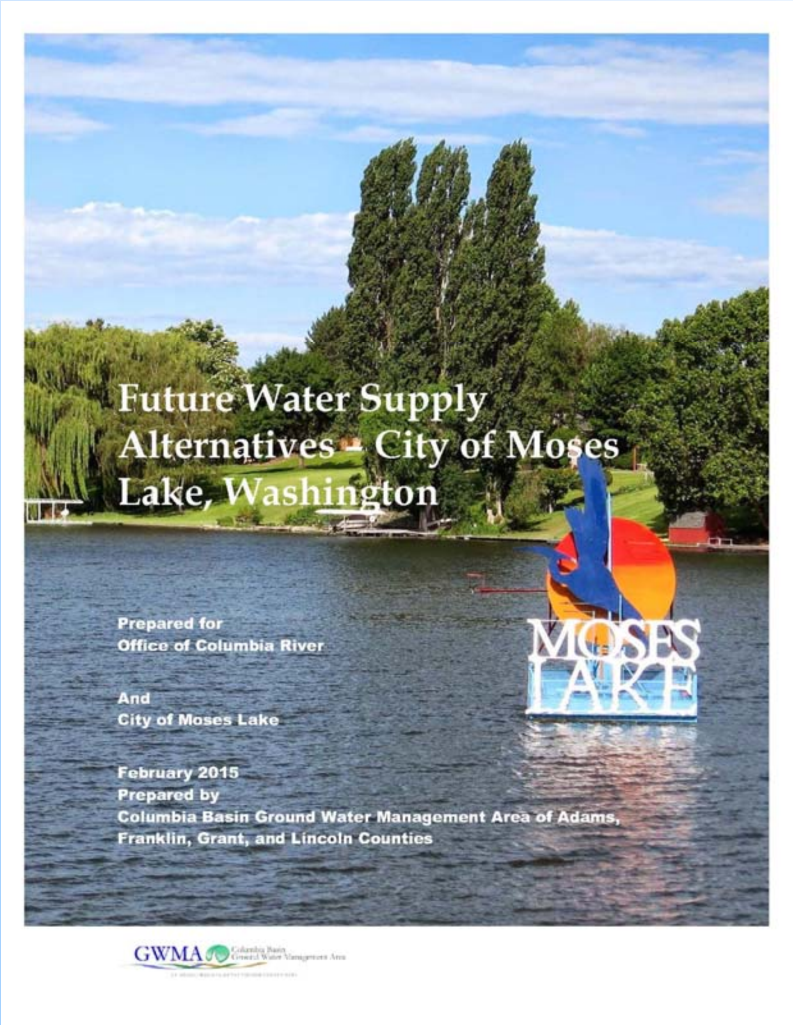
Improving Source Resiliency in the Semi-Arid Inland Northwest:

A CASE STUDY FROM THE CITY MOSES LAKE, WASHINGTON



PNWS-AWWA Annual Conference, May 2016

by

Kevin Lindsey, EAEST, Inc. PBC

Shawn O'Brien, City of Moses Lake

EA Engineering, Science, and Technology, Inc., PBC

CITY OF MOSES LAKE WASHINGTON

Acknowledgements

- Funded by Ecology OCR, via CBGWMA (2012-2015)
- Collaboration between CBGWMA, City, and Consultant Team (GSI, SSPA)

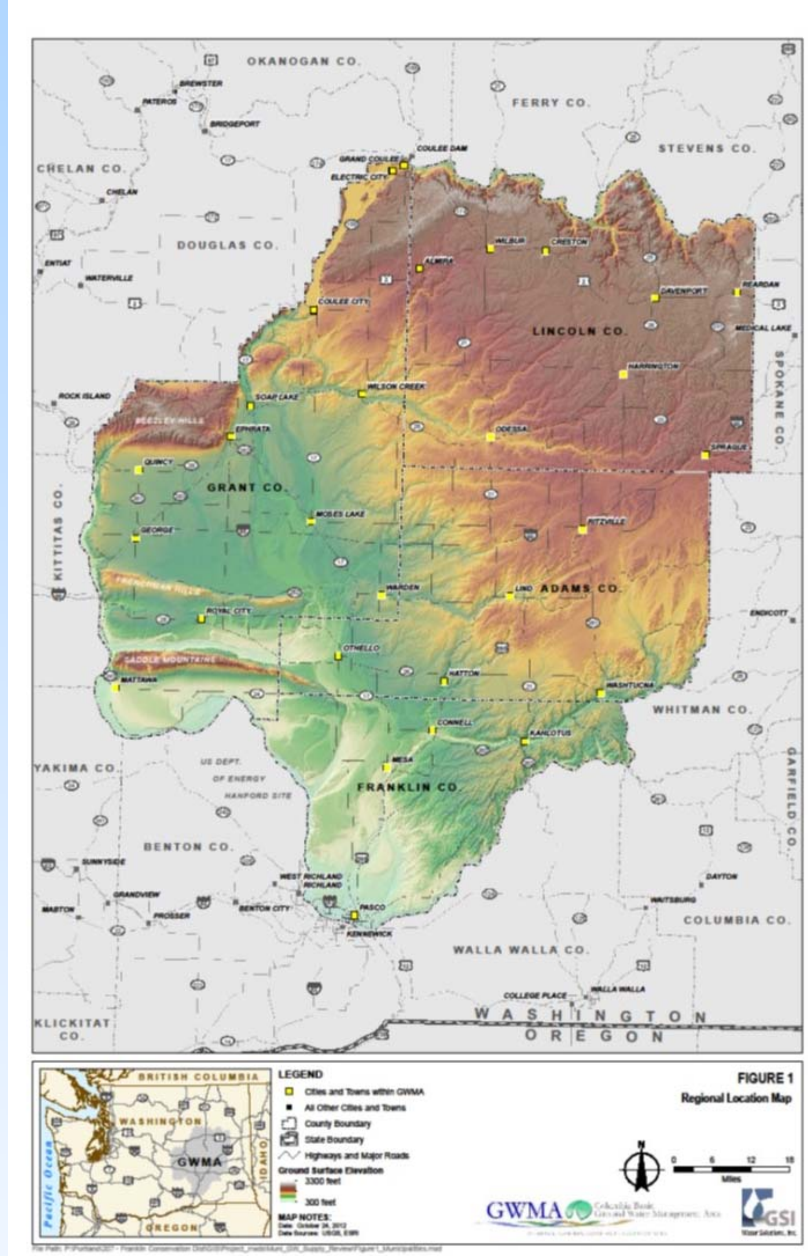
- Today: reporting on where City is a year later

Introduction

- City Background/Setting
- Regional Groundwater Conditions
- City Groundwater Supply Conditions
- Assessment of Supply Sources, Demand, and the Future
- City Decisions
- Lessons Learned

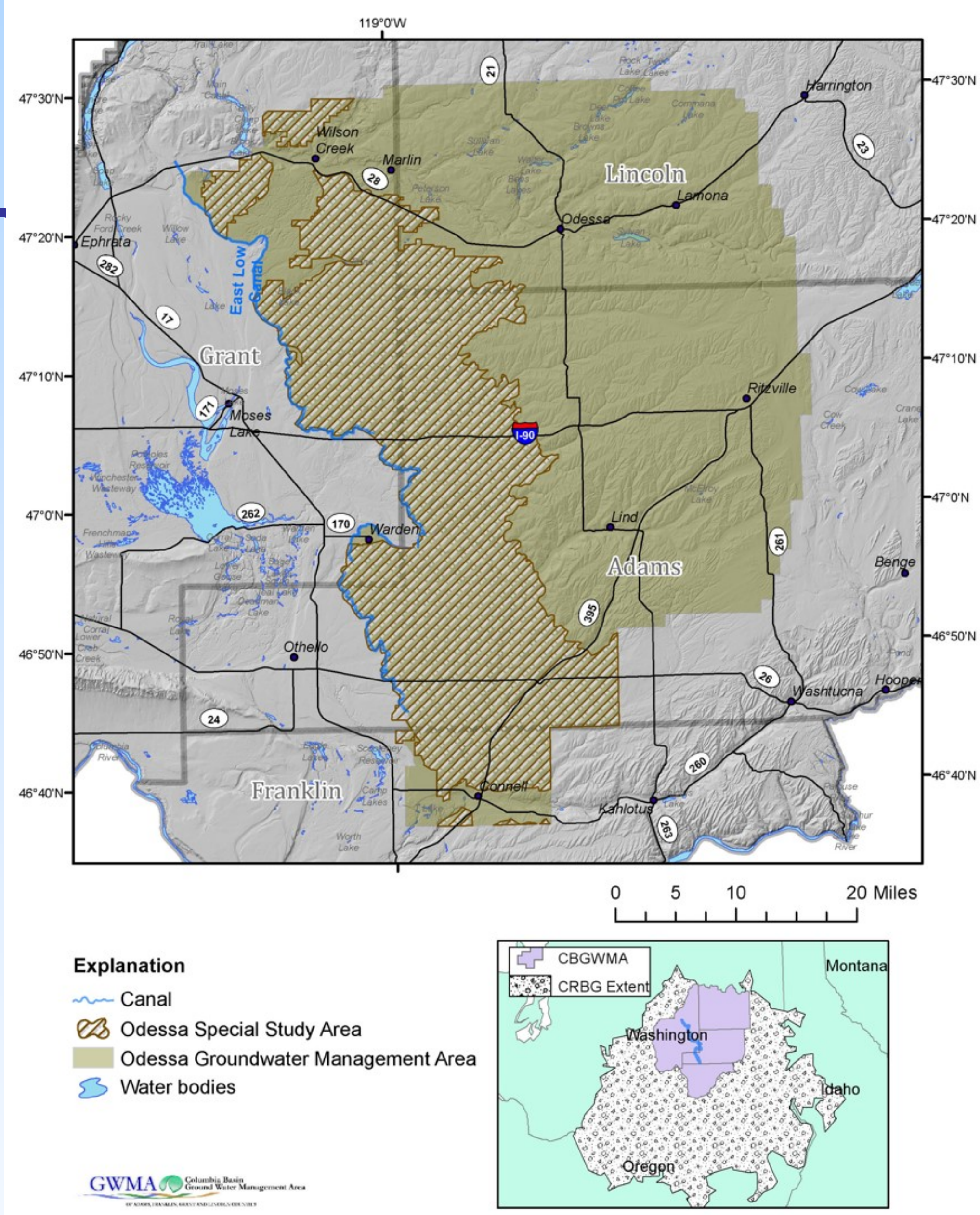
City Background and Setting

- Largest city
- Groundwater supplied
- Regional basalt source
- Looking for resiliency /redundancy

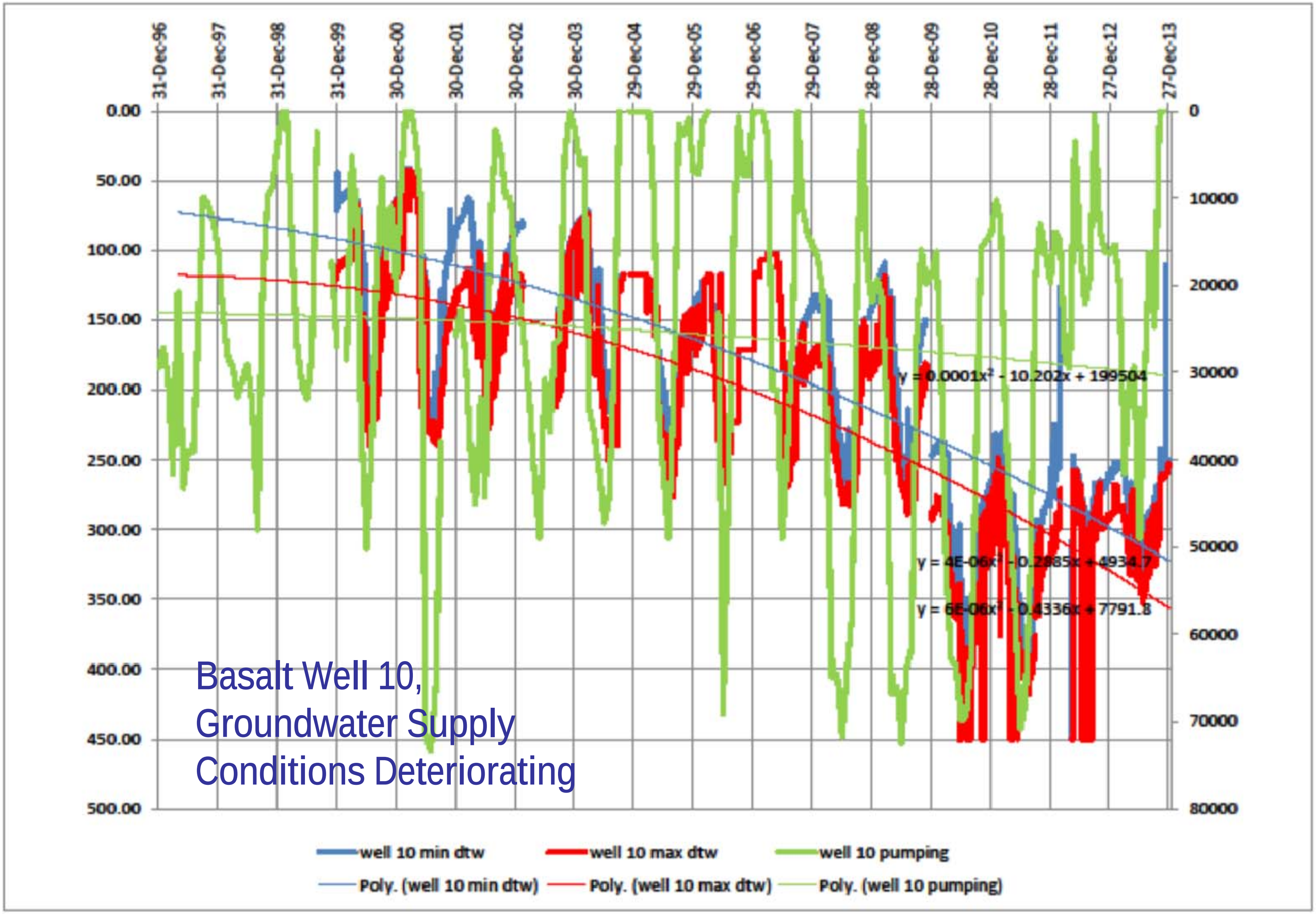


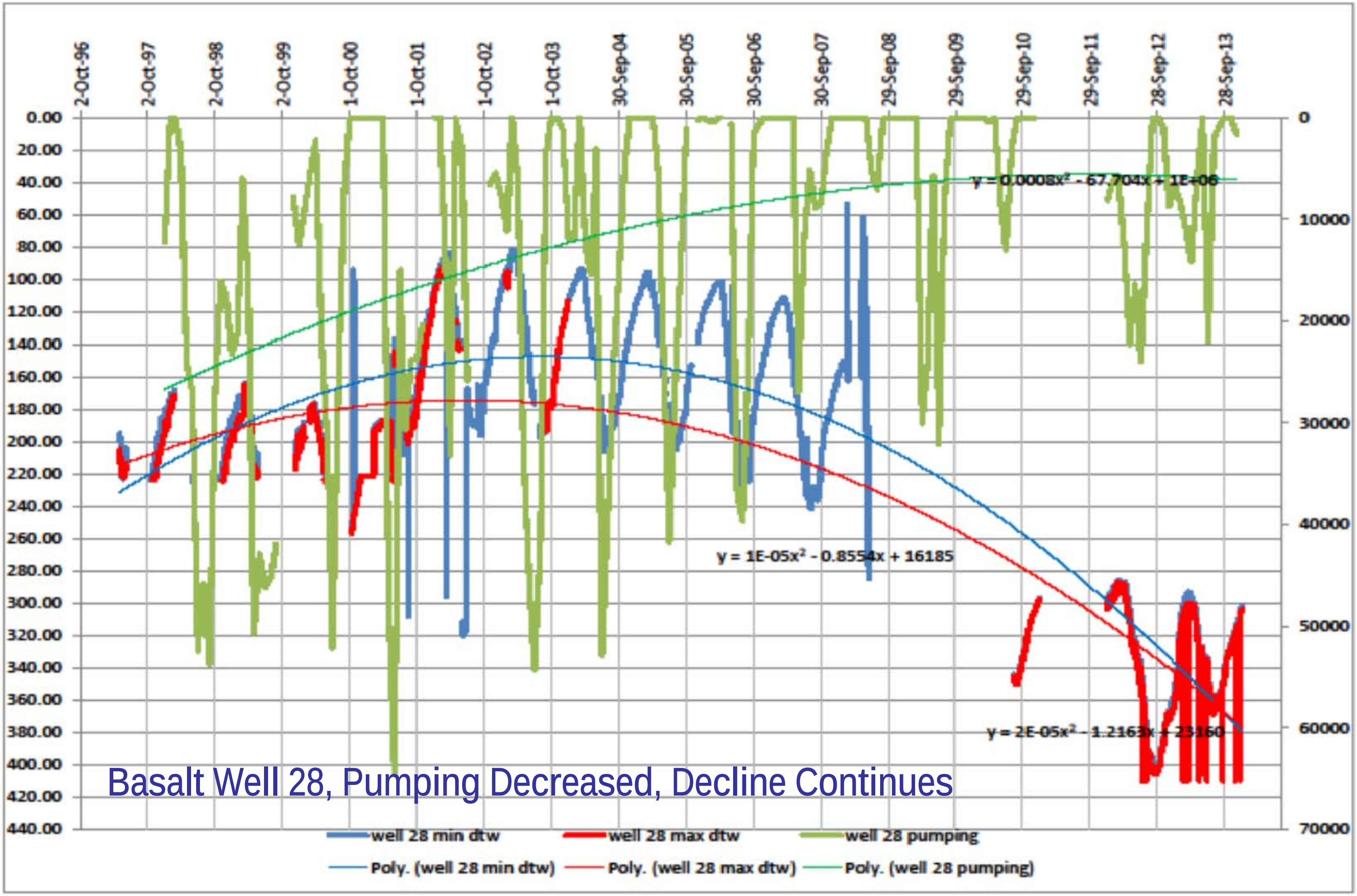
Regional Setting: Odessa Groundwater Subarea

- Groundwater decline
- Irrigation pumping
- Regional basalt system
- Mining/limited recharge



Basalt Well 10, Groundwater Supply Conditions Deteriorating





Basalt Well 28, Pumping Decreased, Decline Continues

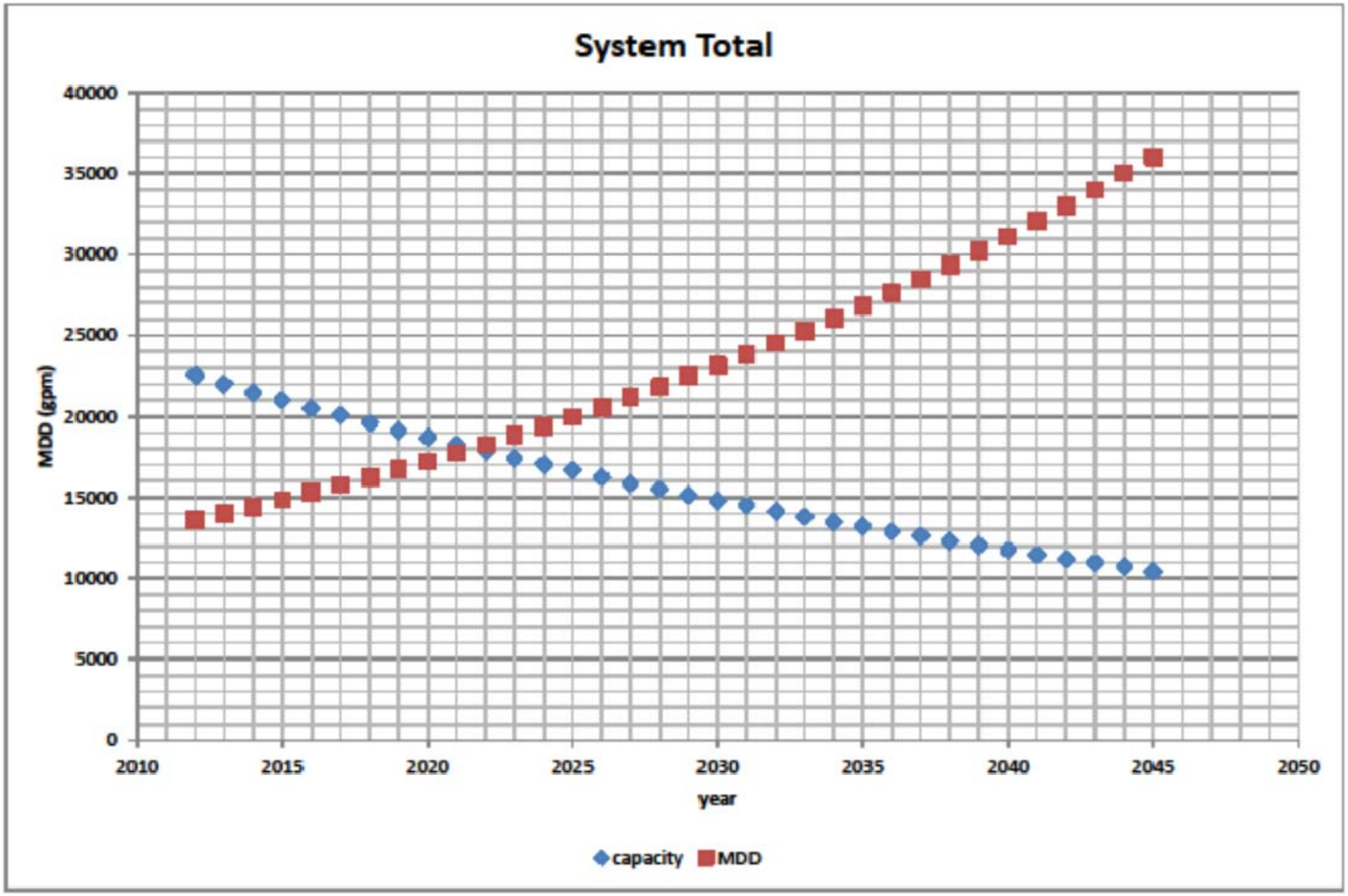
Basalt Aquifer Declines are the Norm

- Min/Max: 1.5 to 12.2 feet/year
- Average: 6.9 feet/year
- Pumping capacity change: -2%/year

zone	# of wells	pumping capacity (gpm)	av static decline rate (ft/yr)	av dynamic decline rate (ft/yr)	pumping capacity decrease (gal/yr)	pumping capacity annual loss (%)
central	4	3560	-3.8	-2.8	-50	-1.4%
knolls vista	4	3800	-7.6	-10.4	-102	-2.7%
lakeview	2	3120	-9.0	-8.6	-15	-0.5%
larson	5	6300	-3.0	-4.2	-58	-0.9%
montlake	1	680	-1.5	-3.0	-28	-4.1%
moses pointe	1	520	-11.1	-17.6	-14	-2.7%
wheeler	2	4000	-12.2	-5.9	-159	-4.0%
		21980	-6.9	-7.5	-426	-2.3%

Supply/Demand Projection

- Demand increases
- Production decreases
- Demand exceeds supply



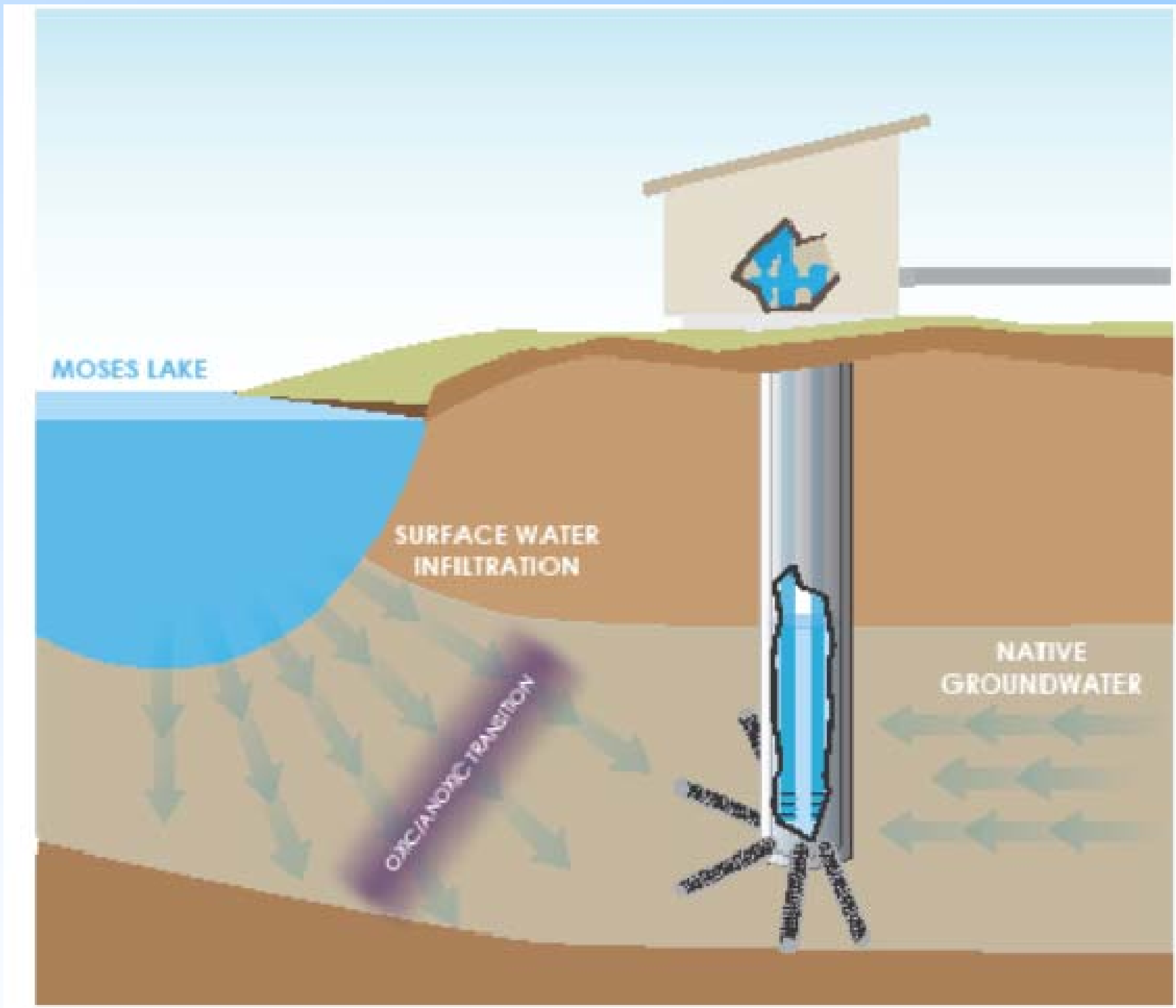
Options

- Basalt well drilling
- Alluvial wells
- Surface water canal/lake
- Separate irrigation from potable

option	Water Supply Source	peak production (gpm)	peak production (mgd)	Central	Knolls Vista	Lake view	Larson	Mont lake	Wheeler
1	New 1000 gpm Wanapum well, 600-800 ft deep, in town, potable supply	1000	1.44	x	x	x	x	x	x
2	New 1000 gpm Wanapum well, 400-600 feet deep, near East Low Canal, potable supply	1000	1.44						x
3	New 1000 gpm Grande Ronde well (>800 feet deep), in town, no fluoride treatment, potable supply	1000	1.44	x	x	x	x	x	x
4	New 1000 gpm Grande Ronde well (>800 feet deep), in town, fluoride treatment , potable supply	1000	1.44	x	x	x	x	x	x
5	New 1000 gpm Grande Ronde well in-town (>800 feet), irrigation supply	1000	1.44	x	x	x	x	x	x
6	Alluvial (100-200 ft), large diameter (24-inch), 1,000 gpm well in-town, potable supply	1000	1.44	x	x	x	x	x	x
7	Alluvial (100-200 ft), large diameter (24-inch), 1,000 gpm well in-town, irrigation supply	1000	1.44	x	x	x	x	x	x
8	Alluvial (100-200 ft), large diameter (24-inch), 1,000 gpm well out of town, potable supply	1000	1.44	x	x	x	x	x	x
9	Alluvial (100-200 ft), large diameter (24-inch), 1,000 gpm well out of town, irrigation supply	1000	1.44	x	x	x	x	x	x
10	Alluvial (100-200 ft), small diameter (8-inch), 250 gpm in-town, irrigation supply	250	0.36	x	x	x	x	x	x
11	Alluvial (100-200 ft), small diameter (8-inch), 250 gpm well in-town, potable supply	250	0.36	x	x	x	x	x	x
12	Alluvial (100-200 ft), small diameter (8-inch), 250 gpm well, out of town, irrigation supply	250	0.36	x	x	x	x	x	x
13	Alluvial (100-200 ft), small diameter (8-inch), 250 gpm well, out of town, potable supply	250	0.36	x	x	x	x	x	x
14	Collector well, 10,000 gpm near Moses Lake, irrigation supply	5000	7.2	x	x			x	
15	Collector well, 10,000 gpm near Moses Lake, potable supply	5000	7.2	x	x			x	
16	Horizontal well, 5,000 gpm, near Moses Lake, irrigation supply	5000	7.2	x	x			x	
17	Horizontal well, 5,000 gpm, near Moses Lake, potable supply	5000	7.2	x	x			x	
18	Canal, no treatment, irrigation supply	5000	7.2						x
19	Canal, treated, potable supply	5000	7.2						x
20	Moses Lake, no treatment, irrigation supply	5000	7.2	x	x			x	
21	Moses Lake, treated, potable supply	5000	7.2	x	x			x	
22	ASR, existing Wanapum well, treated water, from canal	2000	2.88						x
23	ASR, existing Wanapum Well, treated water, from Moses Lake	2000	2.88	x	x			x	
24	ASR, existing Wanapum Well, treated water, from alluvial AR well	2000	2.88	x	x	x	x	x	x
25	ASR, new Wanapum well, treated water, from canal	2000	2.88						x
26	ASR, new Wanapum Well, treated water, from Moses Lake	2000	2.88	x	x			x	
27	ASR, new Wanapum Well, treated water, from alluvial AR well	2000	2.88	x	x	x	x	x	x
28	ASR, existing Grande Ronde well, treated water, from canal	2000	2.88						x
29	ASR, existing Grande Ronde Well, treated water, from Moses Lake	2000	2.88	x	x			x	
30	ASR, existing Grande Ronde Well, treated water, from alluvial AR well	2000	2.88	x	x	x	x	x	x
31	ASR, new Grande Ronde well, treated water, from canal	2000	2.88						x
32	ASR, new Grande Ronde Well, treated water, from Moses Lake	2000	2.88	x	x			x	
33	ASR, new Grande Ronde Well, treated water, from alluvial AR well	2000	2.88	x	x	x	x	x	x

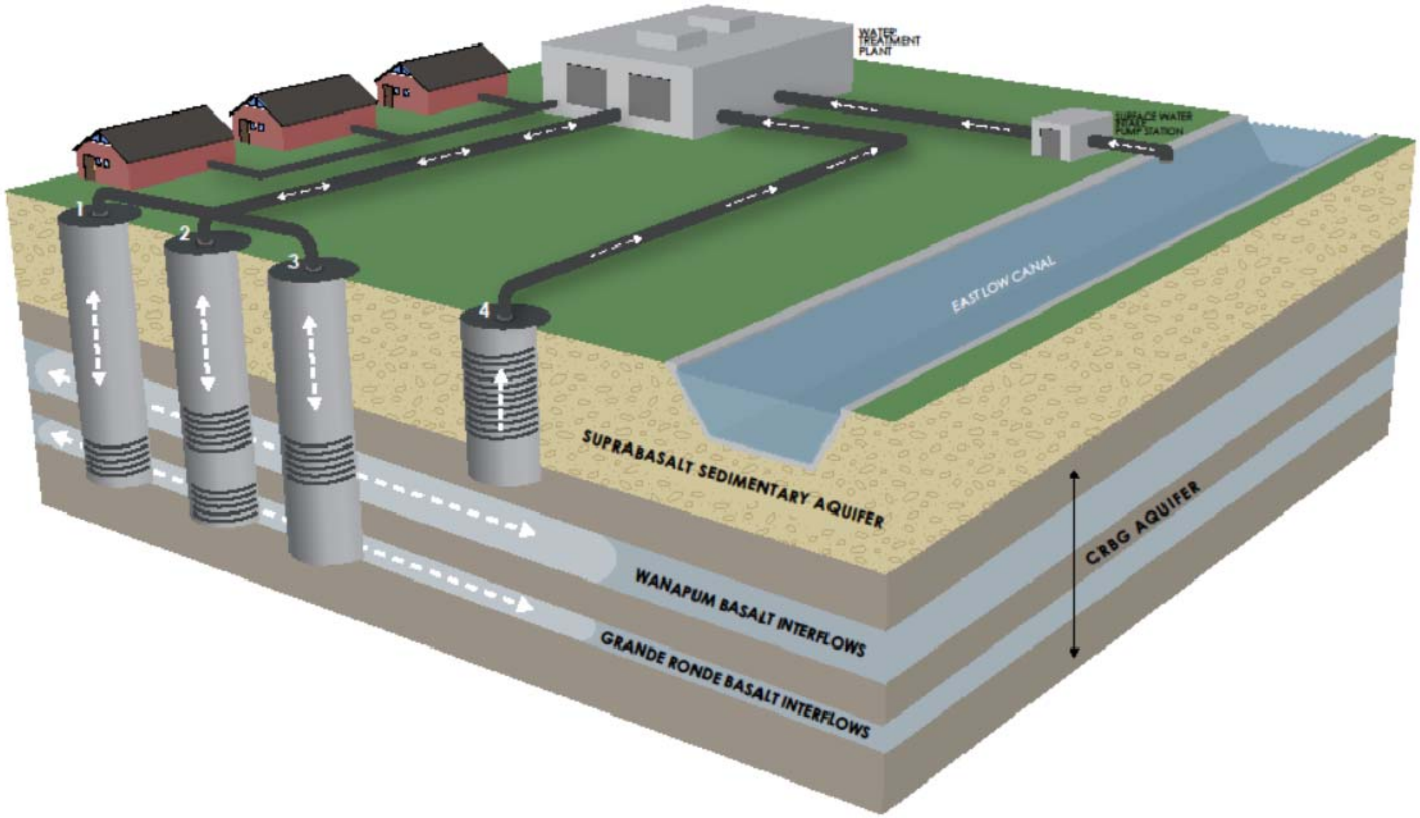
Use the Alluvial Aquifer

- Recharged annually
- Relatively sustainable?



Basalt ASR

- Canal/lake source
- Treatment cost high
- Seasons wrong



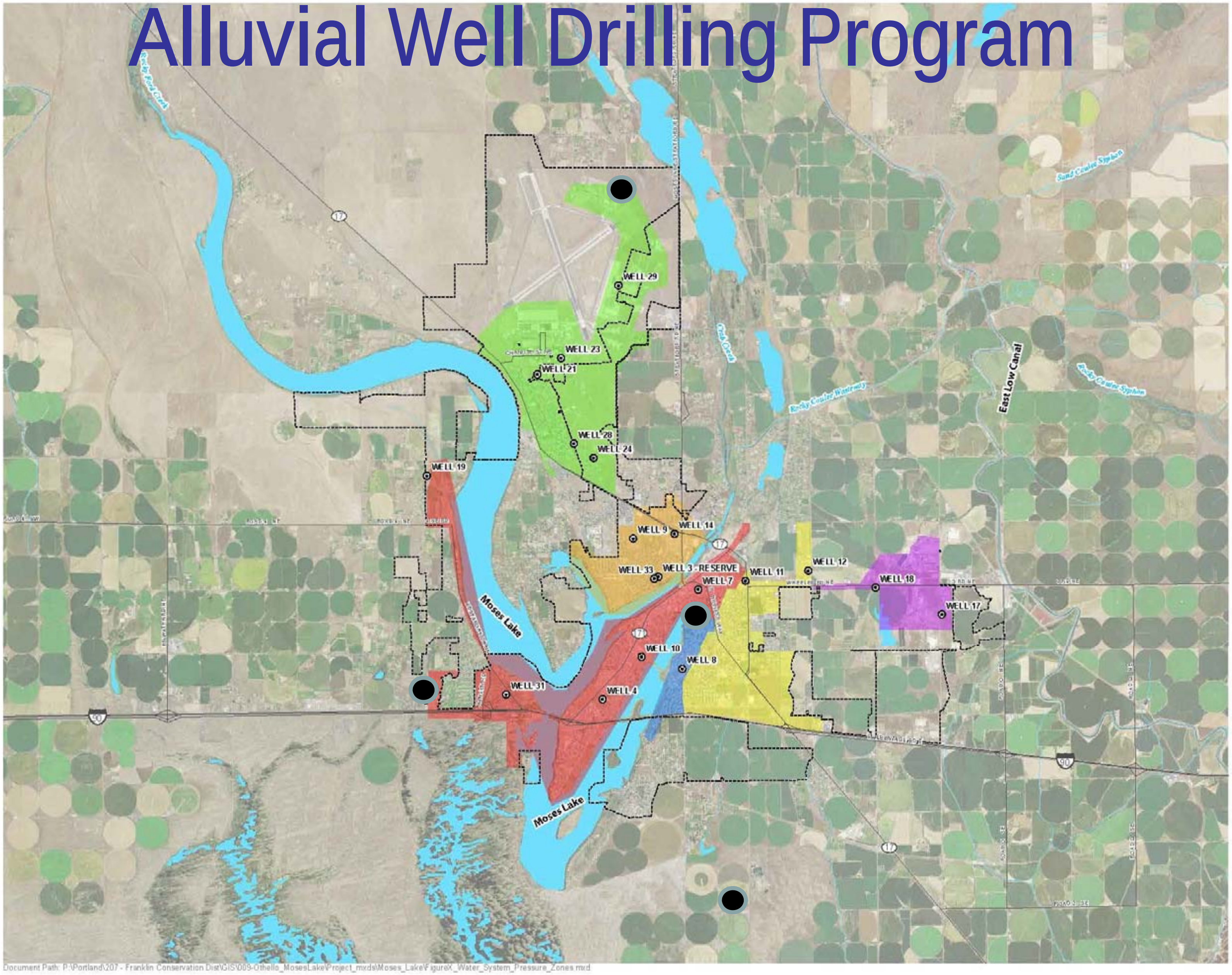
Options

- Continue basalt well drilling
  - Continues mining
- Surface water canal/lake (direct or ASR)
  - Treatment, wrong season, water rights
- Separate irrigation from potable
  - Retrofit costs huge, duplicate system
- Alluvial wells
  - Accessible
  - Quality and sustainability?

Focus on Alluvial

- Present, not stressed
- Productive, at least locally
- Sustainable, annual recharge
- Water Rights, pre-CBP claims
- Well Placement, Water Quality, Wellhead Protection
  - The variables, maybe…

Alluvial Well Drilling Program



Lessons Learned: Change Supply Paradigm

- Don’t change:
  - Mining continues, water quality degrades, chasing water deeper, capital and operations cost continue to increase
- Separating irrigation from potable:
  - Equals huge retrofit $
- ASR appealing:
  - Treatment less than anticipated,
  - But seasonal source access not aligned with demand
- Alluvial targeted:
  - Accessible and potentially sustainable
  - Water quality will need attention, traditional barrier