Deep Aquifer Hydrogeology

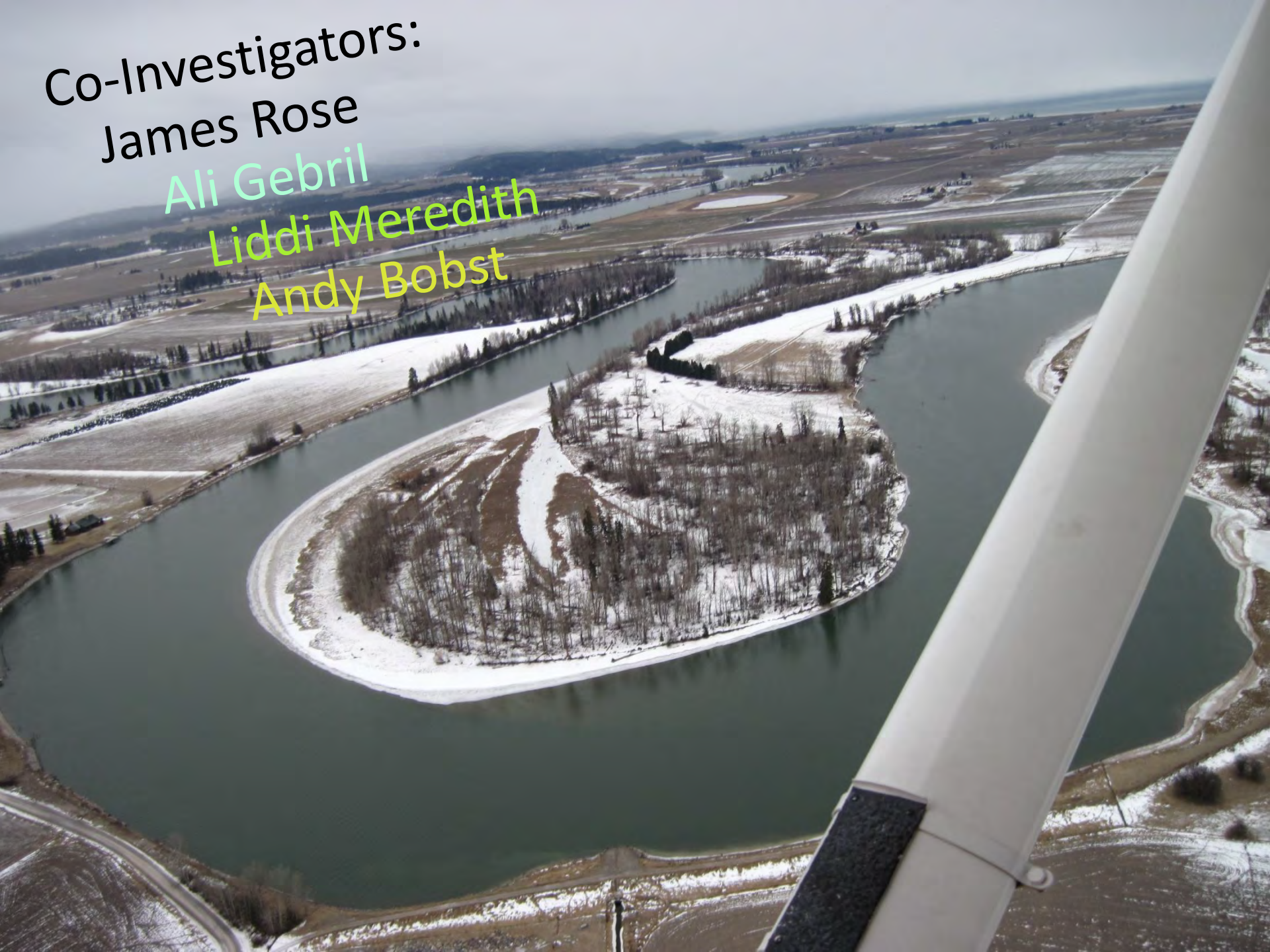
The Flathead (Kalispell) Valley

Montana Bureau of Mines and Geology

Ground Water Investigation Program

Montana AWRA
October 14, 2016

John Wheaton
Montana Bureau of Mines and Geology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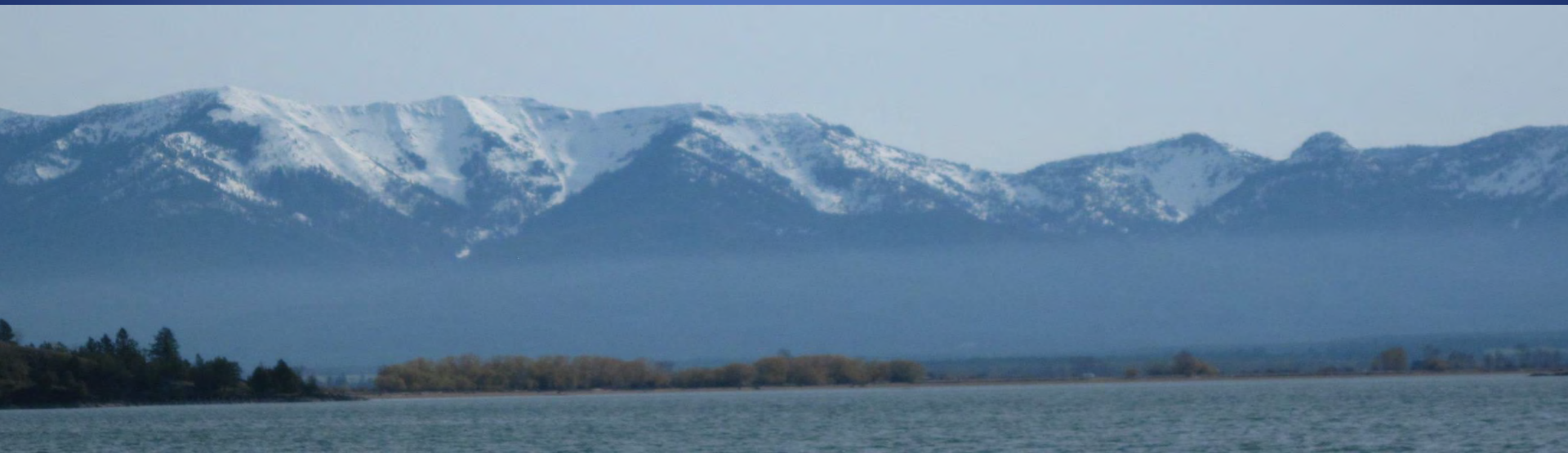
Ali Gebril
Liddi Meredith
Andy Bobst

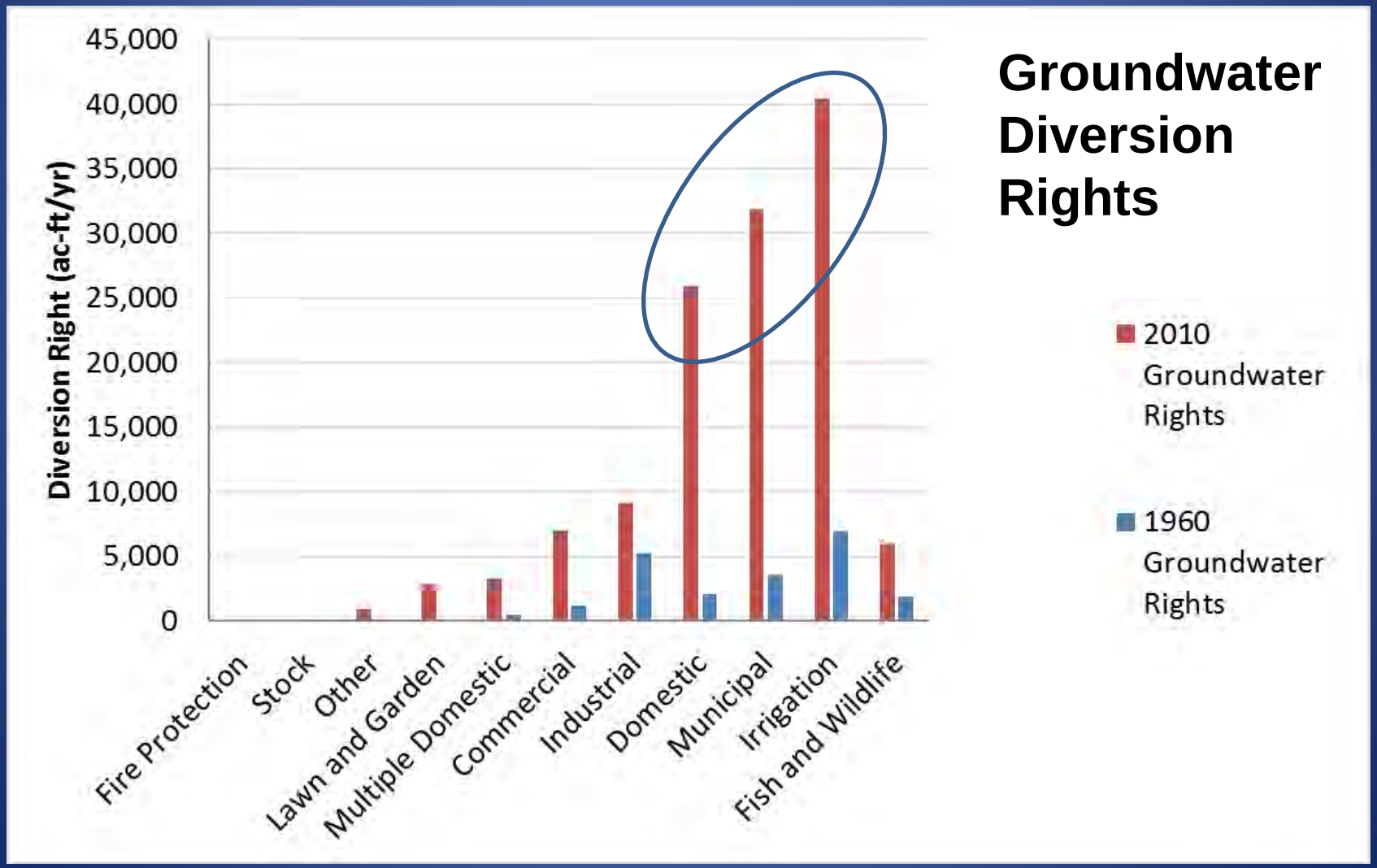
- ✓ **Problem Statement**
- ✓ **How the aquifer functions**
- ✓ **Is the aquifer being depleted?**
- ✓ **Does the deep aquifer discharge to Flathead Lake?**



Is increasing stress:

1 - depleting the aquifer, or

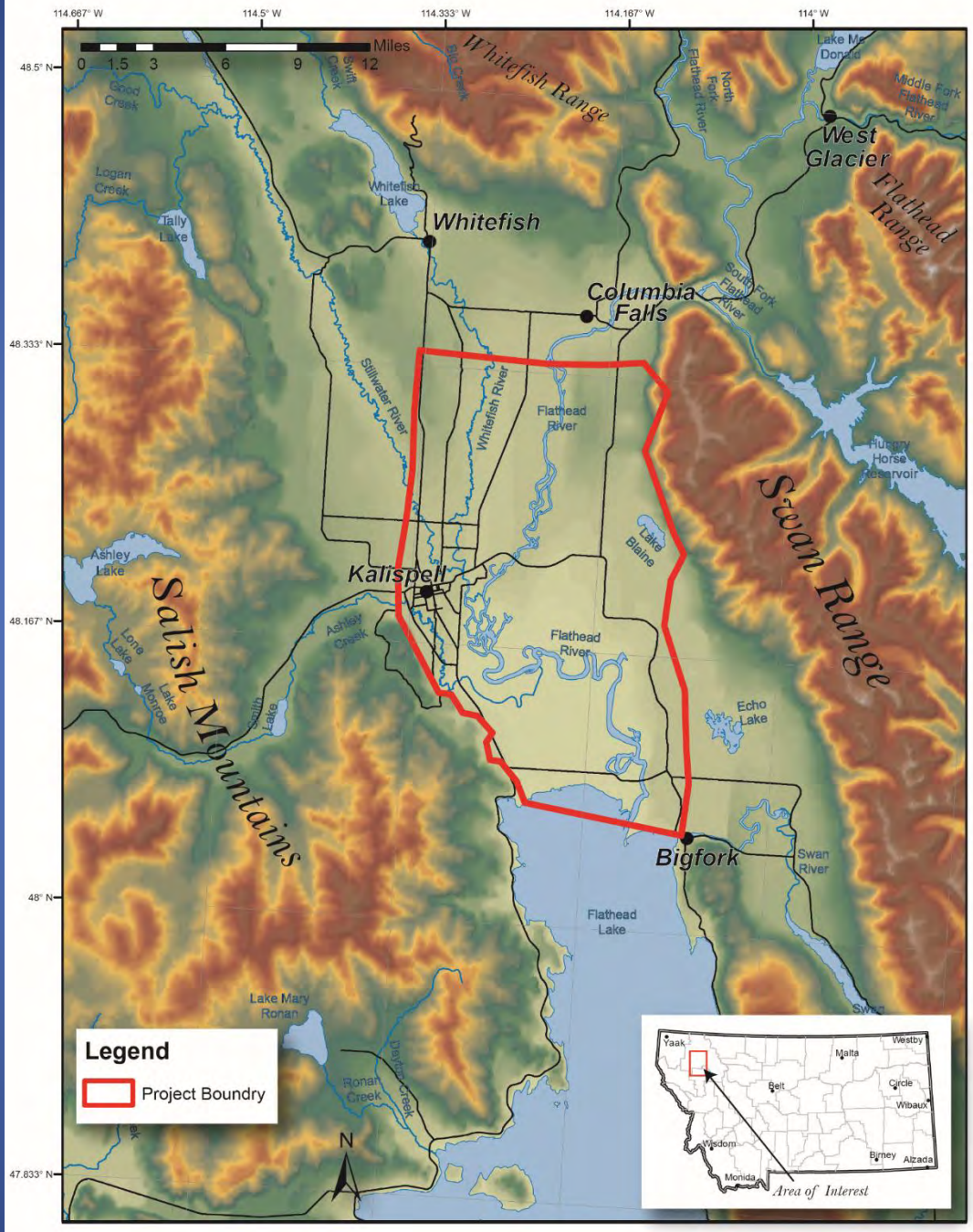
2 - decreasing discharge to Flathead Lake?



Study area

Red polygon north of Flathead Lake is focus area

But, we'll look around the valley also.



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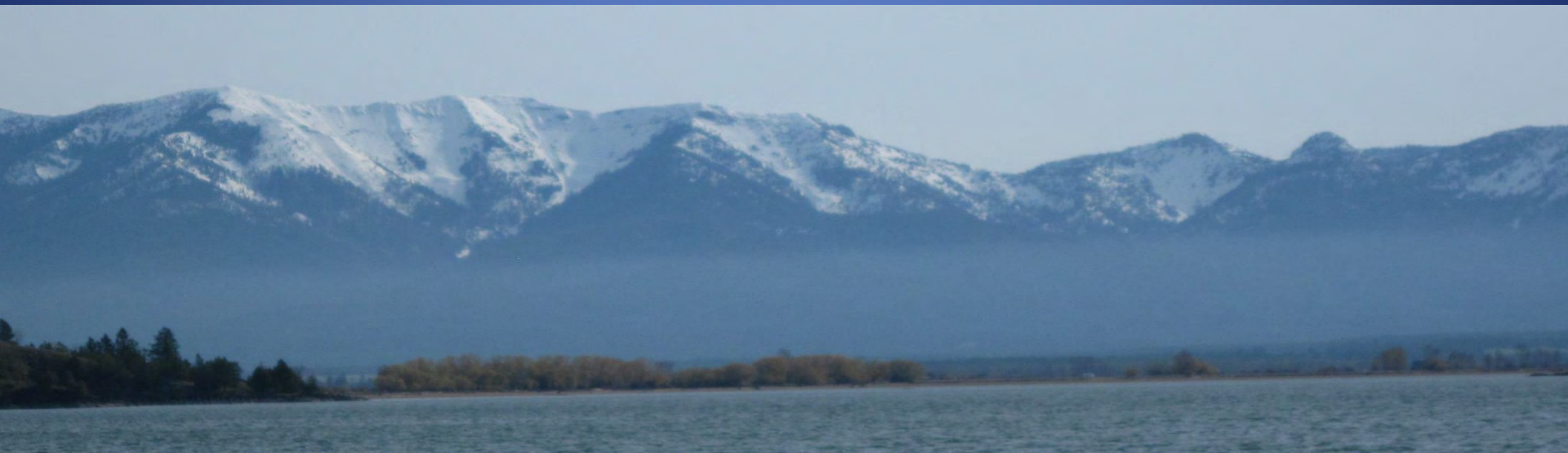
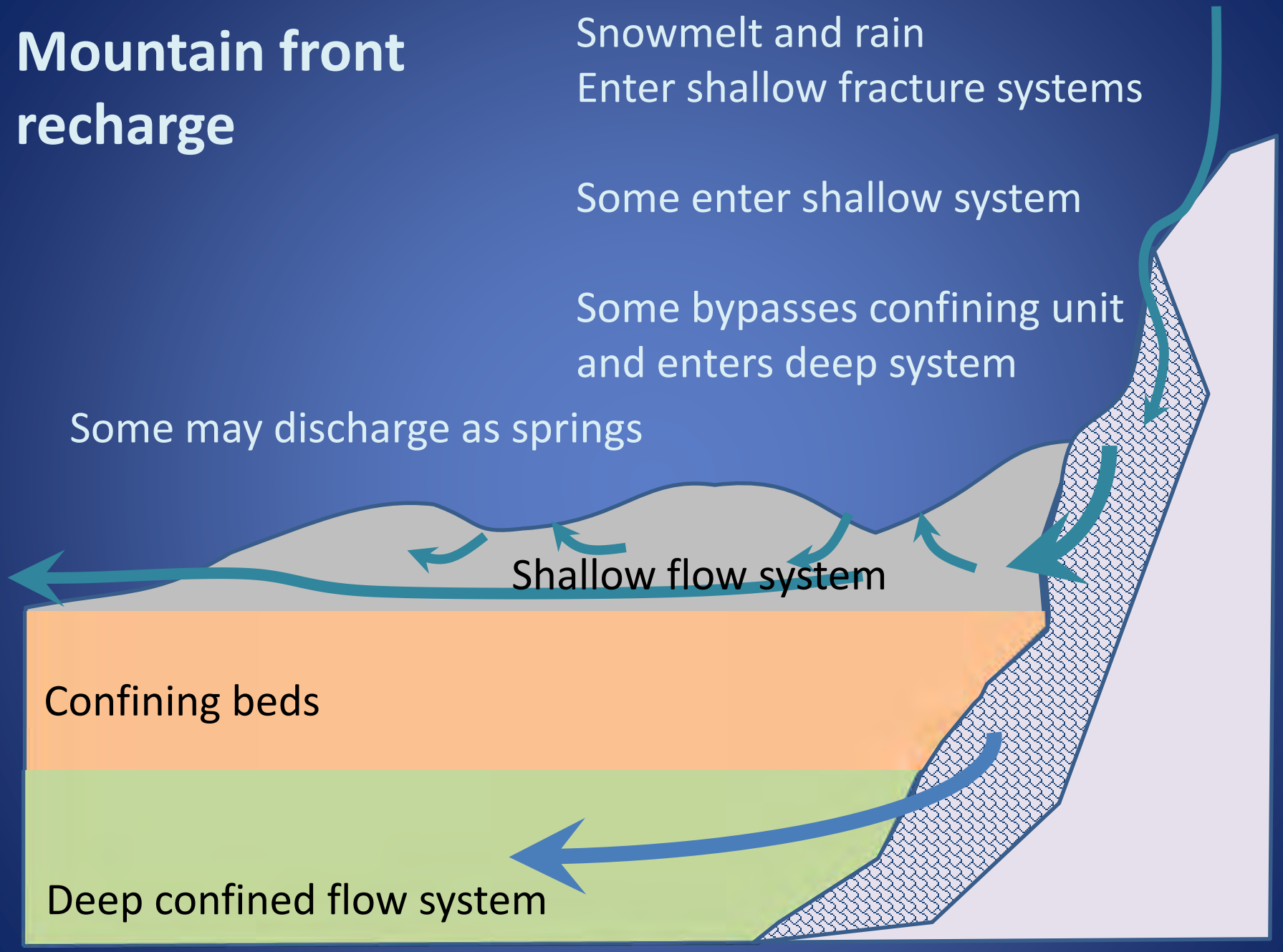


Mountain front recharge



Groundwater generally flows south toward Flathead Lake
Though no direct observation of discharge

Water Budget and Outflow

Stochastic Model Allows for variability

Recharge area model

Discharge area model

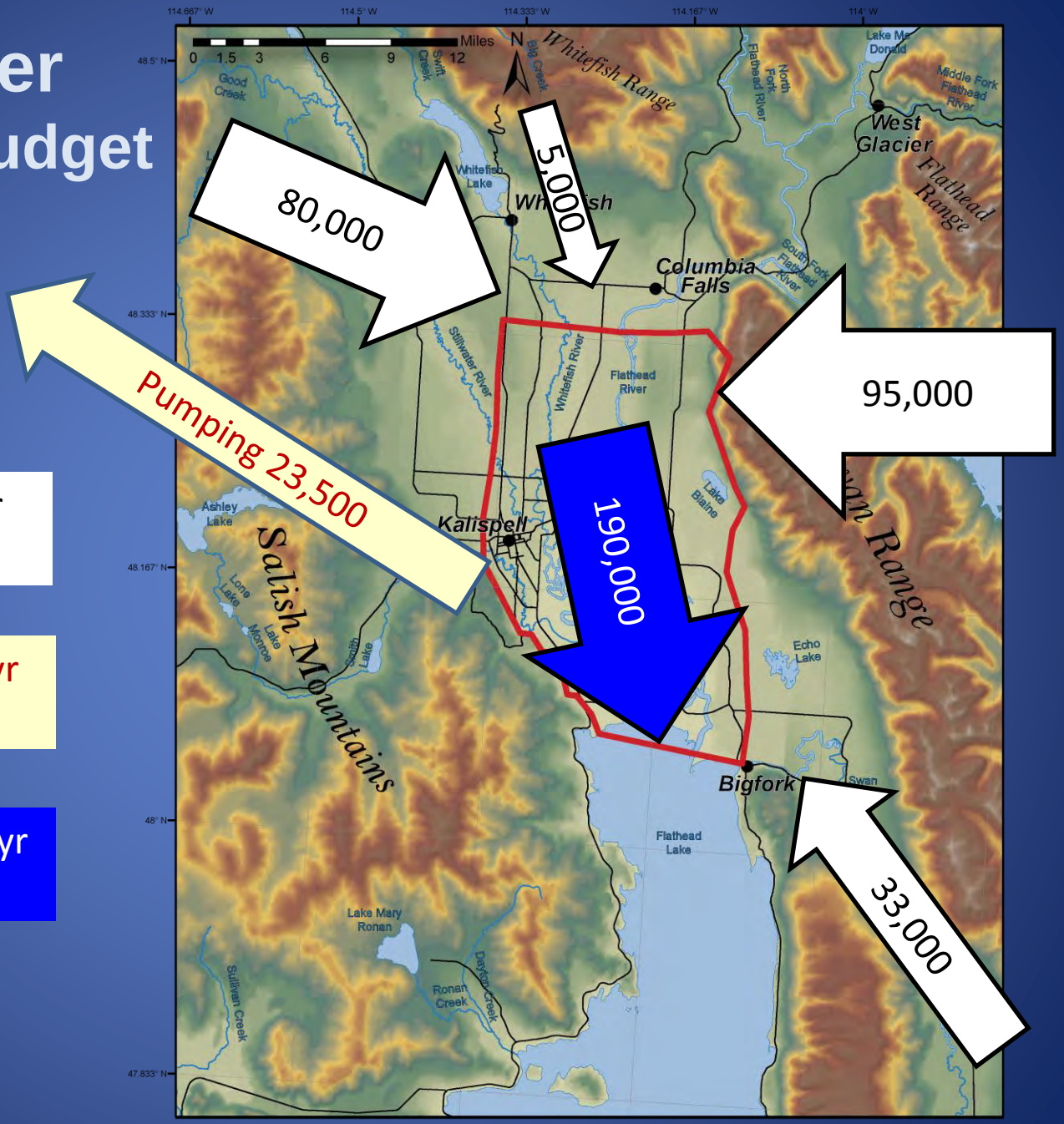
Deep Aquifer Groundwater Budget (2011)

Values are approximate
Based on statistical mean

Inflow = 213,000 acre-ft/yr
300 cfs

Pumping = 23,500 acre-ft/yr
32 cfs

Outflow = 190,000 acre-ft/yr
260 cfs



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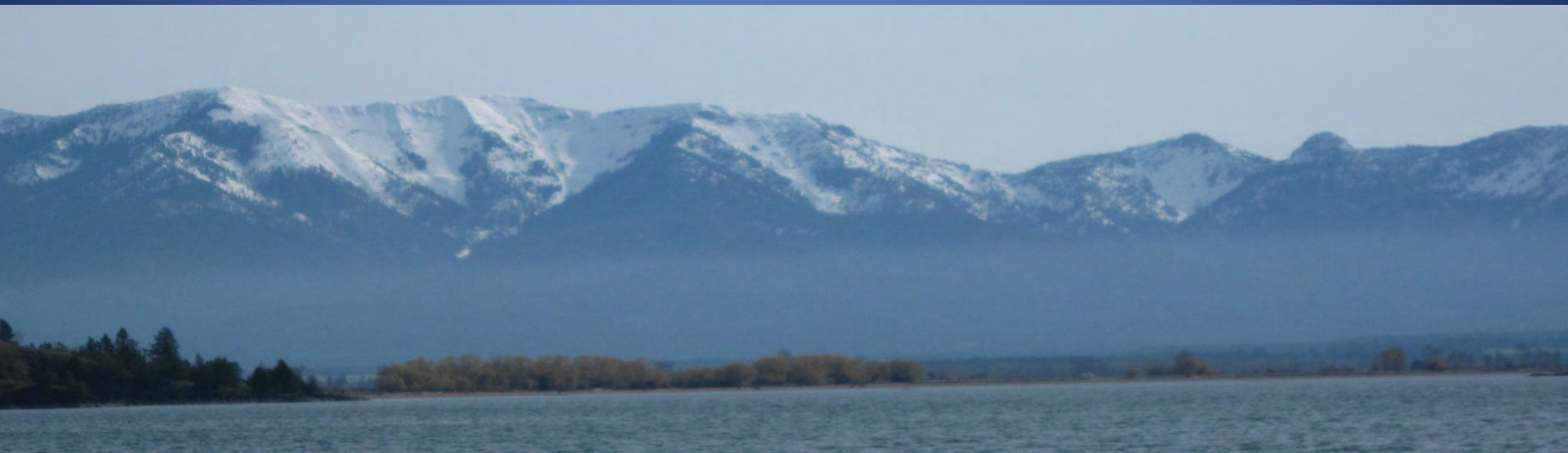
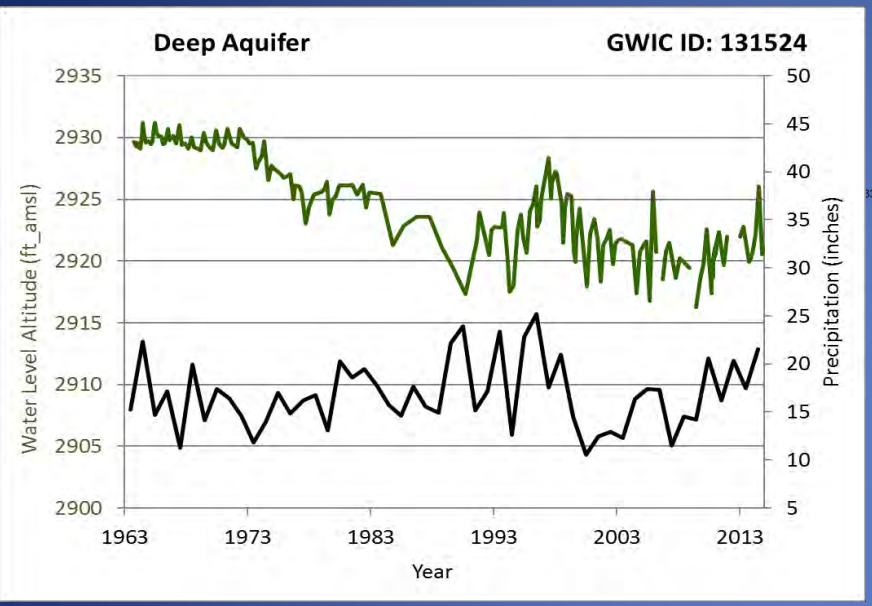
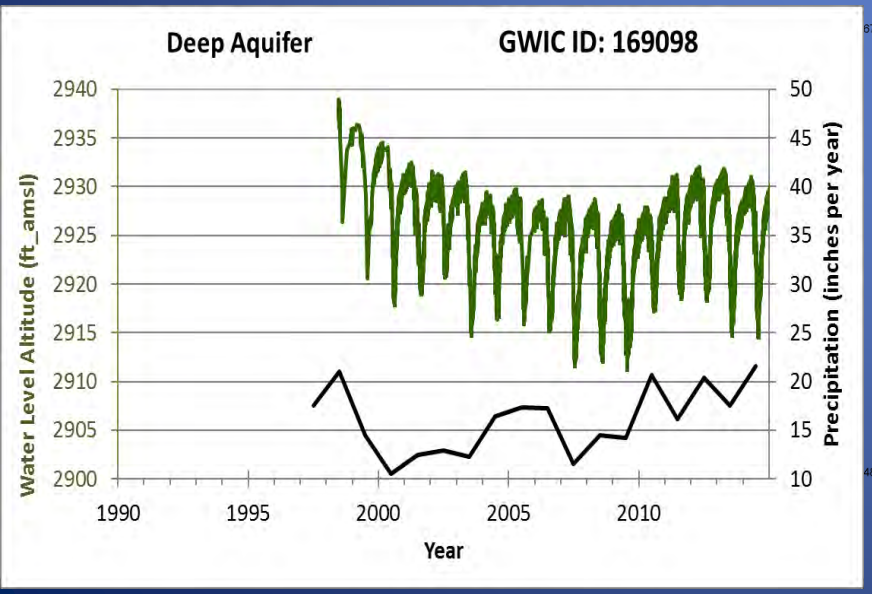
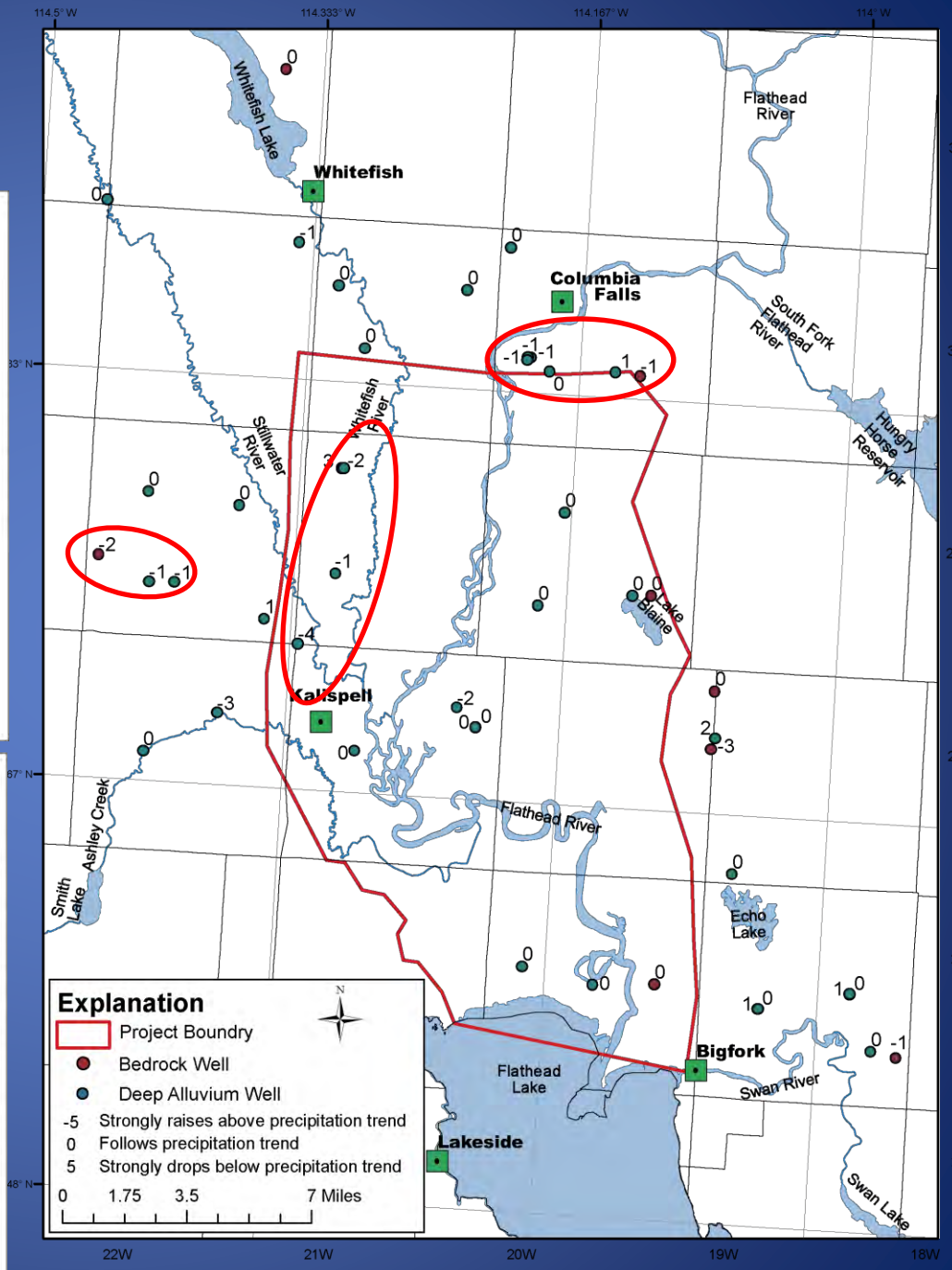


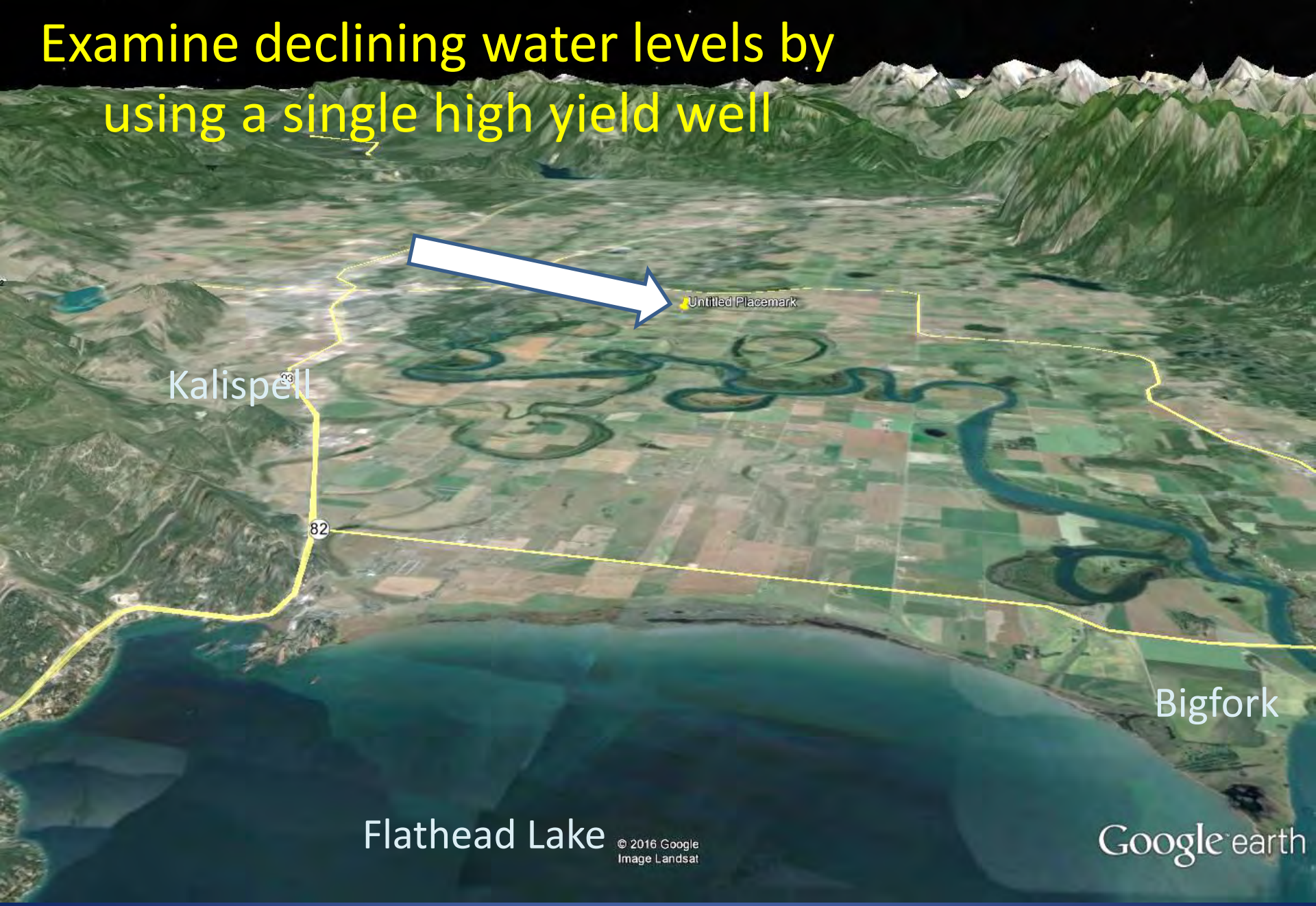
Three areas may have declining water levels

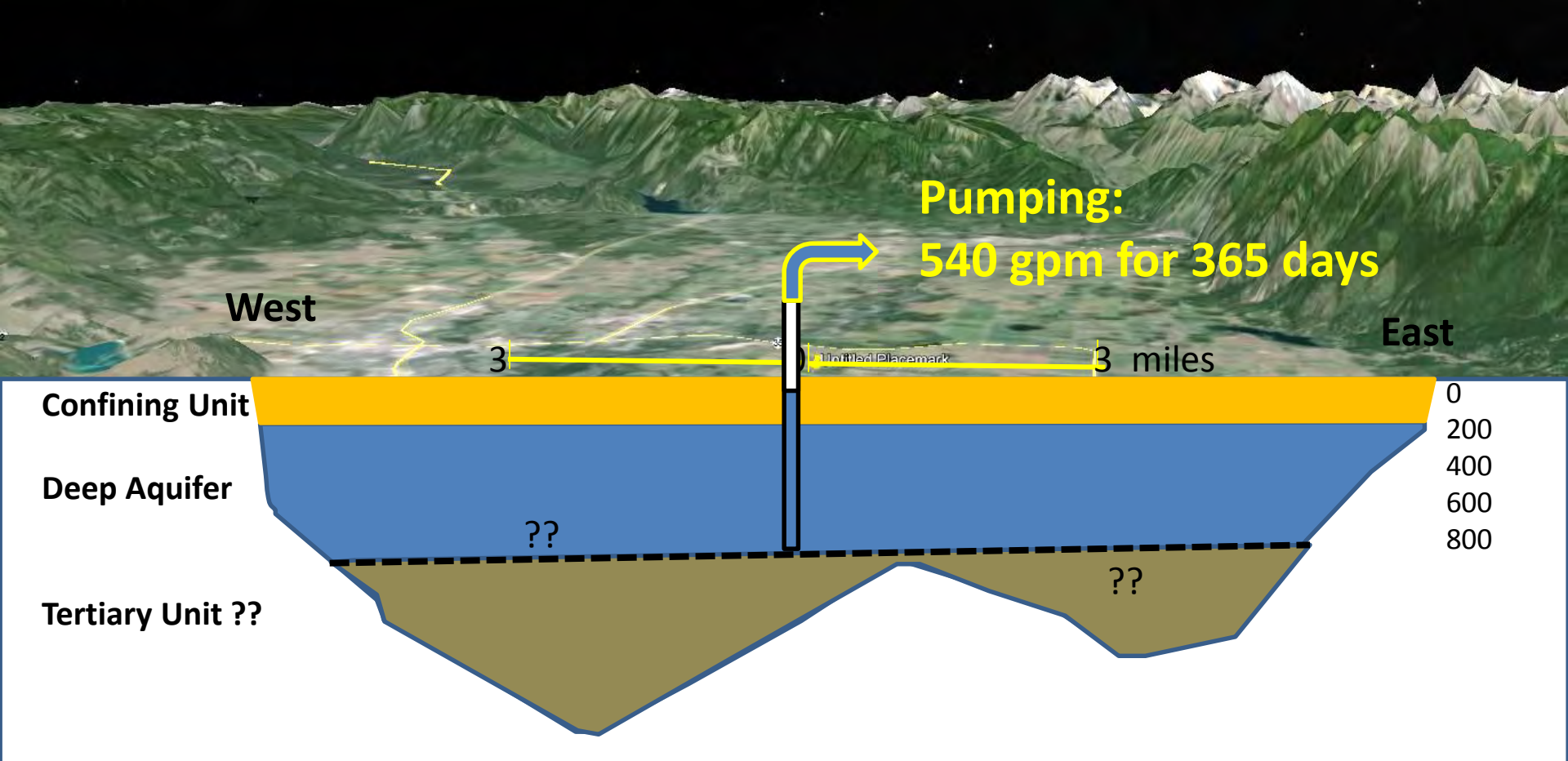






Examine declining water levels by using a single high yield well

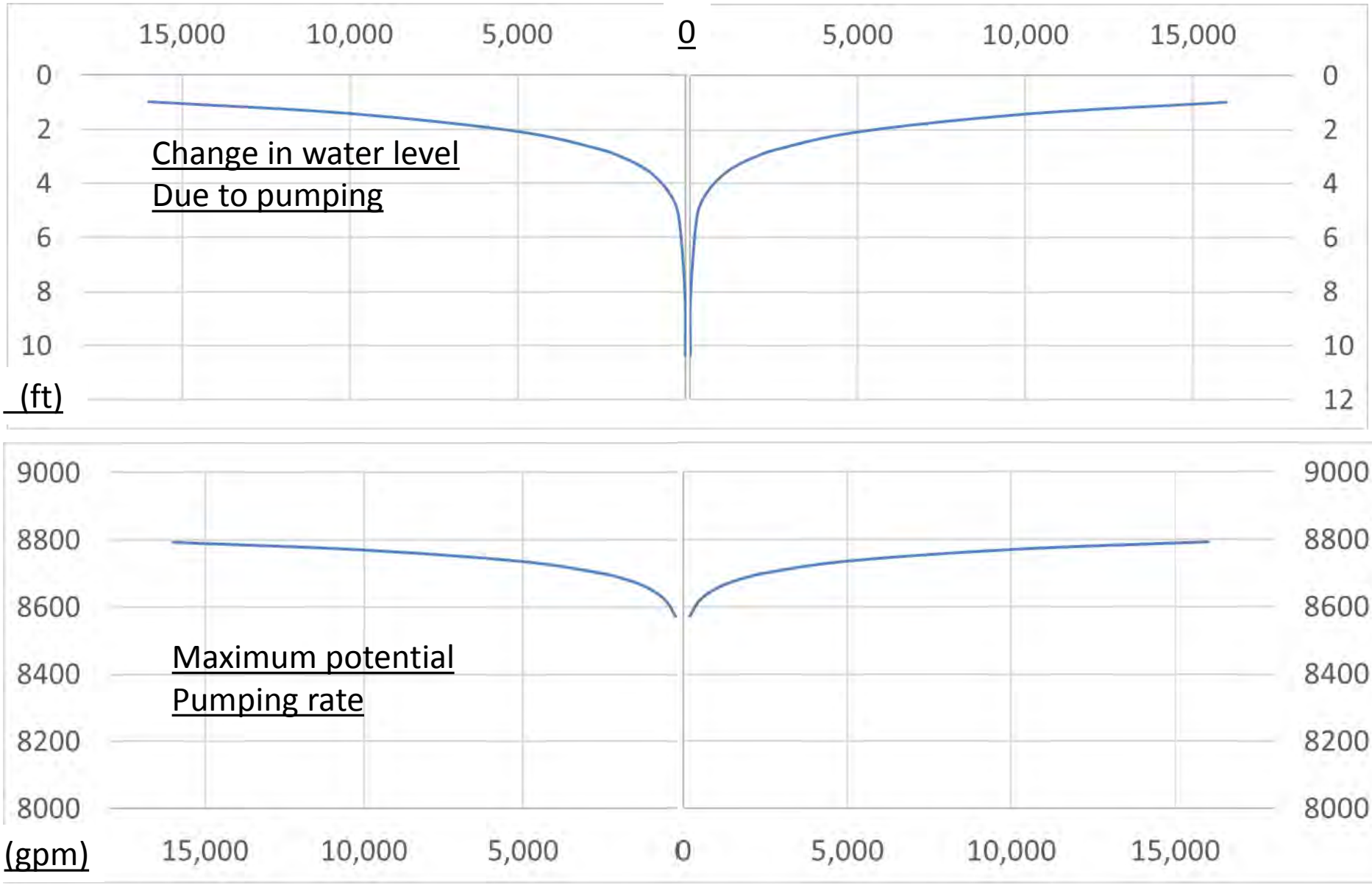




Schematic Geologic cross section

Vertical exaggeration greatly exceeds horizontal.
Blue color represents the deep aquifer.

Change in possible production at 100 days from wells within the cone-of-depression of a hypothetical well pumping for 1-year



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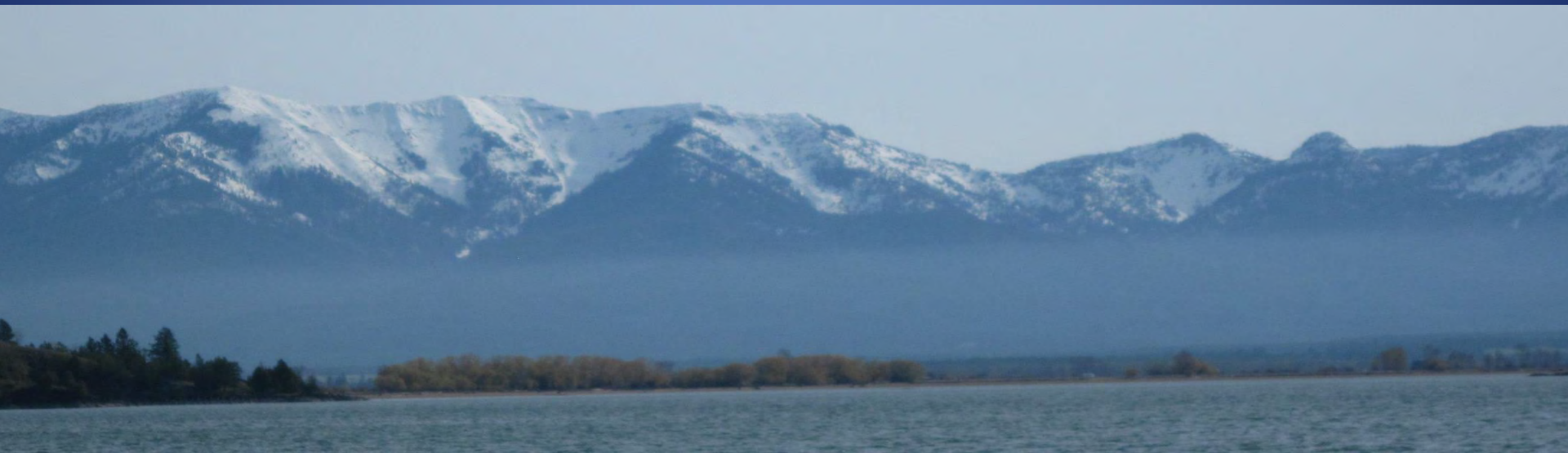
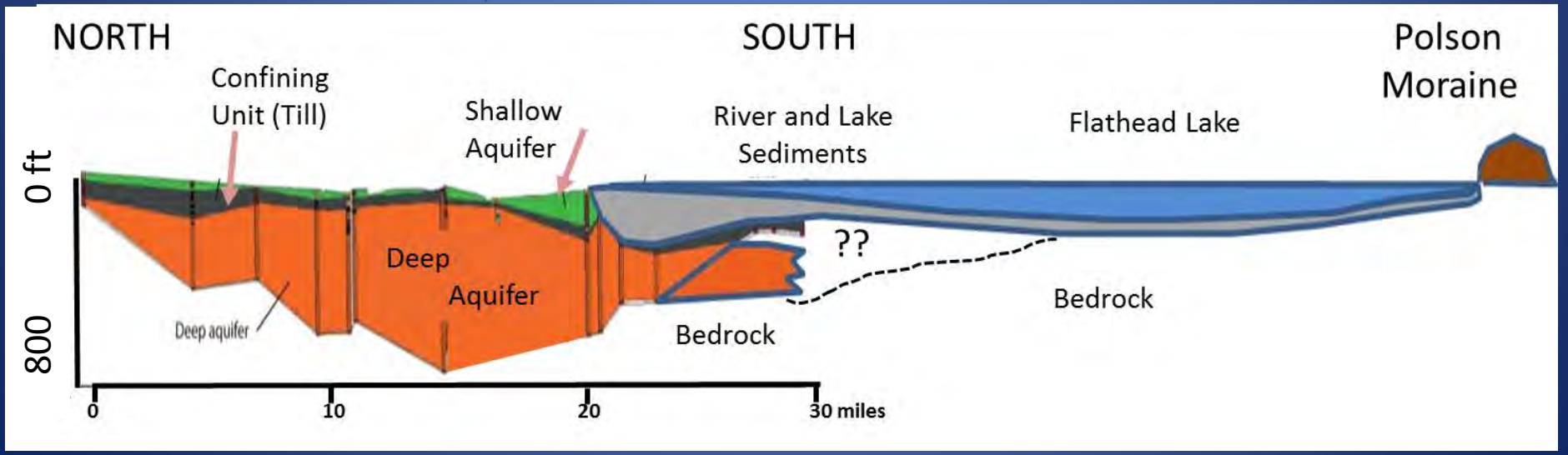


Interaction between deep aquifer and Flathead Lake: Is groundwater pumping in the Flathead Valley impacting lake levels or outflow?

GW Flow

North to South, the big picture.



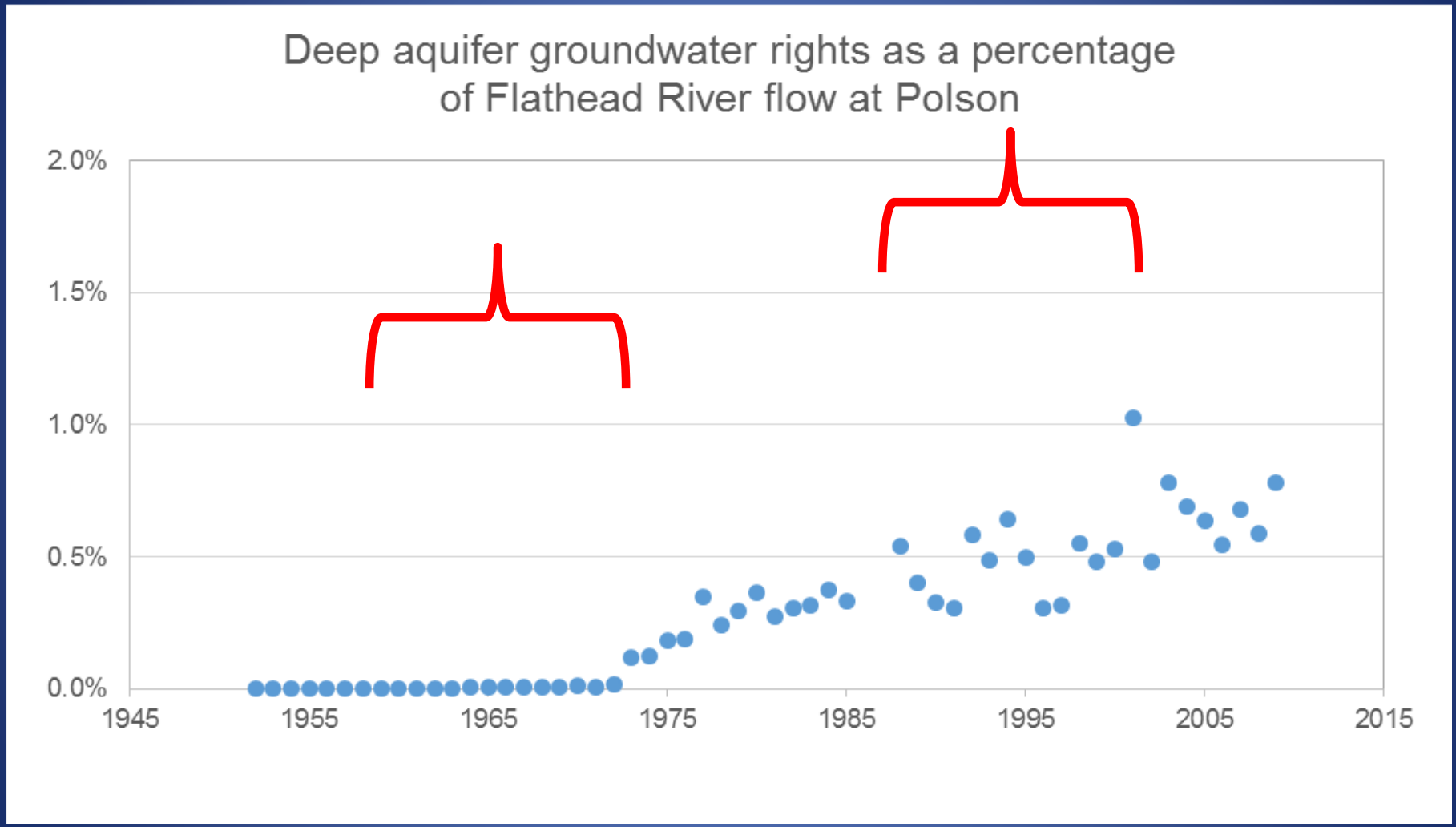
Can we see pumping impacting discharge from Flathead Lake?

Flathead River Flow (2010)

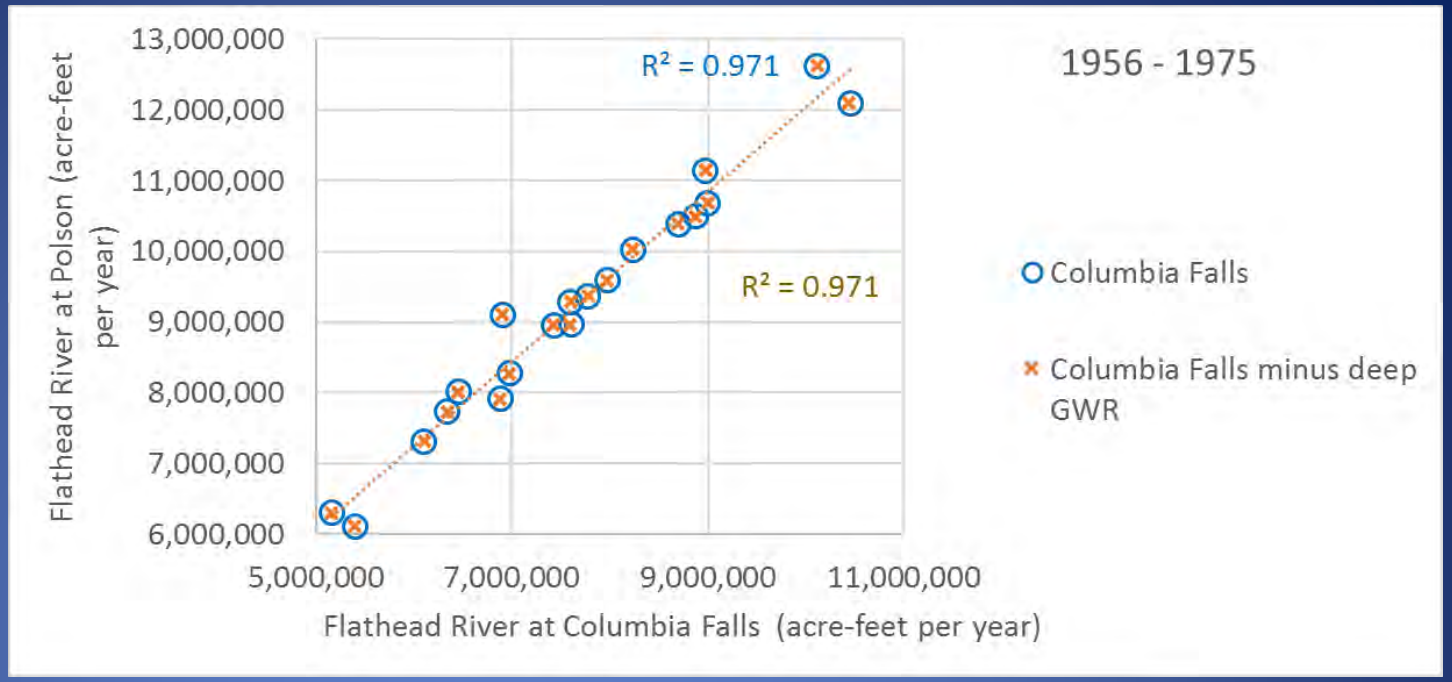
Columbia Falls
5.9 million ac-ft

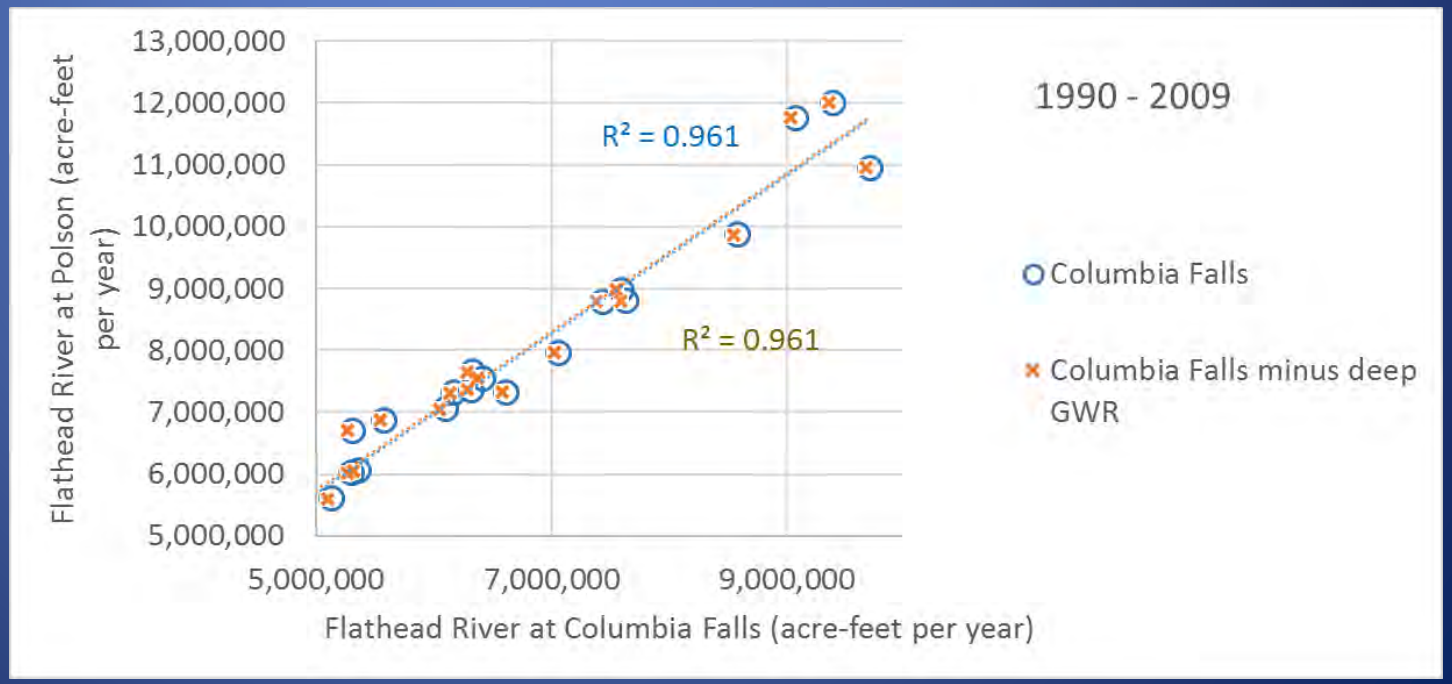
Polson
7.6 million ac-ft

Deep Aquifer
Flow 0.19 million ac-ft (2.6 %)
GWR 0.05 million ac-ft (0.7 %)


Deep aquifer groundwater rights as a percentage of Flathead River flow at Polson
2.0%
1.5%
1.0%
0.5%
0.0%
1945
1955
1965
1975
1985
1995
2005
2015

There is no apparent decrease in groundwater entering Flathead Lake





Summary

Recharge occurs primarily along the mountain fronts surrounding the valley

Annual flow through the deep aquifer is about 200,000 acre-feet per year

Water level declines in response to pumping are limited to isolated areas

Drawdown from wells will change water levels for up to several miles from production wells but will only minimally impact production potential

Slow seepage to Flathead Lake is inferred but not documented

Questions