



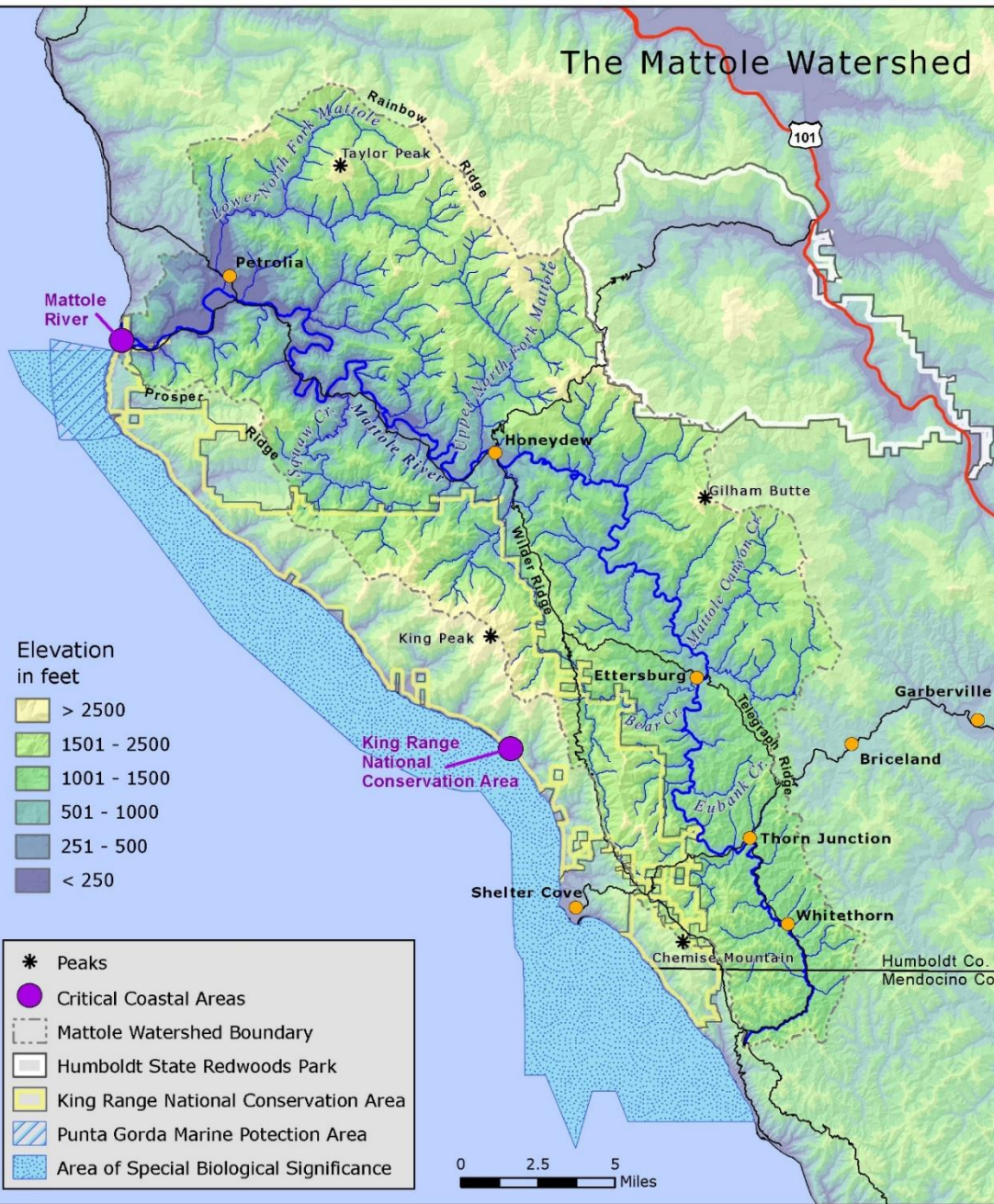
Sanctuary Forest



Sanctuary Forest is a land and water trust whose mission is to conserve the Mattole River watershed and surrounding areas for wildlife habitat and aesthetic, spiritual and intrinsic values, in cooperation with our diverse community.



The Mattole Watershed



Mattole Headwaters Streamflow Enhancement

History and Background:

- Low Flows recognized in 2002 by the Mattole Salmon Group and the community
- Sanctuary Forest Water Program begins in 2005
- Development of broad collaborative network to develop restoration and permitting strategies
- Storage and forbearance, monitoring, and learning: 2005-2023
- Groundwater pilot projects development begins in 2010, implementation, monitoring and learning: 2012 -2023

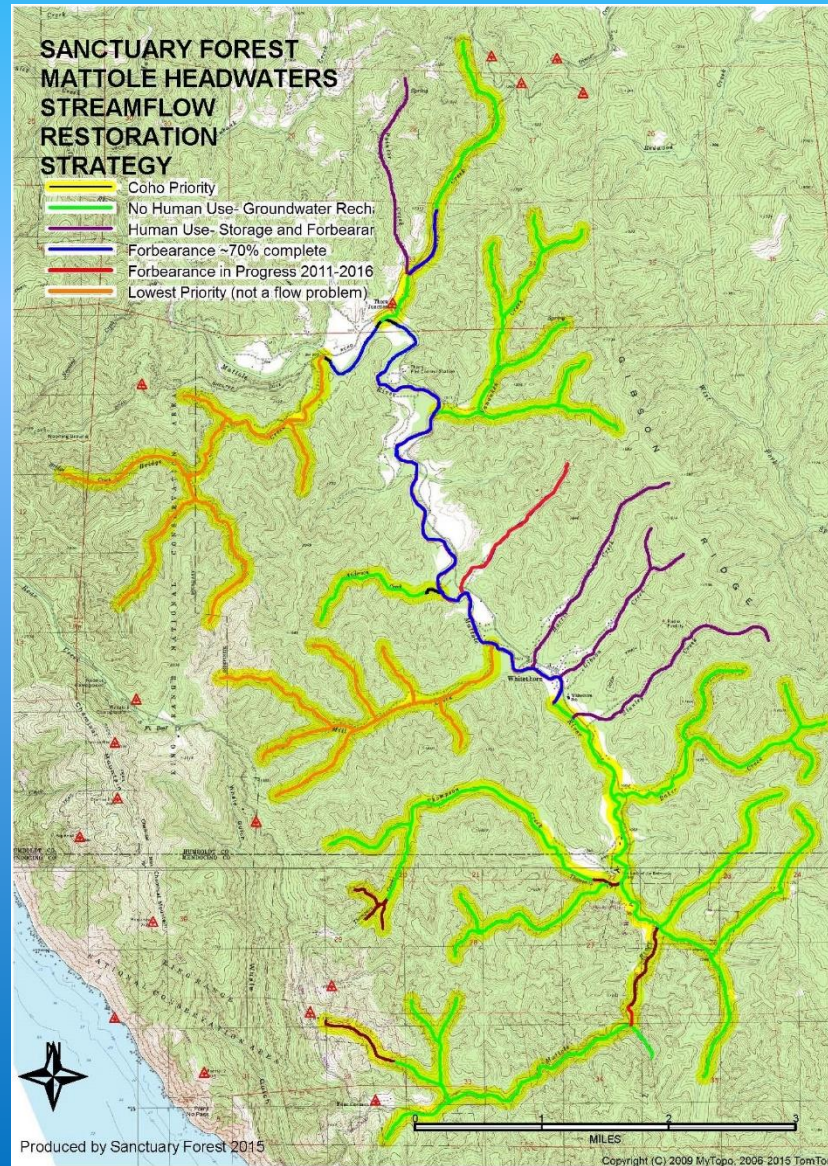


Flow Enhancement Strategies

- Changing human use – storage and forbearance, community outreach, and collaborative water management
- Groundwater recharge – instream and upslope projects with “passive” streamflow benefits
- Upslope ponds with metered flow to the stream
- Forest thinning to reduce evapotranspiration?



Streamflow Restoration Strategy Map: Coho Presence, Human Use Areas, Low Flow Problem

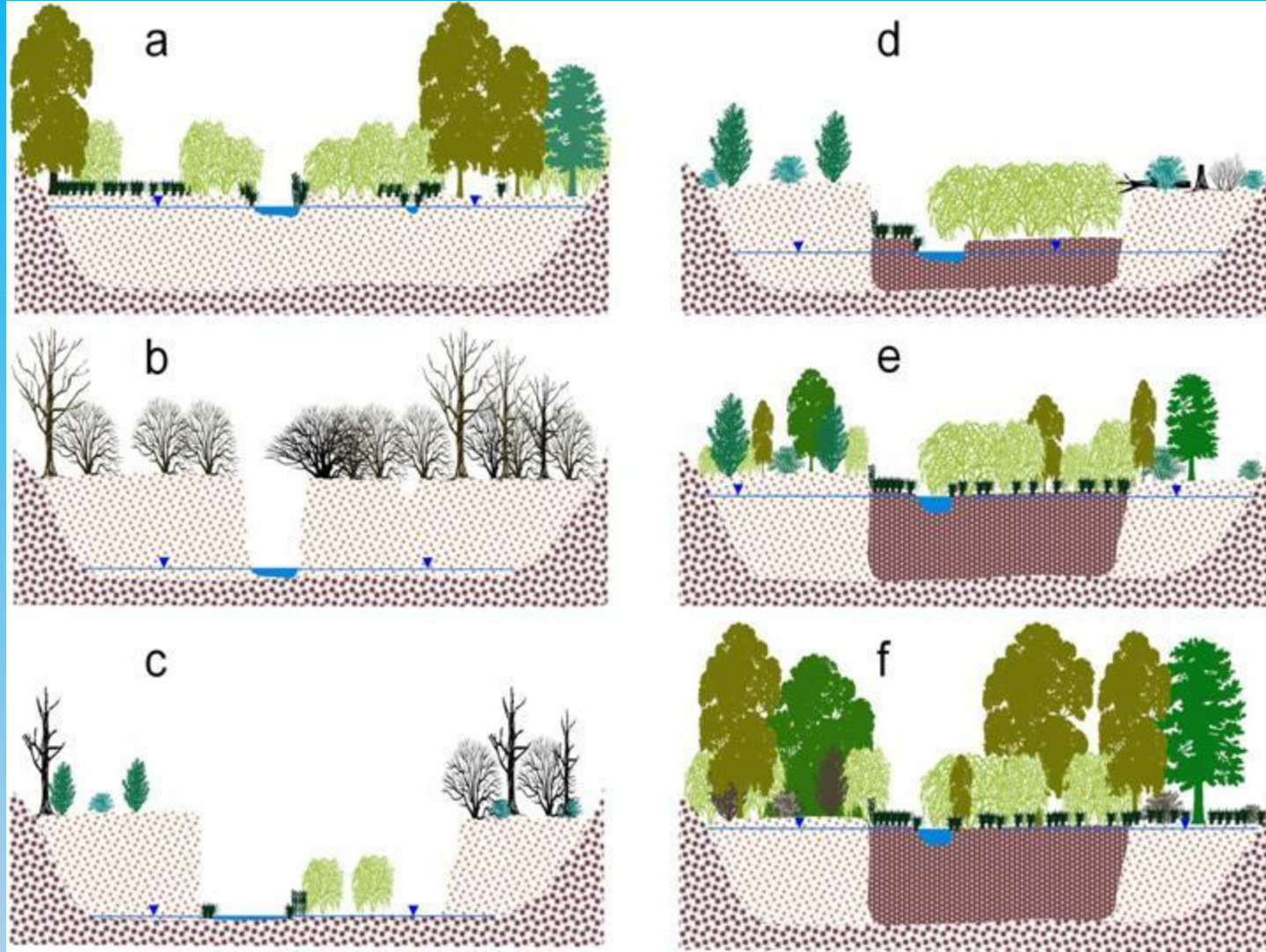


Storage & Forbearance Program:

33 Participants, 2 Million Gallons Stored
Highest flow benefits in late summer



Stream Incision and Loss of Groundwater Recovery process with log weirs or beaver dam analogs



Baker Creek Project: Instream Weirs

Pre-Project

Post-Project



Drought-Resilient Habitat Upstream of Weirs issues –reduced sediment transport



2013/10/01



Weir Design Evolution

Floodplain reconnection with strategic grading & channel filling
improved winter and summer habitat
sediment transport intact



Beaver Dam Analogs in Lost River

Before Winter

During First Post-Project Winter



Adding Stability to BDAs



Post-Project Dry Season

Pools shrink when upstream flows stop,
late August 2020



Post-Project Dry Season

Log weirs with BDA's

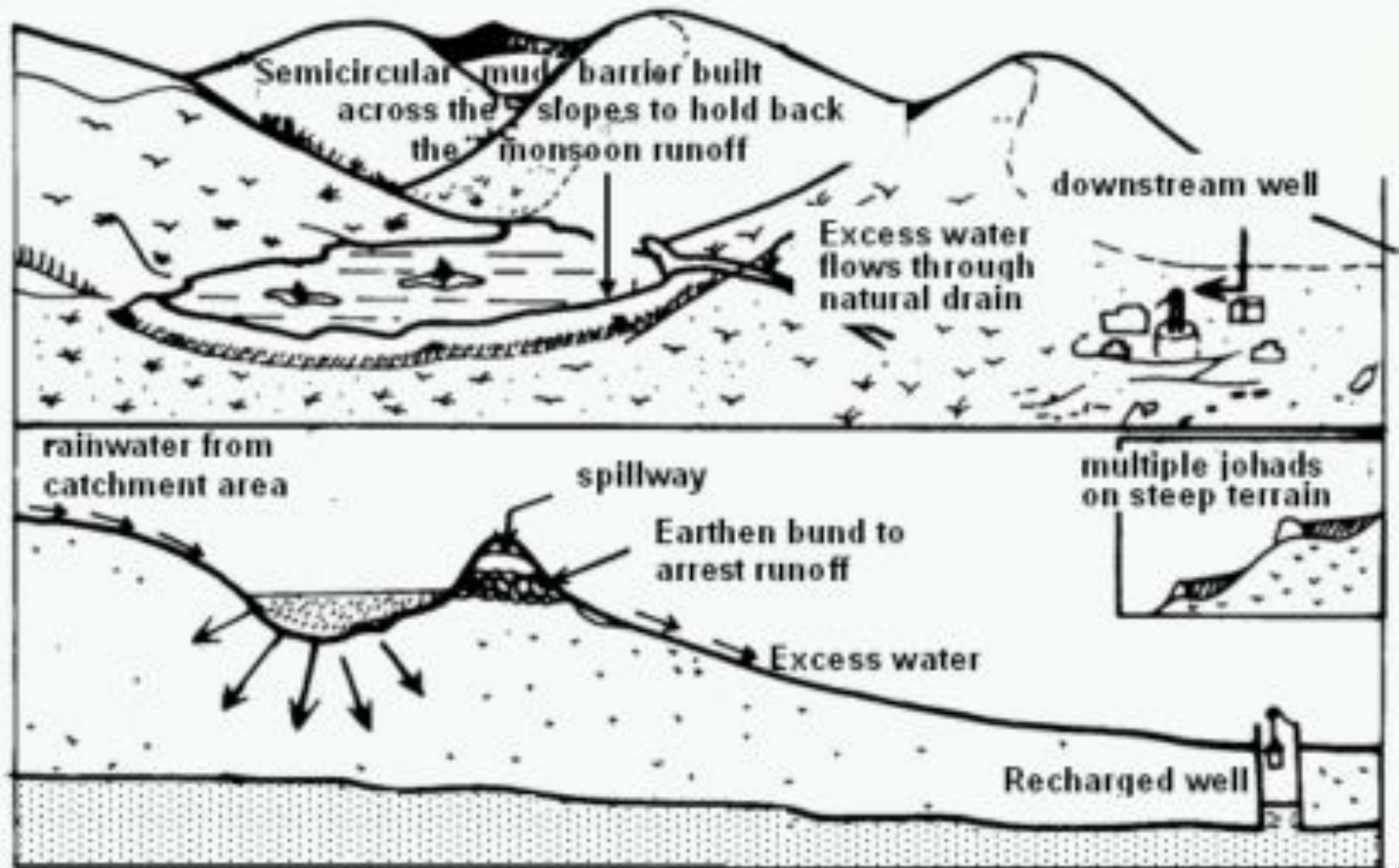
July 18, 2022



Groundwater recharge from upslope projects

Learning from India

Rainwater Harvesting from Johads – National Institute of Hydrology, Roorkee, India



Building the Subsurface Restrictive Barrier



Planting native grasses and sedges



Baker Creek String of Pearls

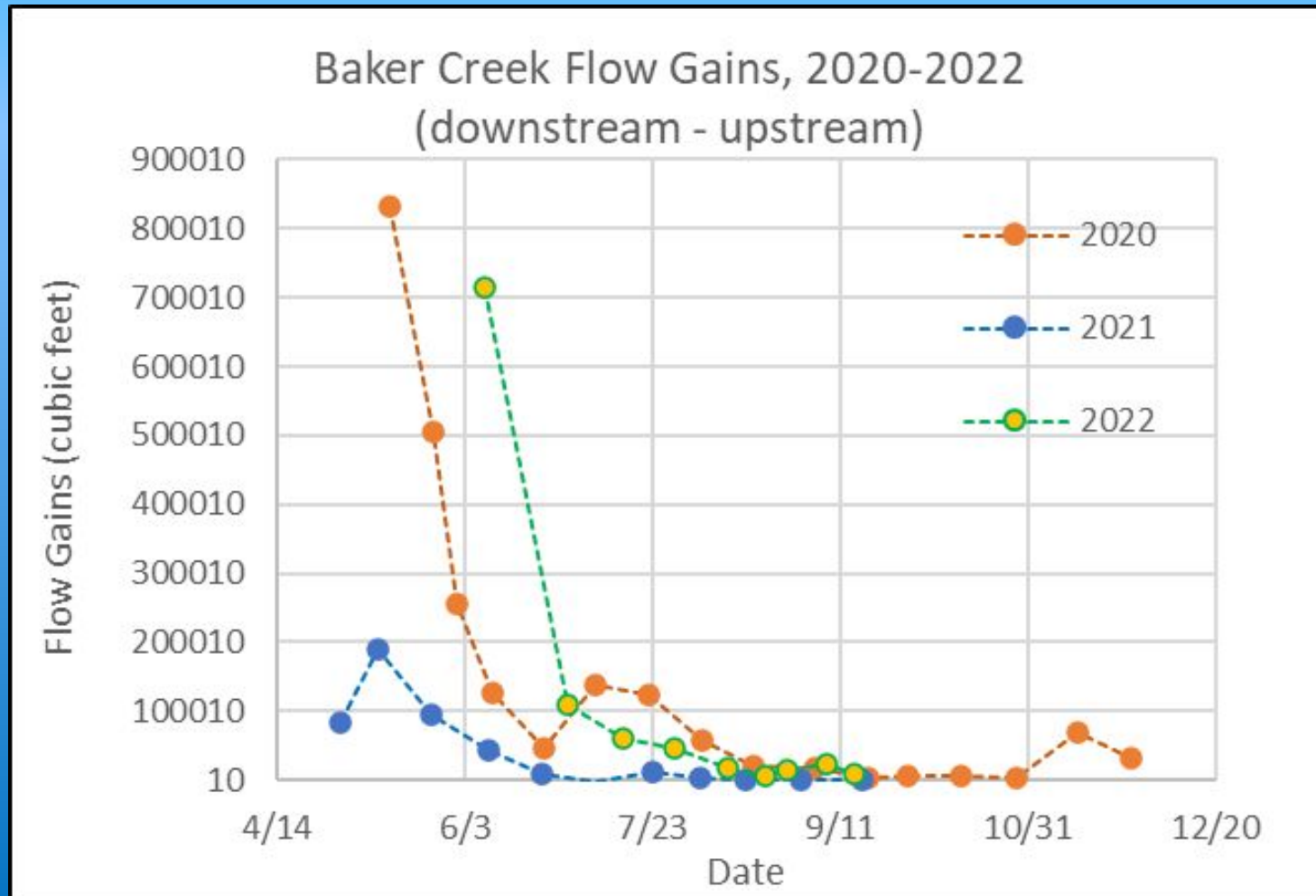
Losing Reach becomes a Gaining Reach

2020 ~ 4.6 million gallons

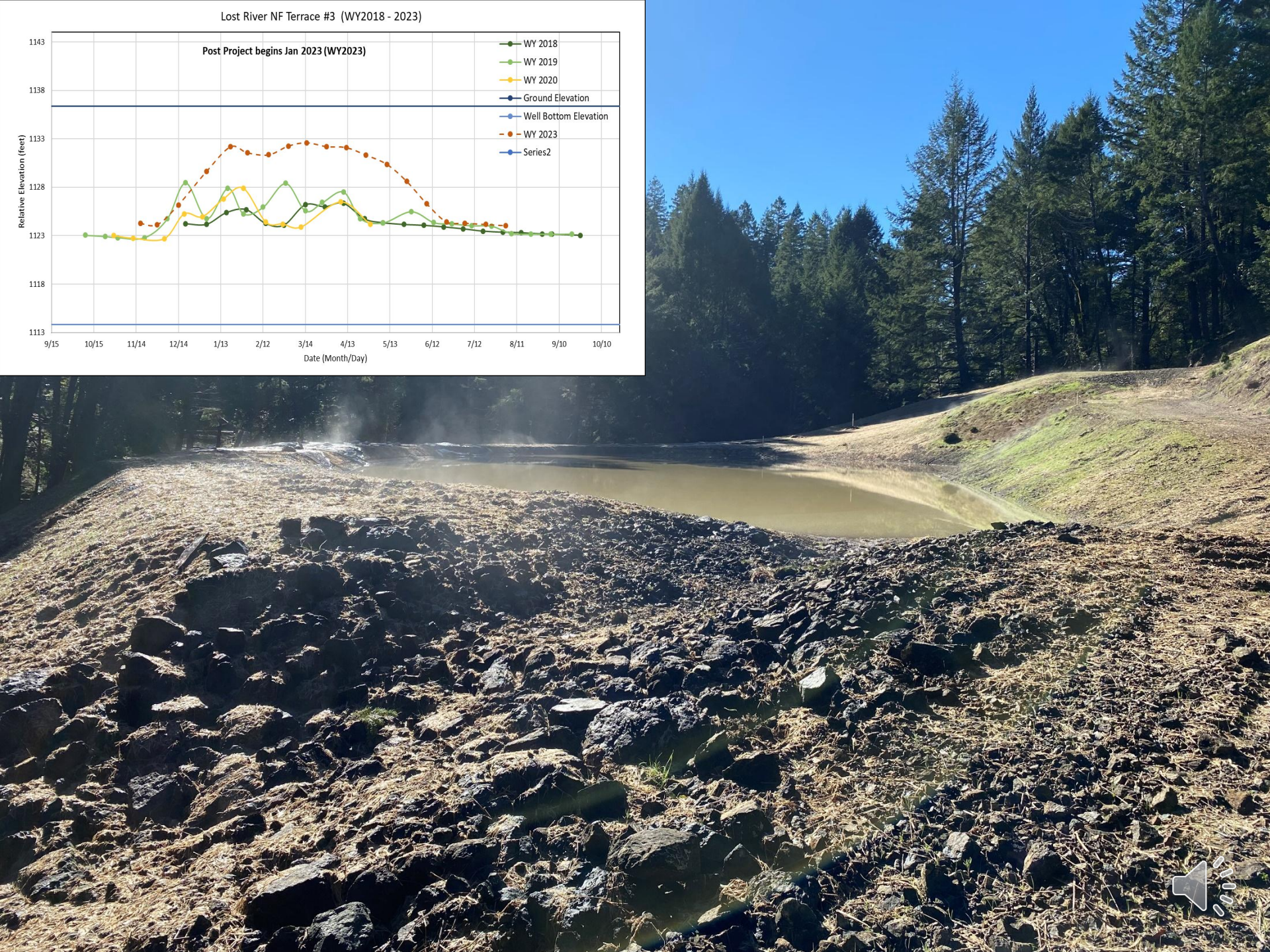
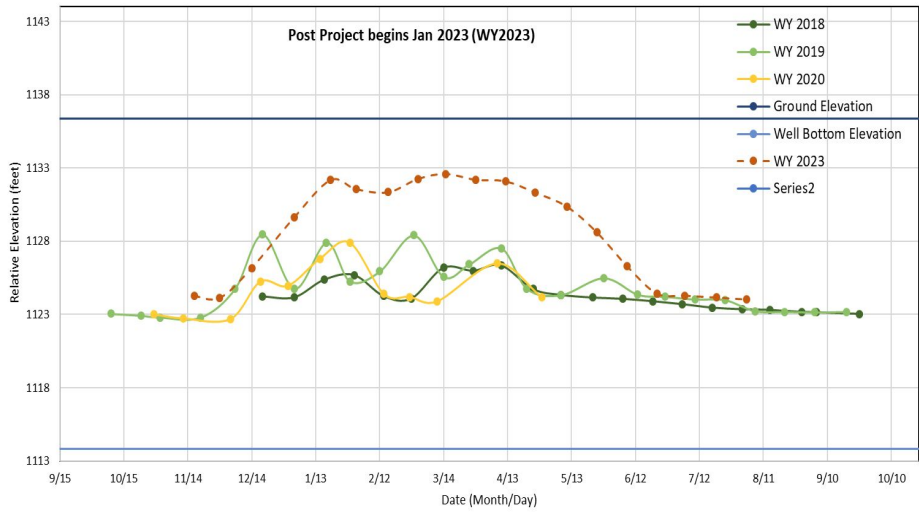
2021 ~ 0.5 million gallons

2022 ~ 7.5 million gallons

(computed flow gains, early June to rainy season, analysis by hydrologist, Randy Klein)



Lost River NF Terrace #3 (WY2018 - 2023)



South Fork Lost River

Upslope pond with metered flow to the stream

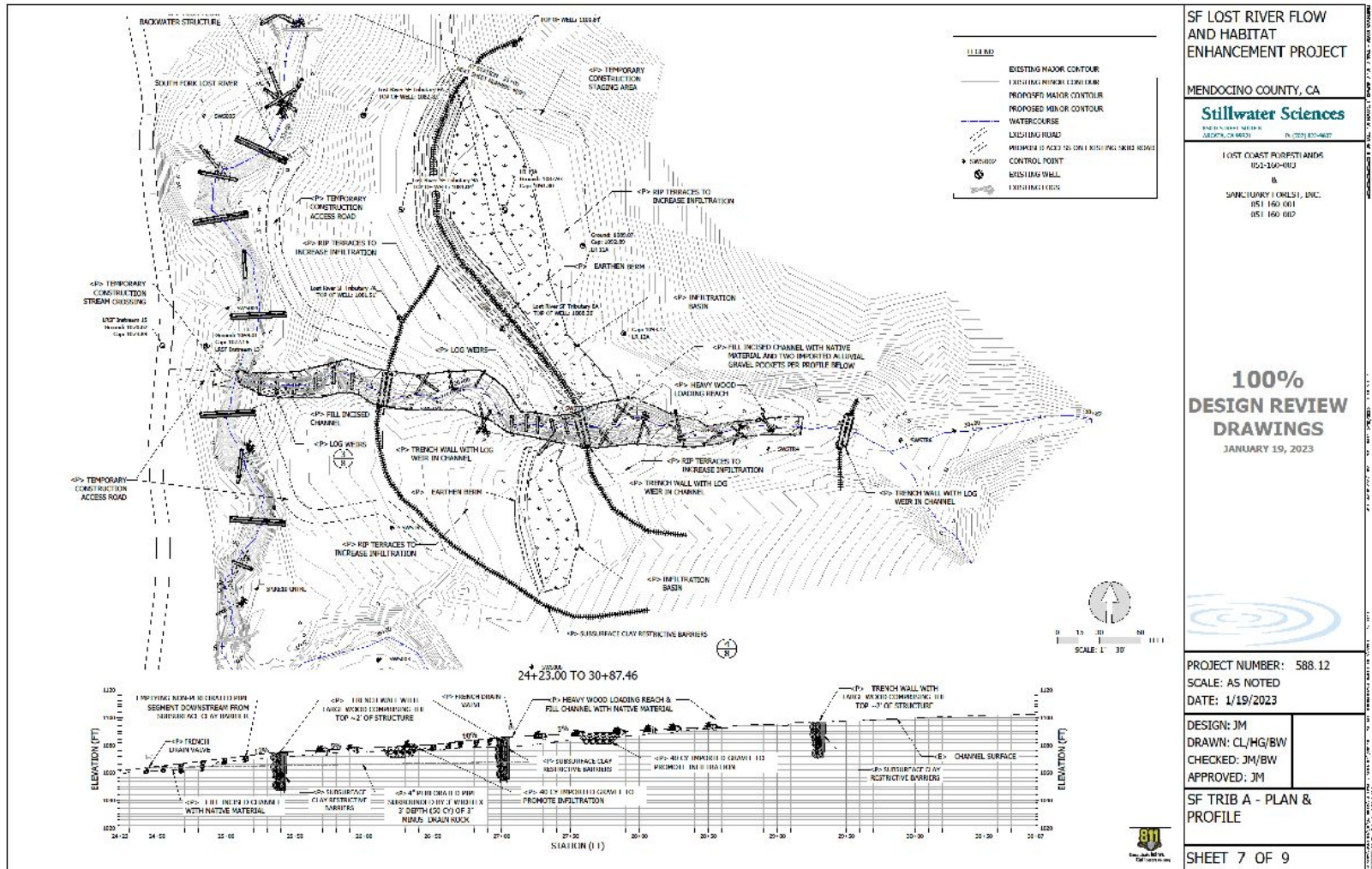
(1 million gallons surface water / 6.8 GPM August 1st to October 15th)



South Fork Lost River

Subsurface clay restrictive barriers for Terrace storage

(Estimated 1.1 million gallons & avg streamflow benefit of 6.5 gpm over 122 days June 15- Oct 15)



Dual strategy – groundwater and metered flow

Lost River Watershed – Example of Dry Season Flow Augmentation

Dry season June 15 - Oct 15 (2-week periods)	June 15 –30	July 1 - 15	July 16-31	Aug 1-15	Aug 16-31	Sept 1-15	Sept 16-30	Oct 1-15	Total Gallons Jun 15 – Oct 15
Measured pre-project flows (gpm)	162	94	40	10	2.6	0.2	0	0	~6.7 million gallons
Estimated flow (gpm) resulting from increased groundwater	131	65	32	15	7	3.5	1.8	0.9	~5.6 million gallons
Metered flow (gpm) from NFLR & SFLR proposed ponds	0	0	0	15.8	15.8	15.8	15.8	15.8	~ 1.8 million gallons
Total estimated post-project flows (gpm)	293	159	72	40.8	25.4	19.5	17.6	16.7	~14 million gallons



Challenges – Learning and Adapting

I Geology –better understanding of what is feasible in our watershed & subsurface analysis with EBA engineering – Wyeth Wunderlich & Bret McIntyre

II Experimental versus known outcomes

- Groundwater recharge & effectiveness of subsurface barriers highly influenced by underlying bedrock
- Sealed ponds more likely to function as designed

III Watershed Approach – Listening, Learning – how to recover balance with nature & what does stewardship look like?

- forest thinning
- restoring incised streams
- upslope infiltration and engineering
- sealed ponds

Thank You to Our Partners!

With acknowledgement to our many mentors and partners including (but not limited to!):

- Joel Monschke, Stillwater Sciences
- Campbell Thompson, Mattole Salmon Group
- Sam Flanagan, Bureau of Land Management
- Randy Klein, Consulting Hydrologist
- EBA Engineering, Wyeth Wunderlich and Bret McIntyre
- Conor Shea, US Fish & Wildlife Service
- Charnna Gilmore, Scott River Watershed Council
- Dr. Michael Pollock, NOAA Fisheries
- Chris Maser, research scientist
- implementation subcontractors, community volunteers and working group/technical advisory committees, 2010 – present
- California Dept. of Fish & Wildlife (Forbearance Program Development)
- Regional & State Water Quality Control Boards (Permitting & Water Rights Pathways)

Thank You to Our Funders!

- California Wildlife Conservation Board
- California Department of Water Resources
- California Department of Fish and Wildlife
- California State Water Resources Control Board
- National Fish and Wildlife Foundation
- National Oceanic and Atmospheric Administration
- Bella Vista Foundation
- California State Coastal Conservancy
- Bureau of Land Management
- US Fish and Wildlife
- Humboldt Area Foundation
- Department of Water Resources
- Kenny Brothers Foundation
- Fish America Foundation
- Firedoll Foundation
- McLean Foundation
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