developed chain and sprocket drive system
- First of the WDFW screens were installed in Yakima Basin in 1936
- Mitchell Act funded screens in 1940's



Federal diversion dam fish screens were constructed during this period by Bureau of Fisheries:

Tieton – 1934

Sunnyside – 1935

Easton – 1935

Wapato – 1939

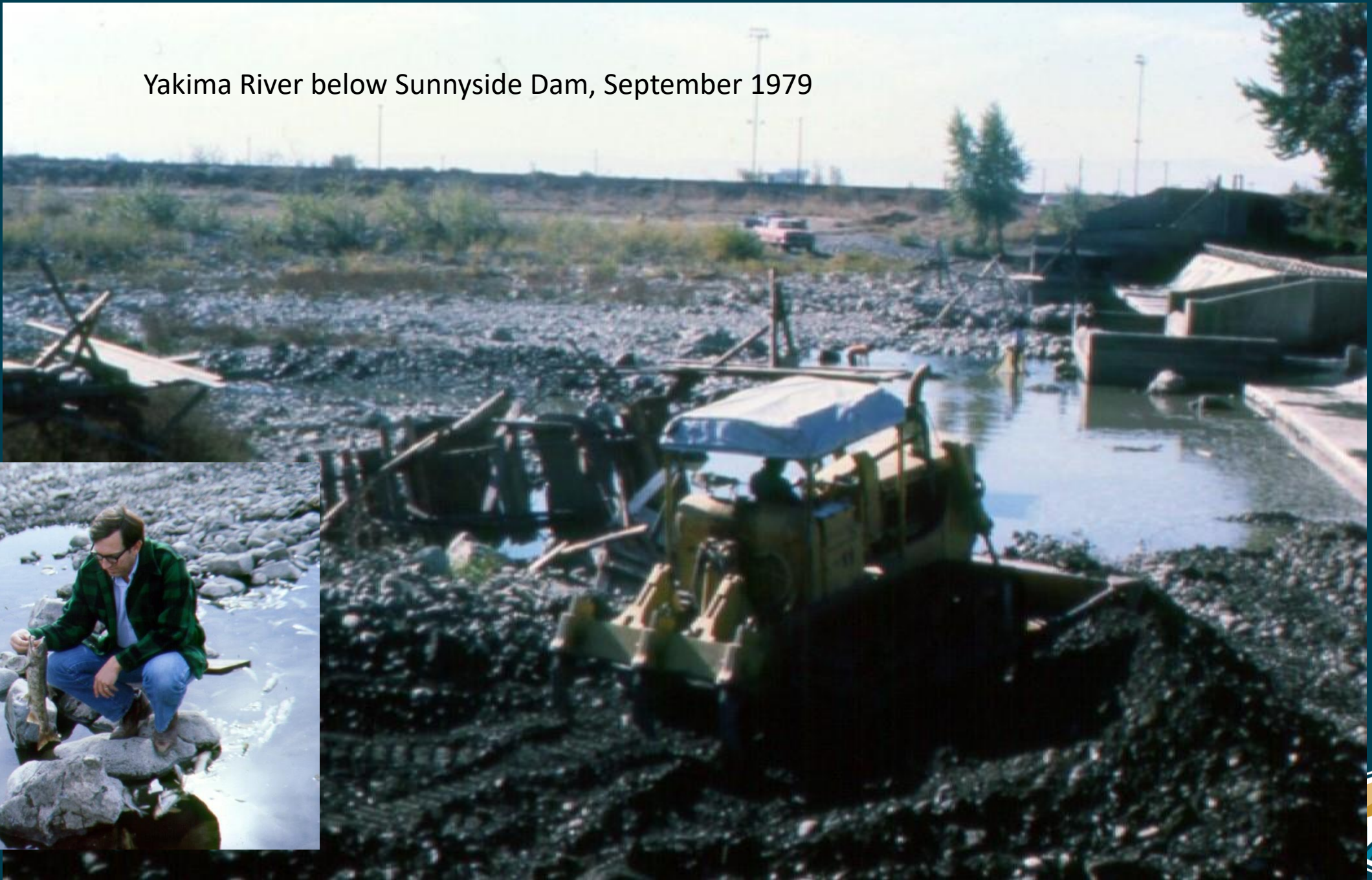
Prosser – 1940

Roza - 1941

Sunnyside Canal Original Fish Screens



Yakima River below Sunnyside Dam, September 1979



1979 Yakima River Basin Water Enhancement Project Act Phase 1

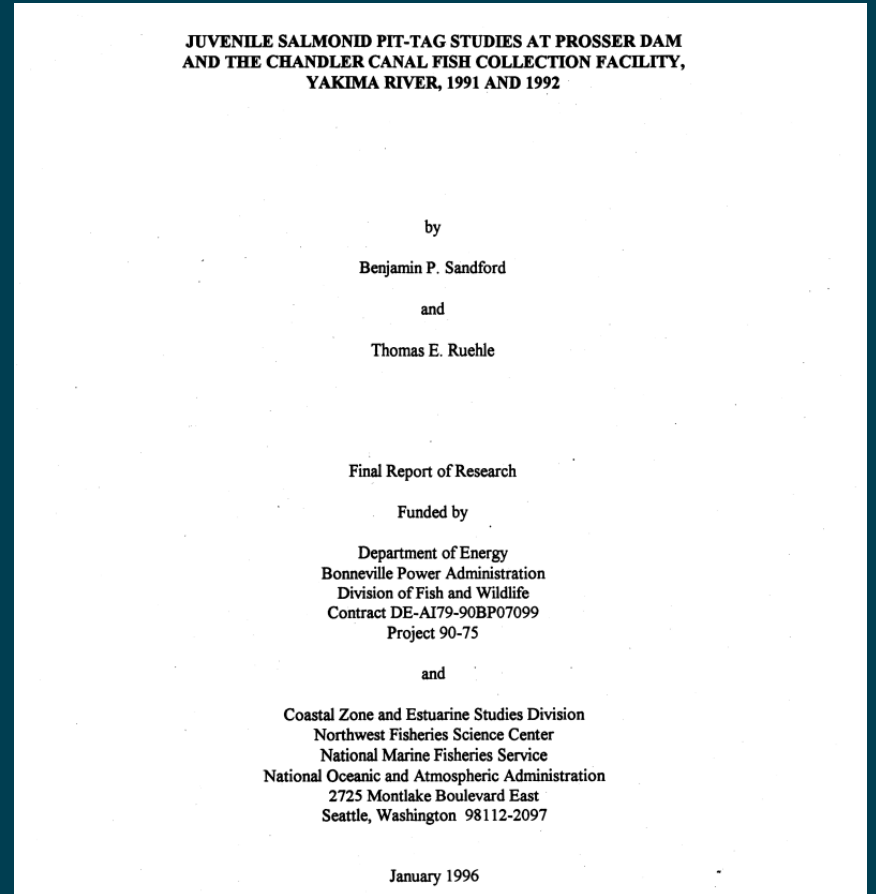
- Upgrades were made over the decades to original screen and fish ladders
- Additional upgrades needed to meet modern screening and passage criteria
- 15 year, \$100 million Phase 1 Fish Passage project funded via BPA Fish and Wildlife program and Reclamation appropriations



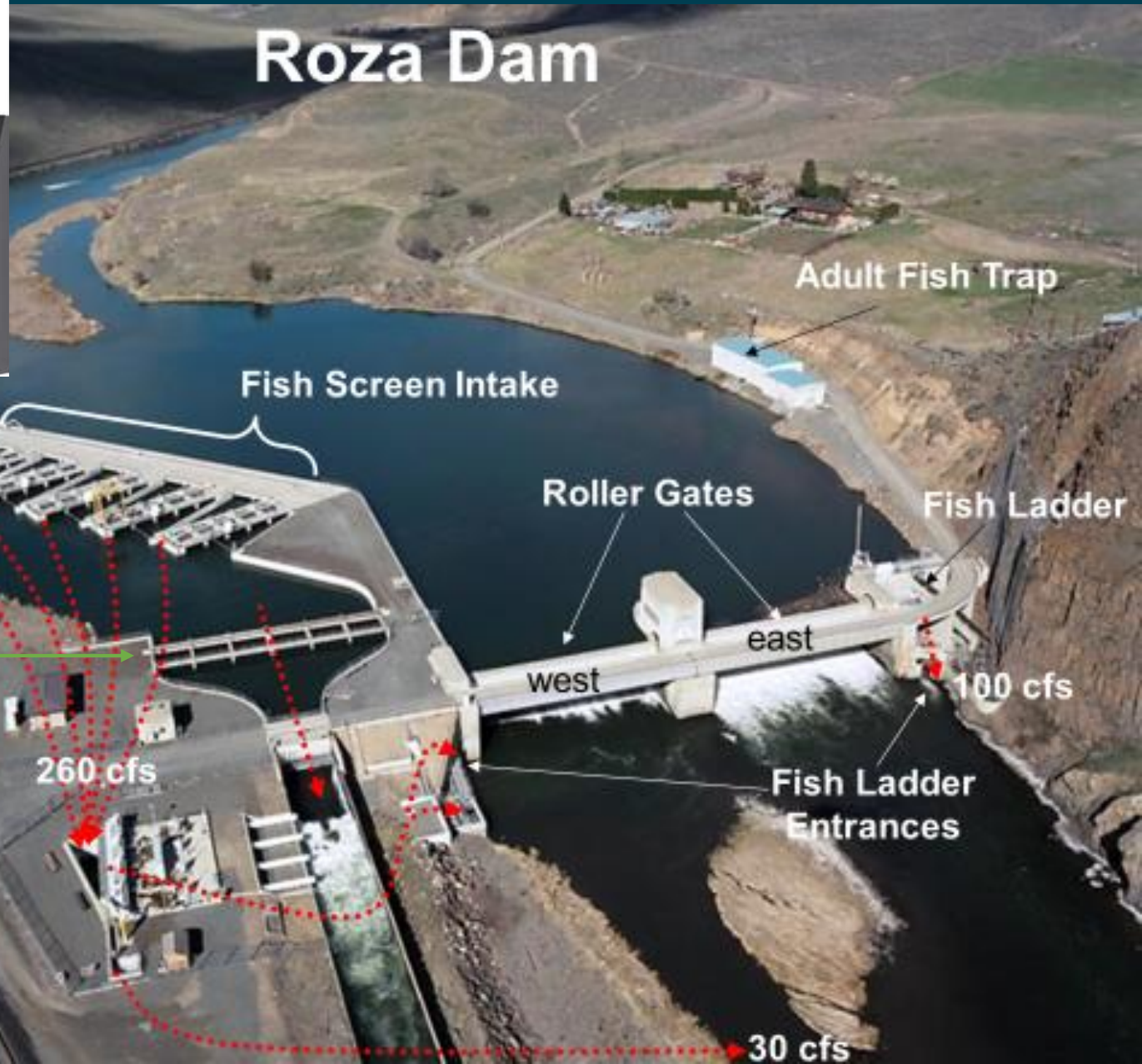
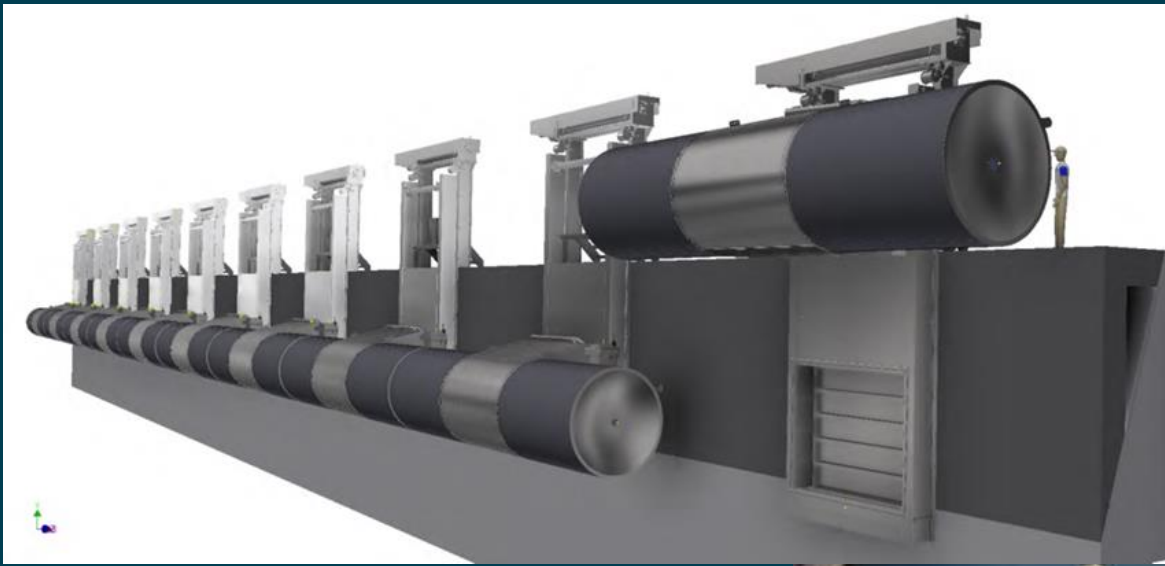
Vertical baffle fishway
constructed during 1955
by the Bureau of Reclamation
at Prosser Dam.

Current and Upcoming Activities

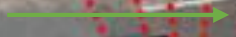
- Smolt survival studies-cooperative research
- Roza Dam Screens and Roller Gate Re-regulation
- Sunnyside Fish Guidance structure: boom and gate
- Easton Dam PIT tag detection and passage review
- Wapato Dam
- Prosser Dam initial stages



Phase 1 Screen replacement 2024-26



Original fish screen site

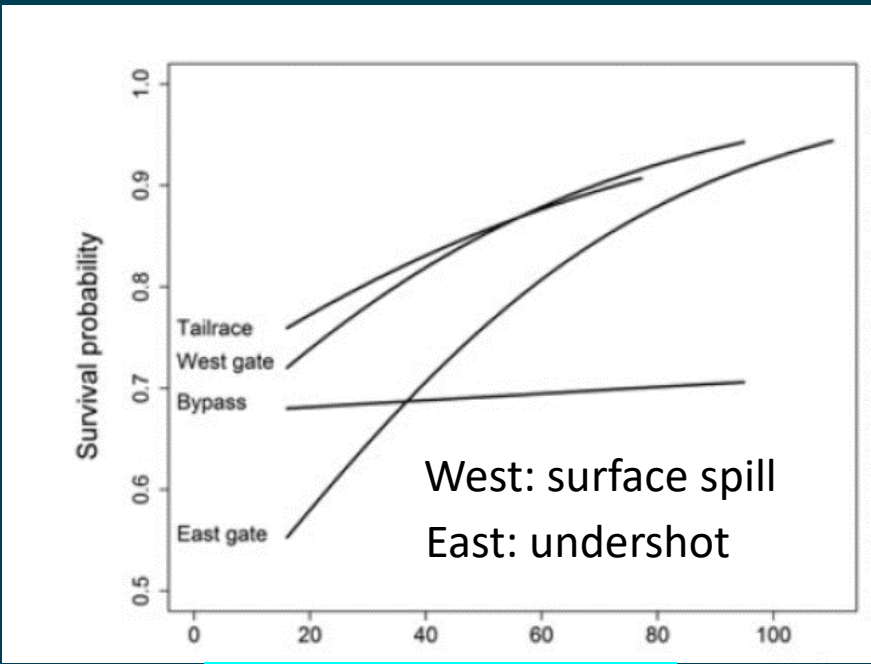


260 cfs

30 cfs

R.W. Perry et al. 2016. Dam operations affect route-specific passage and survival of juvenile chinook salmon at a main-stem diversion dam. River Res. and Applications. DOI: 10.1002/rra.3059

Below: West gate in fixed configuration passed **60-870** cfs at a depth of about 1.6 ft.



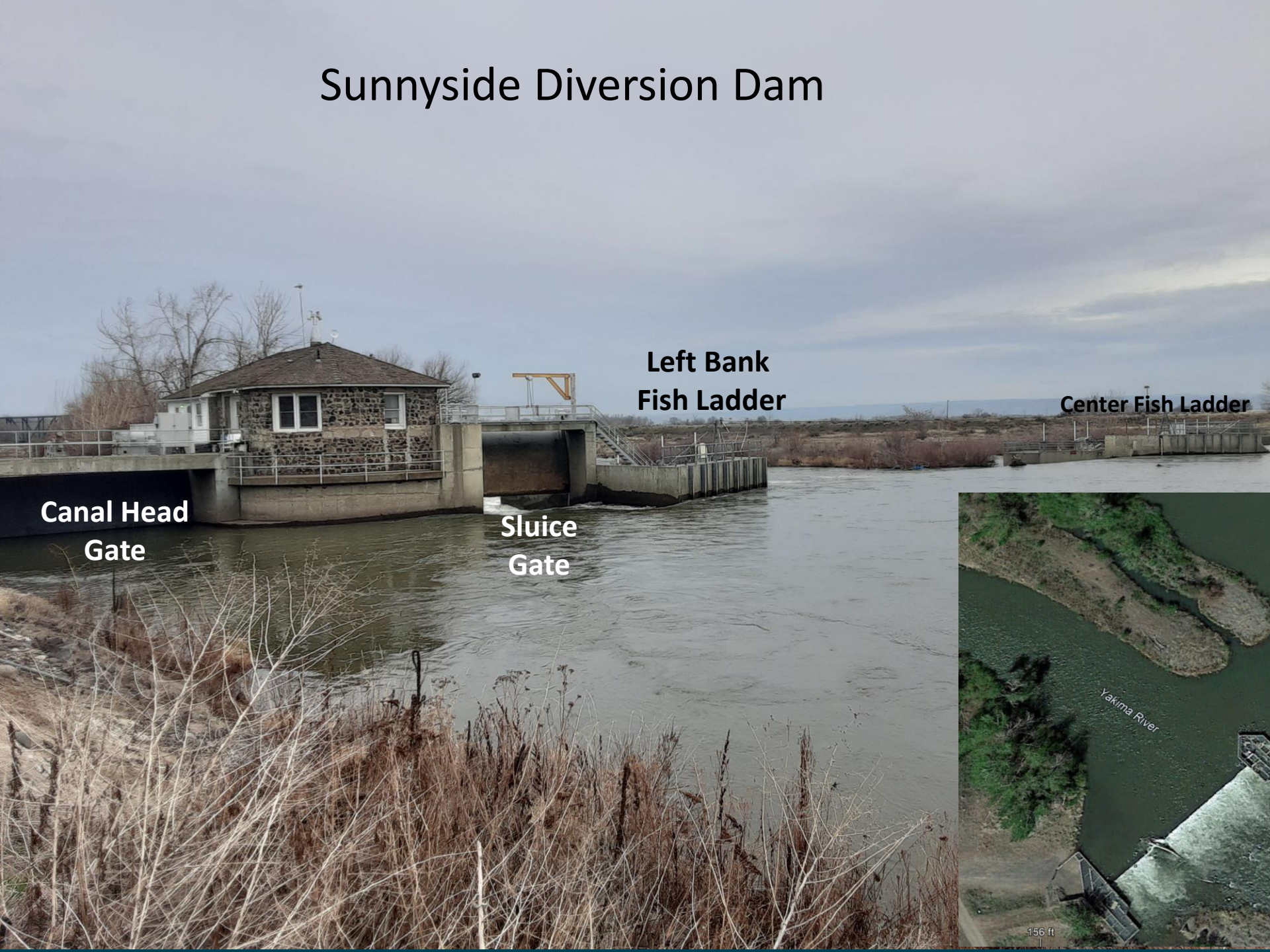
Flow below Roza in CMS



To the right: the reprogrammed West gate passes approx. **60-2800** cfs at a water depth greater than 3 ft.



Sunnyside Diversion Dam



Canal Head Gate

Sluice Gate

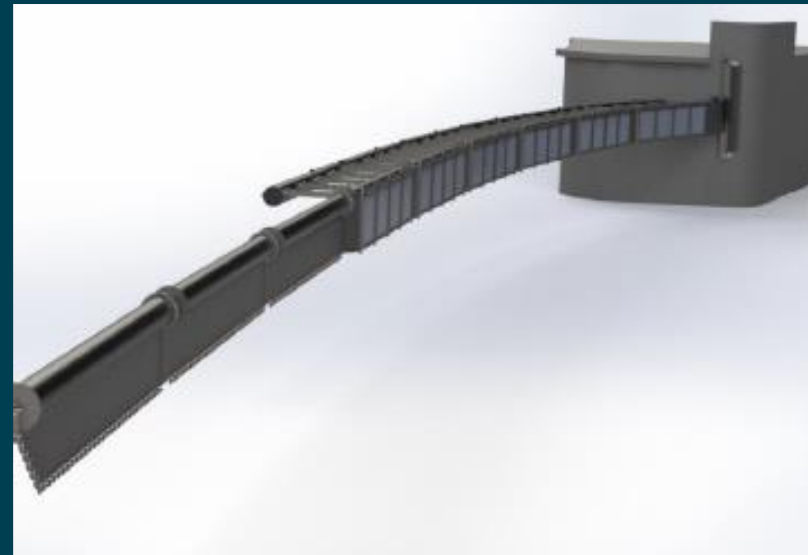
Left Bank Fish Ladder

Center Fish Ladder



156 ft

Google Earth



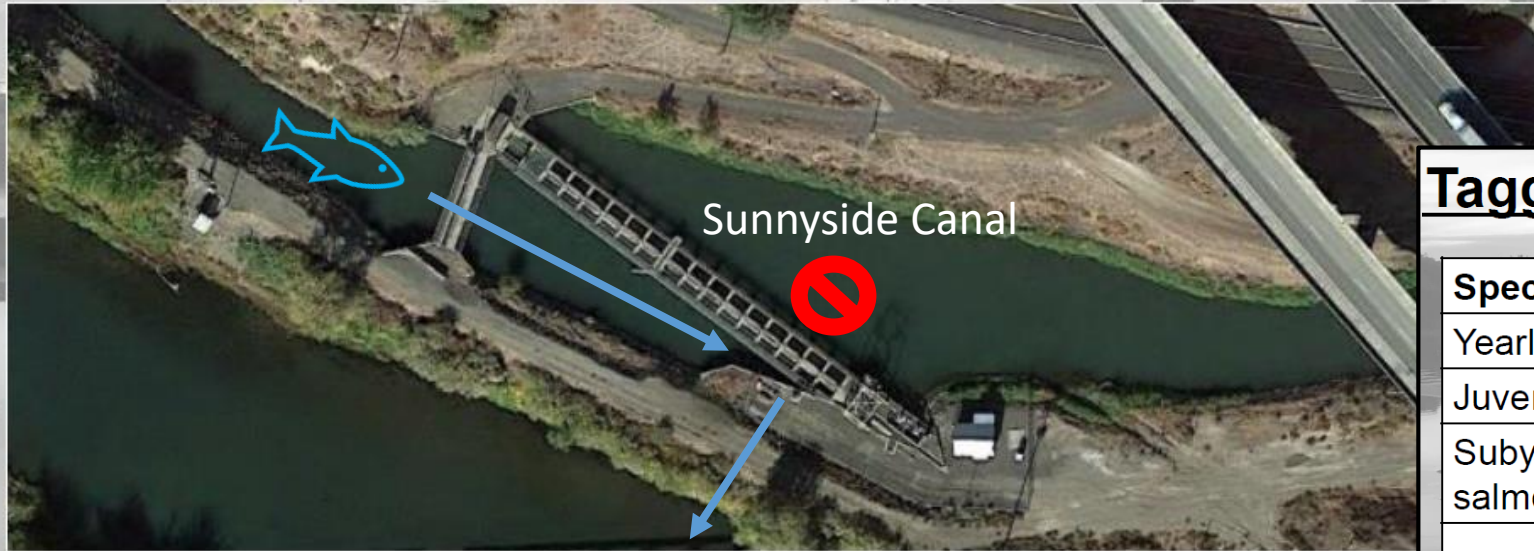


Easton Dam Juvenile Bypass
PIT tag antenna installation
PTAGIS Site Code: ESD





Screen Effectiveness



Tagging Summary

Species	2018	2019	2020
Yearling Chinook salmon	429	590	347
Juvenile Steelhead	313	350	376
Subyearling Chinook salmon	344	393	495
Total =	1,086	1,333	1,218

Monitoring sites located downstream of fish screens:

- Roza Dam: 2012 – 2014
- Wapato Dam: 2018 – 2020
- Sunnyside Dam: 2018 – 2020
- Prosser Dam: 2018 – 2020
- Wanawish Dam: 2018 – 2020

- 0 tagged fish detected downstream of screens
- All sites downstream of screens removed for 2021 study

WAPATO DIVERSION

DAM

Select Headworks Design

Concepts

Adapted from 5/24/2023 Presentation

Yakima Basin Science & Management

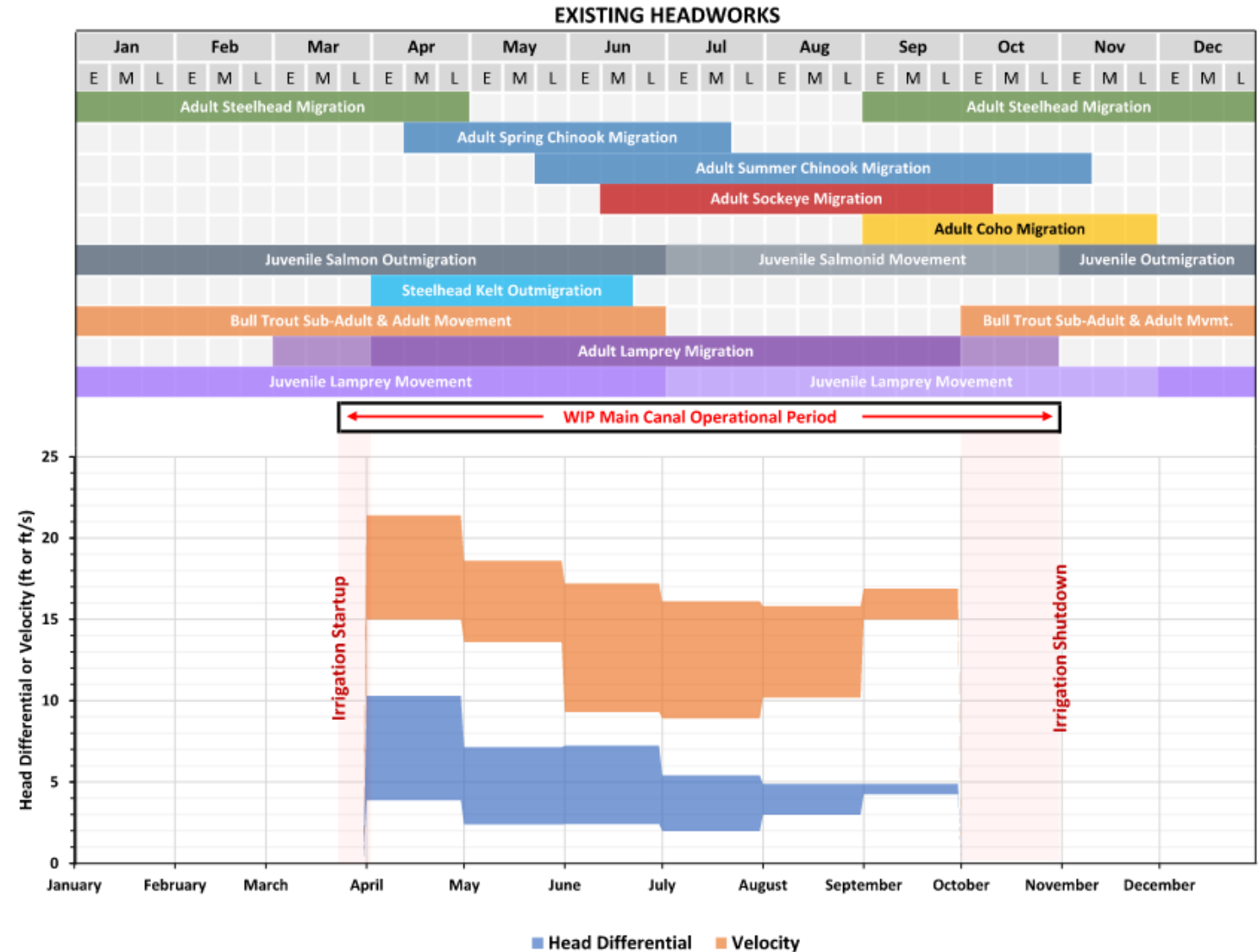
Conference



EXISTING HEADWORKS HYDRAULICS

- **Head Differential:**
2 to 10 ft
- **Headworks Gate Velocity¹:**
9 to 21 ft/s

¹Assuming all gates are open the same amount



HEADWORKS DESIGN CONSIDERATIONS

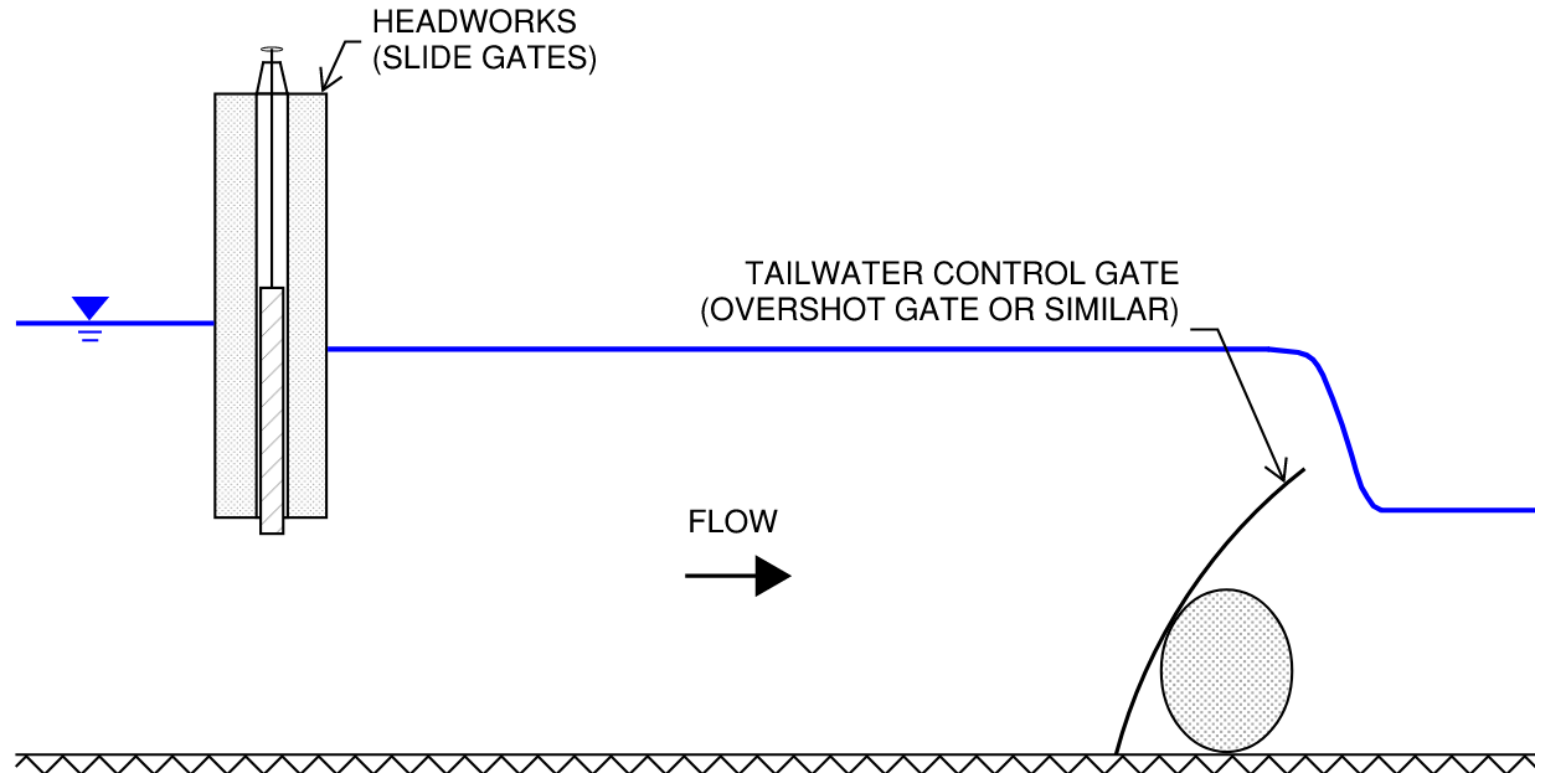
If In-River Screens are not Feasible

- Trash rack
- Dam crest gate (between trash rack and ladder, ~65ft wide)
- Access bridge over trash rack and west dam (non-public use)
- Increased headworks gate capacity (from six 6.5'x6.5' to five 10'x10')
- Increased railroad bridge span with raised low chord
- Tailwater control gate (downstream from headworks)



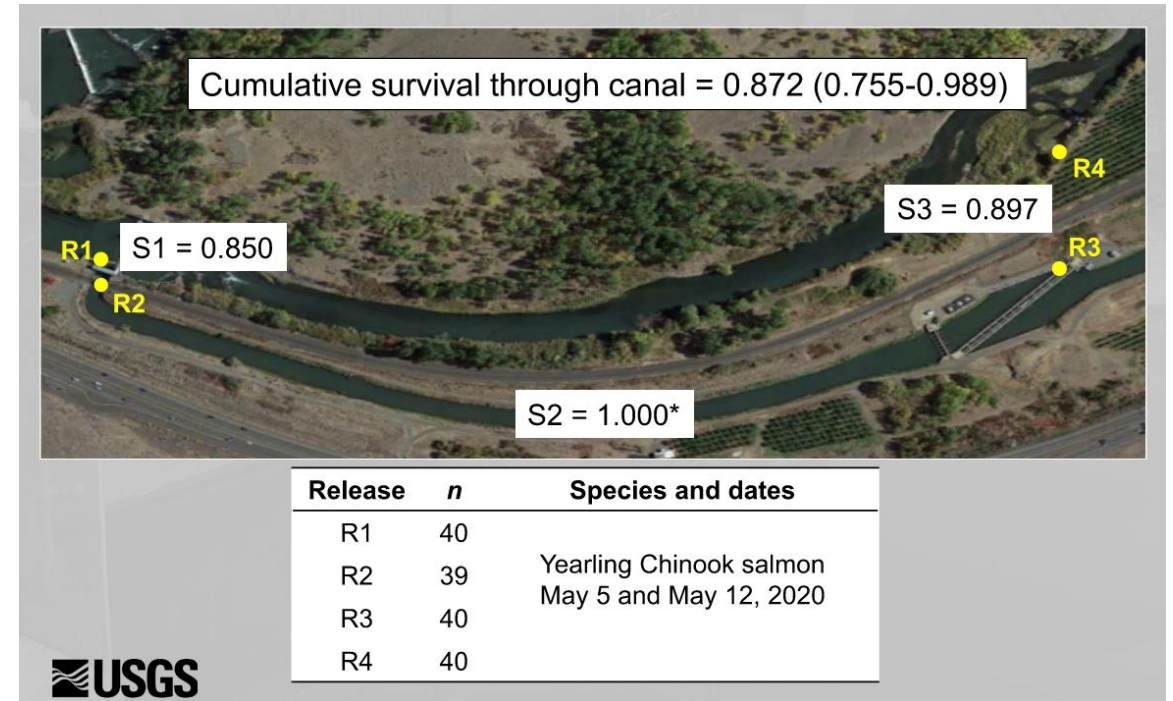
HEADWORKS REPLACEMENT HYDRAULIC CONCEPT

- **Minimize headworks velocity & head differential**
- **Most of the head differential would occur over the tailwater control gate**



HEADWORKS REPLACEMENT HYDRAULICS – CASE STUDY

Hydraulic Parameter	Existing Headworks	Replacement Option		
		Option A	Option B	Option C
River Flow Upstream		4,317 - 7,771 cfs		
Main Canal Flow		1,382 - 1,374 cfs		
Head Differential	3.8 - 5.0 ft	1.9 - 3.2 ft	2.1 - 3.4 ft	0.5 - 1.2 ft
Headworks Velocity	12 - 14 ft/s	8 - 10 ft/s	9 - 10 ft/s	5 - 6 ft/s
Headworks Survival Rate	85%	-	-	-



Conclusions

- Diversions screened in 1930's, designs have evolved over time.
- Recent smolt survival studies studies have identified mortality factors diversion dams.
- In response, Roza Dam fish screen project will start winter 2024-25 and (hopefully!) be completed by March 2026 (\$20 million). Roller gate reregulation will be evaluated.
- Sunnyside Dam fish guidance boom and gate project implemented in 2021-22 currently under evaluation.



Conclusions

- Prosser Dam stakeholder team formed with Reclamation project management and Yakama Nation Fisheries leading
- Easton Dam review in next few years
- Wapato Dam redesign underway
- Most major Yakima Basin diversion dams improved passage in next 10 years??



Acknowledgements

- John Easterbrooks (WDFW retired)
- Yakama Nation Fisheries and BPA
- YFO Fish Operations Crew
- Sunnyside Valley Irrigation District
- Kittitas Reclamation District
- Roza Irrigation District
- Kennewick Irrigation District
- Integrated Plan stakeholders
- Toby Kock and staff, USGS
- Salmon Recovery Funding Board
- NOAA Fisheries, Sean Gross and Jeff Brown
- WDFW, Perry Harvester
- Walt Larrick, Joel Hubble
- Mark Johnston, Yakama Nation

