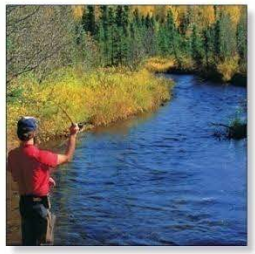
August Calibration Run

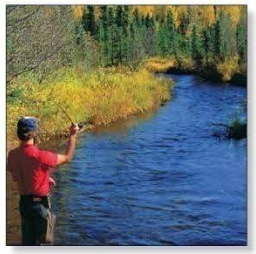
Presented by Allan Wylie, IDWR

August 6, 2015



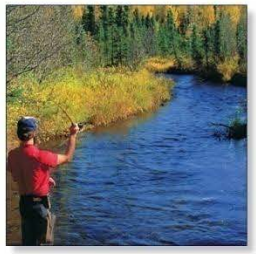
Outline

- Transient Calibration Run
- Are we there yet?
  - We expect to submit this version for review



Review

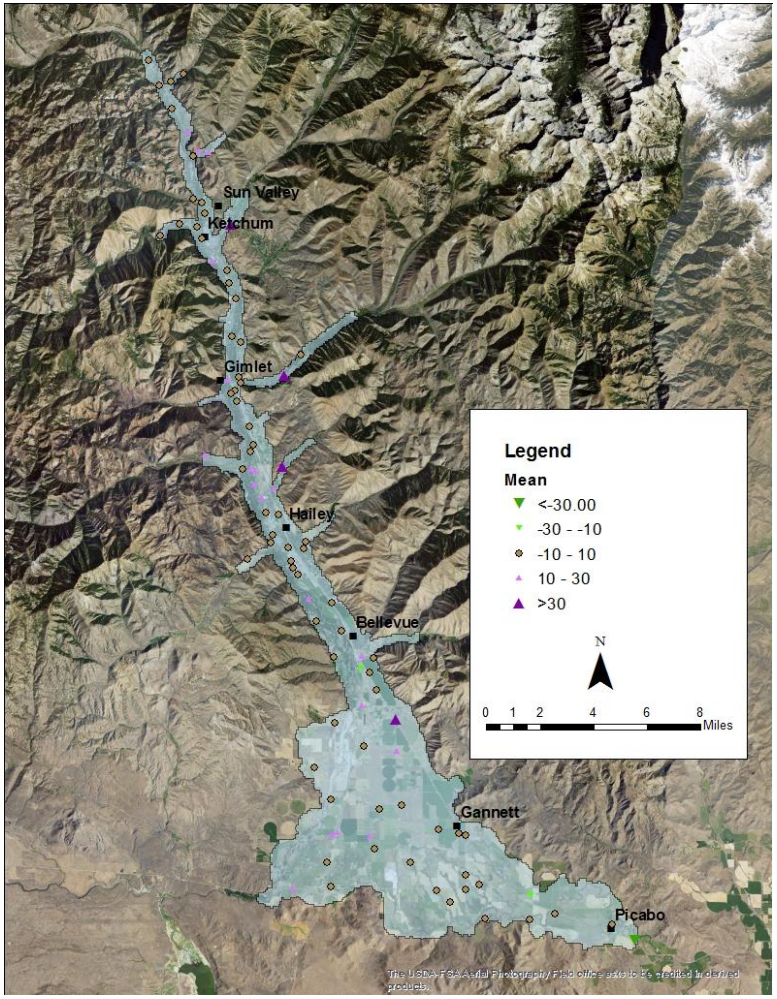
- Recharge program
  - Tributary underflow
    - Adjusted by multiplying starting values by a scalar
    - Adjust seasonal amplitude
    - Adjust averaging period
  - Surface water irrigation efficiency
  - Canal seepage FIXED percentage of diversion
- Physical properties adjusted by changing values in MODFLOW input files
  - Aquifer hydraulic conductivity and storage
  - Riverbed conductance
  - Drain conductance



Changes since last meeting

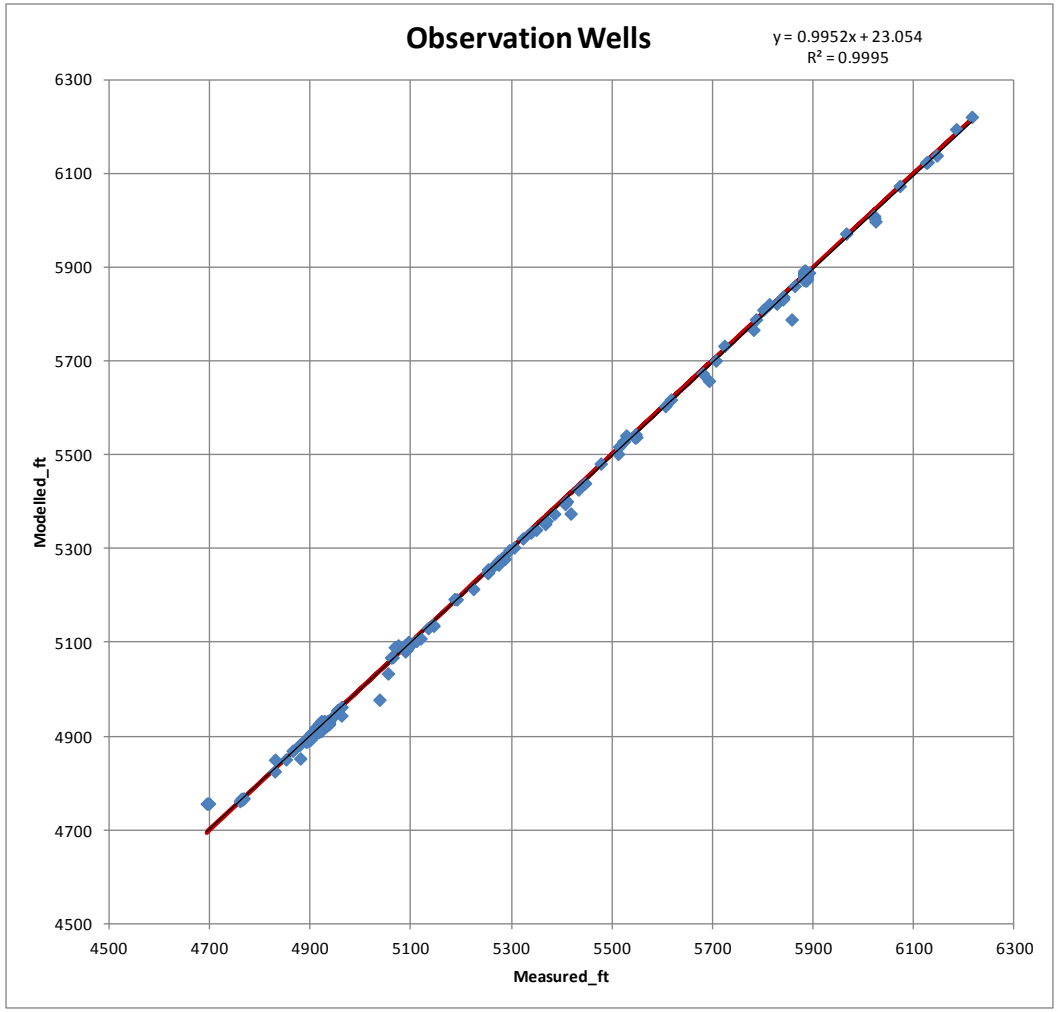
- Added drains with elevations set to land surface target discharge set to 0.0 in Cove Cr and Greenhorn Gulch
- Set maximum tributary underflow to 20% of average annual precipitation within the basin
  - Carter and Driscoll (2005)
    - Total basin yield up to over 30% average annual precipitation
    - Our basin yield is partitioned between surface runoff and underflow
- Set kriging limit for Sy at 0.30
- Lowered weight on outflow at Silver Creek
- Lowered regularization weight for irrigation entity efficiency

Observation Wells



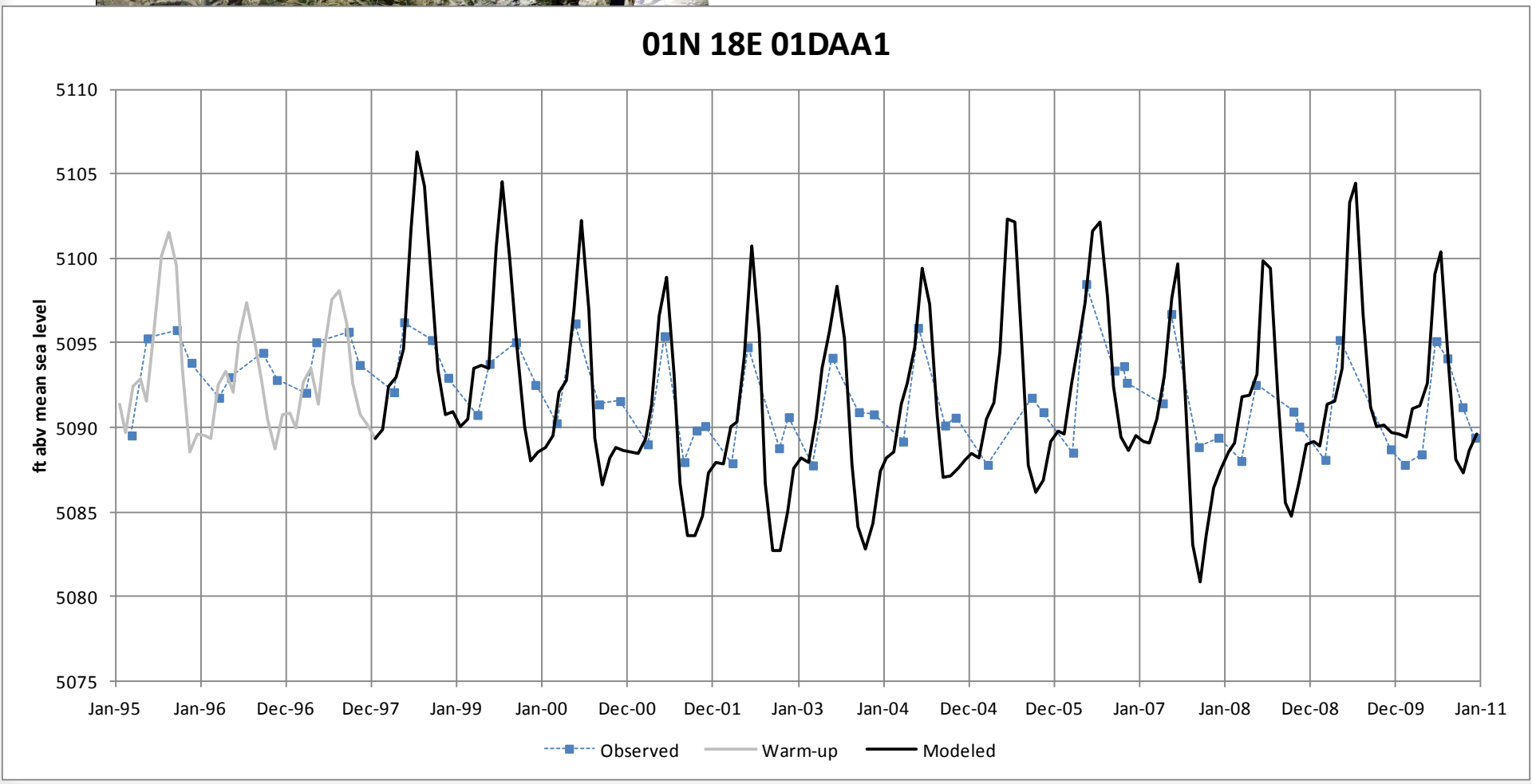
- Wells with GPS or surveyed location
- Measured by a trained technician
- Total head change from north to south is about 1,500 ft
  - 30 ft mismatch = 2%

Observation Wells



- Wells with GPS or surveyed location
- Measured by a trained technician
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$
  - All points on the red line

Observation Wells



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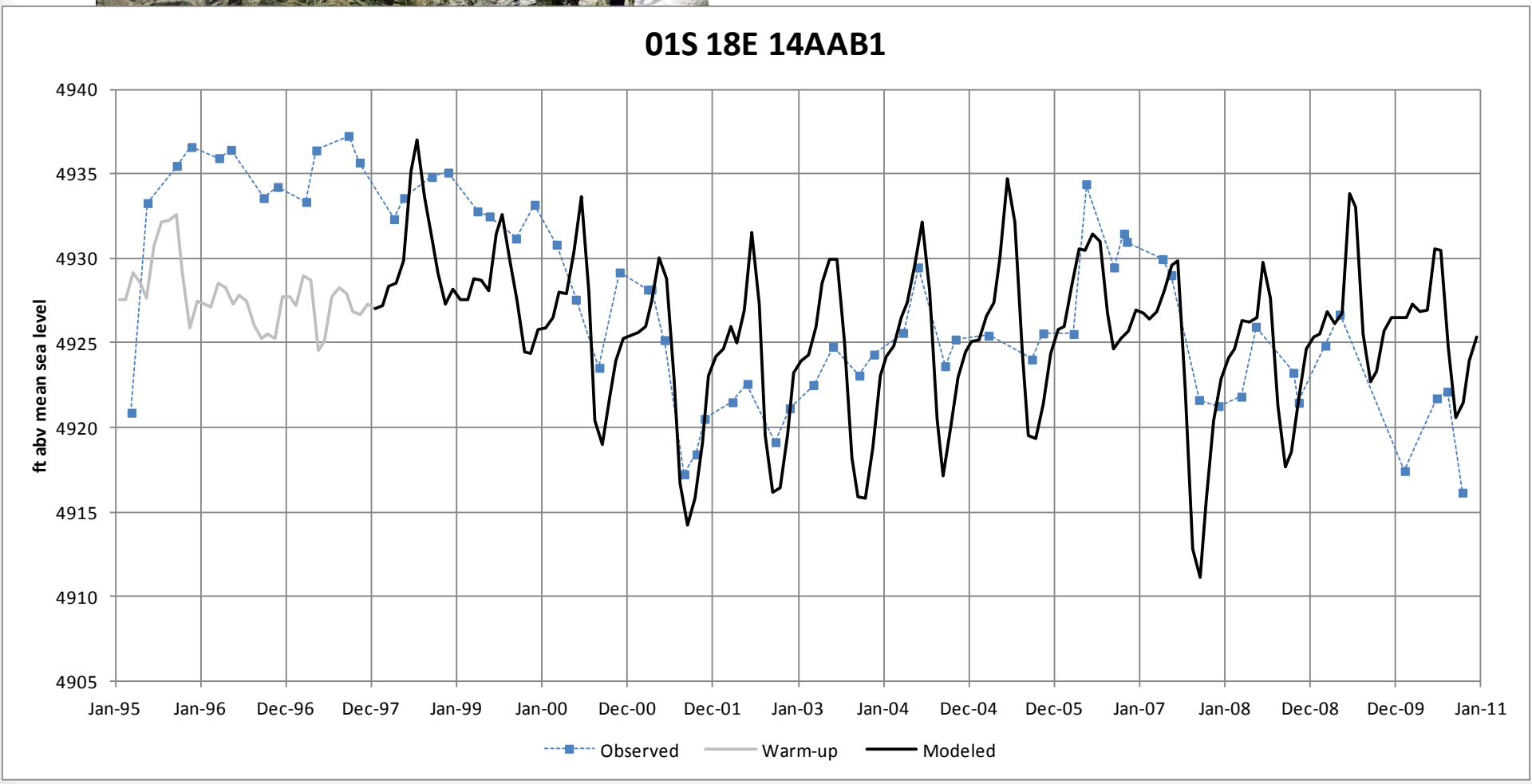
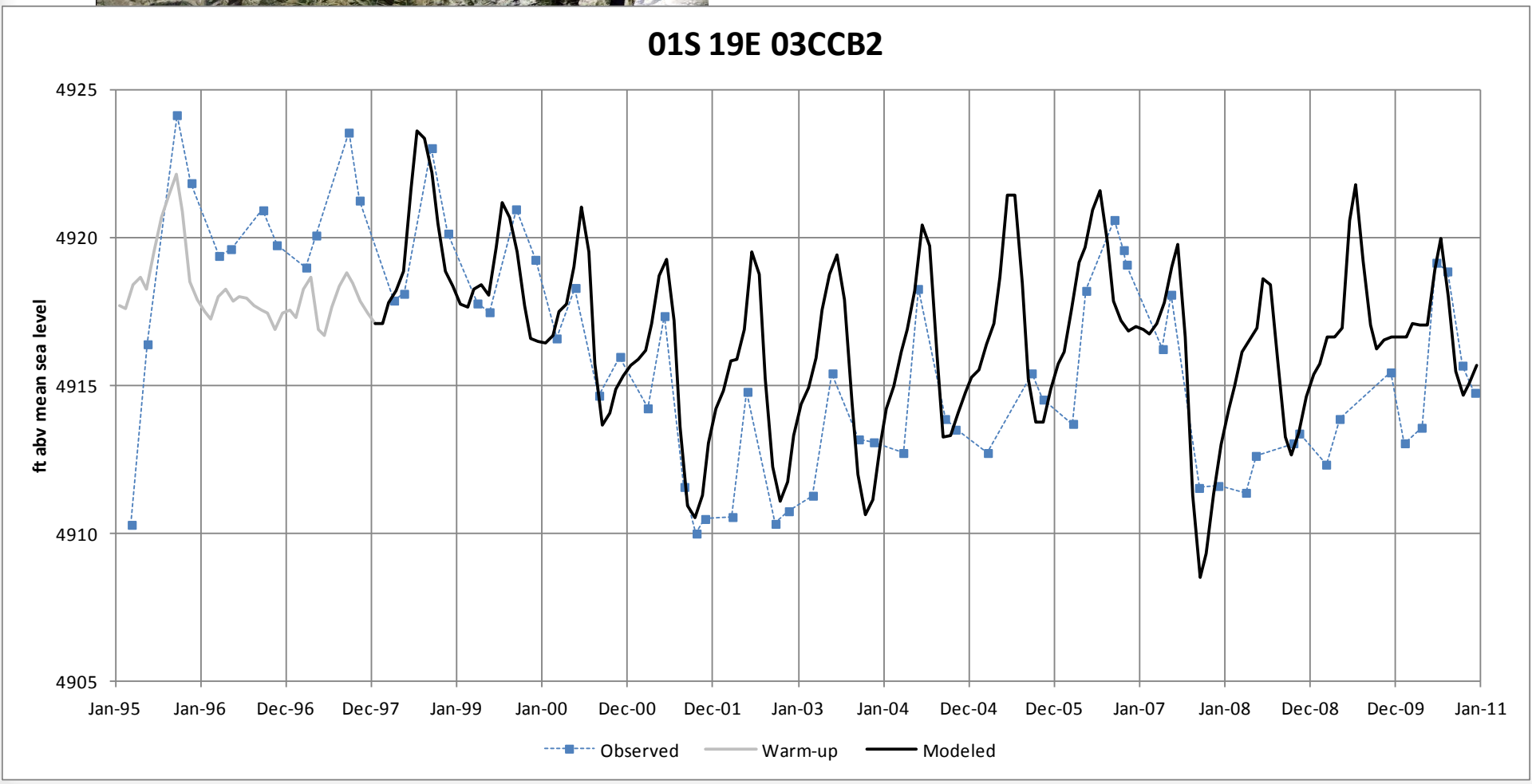


Observation Wells



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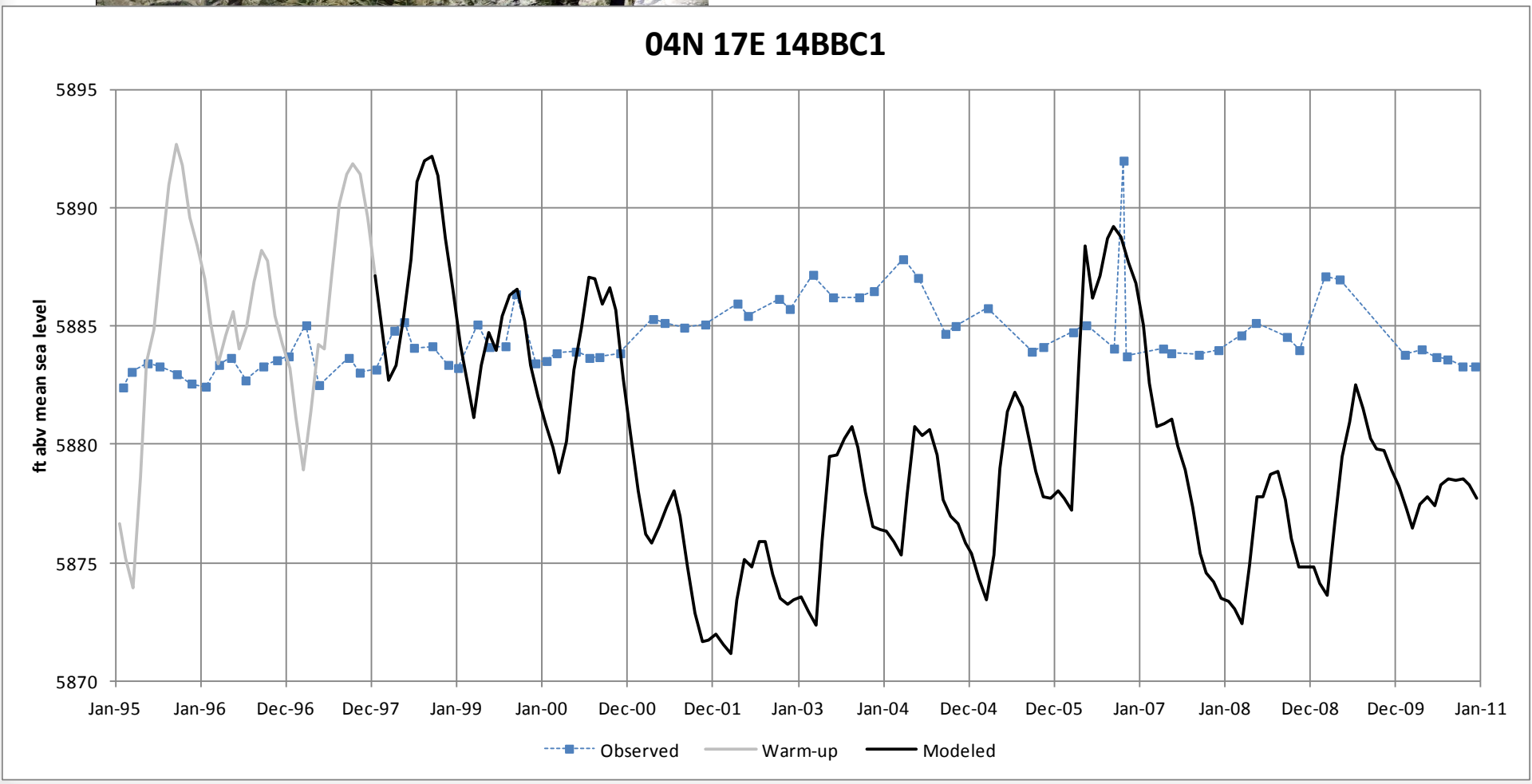
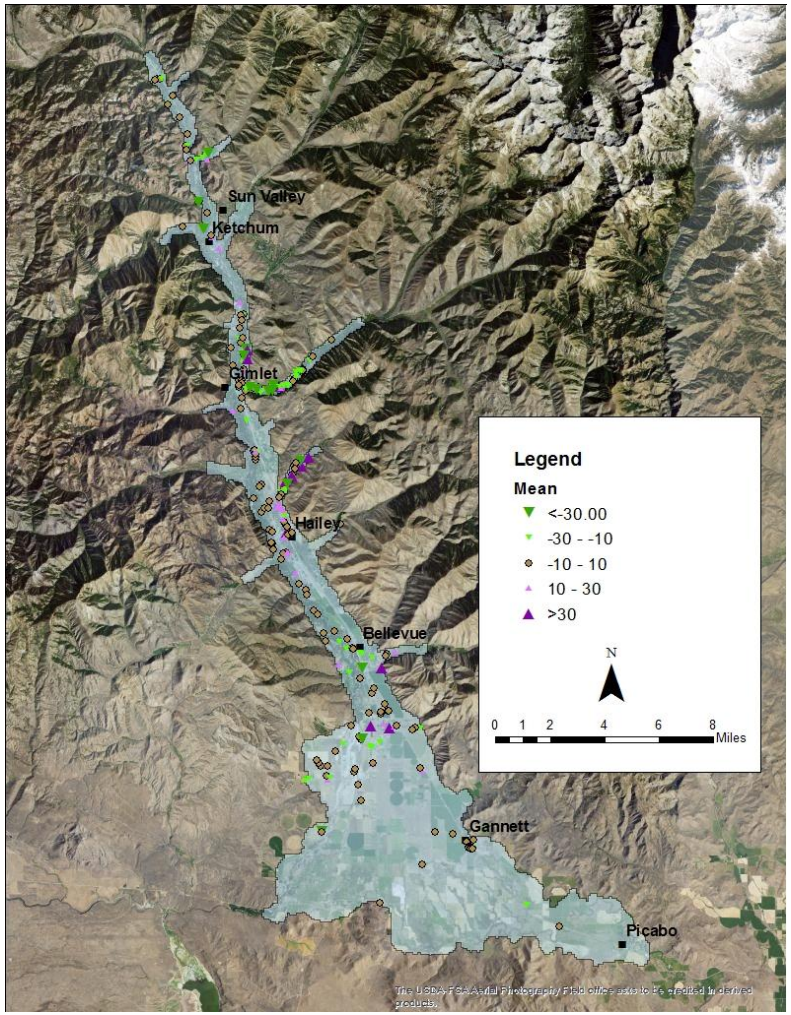
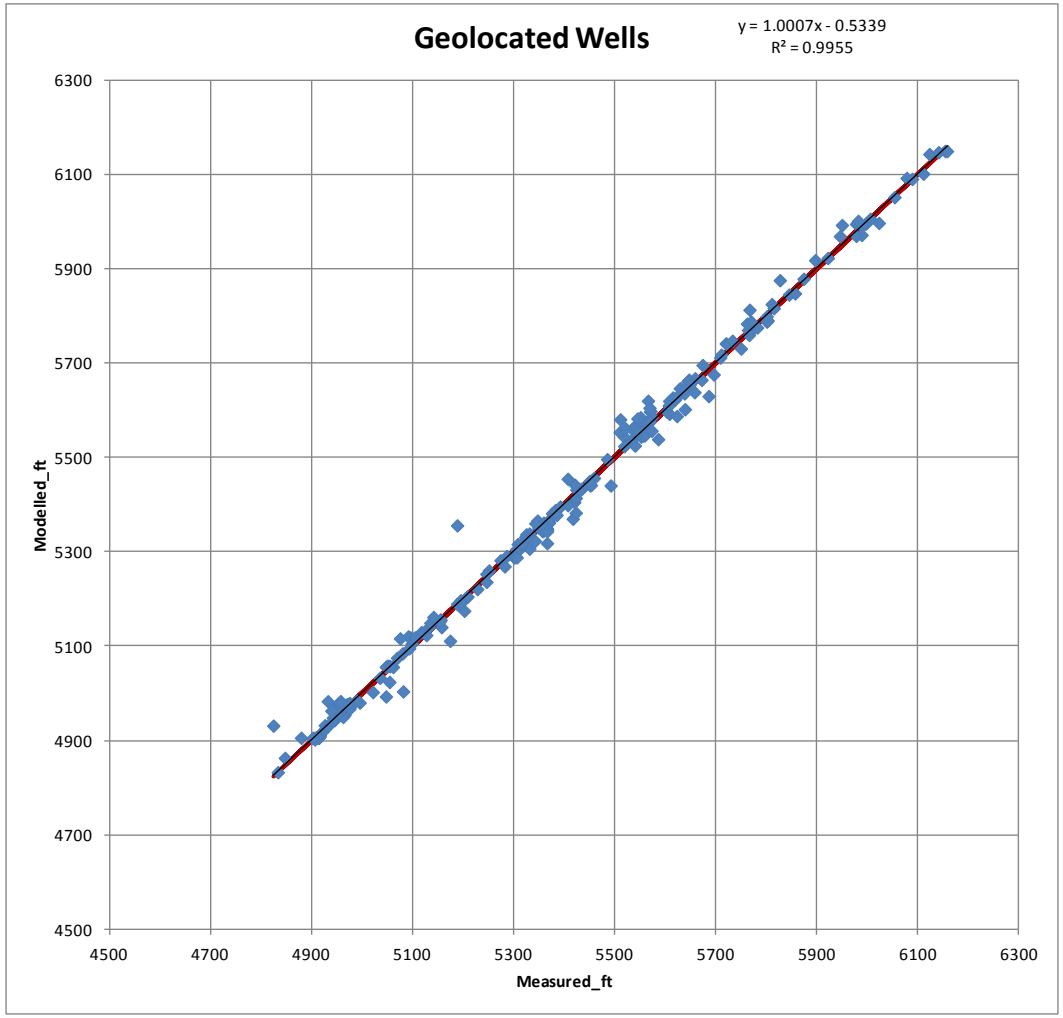


Geo-located Wells



- Wells located by address
- Measured by driller

Geo-located Wells



- Wells located by address
- Measured by driller
- If fit was perfect
  - Intercept = 0
  - Slope = 1
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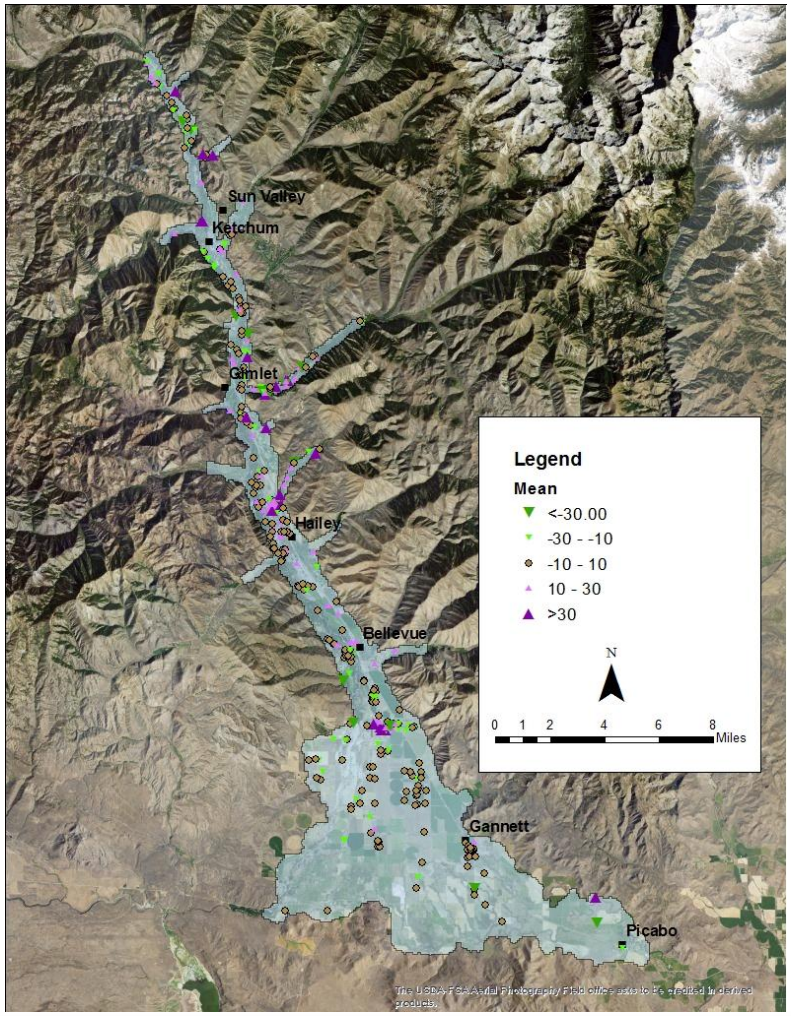
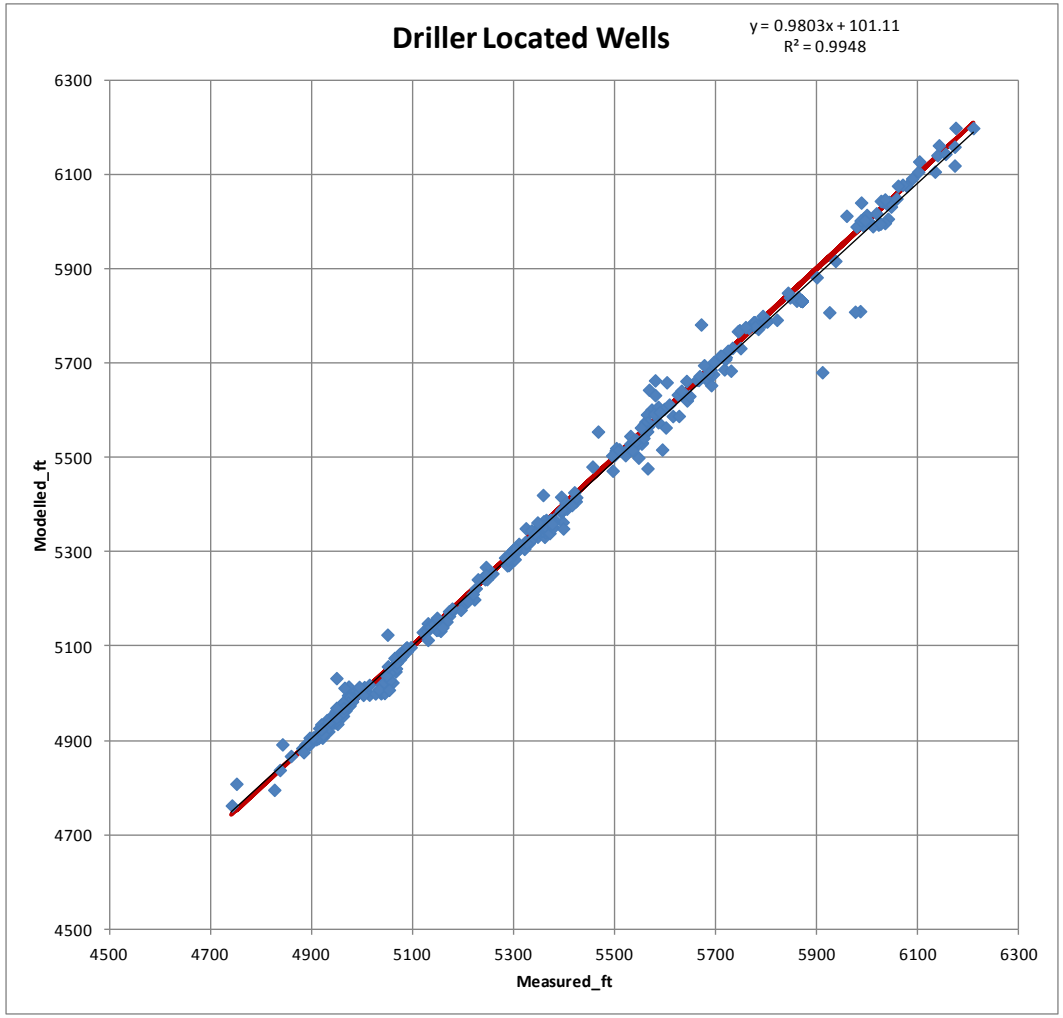
  - All points on the red line

Driller Wells



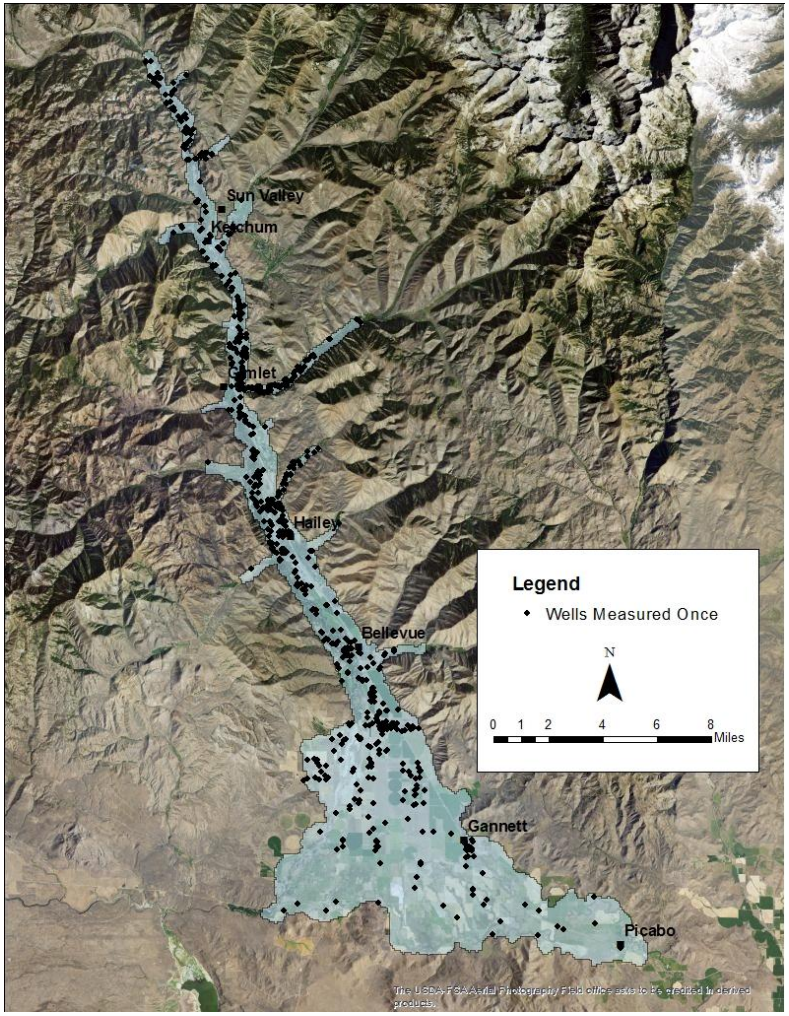
- Wells located by PLS
- Measured by driller

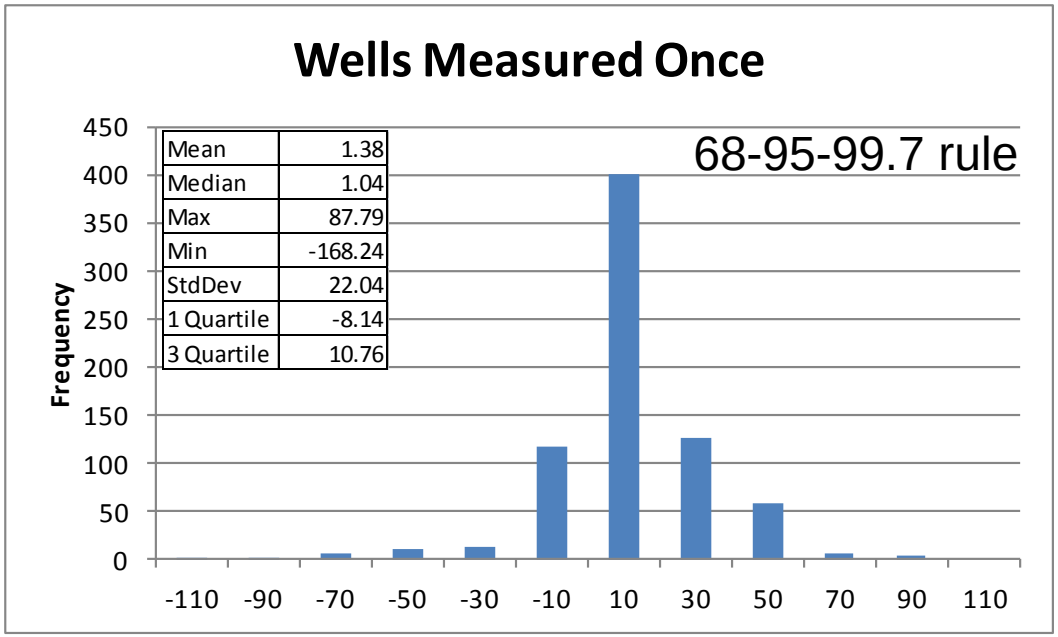
Driller Wells



- Wells located by PLS
- Measured by driller
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$
  - All points on the red line

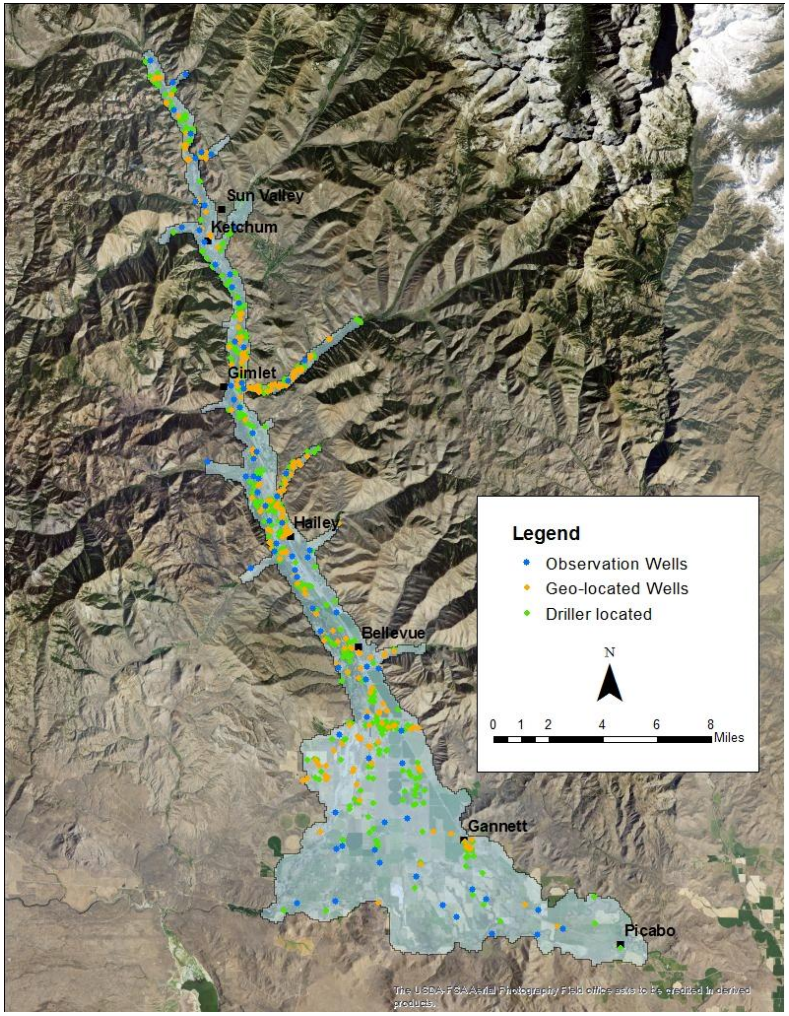
All Wells Measured Once

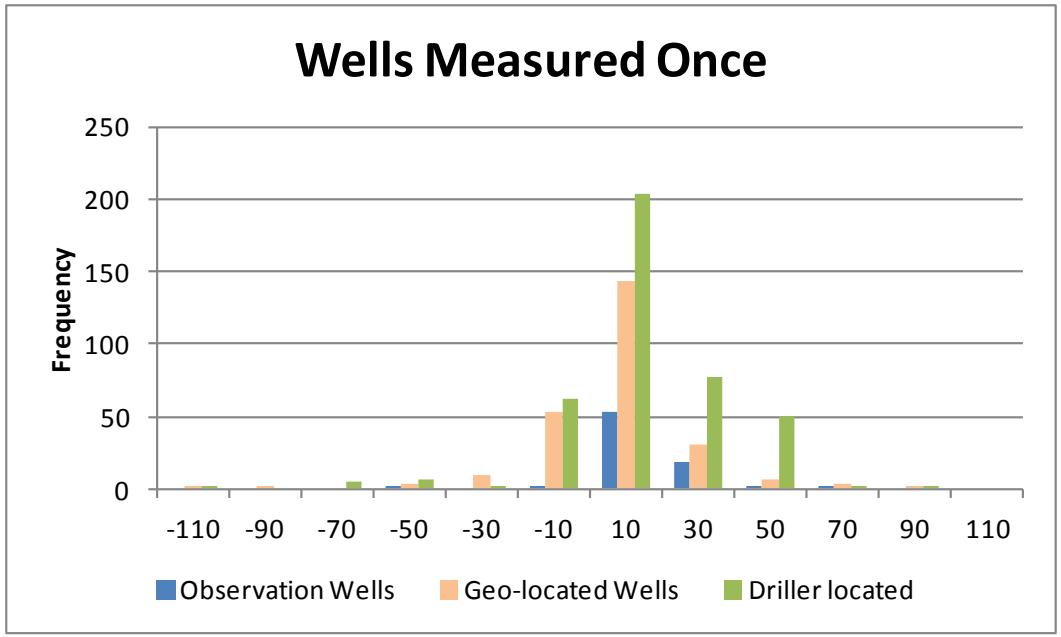




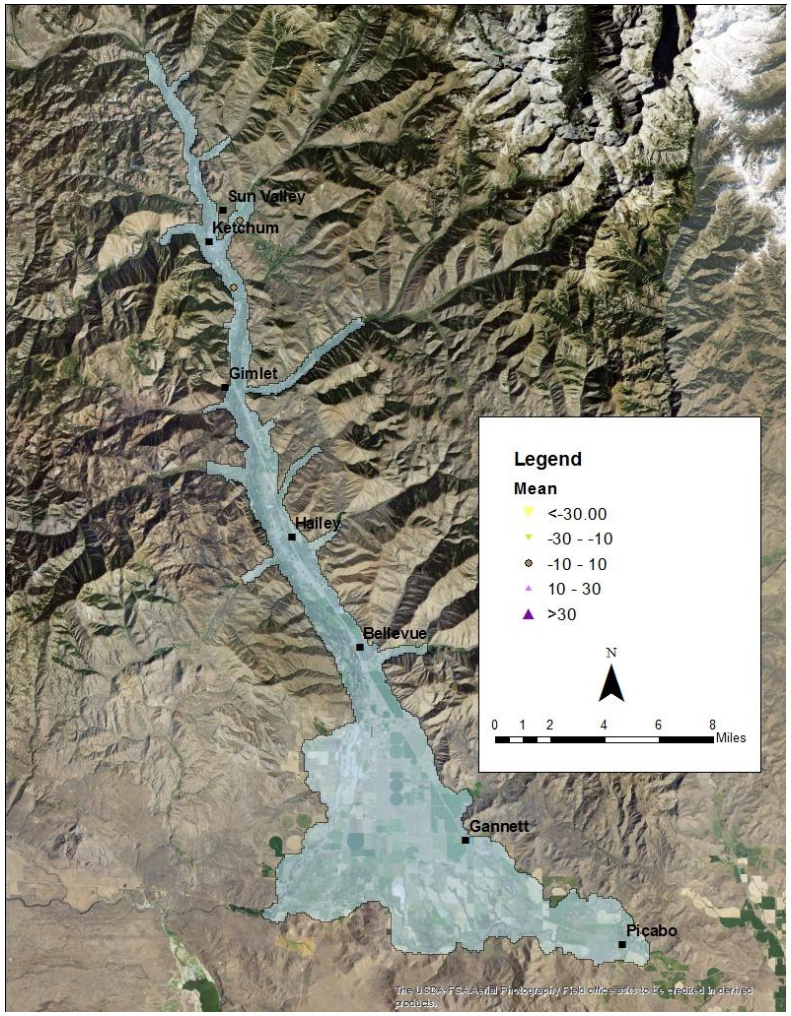
Mean	1.38
Median	1.04
Max	87.79
Min	-168.24
StdDev	22.04
1 Quartile	-8.14
3 Quartile	10.76

All Wells Measured Once



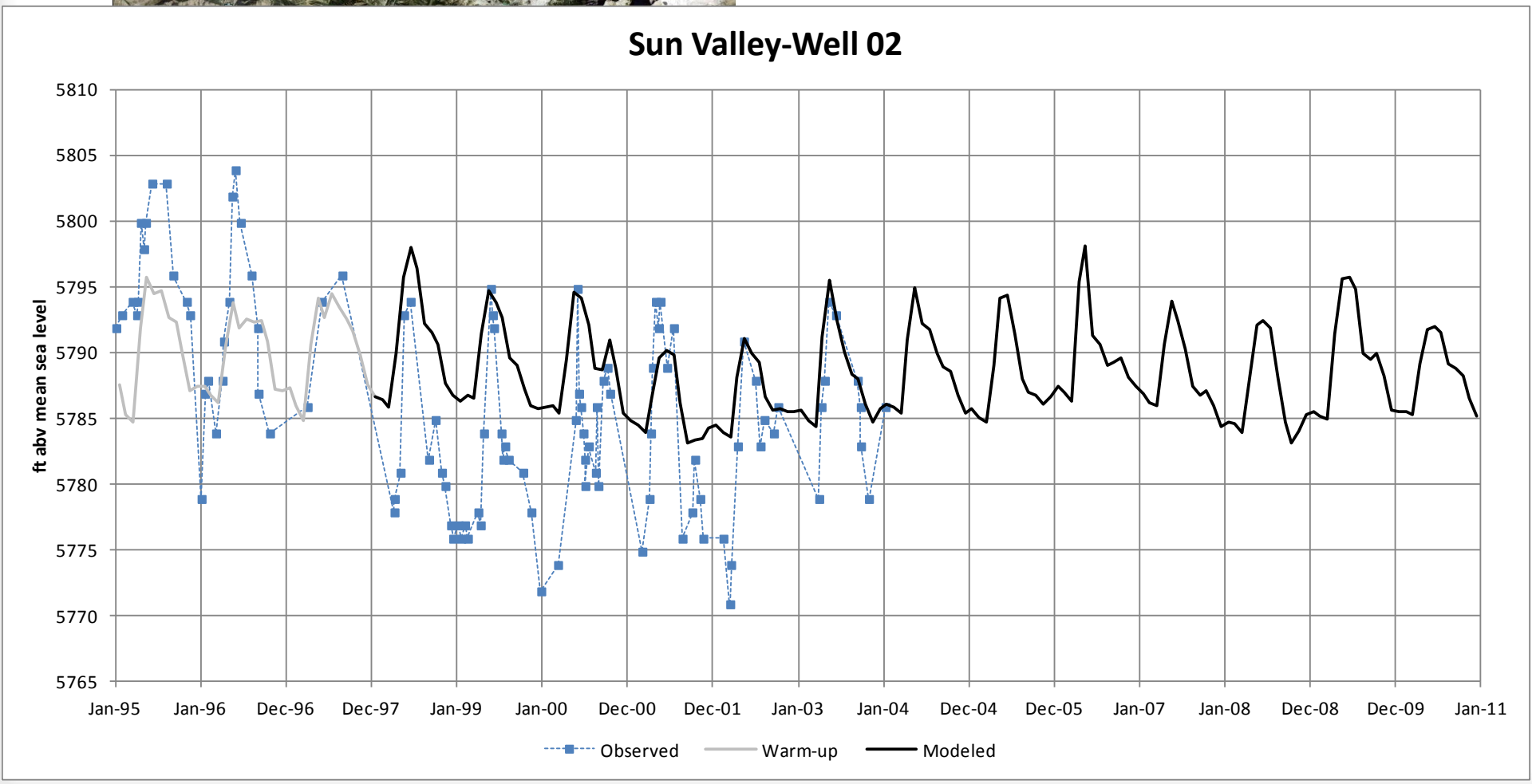


Sun Valley Wells



- Municipal production wells
- 2 well fields
- Measured by municipal employee
- One well from each field

Sun Valley Wells



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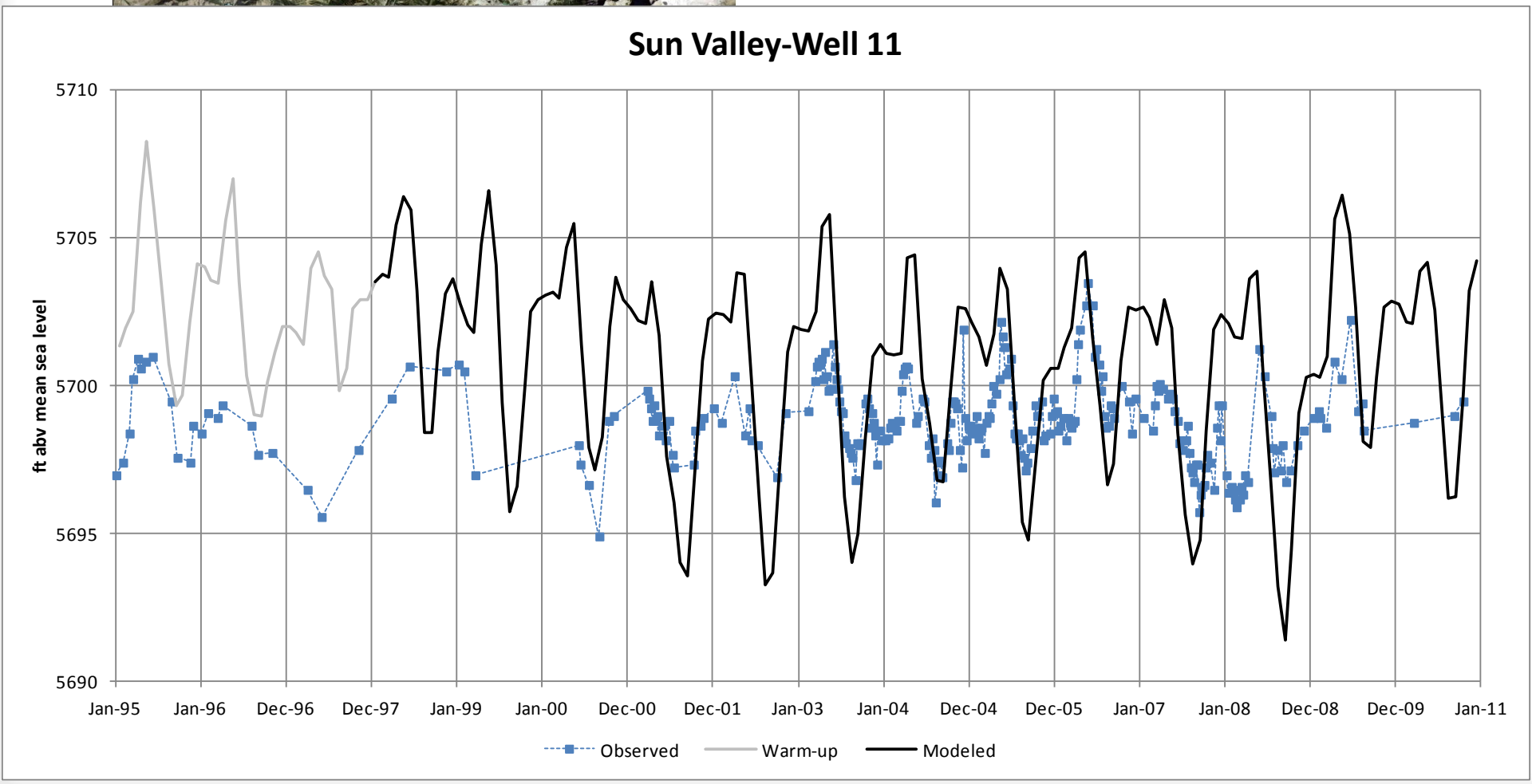
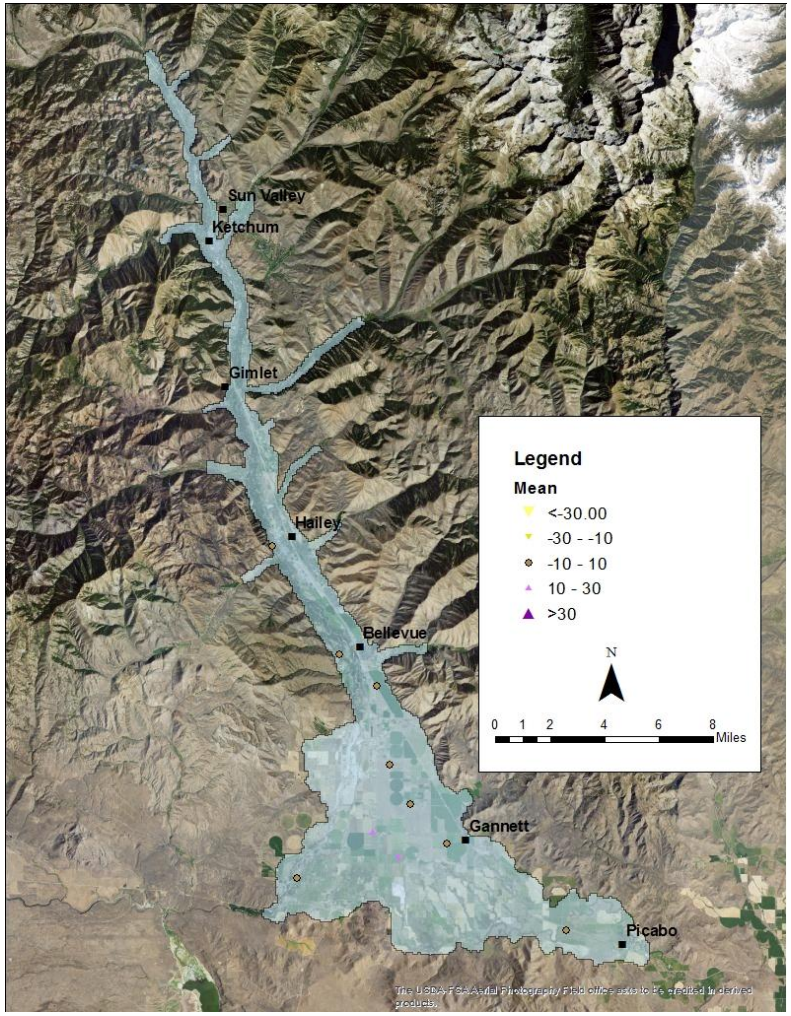
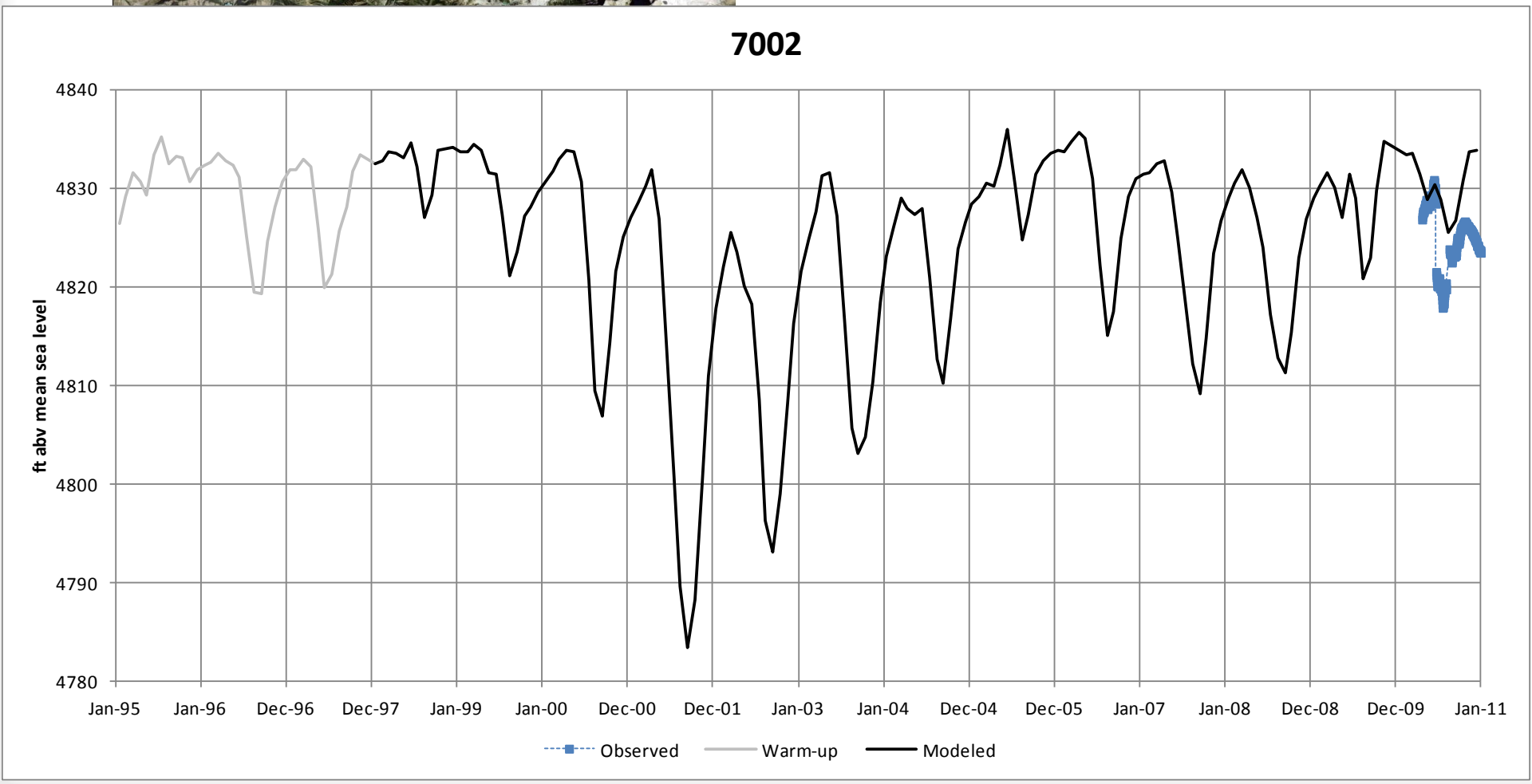


The Nature Conservancy Wells



- Graduate student installed transducers
- 12 wells
- 2 are wells we already use
- Not all wells useful for us
- Measurements every 15 min
- Mid 2010 to mid 2011
- Reduced 15 min frequency to one per day
- 5 domestic wells
  - Filtered out pumping events

The Nature Conservancy Wells



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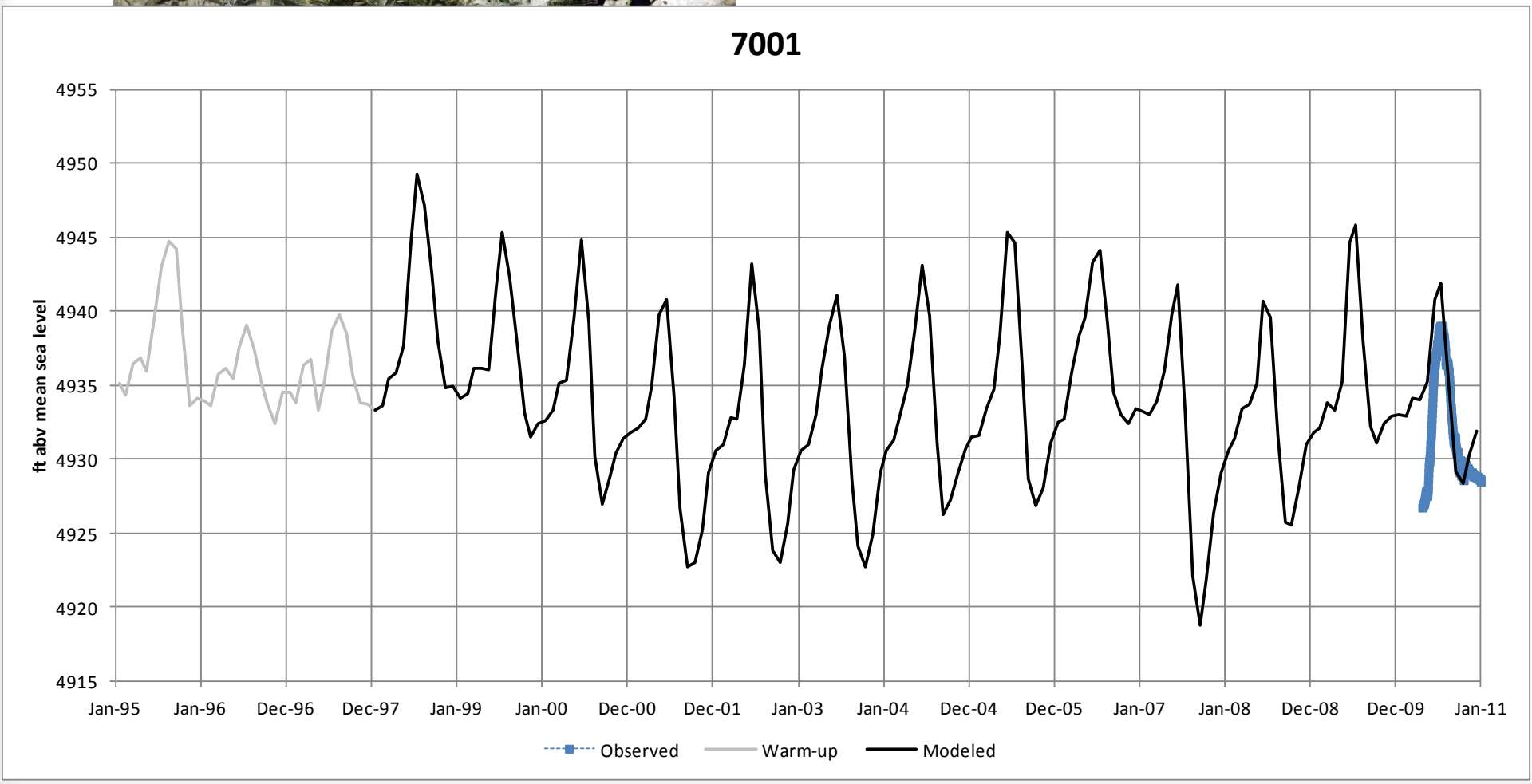

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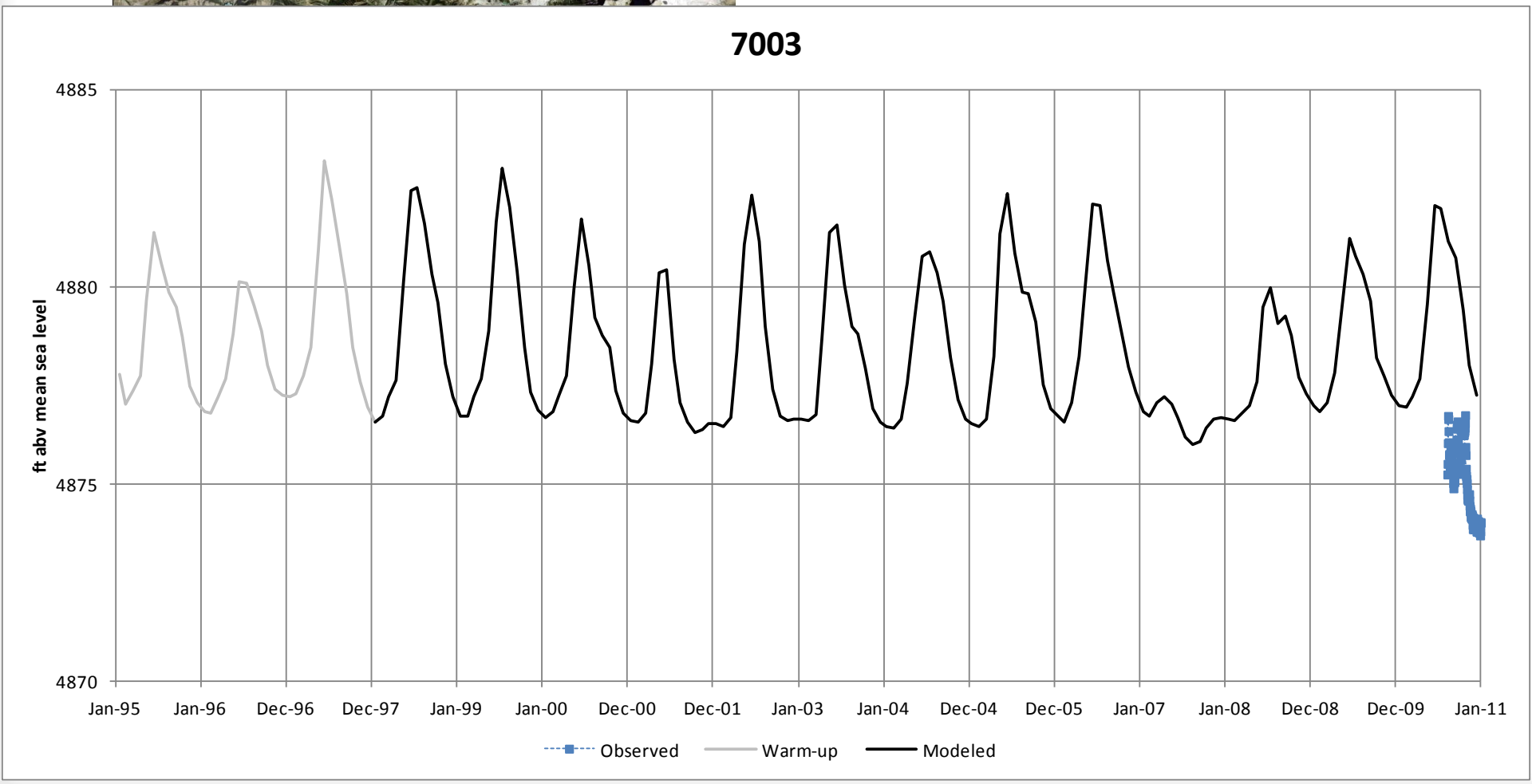

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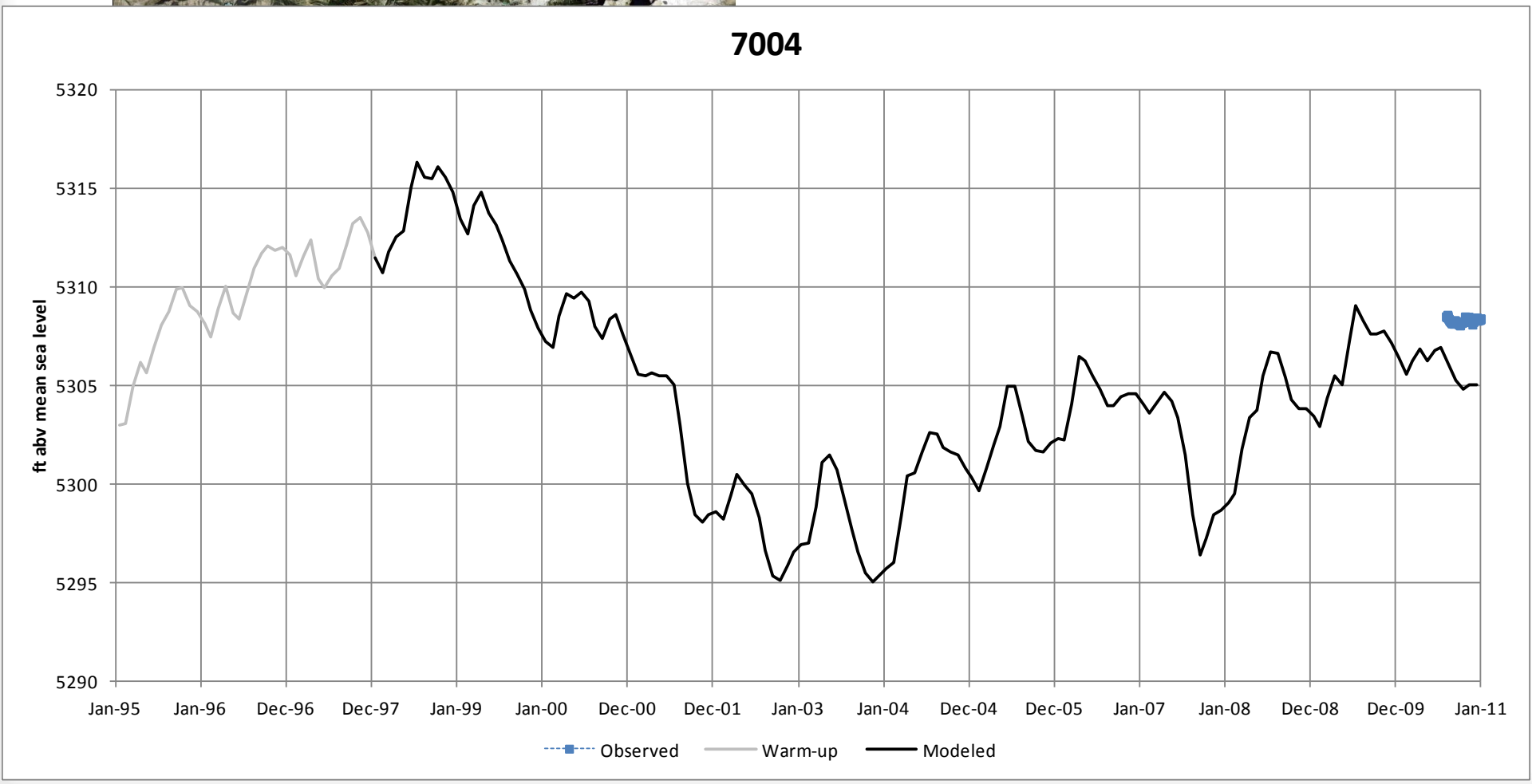

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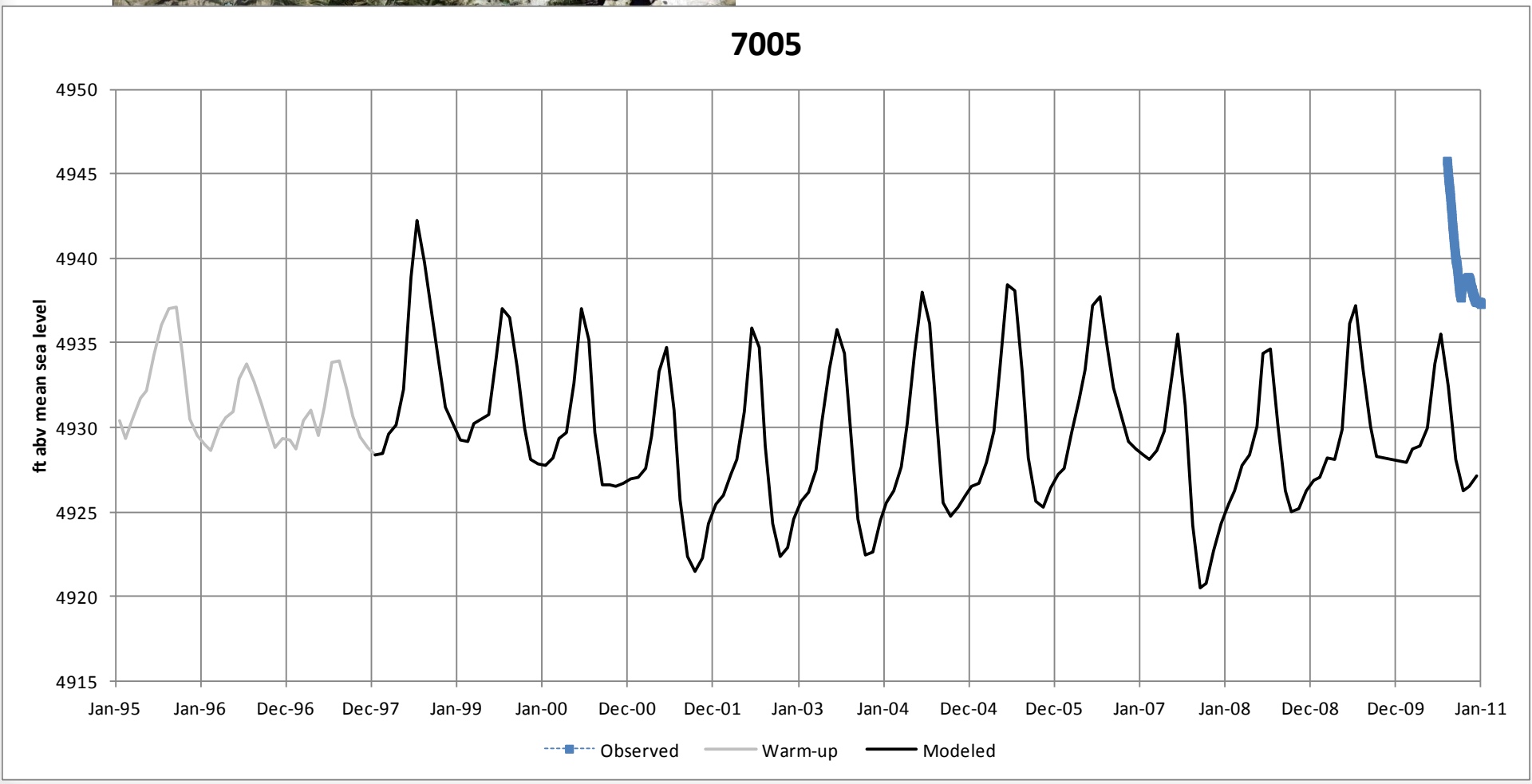

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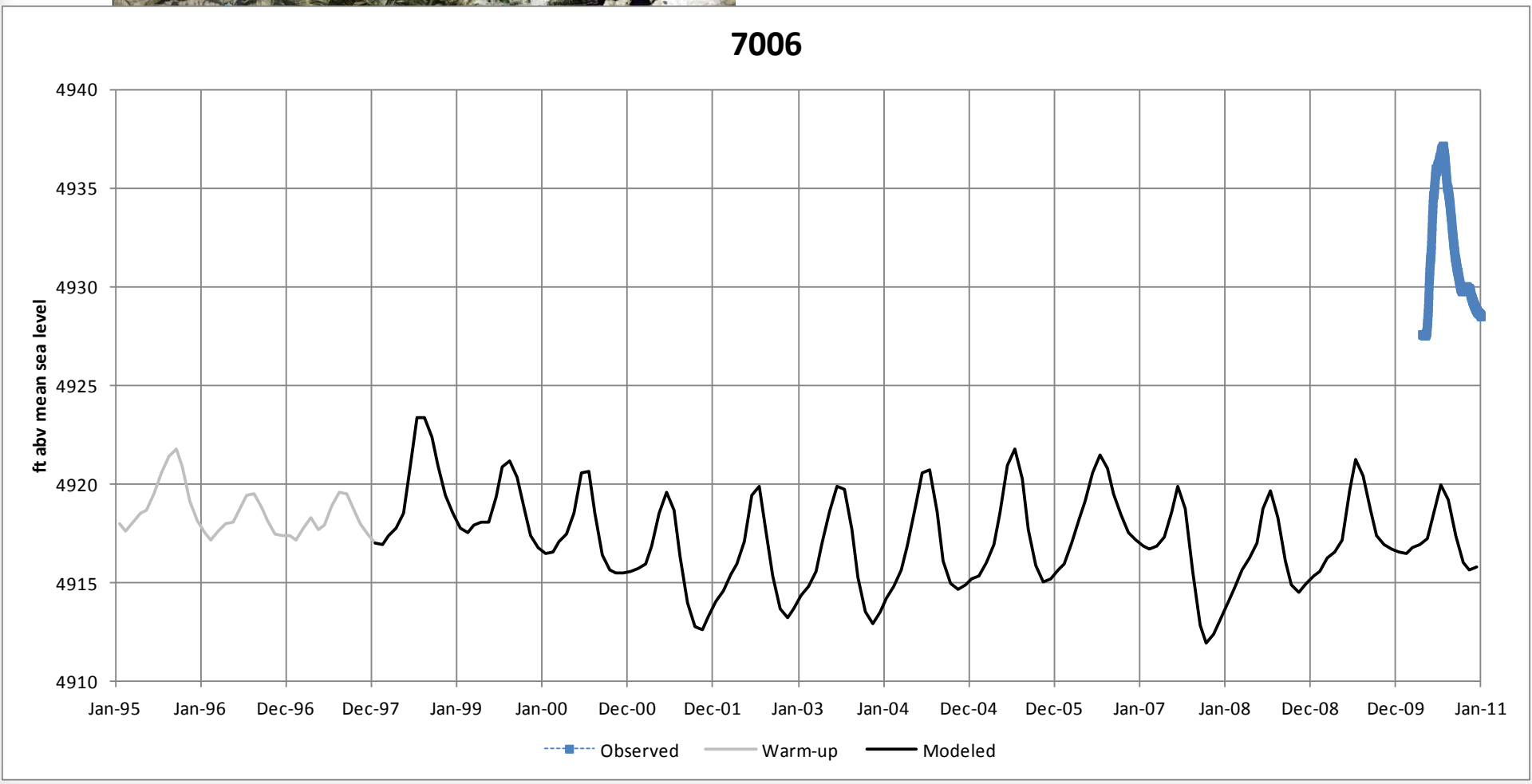

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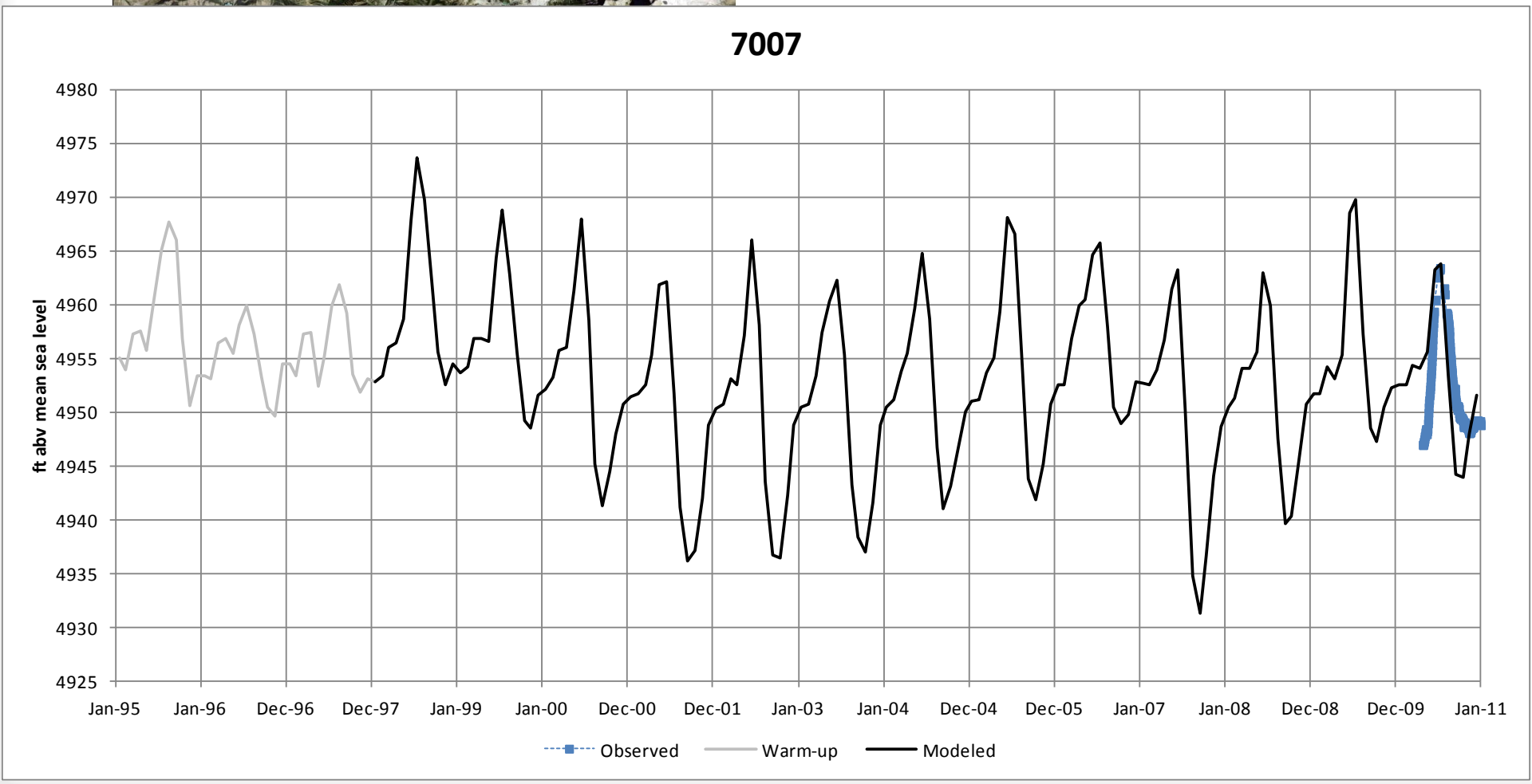

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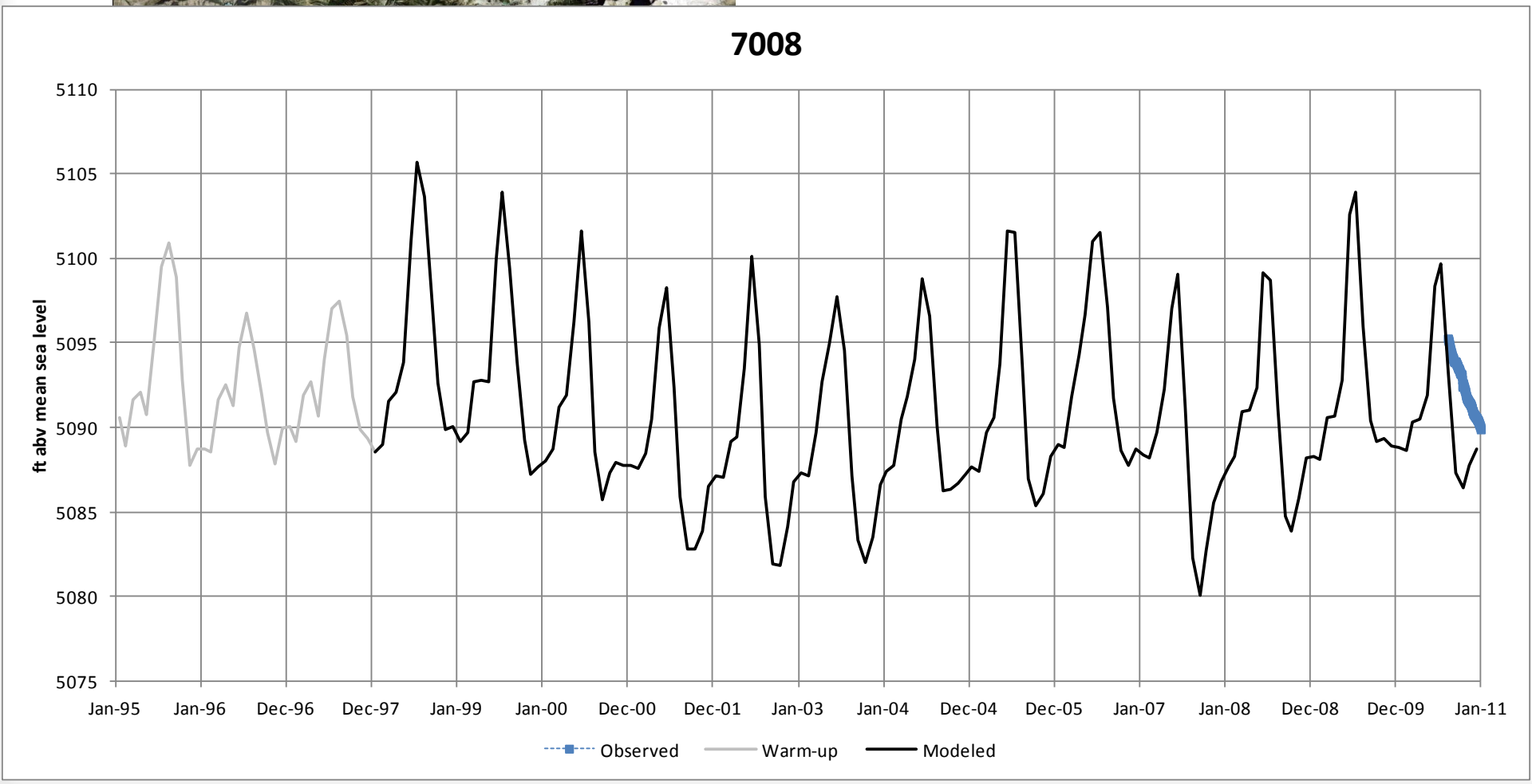

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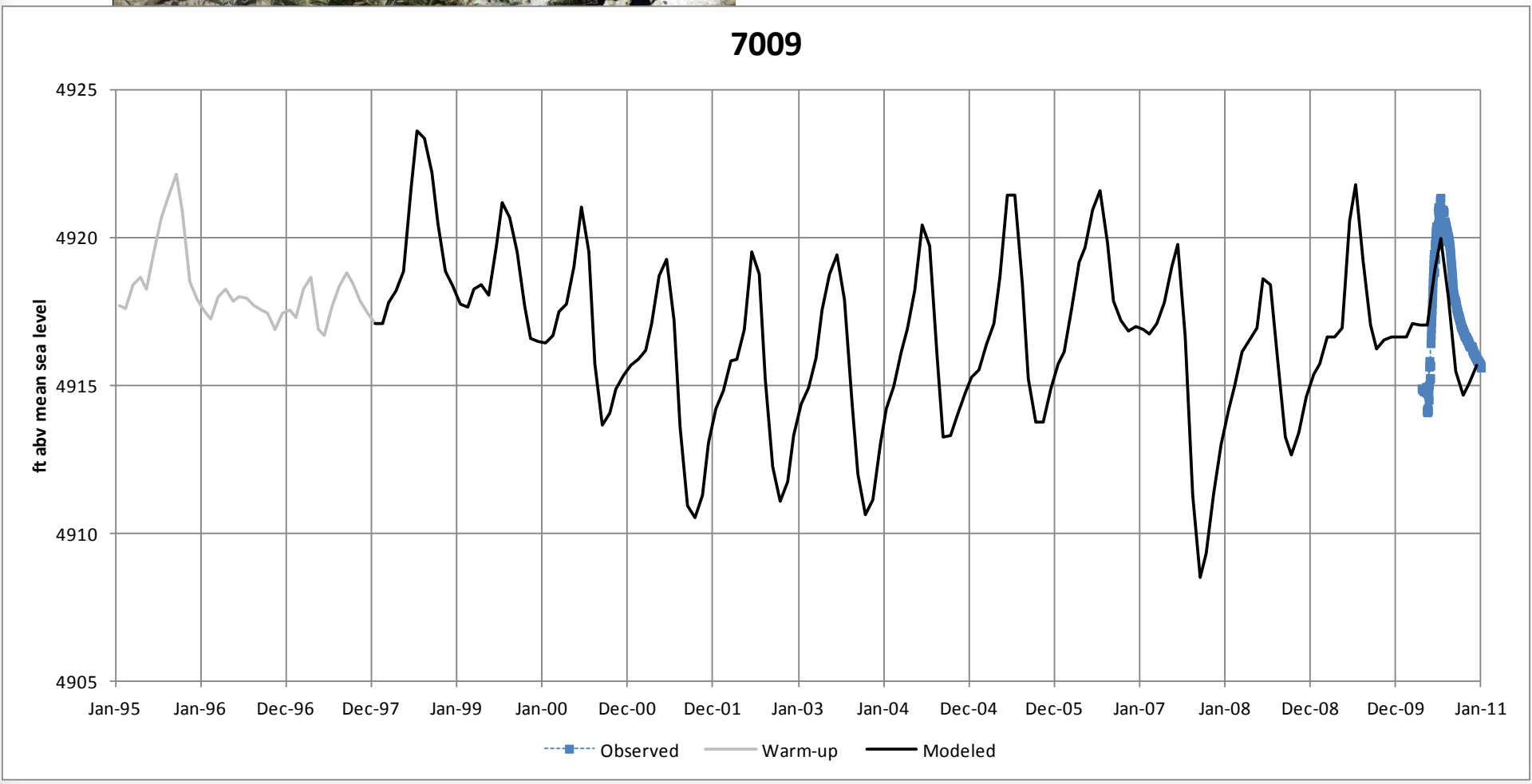

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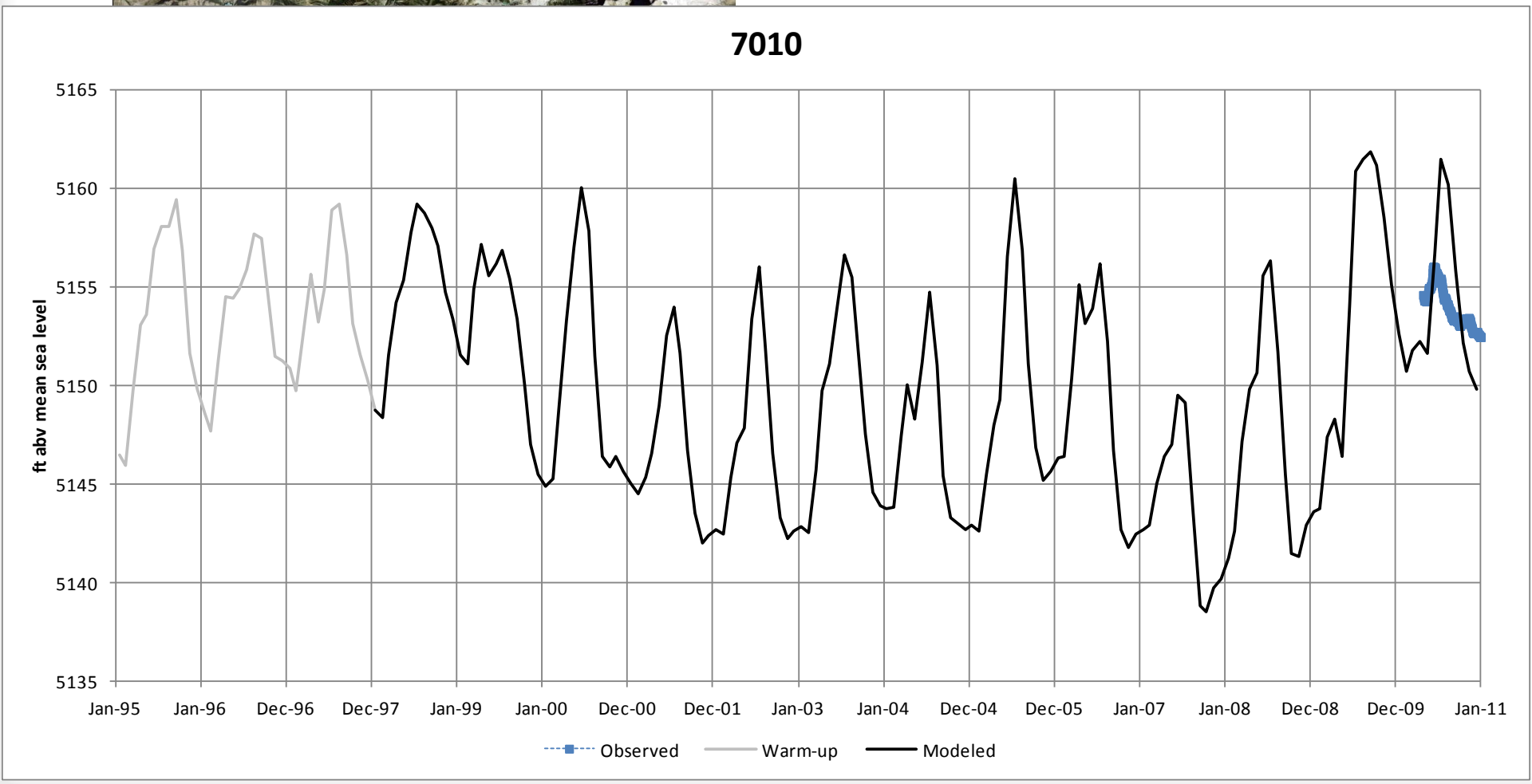
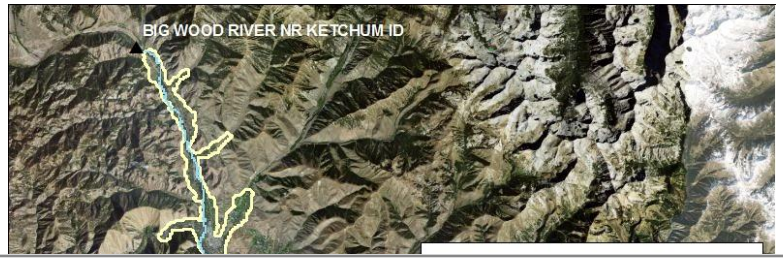
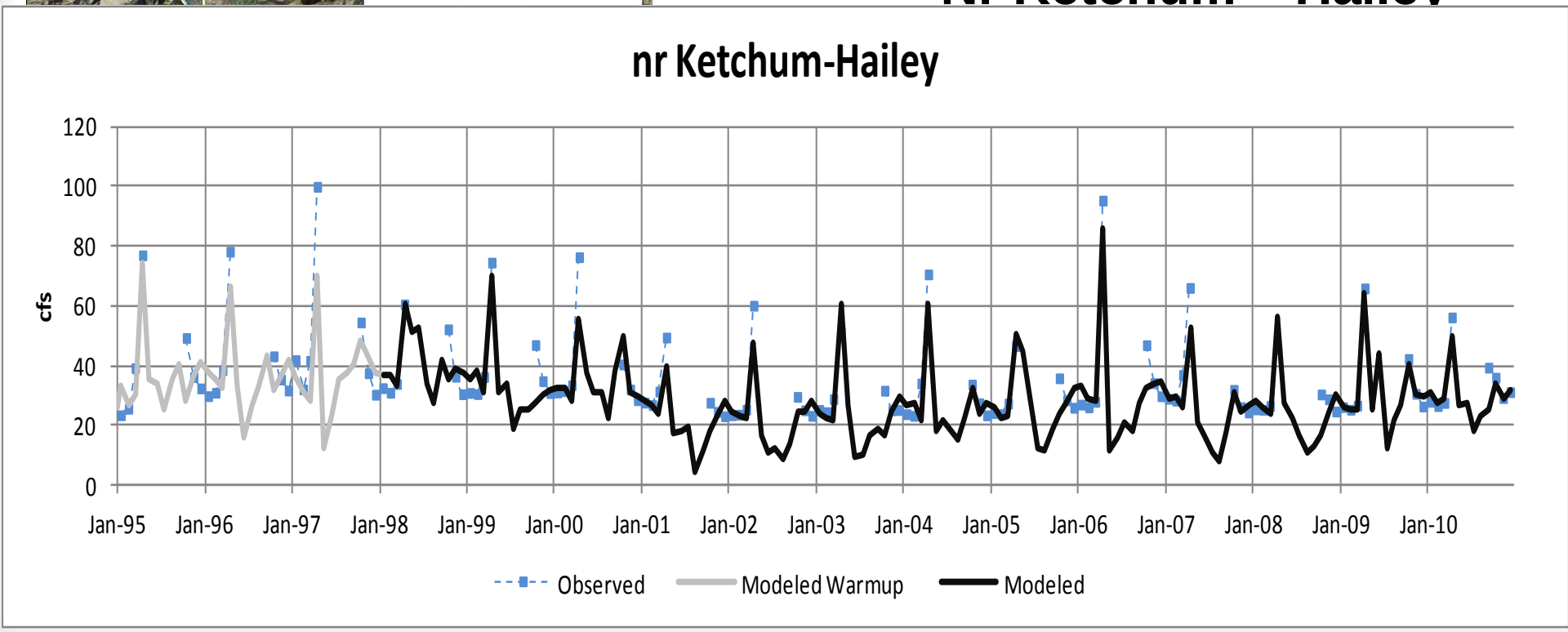


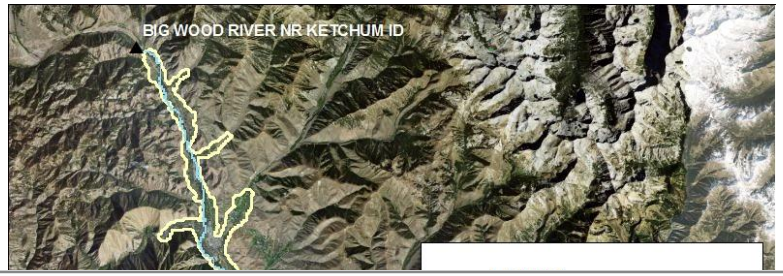
River Gains and Losses



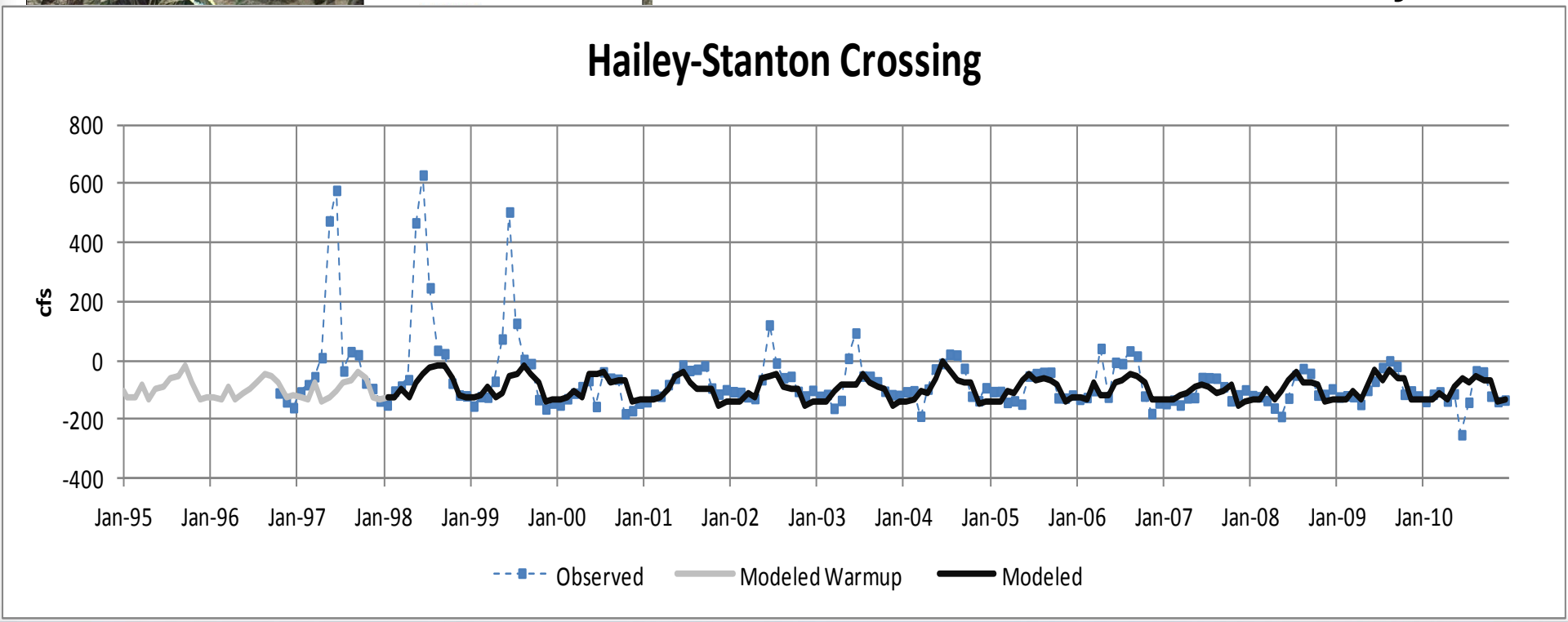
- Transient Gains
  - **Nr Ketchum – Hailey**



River Gains and Losses



- Transient Gains
  - Nr Ketchum – Hailey



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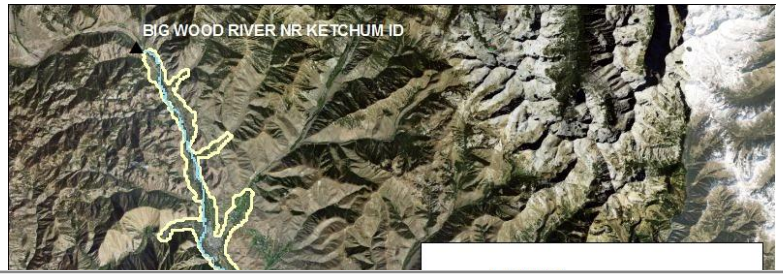
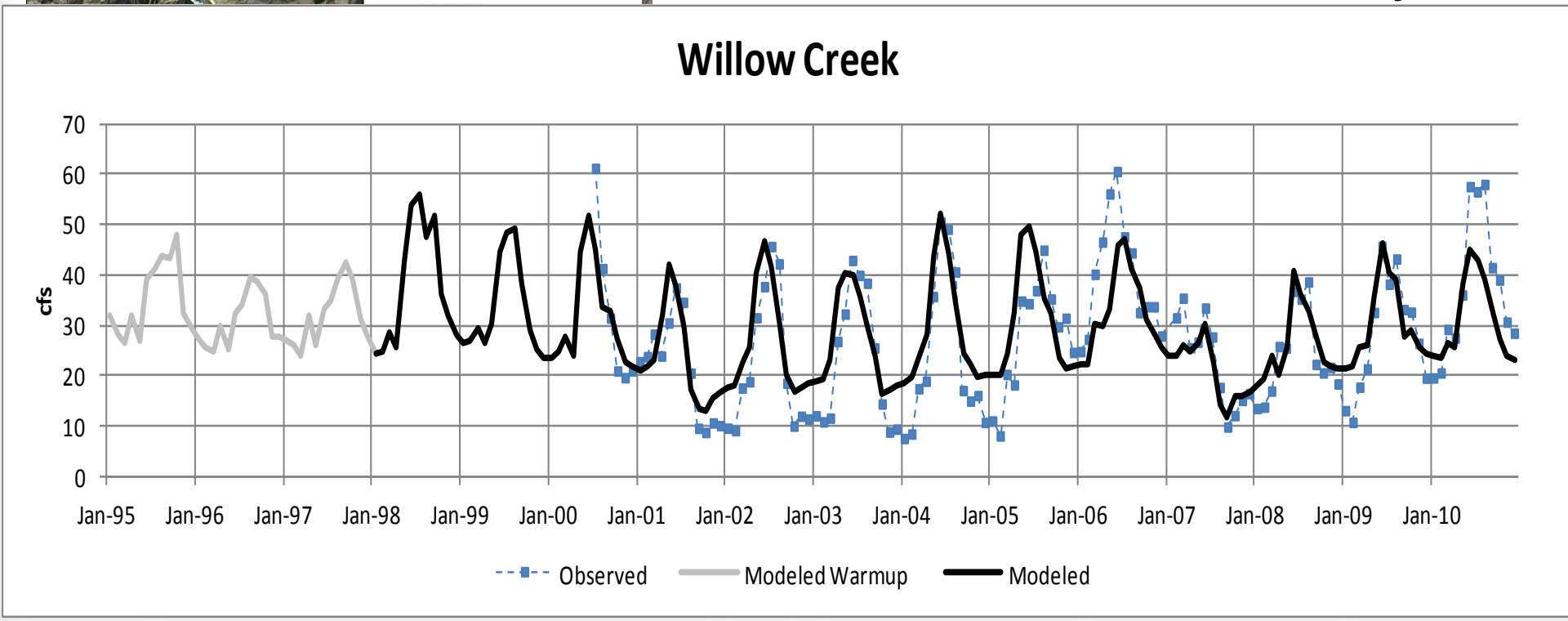


- Transient Gains
  - Nr Ketchum – Hailey



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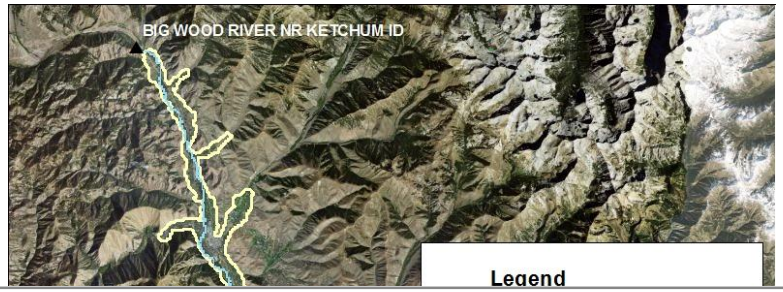
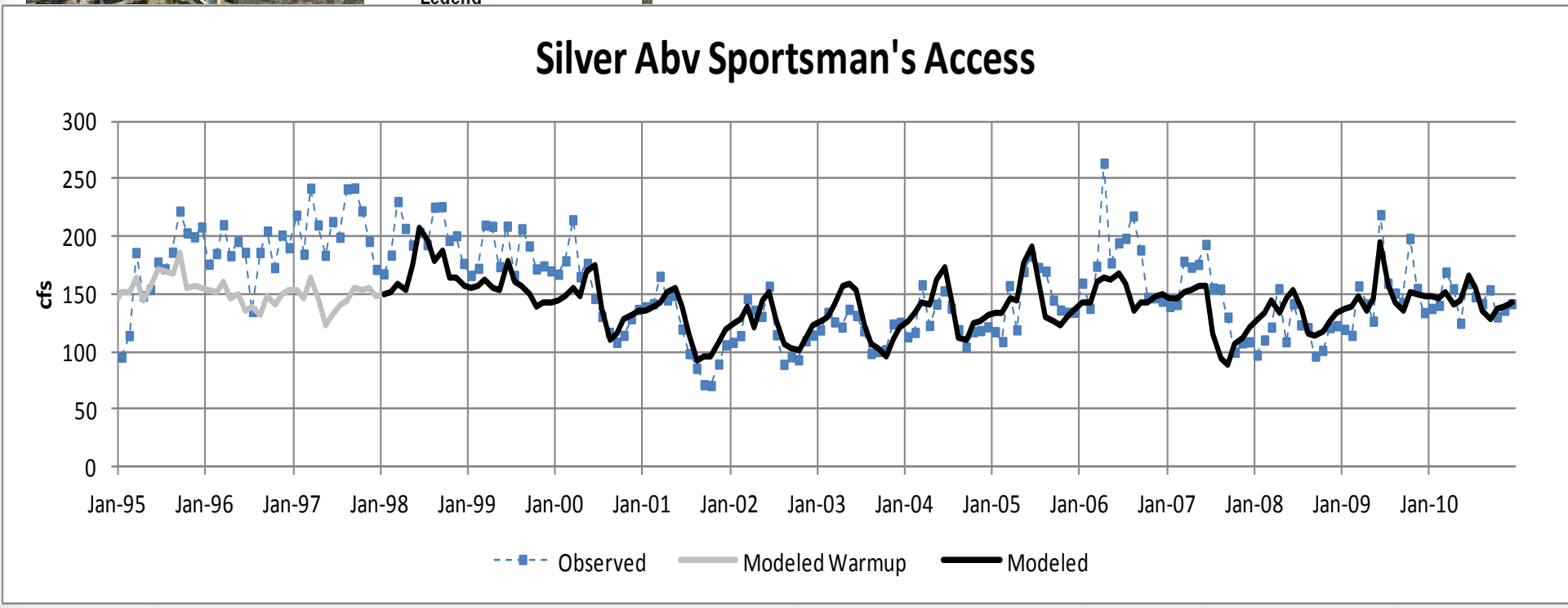


- Transient Gains
  - Nr Ketchum – Hailey



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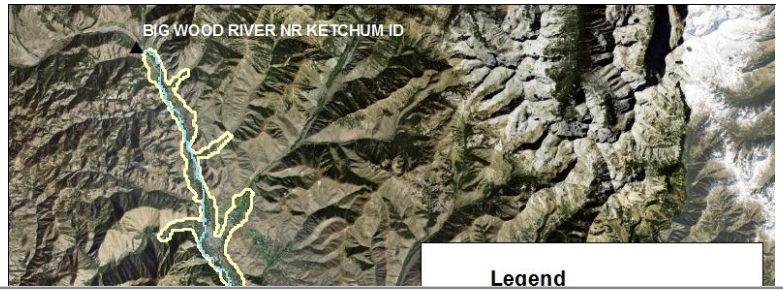

- Transient Gains
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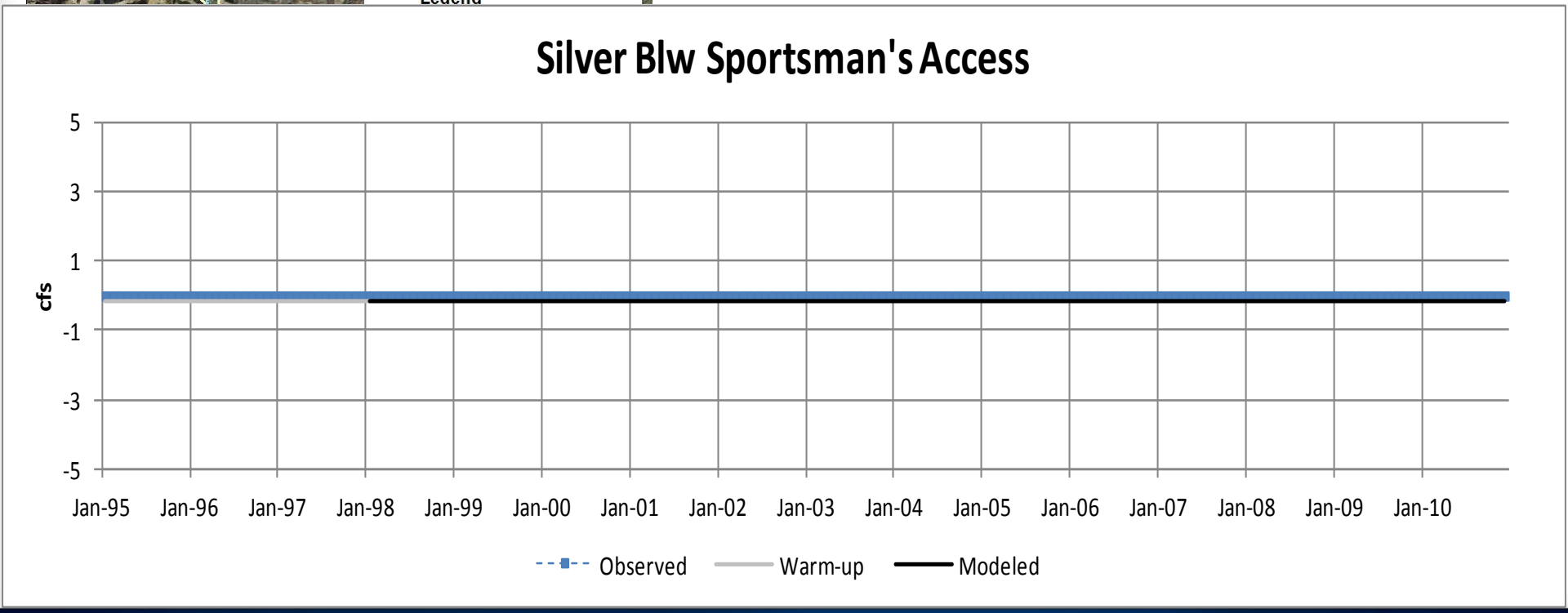
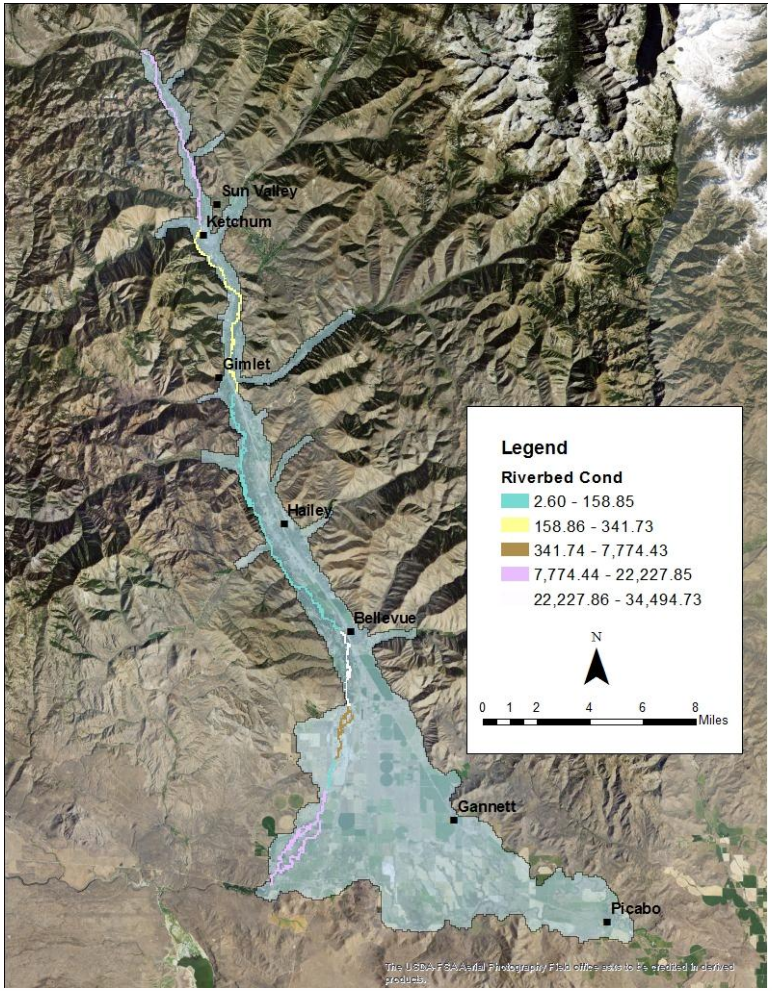
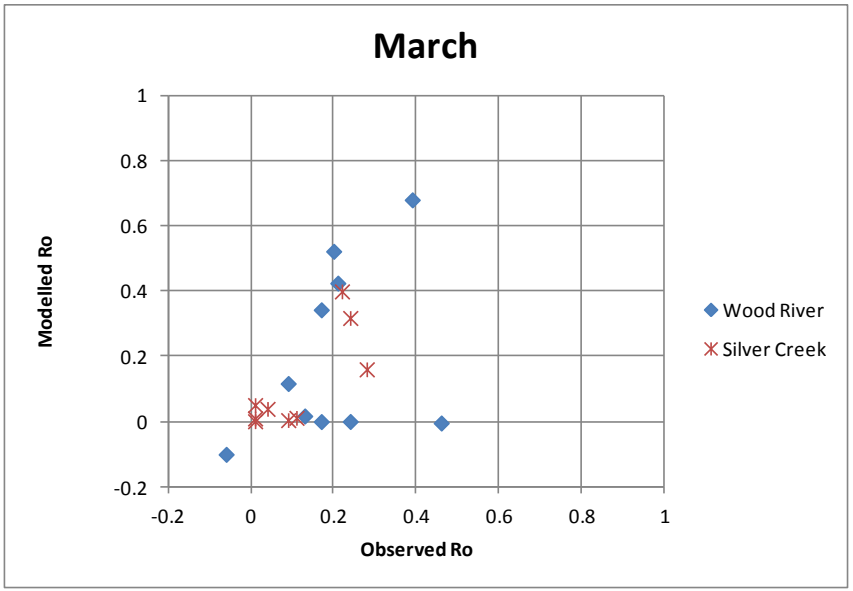


Riverbed Conductance



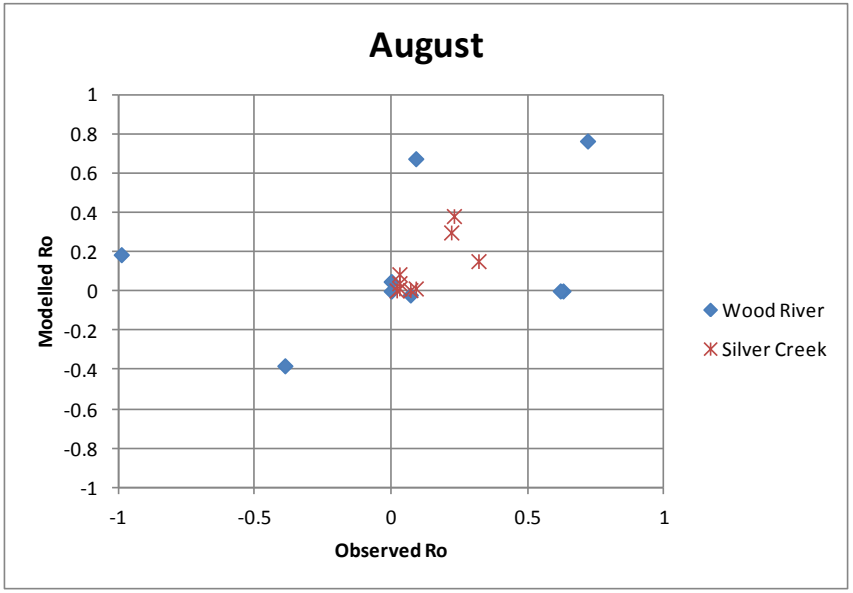
- Riverbed conductance in M^2/d
- Wood River

Sub-reach Targets



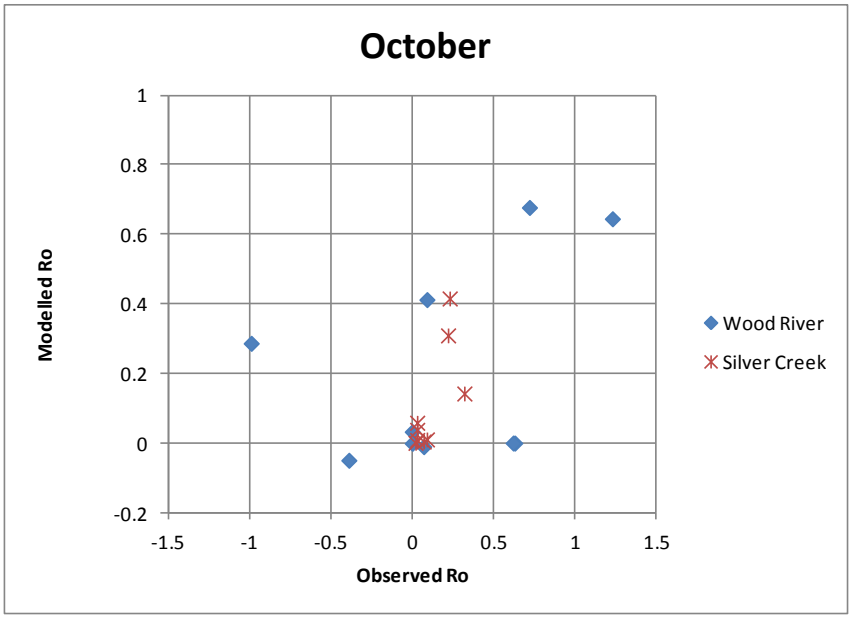
- March 2013 seepage run
- Match ratios to larger reach

Sub-reach Targets



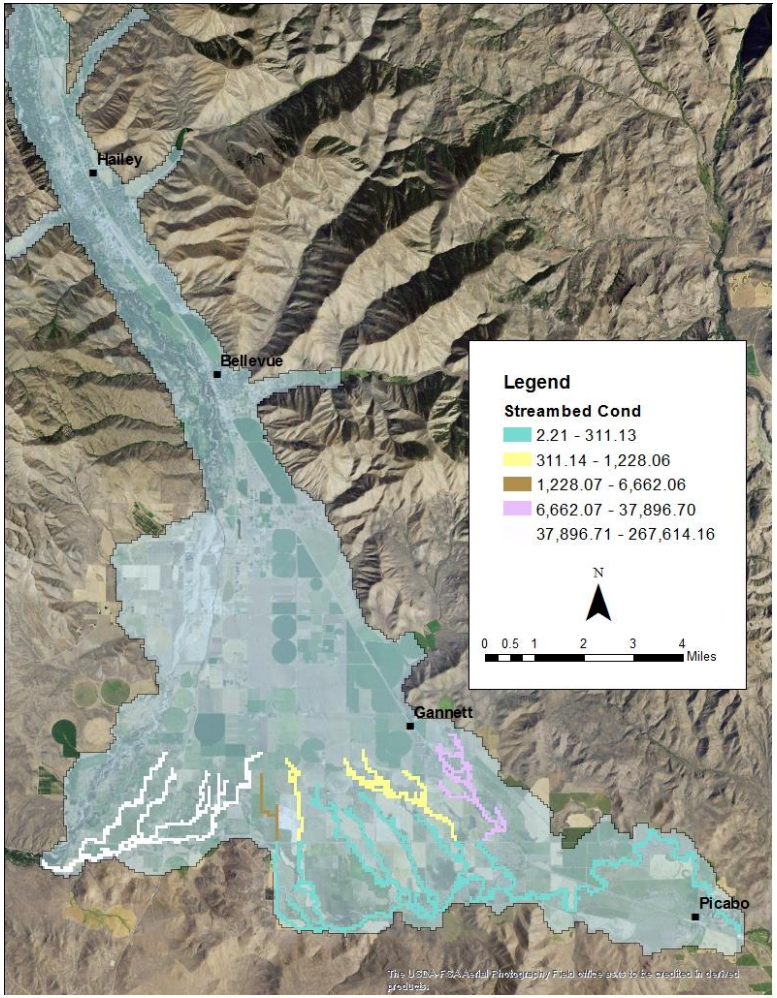
- August 2012 seepage run
- Match ratios to larger reach
- Flows for nr Ketchum to Hailey are unusual
- Seepage run results removed for nr Ketchum to Hailey

Sub-reach Targets



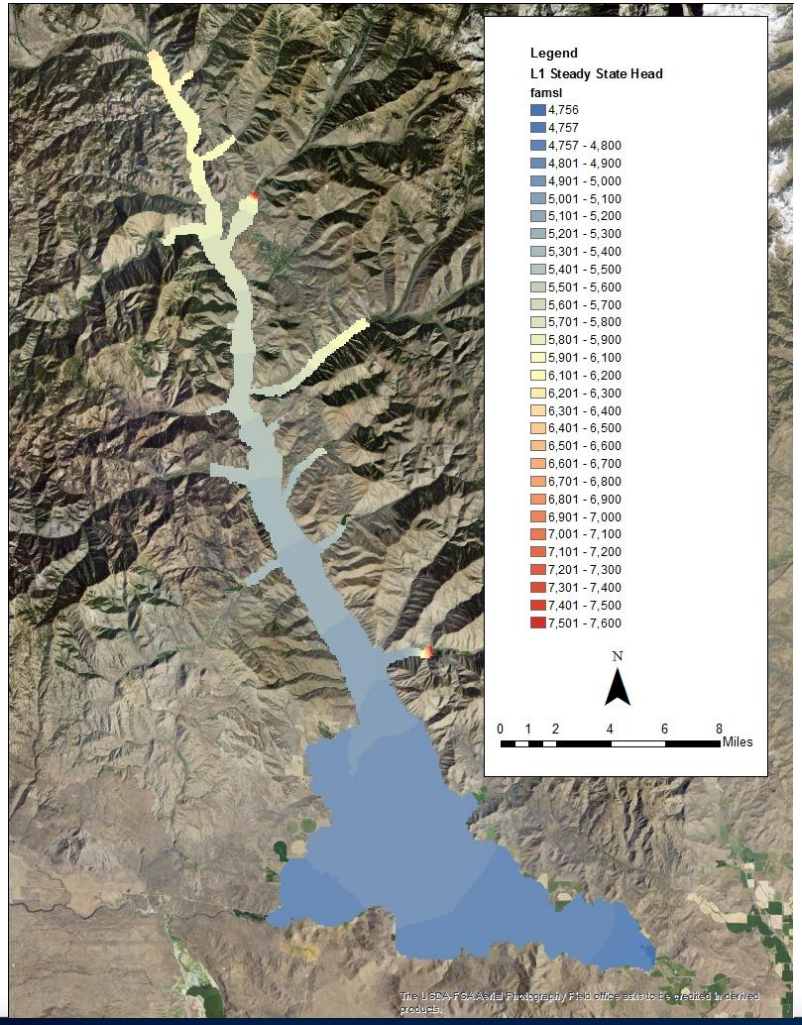
- October 2012 seepage run
- Match ratios to larger reach

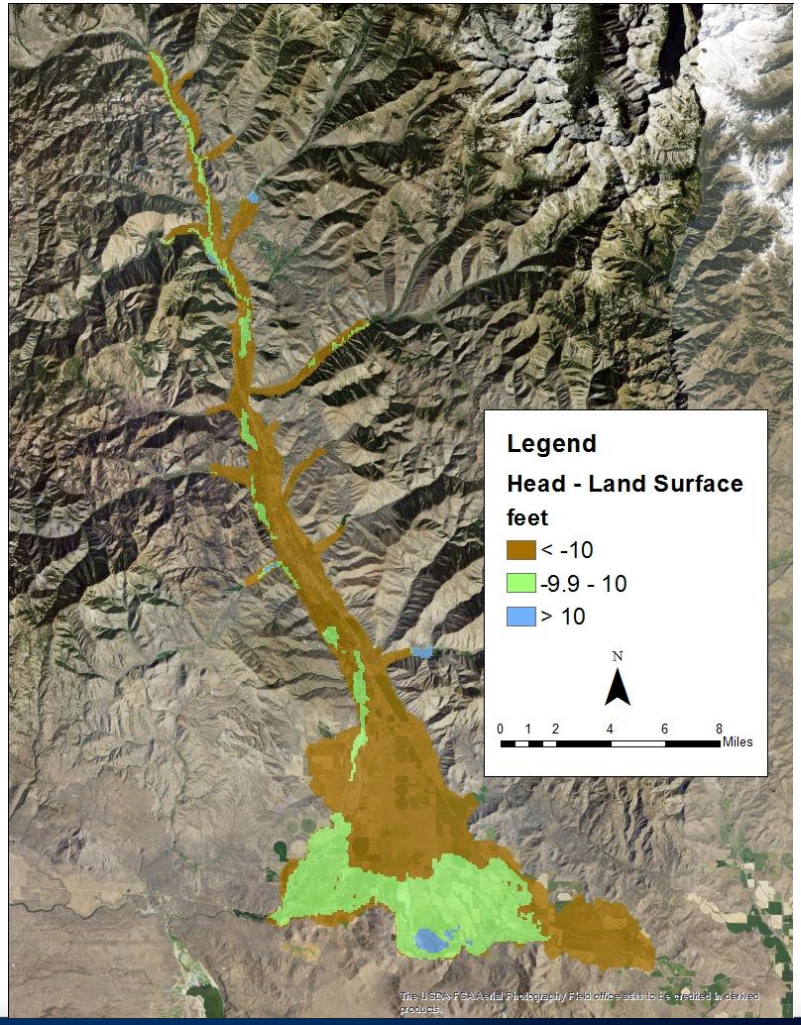
Streambed Conductance



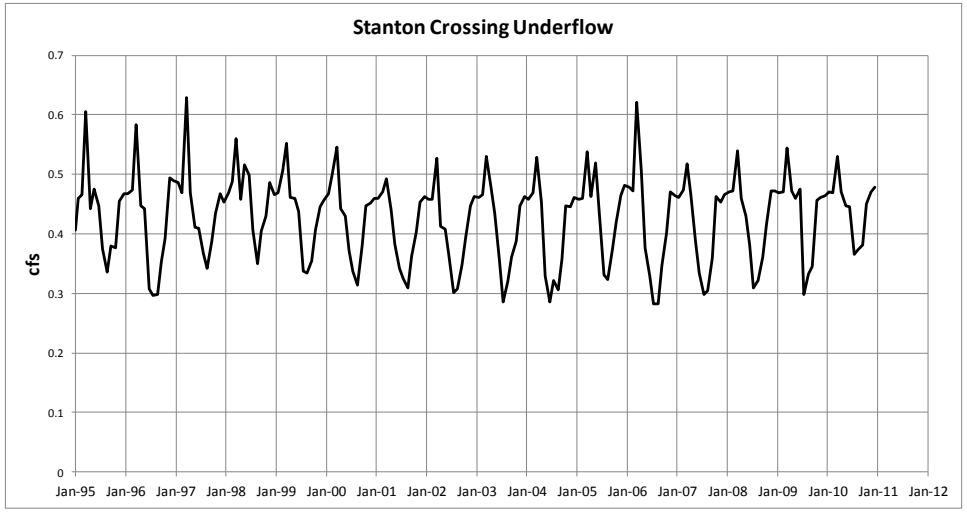
- Riverbed conductance in M^2/d
- Willow Cr, and Silver Cr

Layer 1 Aquifer head (famsl)



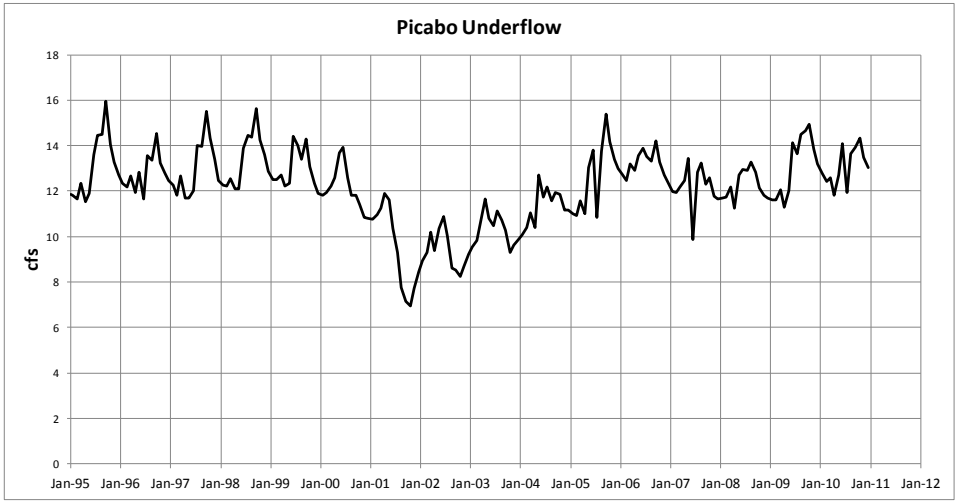


Subsurface Discharge From Model



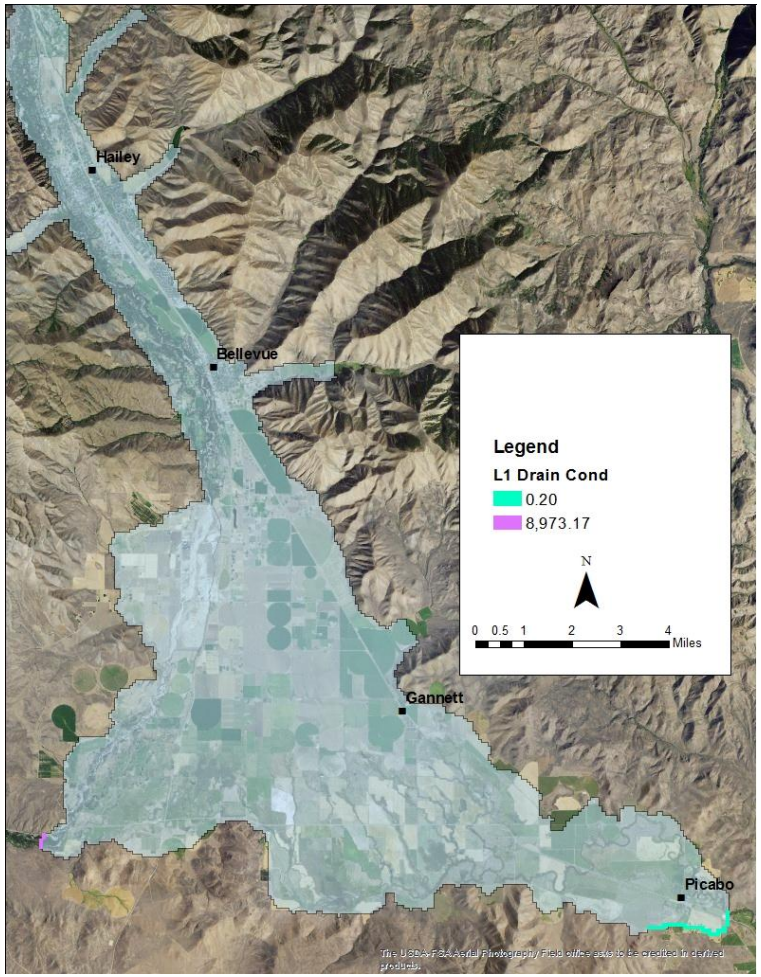
- Weight on these observations is low
- Stanton Crossing
  - Estimated ~ Negligible
    - 300 ac-f/yr
      - 0 - 0.41 cfs
      - Modeled = 0.43 cfs
        - 310 ac-ft

Subsurface Discharge From Model



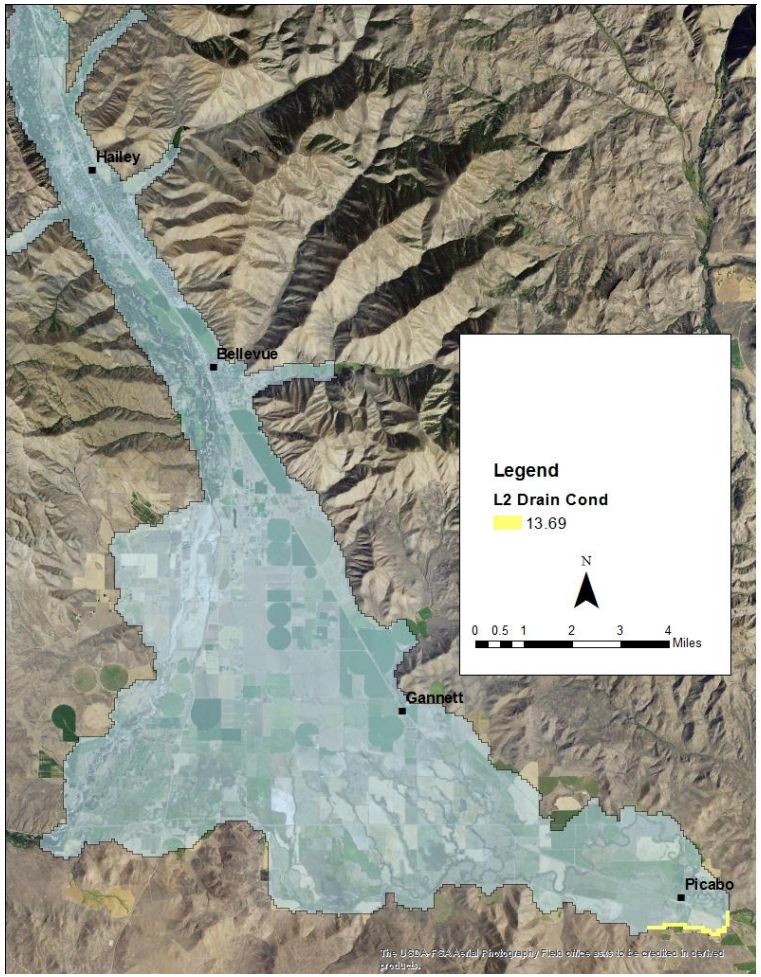
- Weight on these observations is very low
- Silver Cr underflow
  - Estimated ~ 4,000 – 53,000 ac-f/yr
    - 5.5 – 73 cfs
    - Modeled = 12.14 cfs
      - 8,795 ac-ft

Drain Conductance



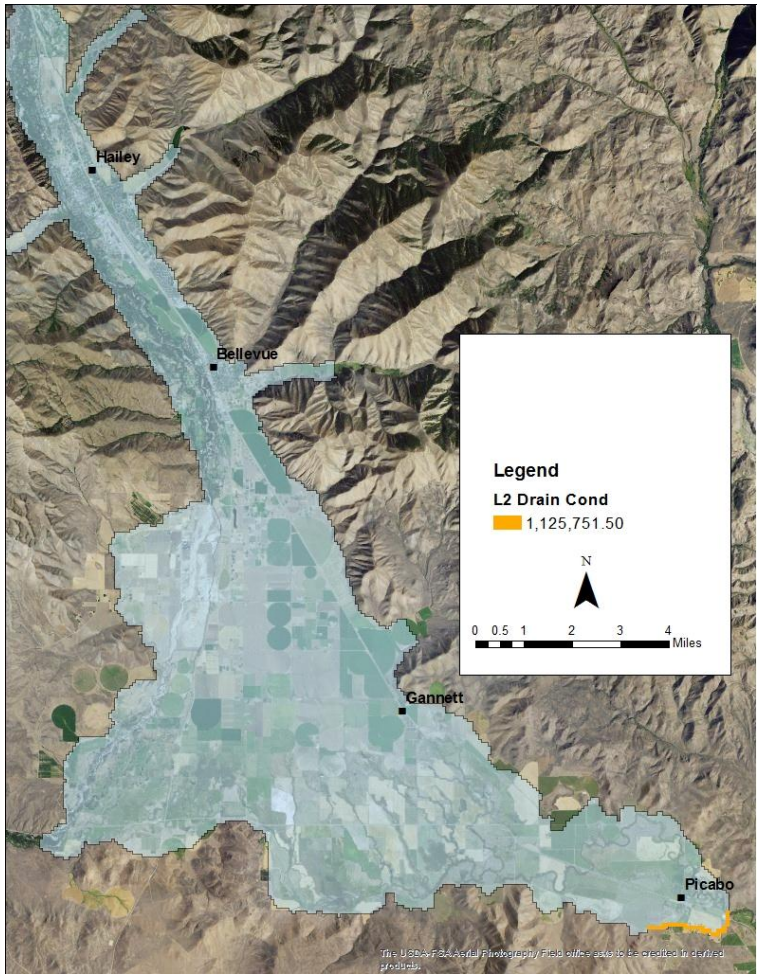
- Drain conductance in M^2/d
- Layer 1
  - Silver Creek
  - Stanton Crossing

Drain Conductance



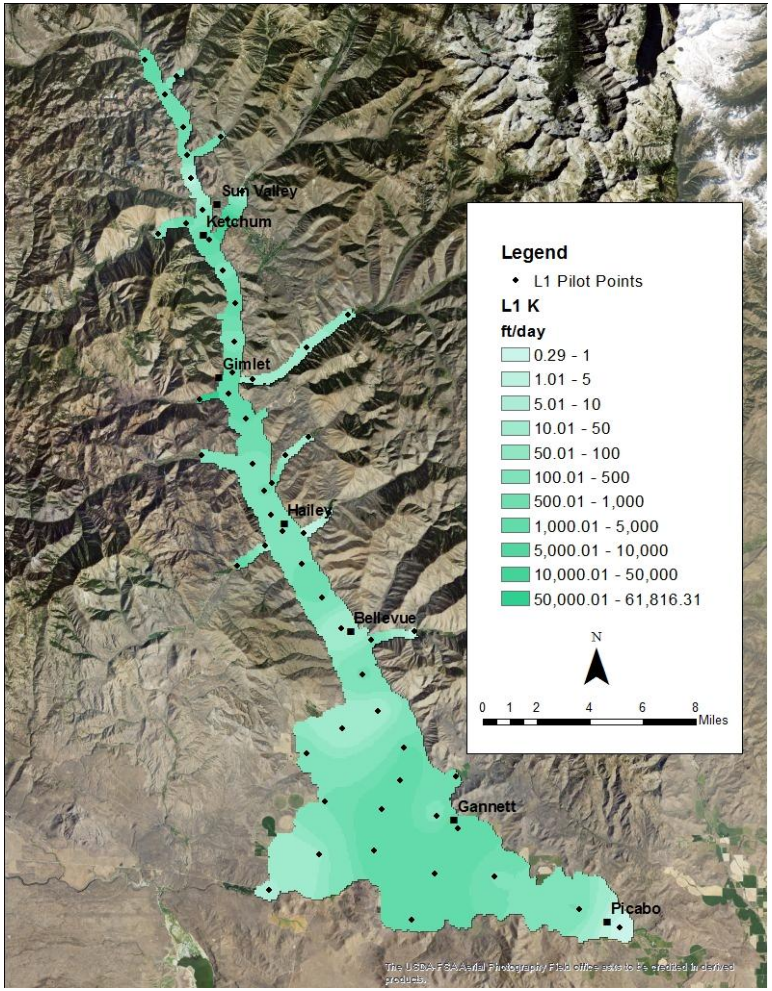
- Drain conductance in M^2/d
- Layer 2
  - Silver Creek

Drain Conductance



- Drain conductance in M^2/d
- Layer 3
  - Silver Creek

Layer 1 Hydraulic Conductivity



- Layer 1 modeled as non-time varying transmissivity
- Pilot points can be moved
- Number of pilot points not fixed
- Tributary valleys are in their own zones
- In valley and triangle
  - Min = 0.29 ft/day
  - Max = 4,194.3 ft/day
  - Mean = 484.8 ft/day

Layer 1 Hydraulic Conductivity

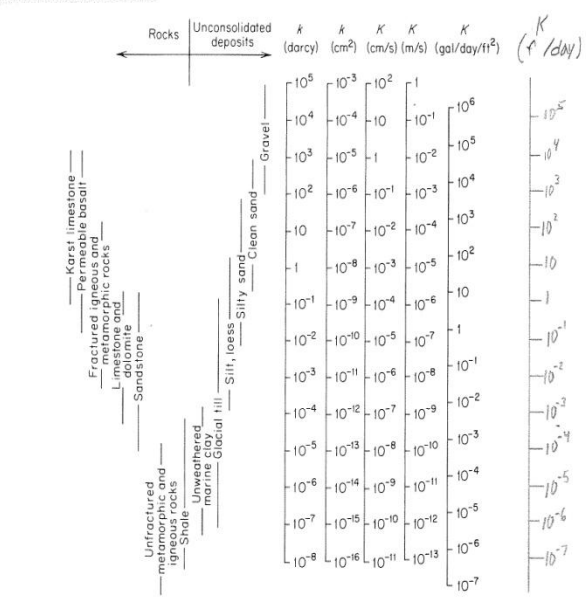


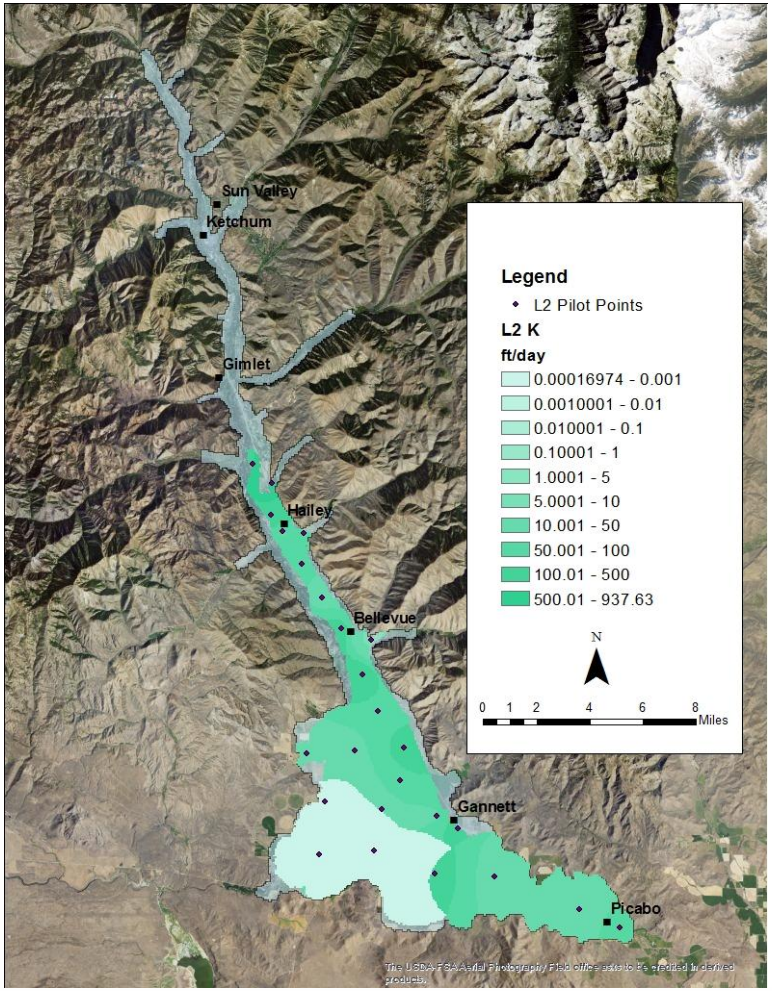
Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft²
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	3.15×10^{4}	3.05×10^{-1}	1	6.46×10^{5}
U.S. gal/day/ft²	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 0.29 ft/day
  - Max = 4,194.3 ft/day
  - Mean = 484.8 ft/day
- 437 wells in Wood River alluvial sediments.

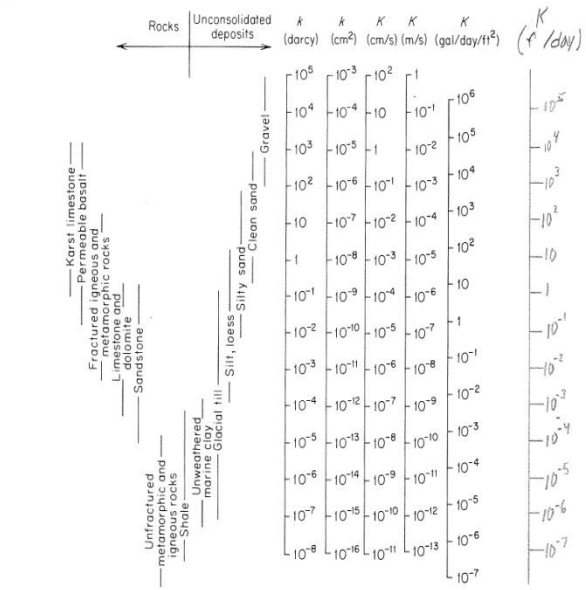
Groundwater, Freeze & Cherry, 1979

Layer 2 Hydraulic Conductivity



- Layer 2 modeled as confined
- Includes basalt in east
- Includes confining layer
- Sand and gravel aquifer in valley and triangle
  - Min = 3.31 ft/day
  - Max = 937.6 ft/day
  - Median = 63.2 ft/day

Layer 2 Hydraulic Conductivity



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	Permeability, k*			Hydraulic conductivity, K		
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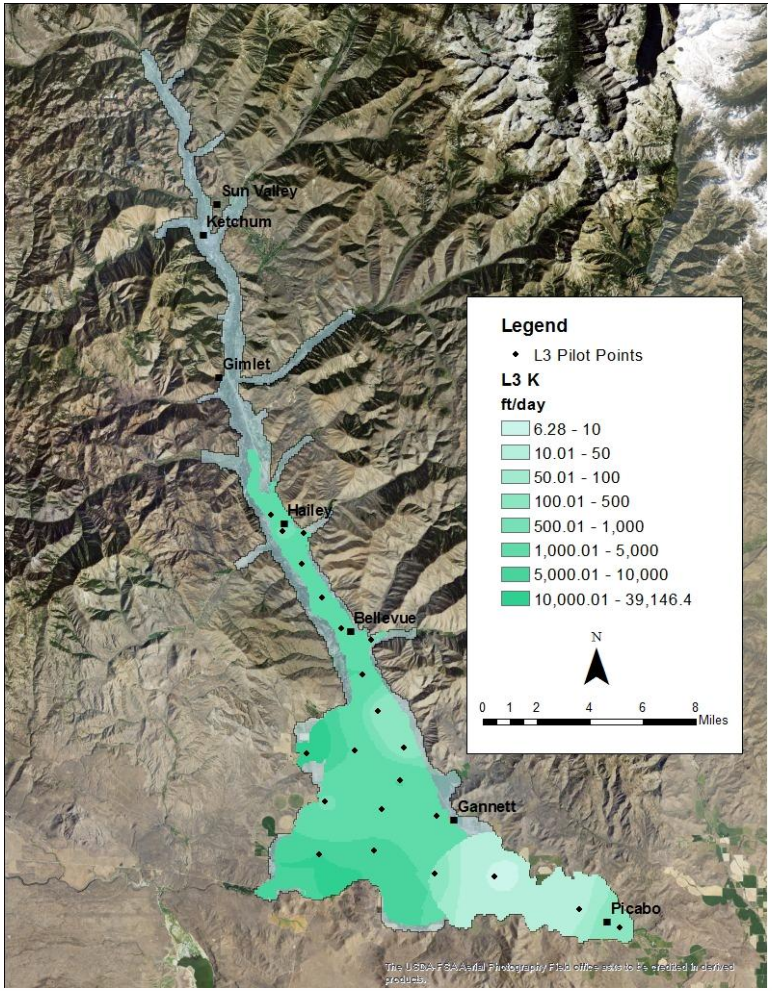
Groundwater, Freeze & Cherry, 1979

- Low hydraulic conductivity in confining layer
  - Min = 0.00017 ft/day
  - Max = 0.000971 ft/day
- Basalt
  - Min = 19.7 ft/day
  - Max = 219.7 ft/day
- Sand and gravel In valley and triangle
  - Min = 3.31 ft/day
  - Max = 937.6 ft/day
  - Median = 63.2 ft/day
- 14 wells in Wood River alluvial sediments.

Layer 3 Hydraulic Conductivity



- Layer 3 modeled as confined
- Basalt
  - Min = 6.3 ft/day
  - Max = 425.3 ft/day
- Sand and gravel aquifer in valley and triangle
  - Min = 175.3 ft/day
  - Max = 39,146.4 ft/day
  - Median = 2,757.7 ft/day

Layer 3 Hydraulic Conductivity

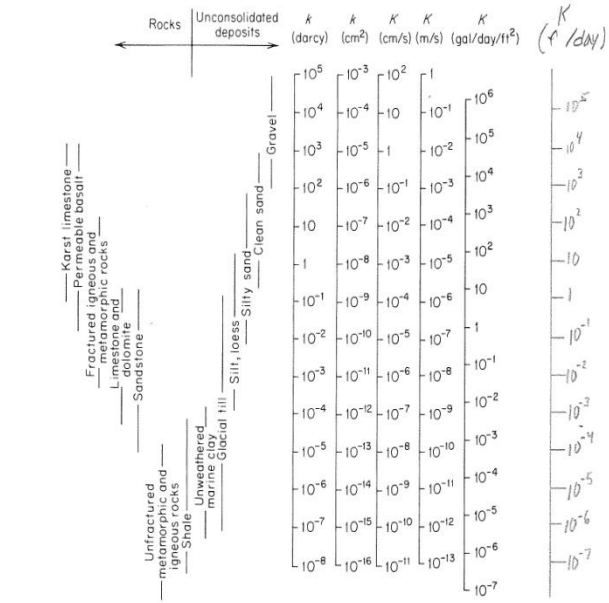


Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft^2
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
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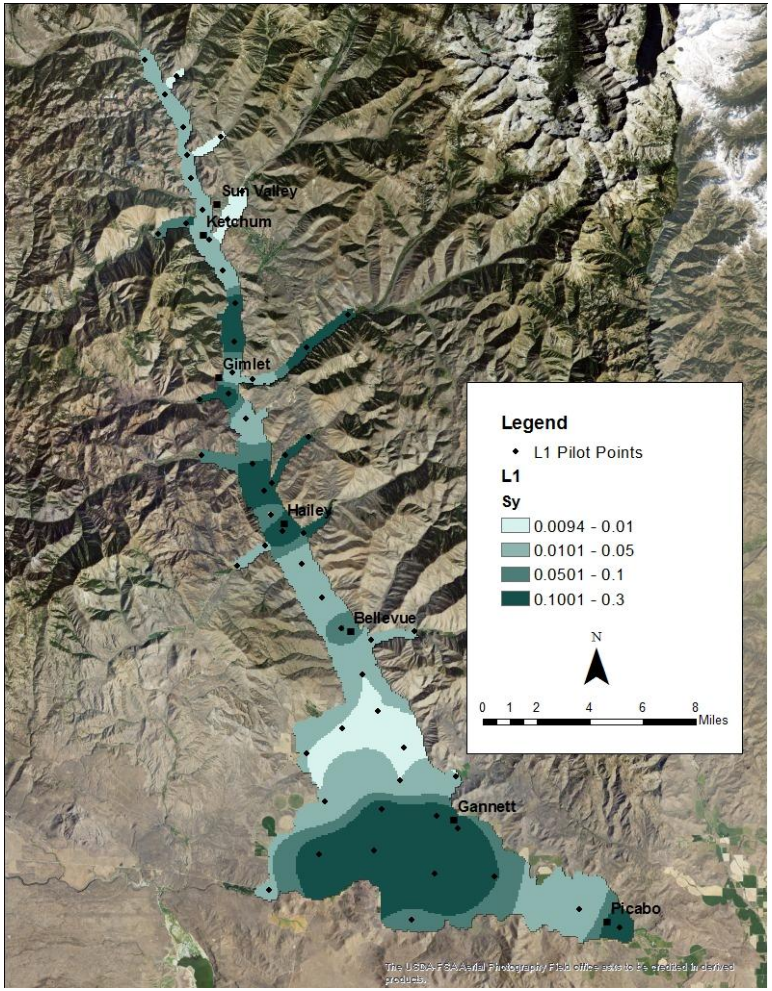
Groundwater, Freeze & Cherry, 1979

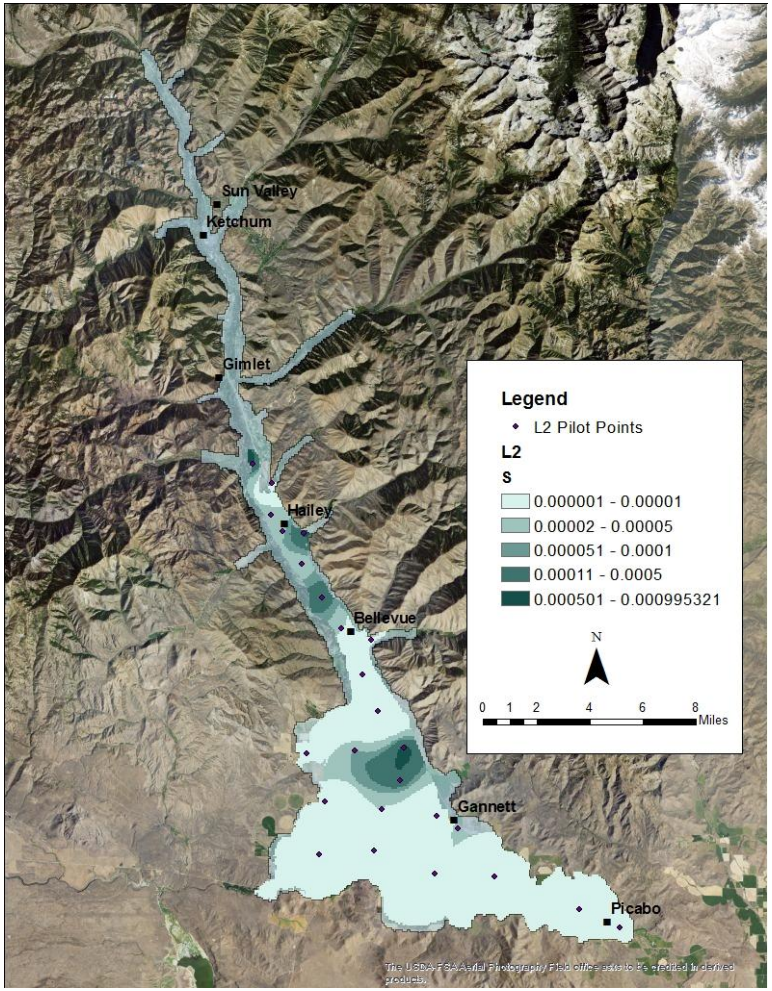
- Basalt
  - Min = 6.3 ft/day
  - Max = 425.3 ft/day
- Sand and gravel aquifer in valley and triangle
  - Min = 175.3 ft/day
  - Max = 39,146.4 ft/day
  - Median = 2,757.7 ft/day

Layer 1 Storage



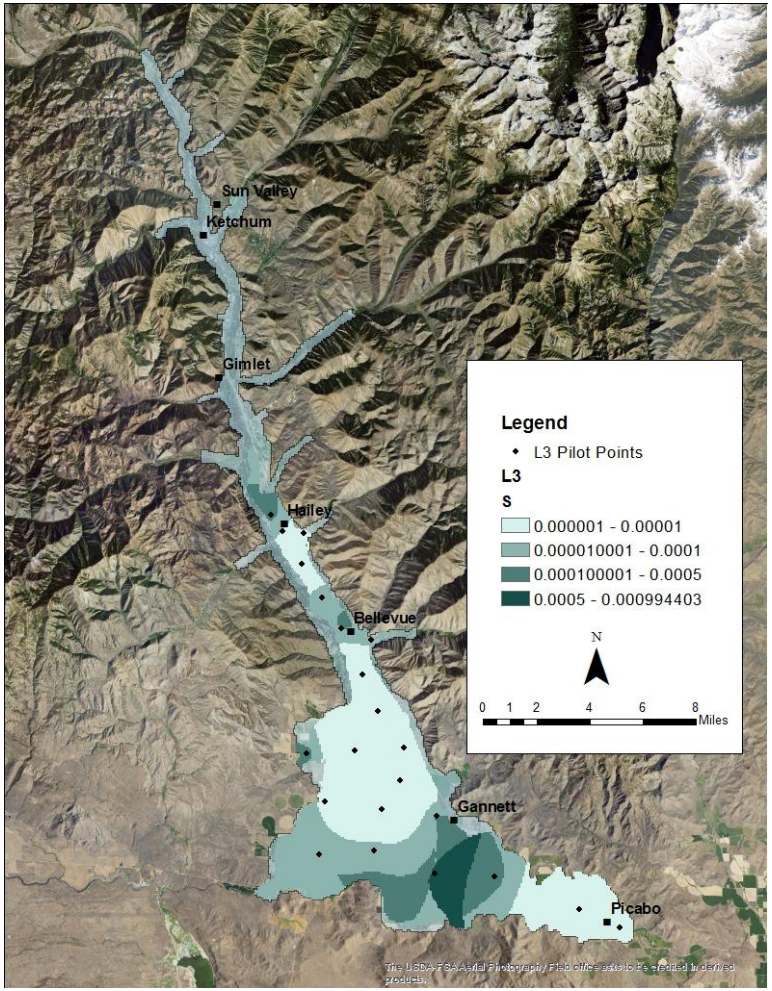
- Layer 1 temporarily modeled as non-time varying thickness
- Pilot points can be moved
- Number of pilot points not fixed

Layer 2 Storage



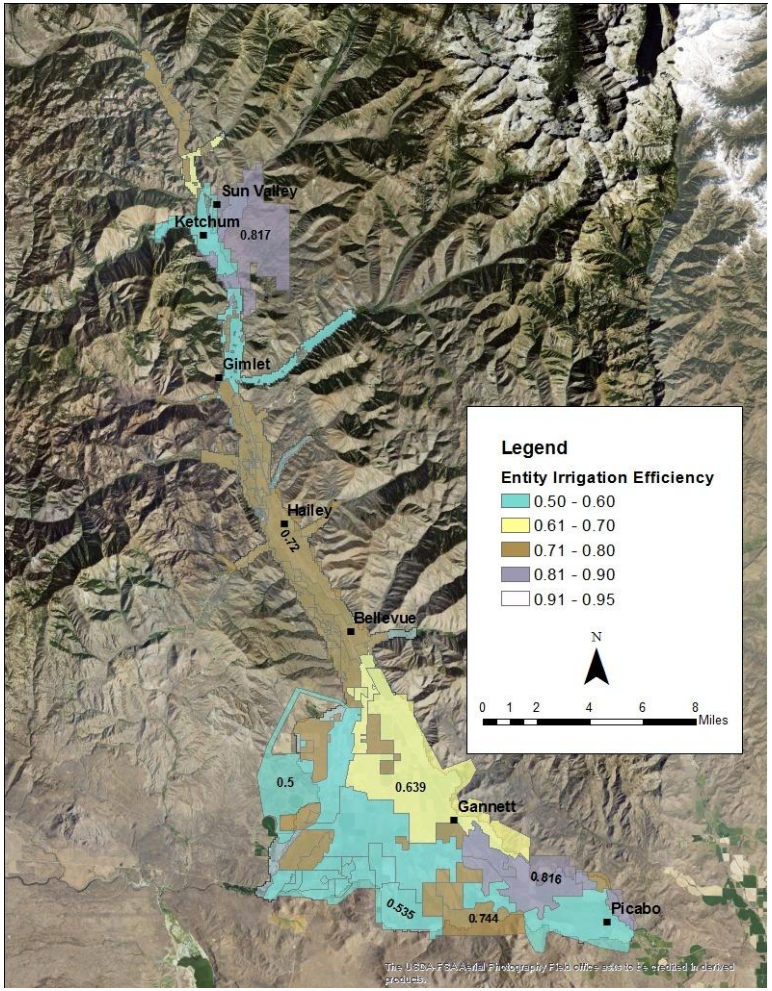
- Layer 2 modeled as storage
- Includes basalt in east
- Includes confining layer
- Pilot points can be moved
- Number of pilot points can be changed

Layer 3 Storage



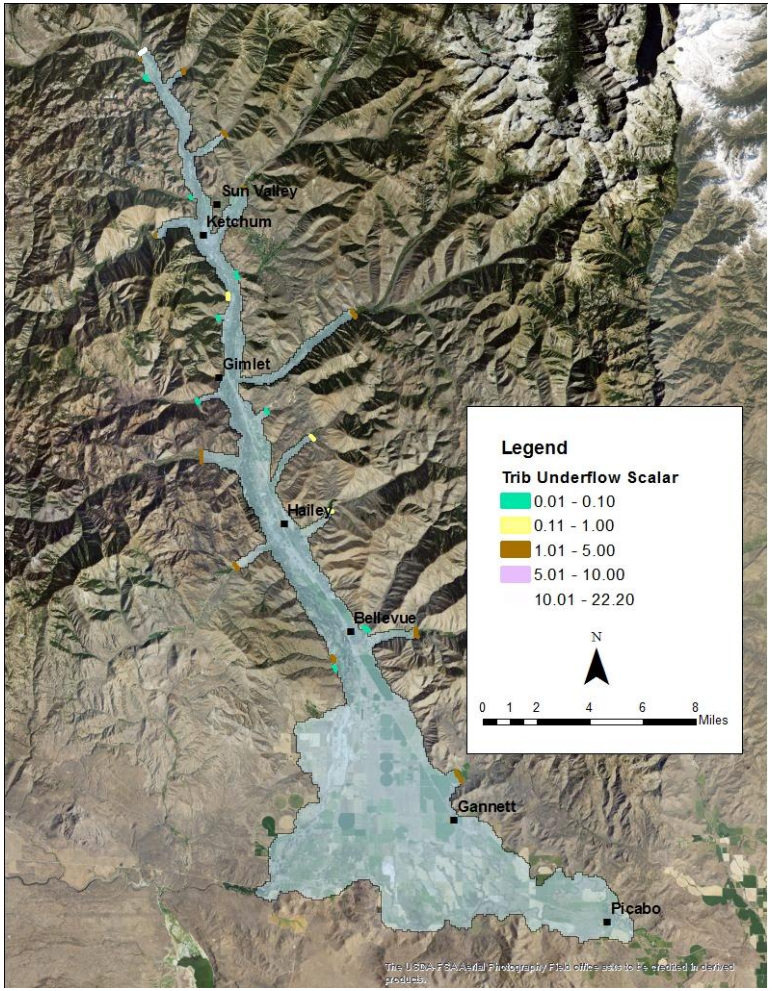
- Layer 3 modeled as storage
- Includes basalt in east
- Pilot points can be moved
- Number of pilot points can be changed

Surface Water Irrigation Efficiency



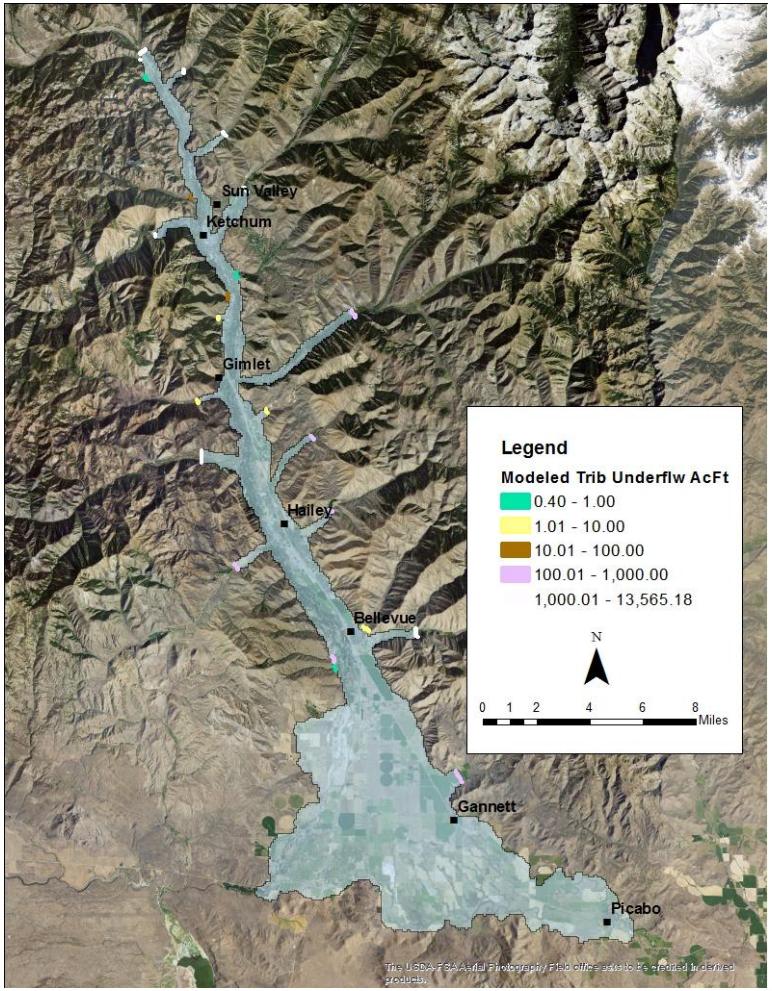
- Inefficient fraction infiltrates into layer 1 aquifer
  - Note to the engineers
    - Low efficiency is not necessarily bad

Tributary Underflow



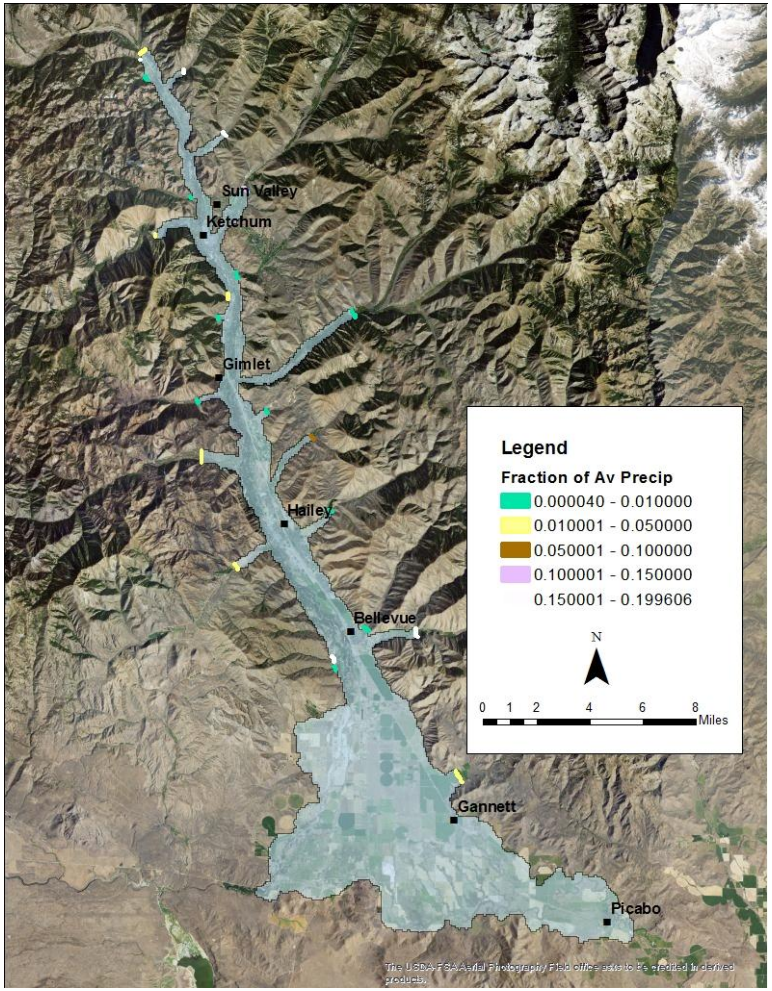
- Trib underflow adjusted using
  - Adjustment factors
    - Adjust average flux
  - Reduction factor
    - Adjust seasonal amplitude
  - Averaging period
    - 200 day, 300 day, 400 day , etc

Tributary Underflow



Tributary	Scalar	Av Basin Precip A-Ft	Mod A-Ft	% Basin Yield
Adams Gulch	0.02	17600	12.97	0.07%
Chocolate Gulch	0.01	864	0.58	0.07%
Cold Springs Gulch	0.26	3,341	46.36	1.39%
Clear Creek	0.01	2,288	1.06	0.05%
Cove Canyon	2.68	11,200	382.64	3.42%
Croy Creek	1.10	23,595	773.95	3.28%
Deer Creek	1.97	74,213	2,870.21	3.87%
Eagle Creek	3.40	17,248	3,442.80	19.96%
Elkhorn Gulch	0.01	12,757	0.51	0.00%
East Fork	1.31	120,629	616.62	0.51%
Greenhorn Gulch	0.01	30,464	6.81	0.02%
Indian Creek	0.40	10,149	950.11	9.36%
Lake Creek	1.44	17,280	3,441.64	19.92%
Lees Gulch	3.20	2,240	381.35	17.02%
Ohio Gulch	0.01	4,270	2.12	0.05%
Oregon Gulch	3.92	6,919	1,348.09	19.48%
Quigley Creek	0.18	15,504	101.73	0.66%
Seamans Creek	1.93	18,768	3,740.12	19.93%
Slaughterhouse Gulch	0.01	11,509	5.03	0.04%
Trail Creek	3.93	111,274	11,329.95	10.18%
Townsend Gulch	0.01	960	0.40	0.04%
Upper Big Wood River	22.20	313,278	13,565.18	4.33%
Warm Springs Creek	4.74	180,735	2,289.61	1.27%

Tributary Underflow



Tributary	Scalar	Av Basin Precip A-Ft	Mod A-Ft	% Basin Yield
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Chocolate Gulch	0.01	864	0.58	0.07%
Cold Springs Gulch	0.26	3,341	46.36	1.39%
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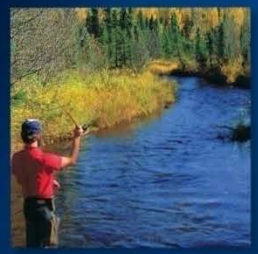
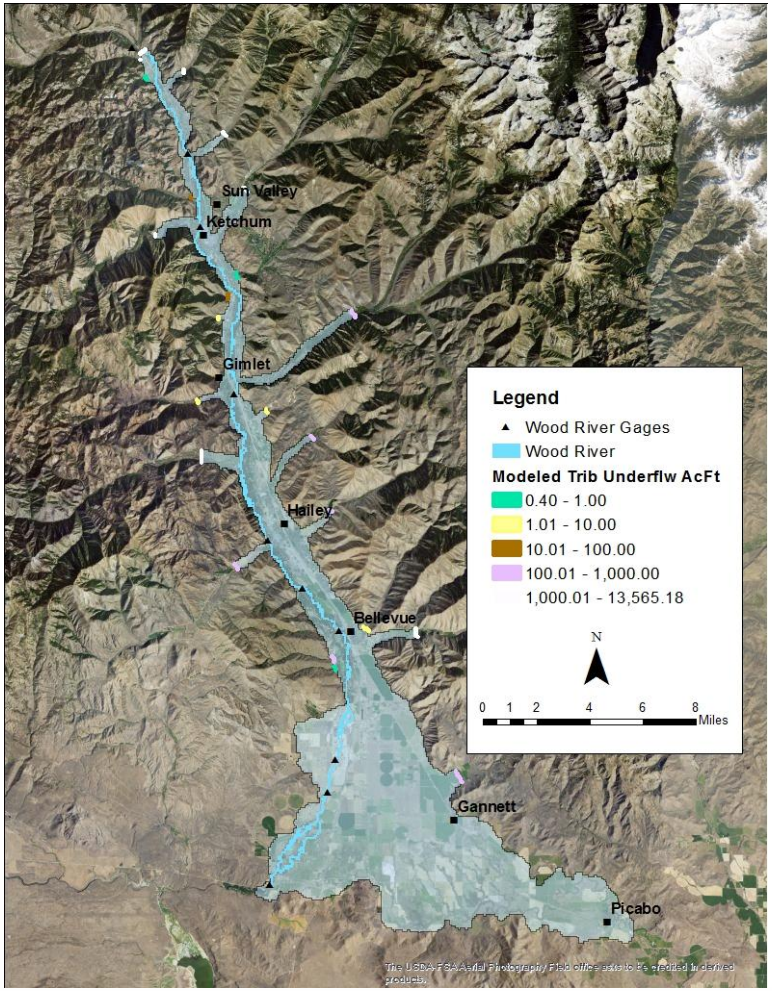
IDAHO Department of Water Resources



End

Tributary Underflow



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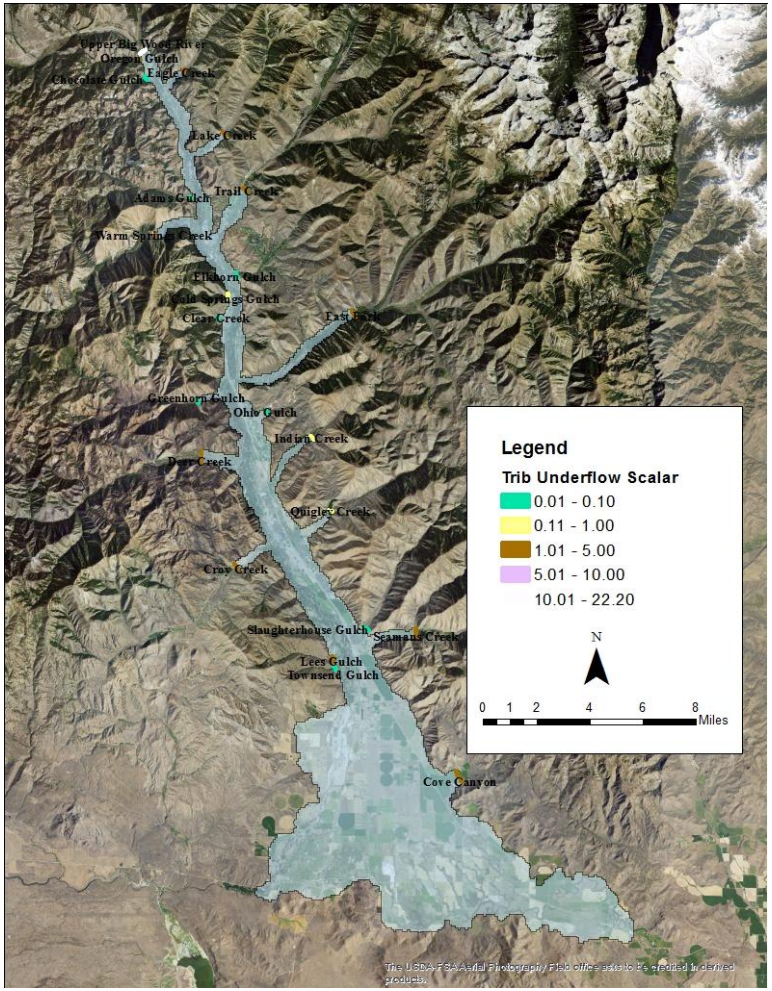
Tributary Underflow



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  - Reduction factor
    - Adjust seasonal amplitude
  - Averaging period
    - 200 day, 300 day, 400 day , etc