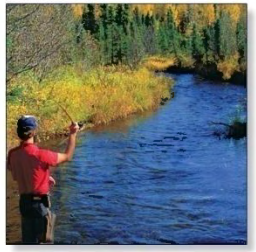
Preliminary Calibration Run

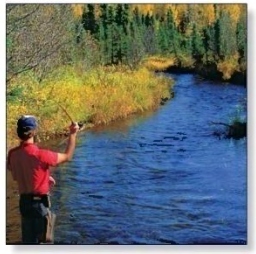
Presented by Allan Wylie, IDWR

May 17, 2018



Reminders

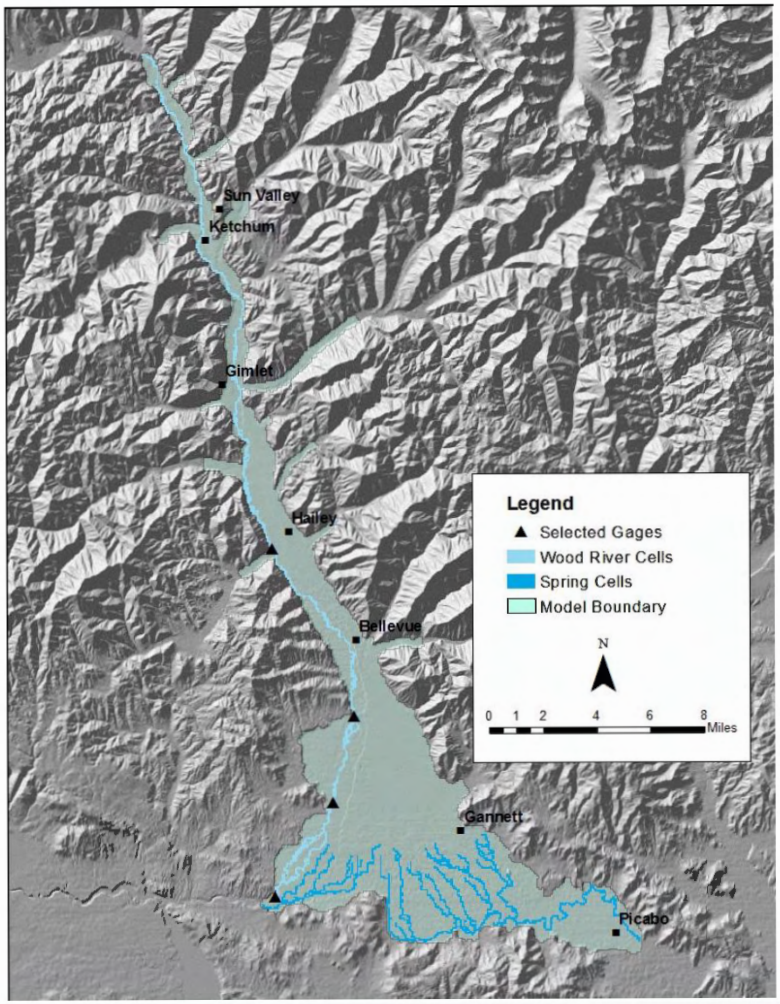
- Set maximum tributary underflow to 20% of average annual precipitation within the basin
- Set kriging limit for Sy to between 0.10 to 0.30
- Added geolocated driller wells
- Stage for Glendale Bridge - Wood River Ranch reach at DEM elevation when it has water



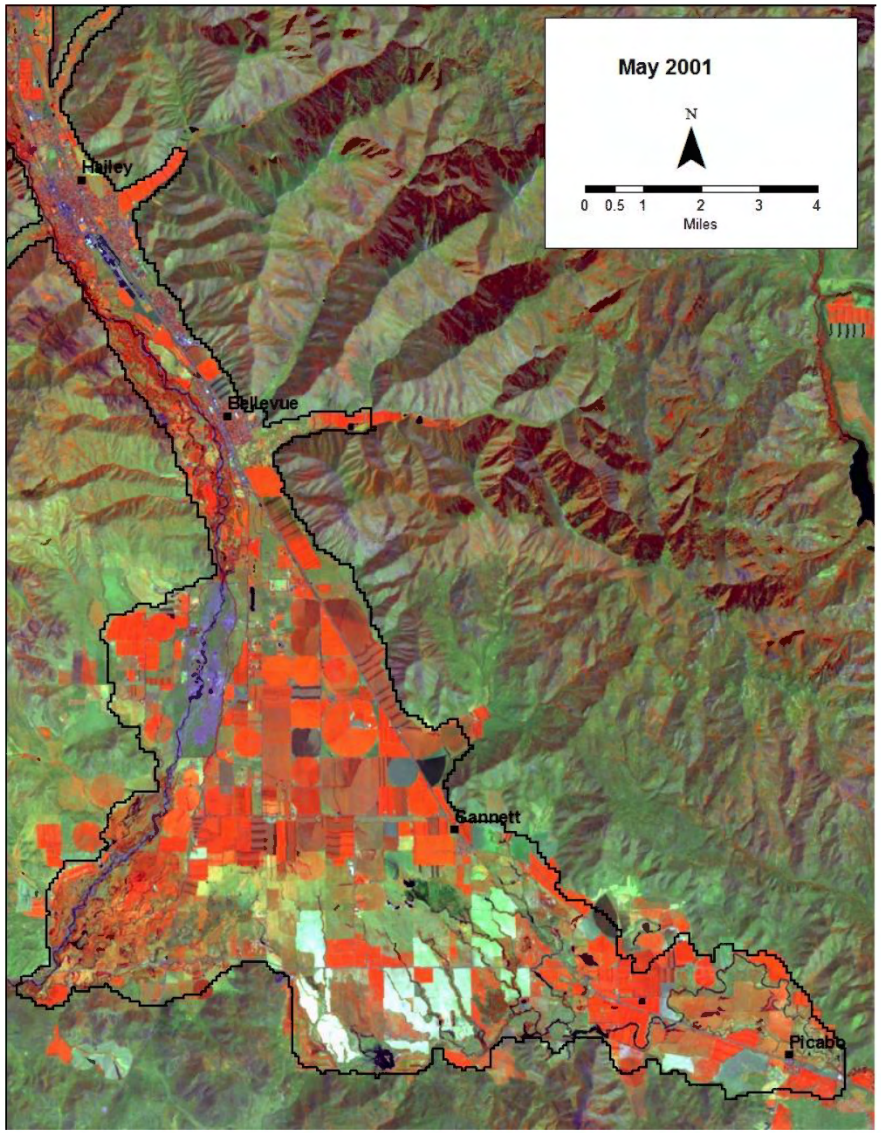
Changes

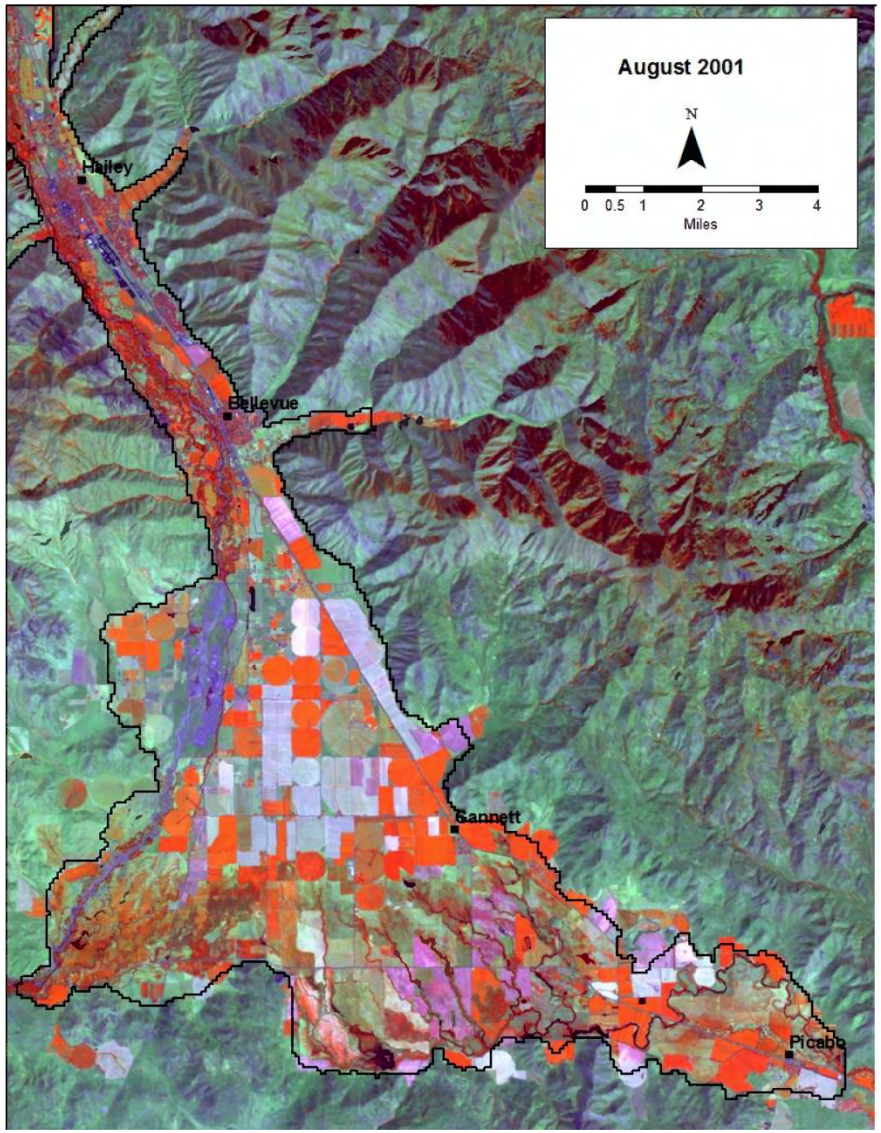
- Used water master records and Landsat photos to determine when Drybed and Wood River Ranch-Stanton Crossing reaches are dry and when they have water

Changes in River file



- Druing irrigation season Glendale Rd to Wood River Ranch dry when water master records indicate it is dry.
  - Remains dry until Landsat photos show it has water
- Wood River Ranch to Stanton Crossing dry when Landsat photos show it is dry


May 2001
N
0 0.5 1 2 3 4
Miles
Hailey
Bellevue
Gannett
Picabo


August 2001
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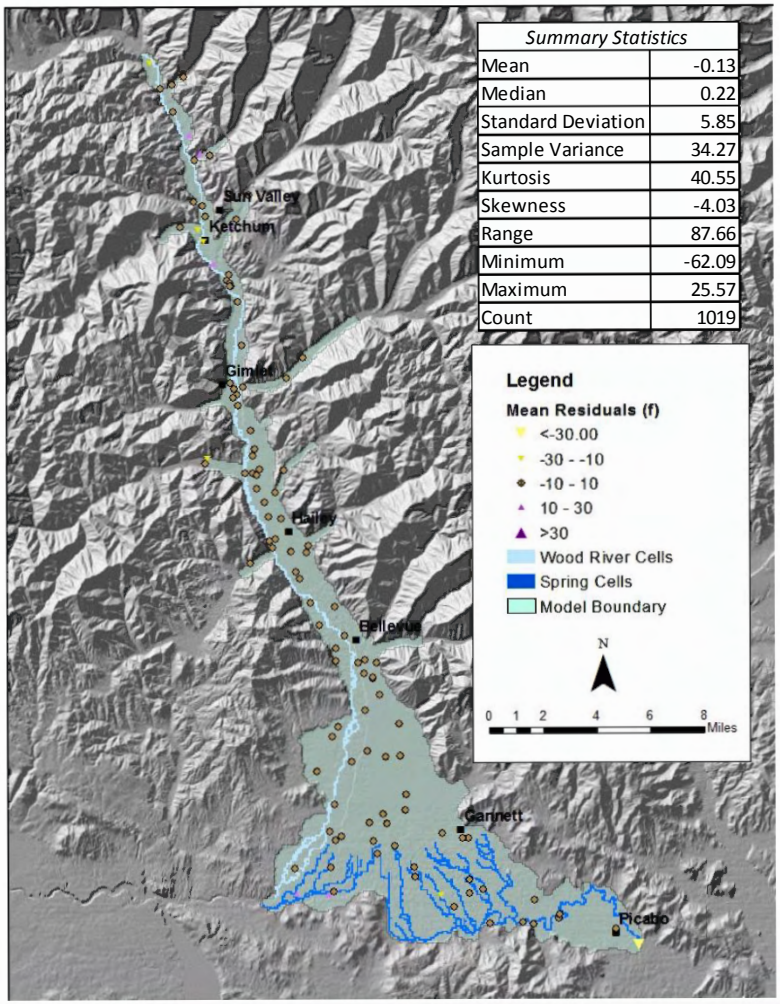
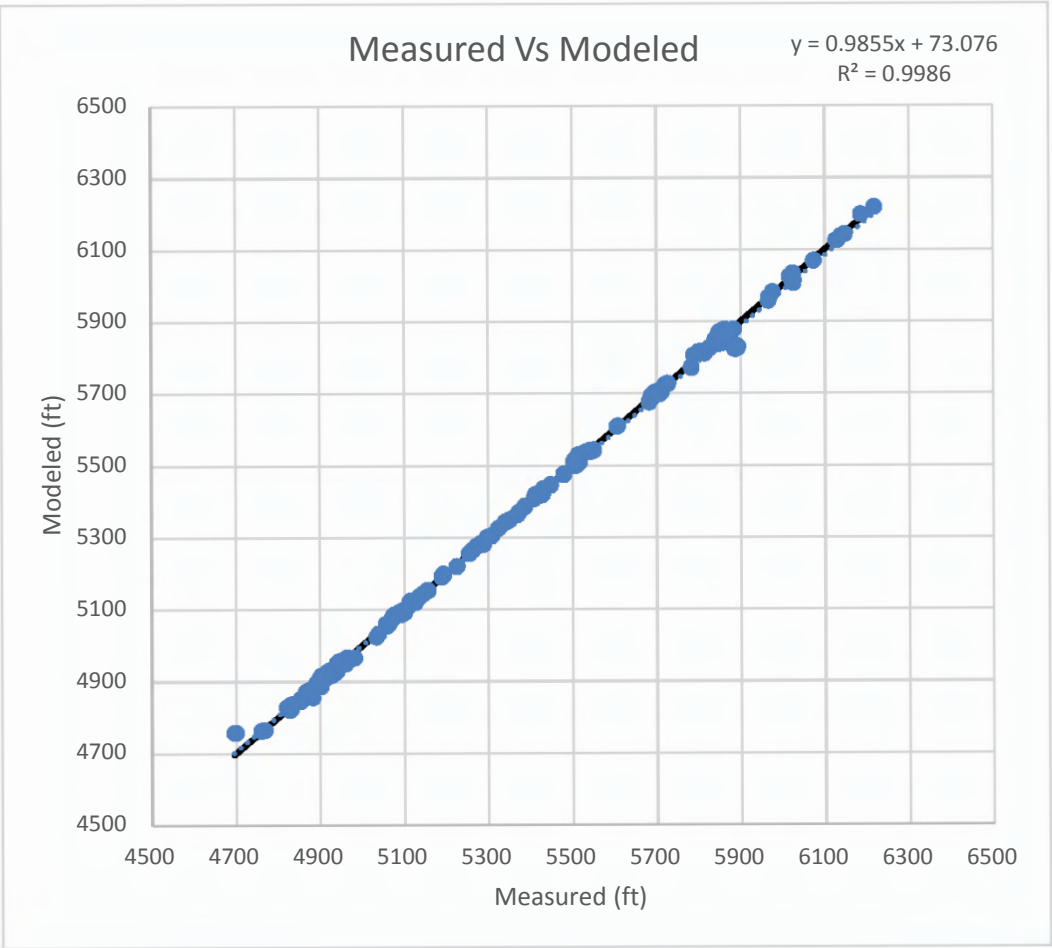
Observation Wells



Summary Statistics	
Mean	-0.13
Median	0.22
Standard Deviation	5.85
Sample Variance	34.27
Kurtosis	40.55
Skewness	-4.03
Range	87.66
Minimum	-62.09
Maximum	25.57
Count	1019

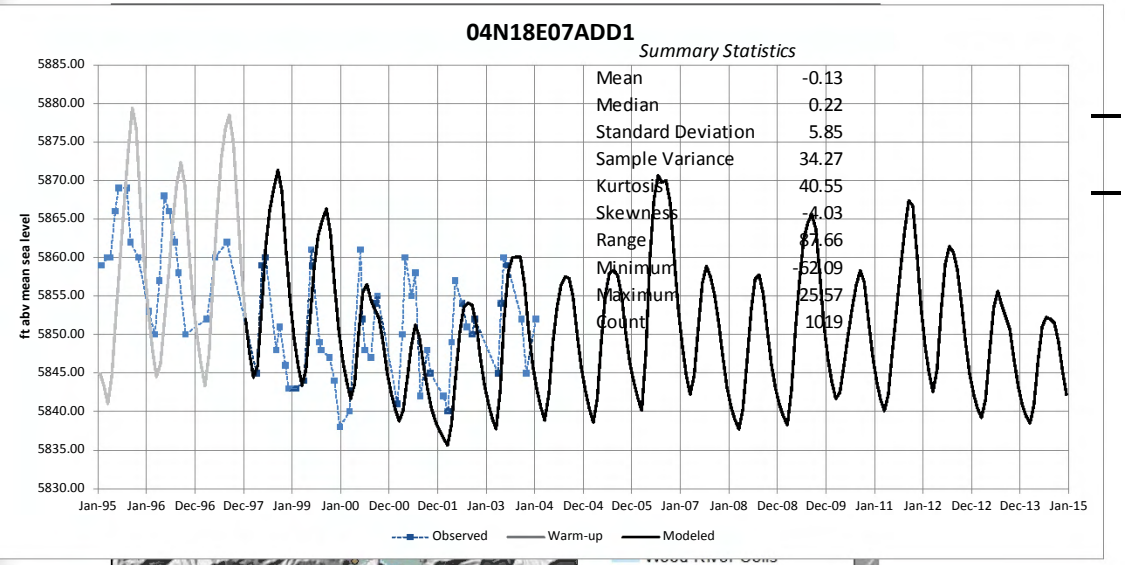
- Wells surveyed
- Total head change from north to south is more than 1,100 ft
  - 30 ft mismatch ~ 2%

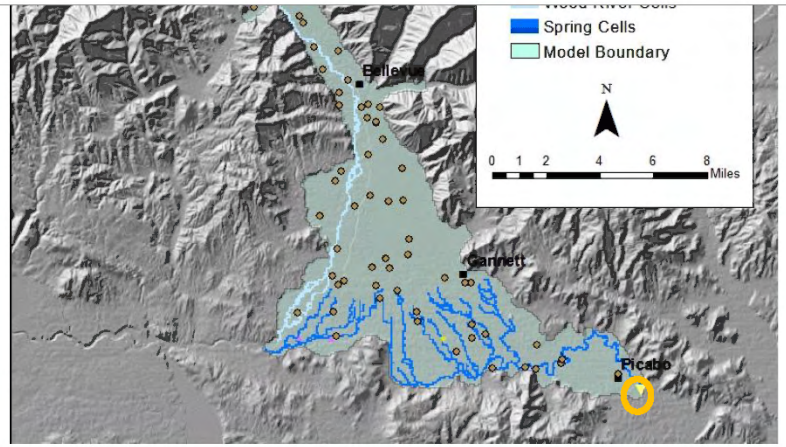
Observation Wells



- Wells surveyed
- Every measured water level plotted
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$

Observation Wells





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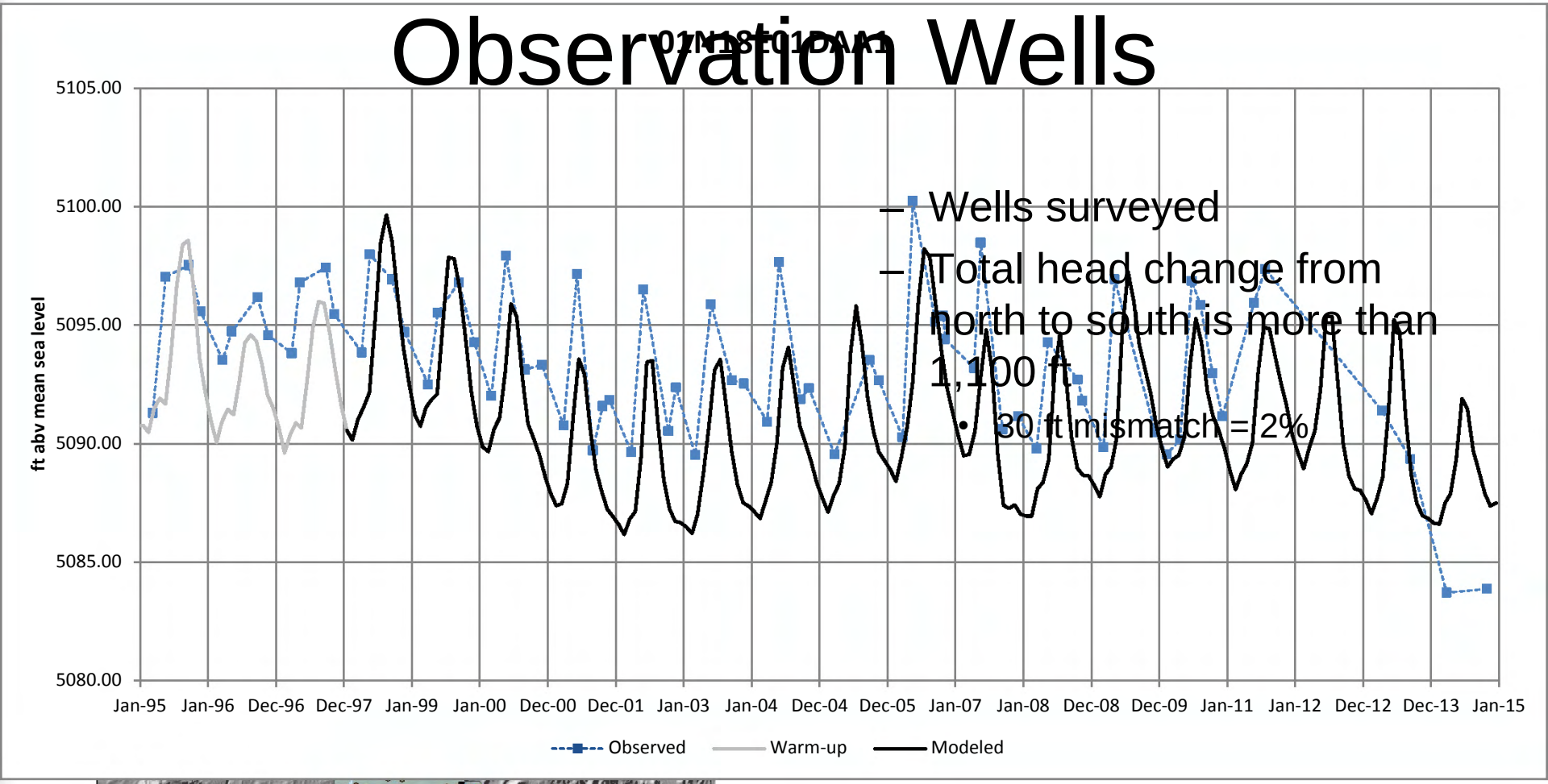

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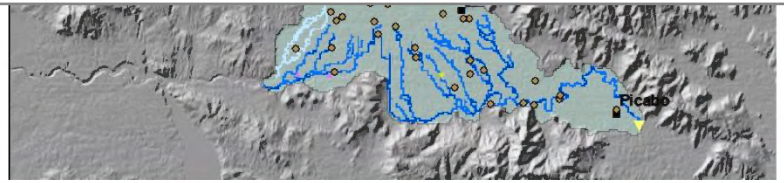

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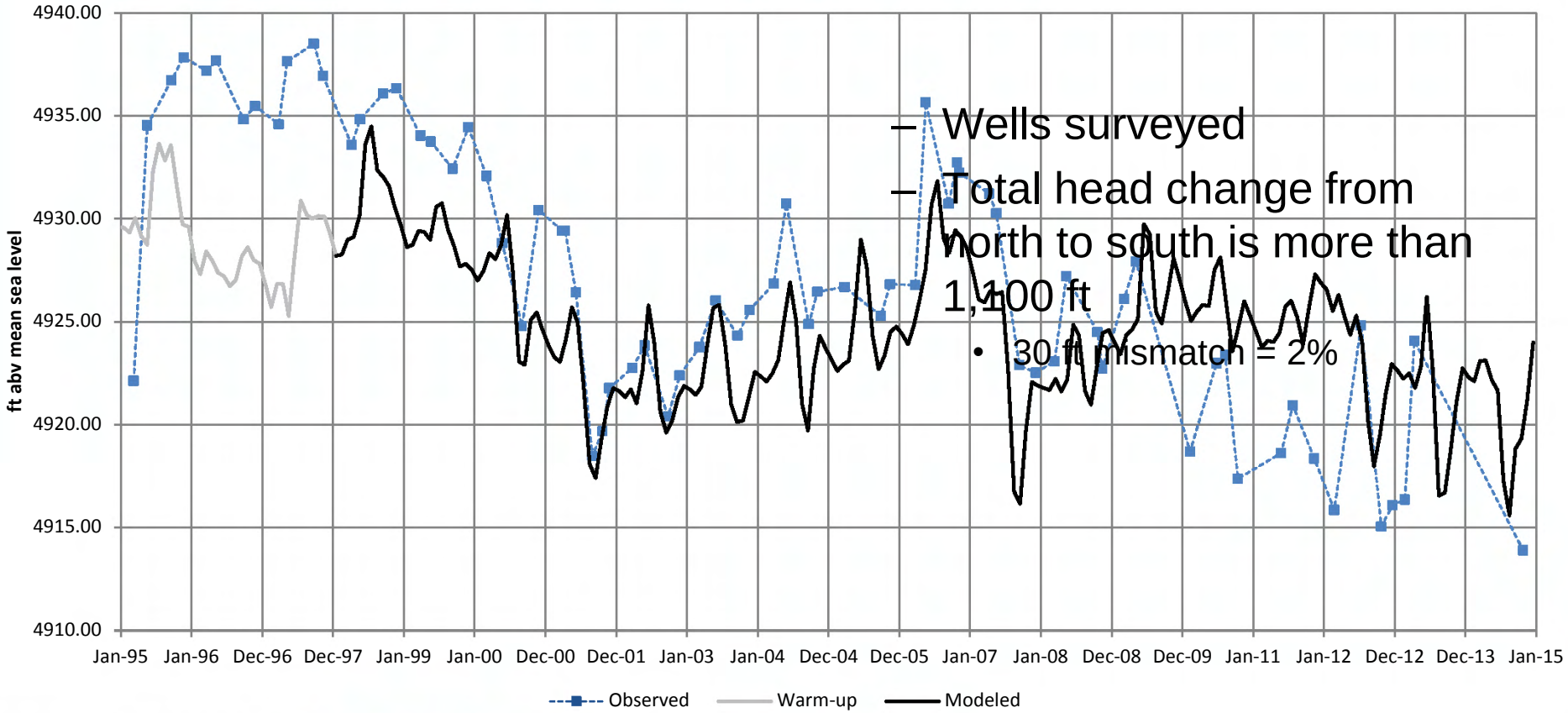

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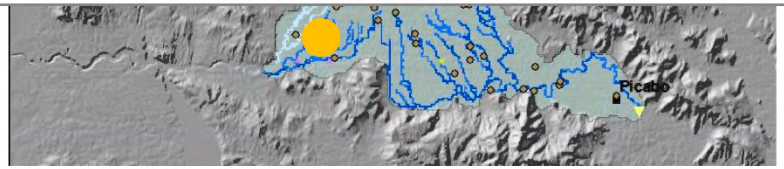

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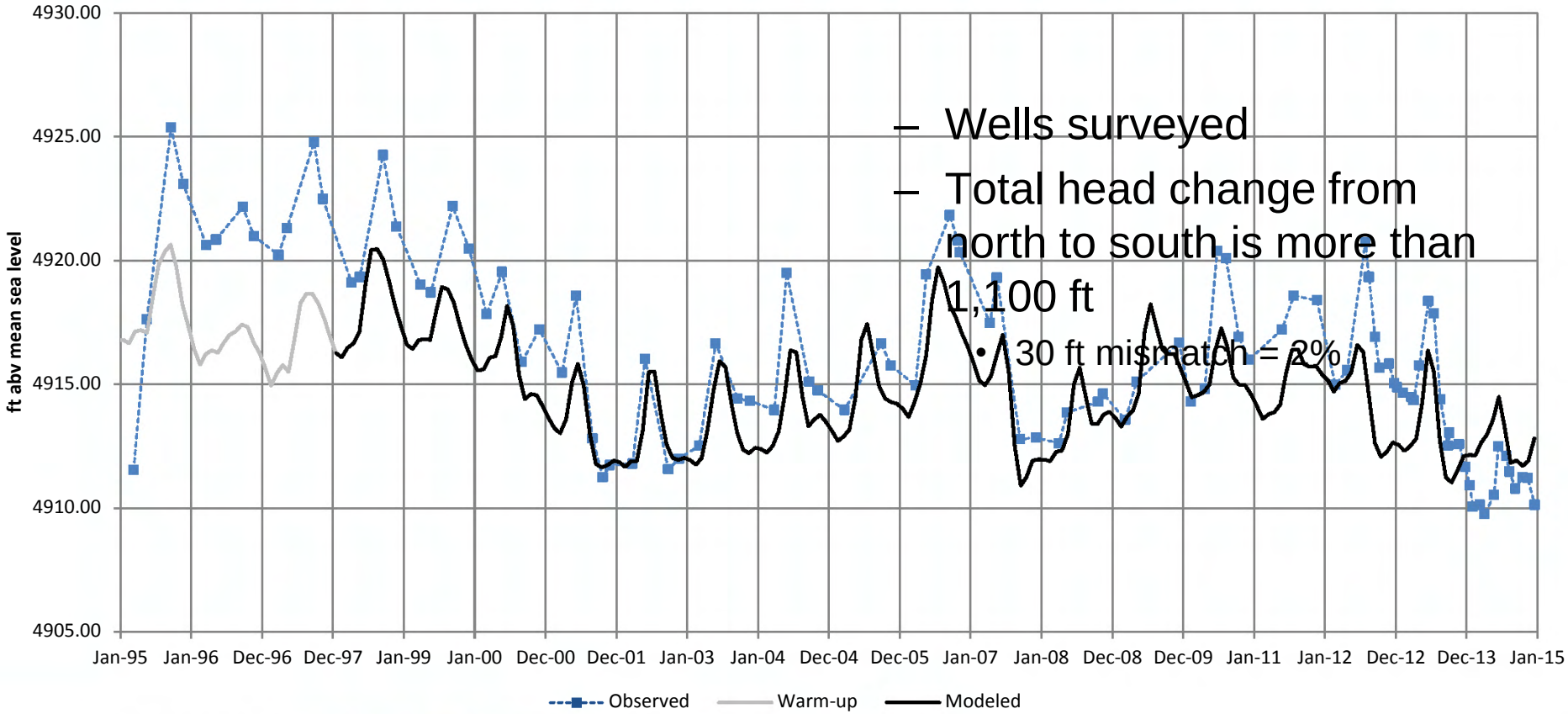

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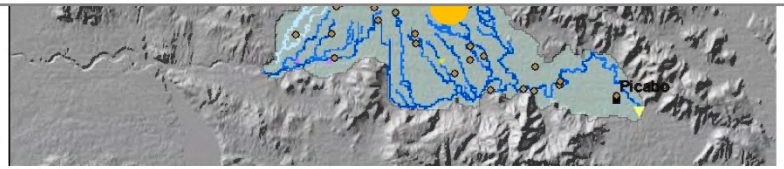

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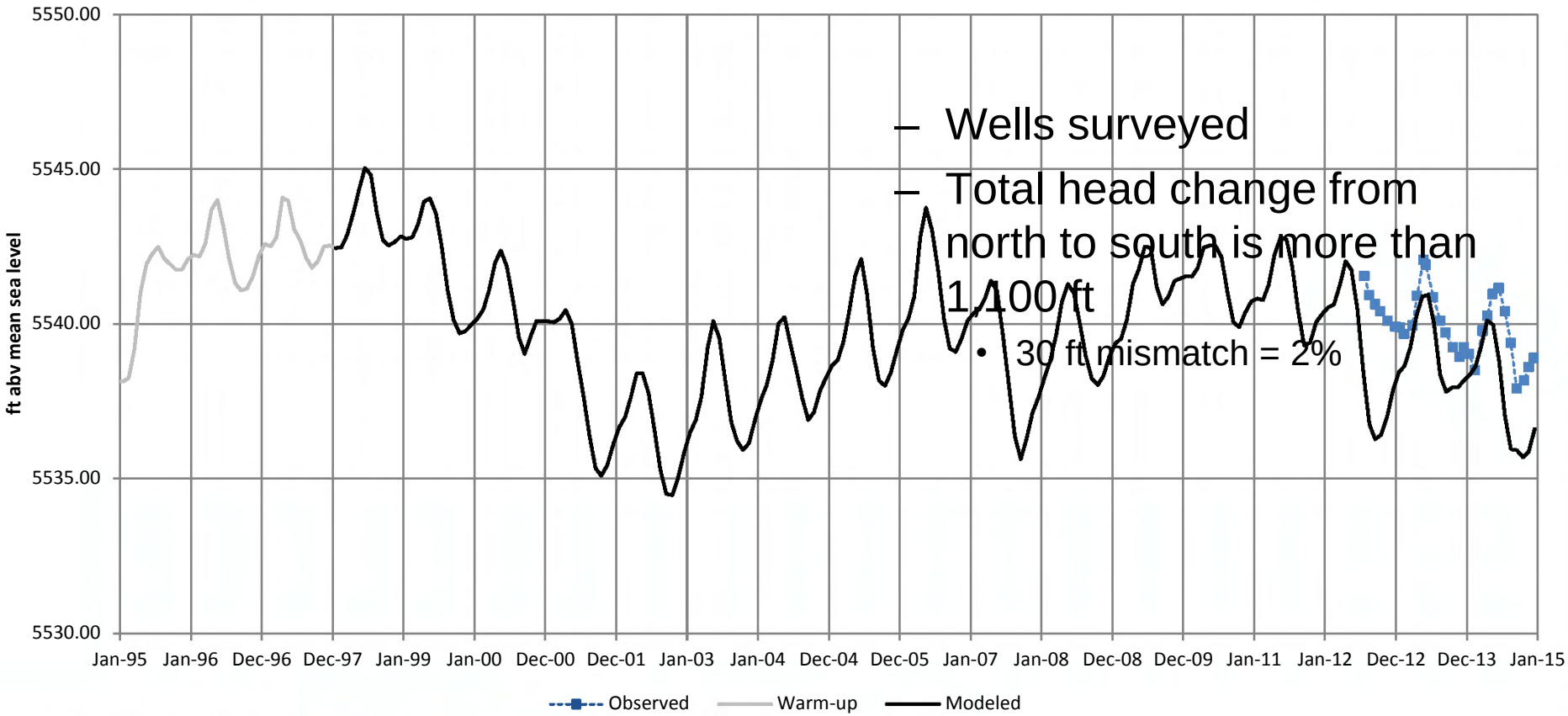

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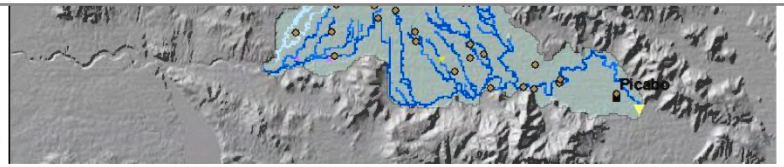

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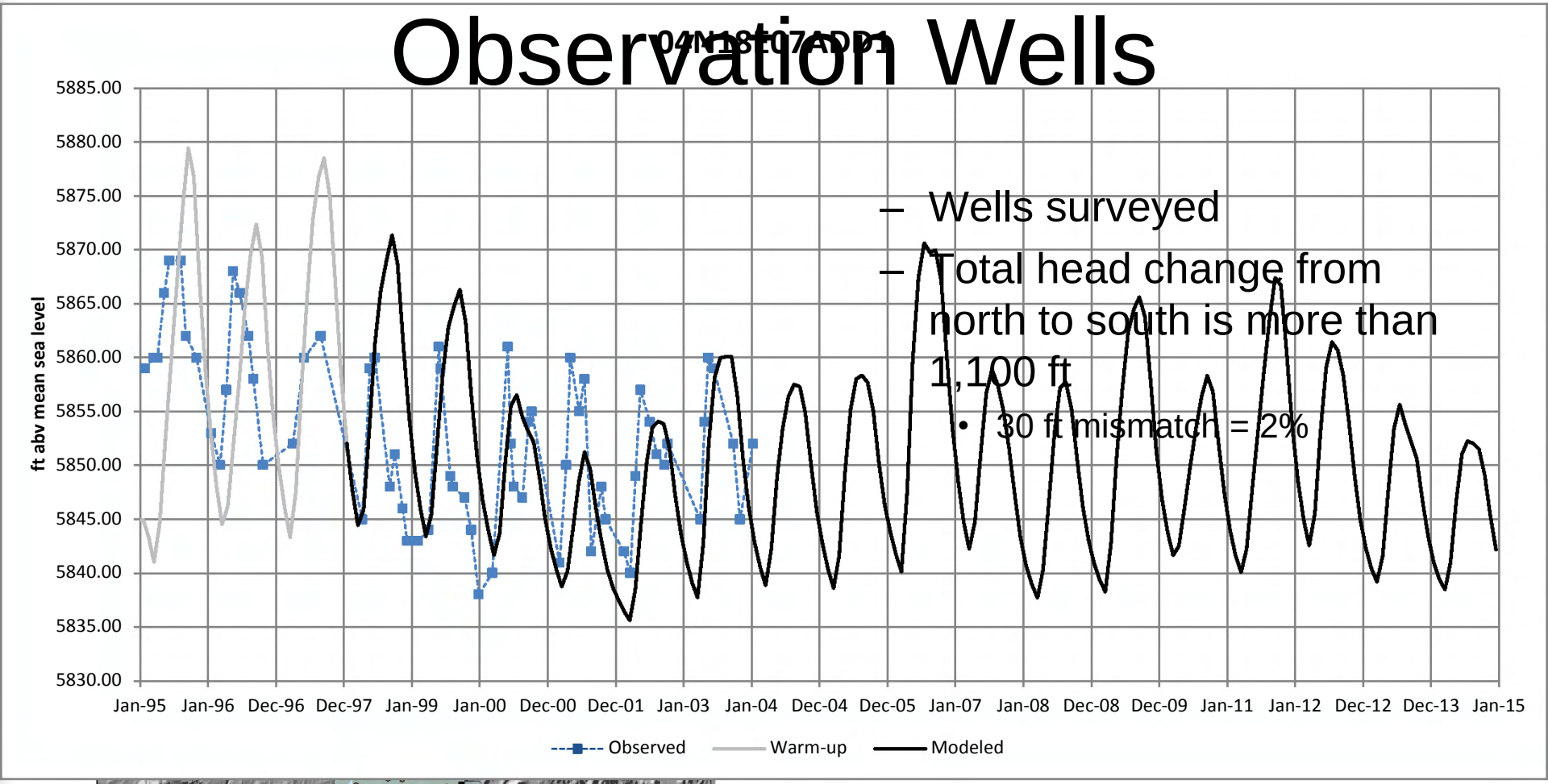

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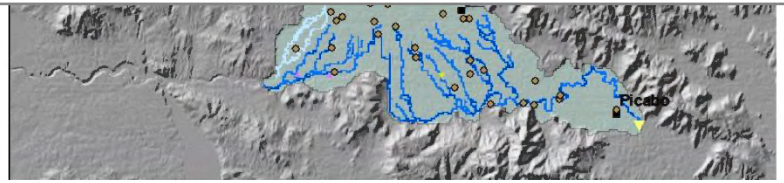

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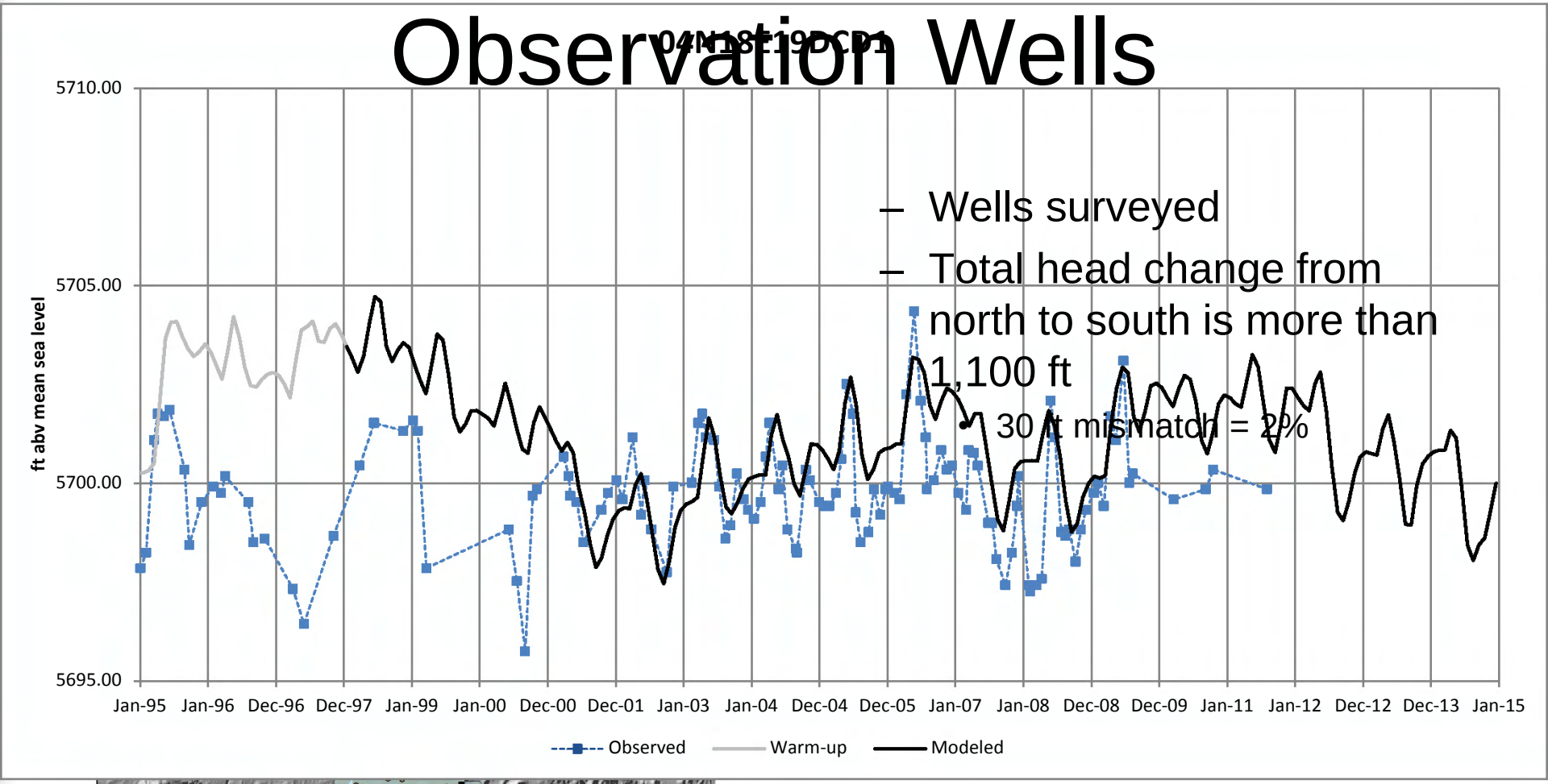

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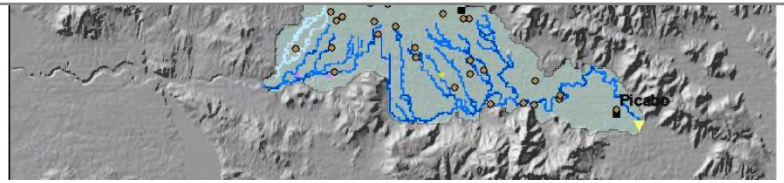

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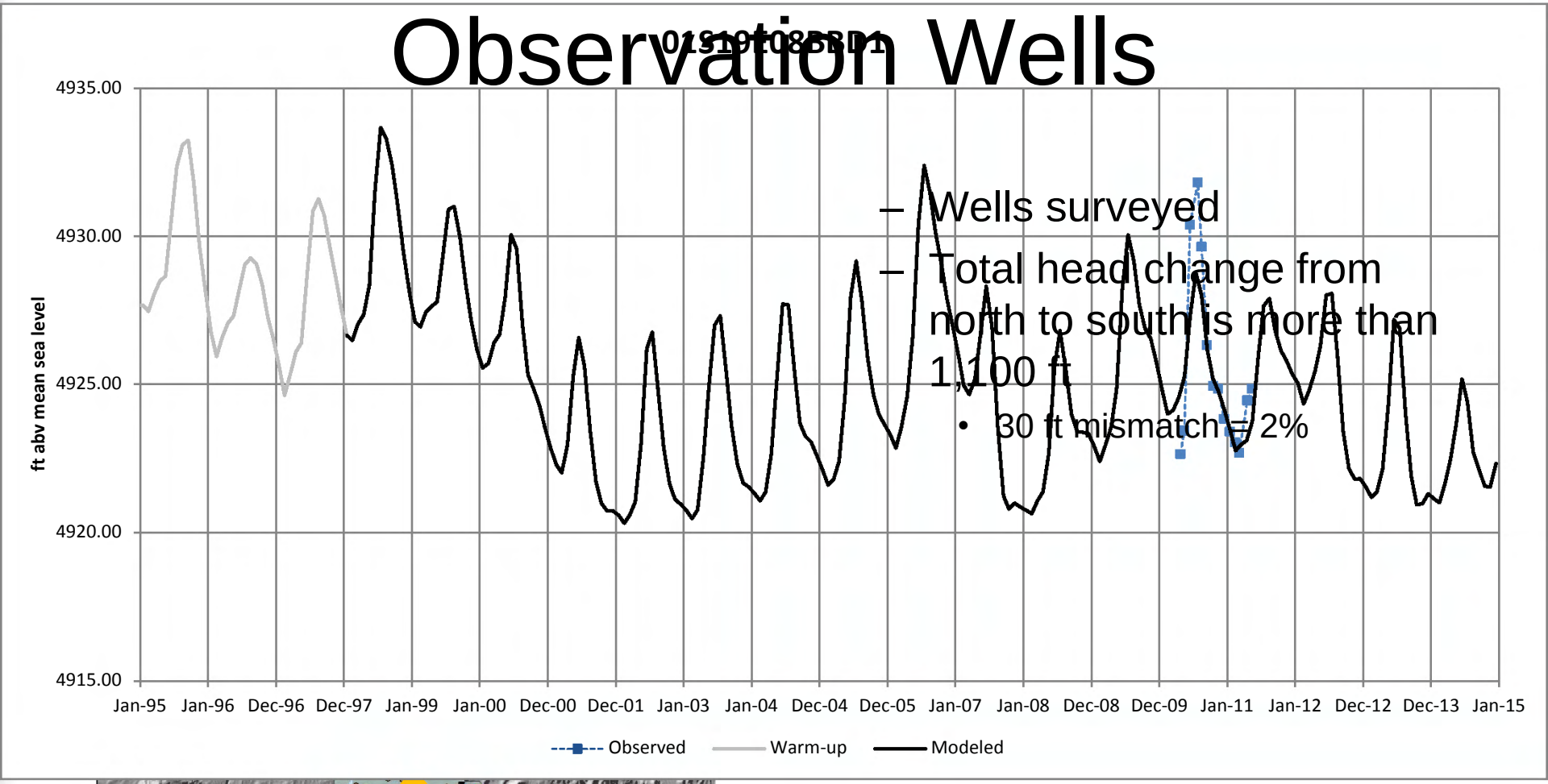

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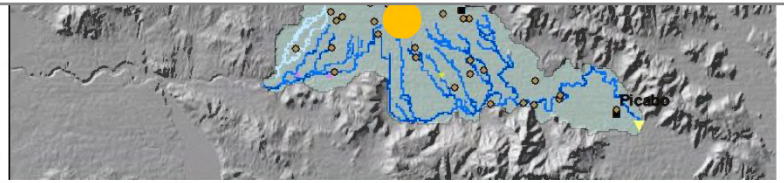

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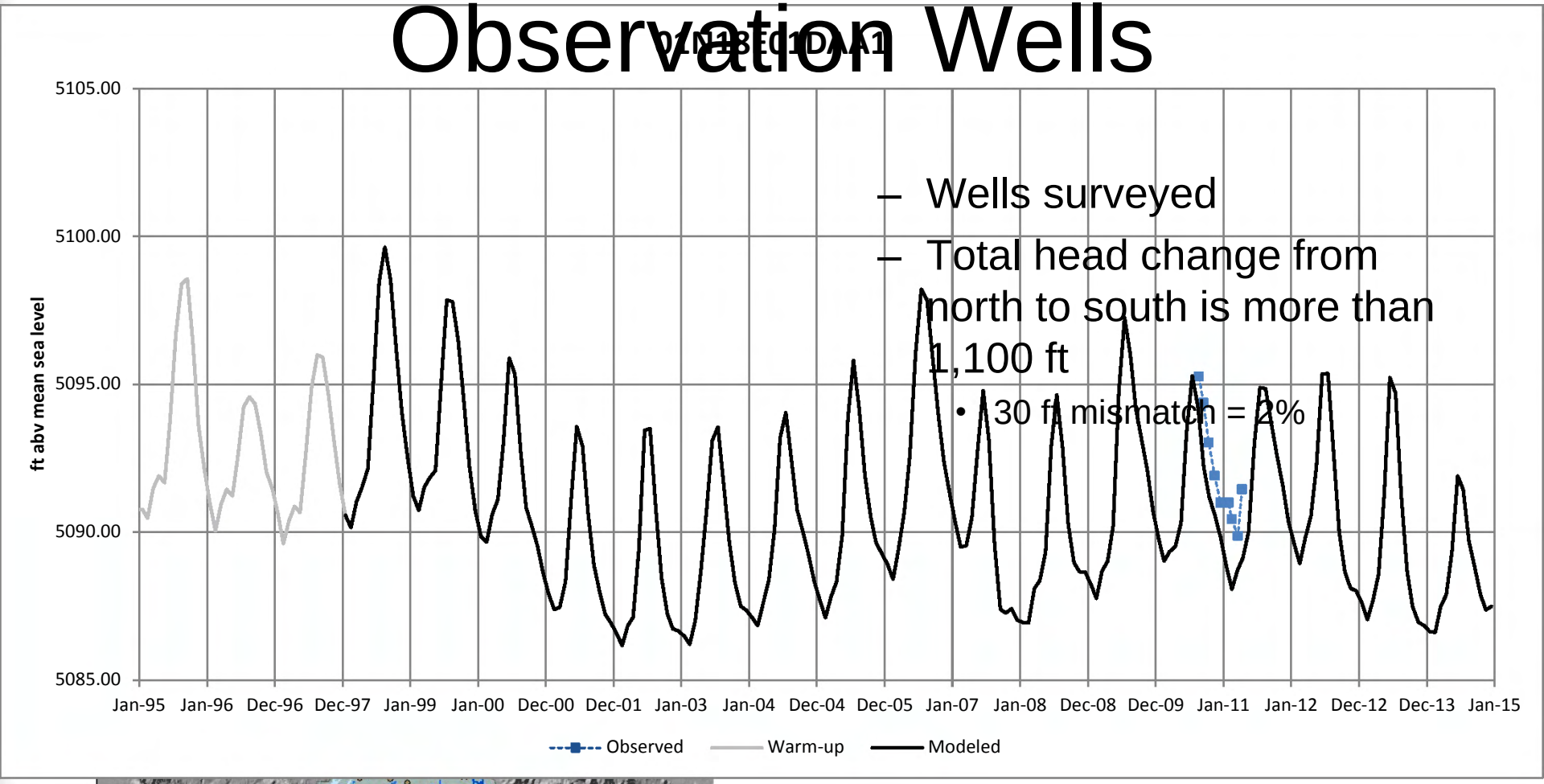

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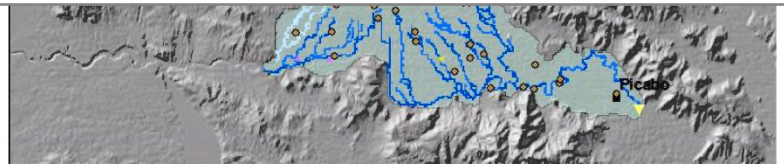
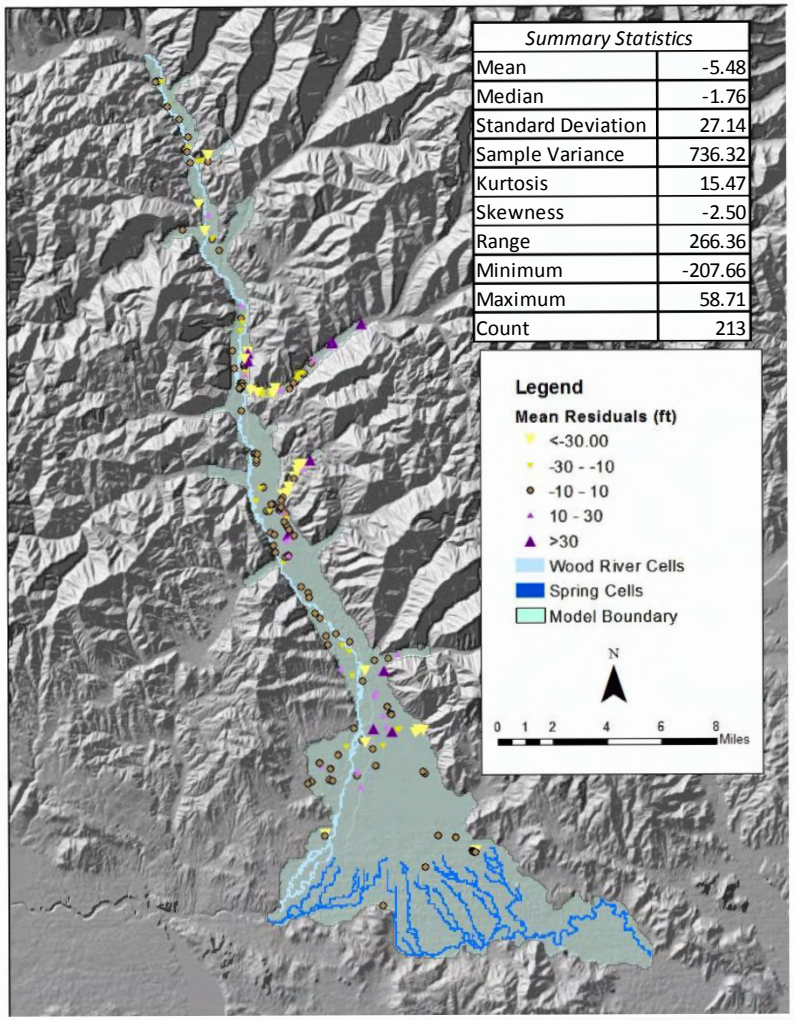


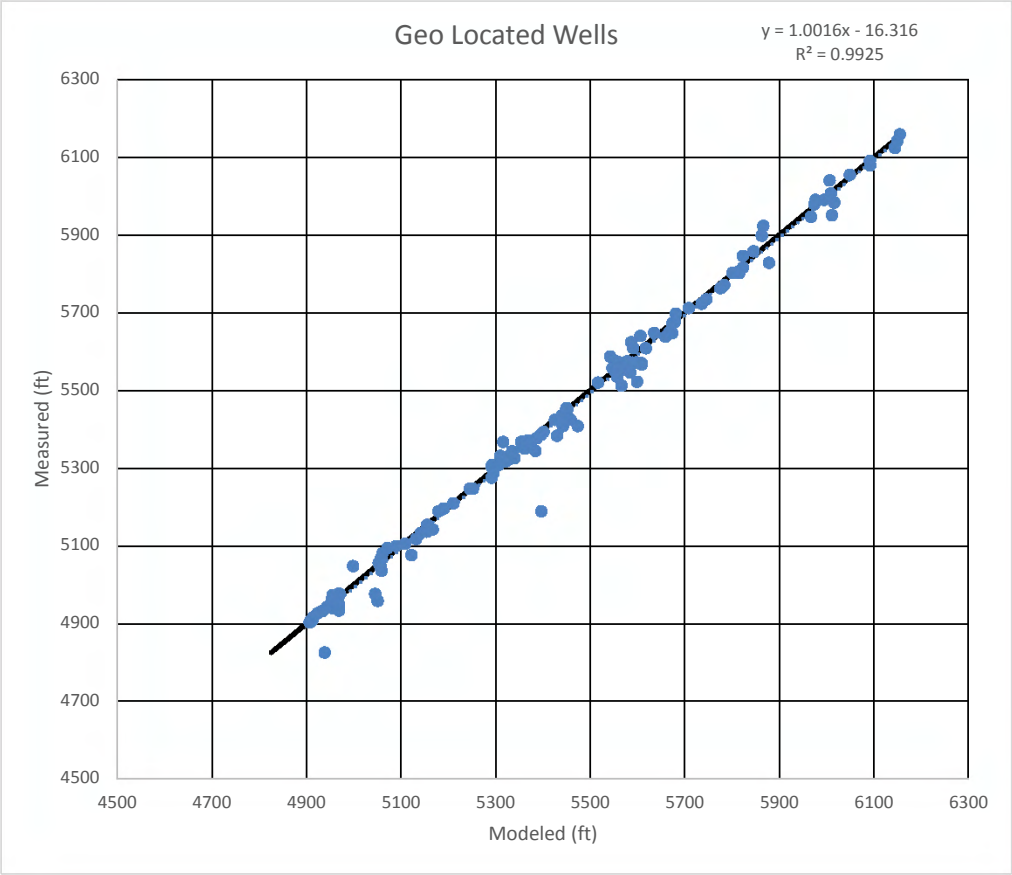
Geo Located Driller Wells



Summary Statistics	
Mean	-5.48
Median	-1.76
Standard Deviation	27.14
Sample Variance	736.32
Kurtosis	15.47
Skewness	-2.50
Range	266.36
Minimum	-207.66
Maximum	58.71
Count	213

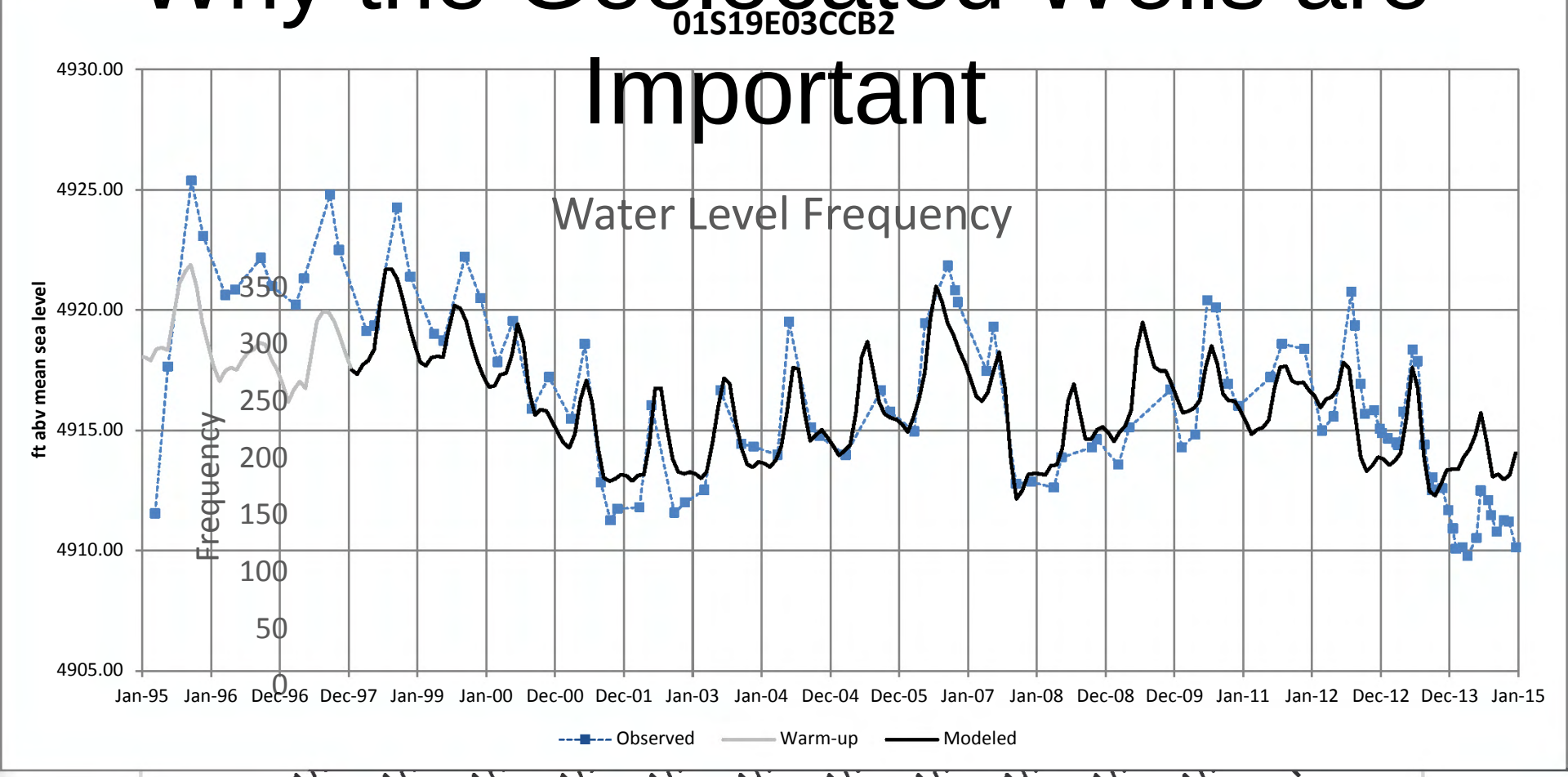
- Wells located by driller using GPS or address
- Measured by driller

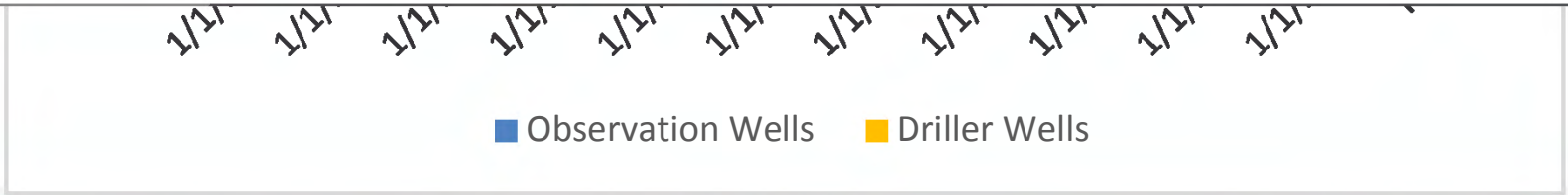
Driller Wells



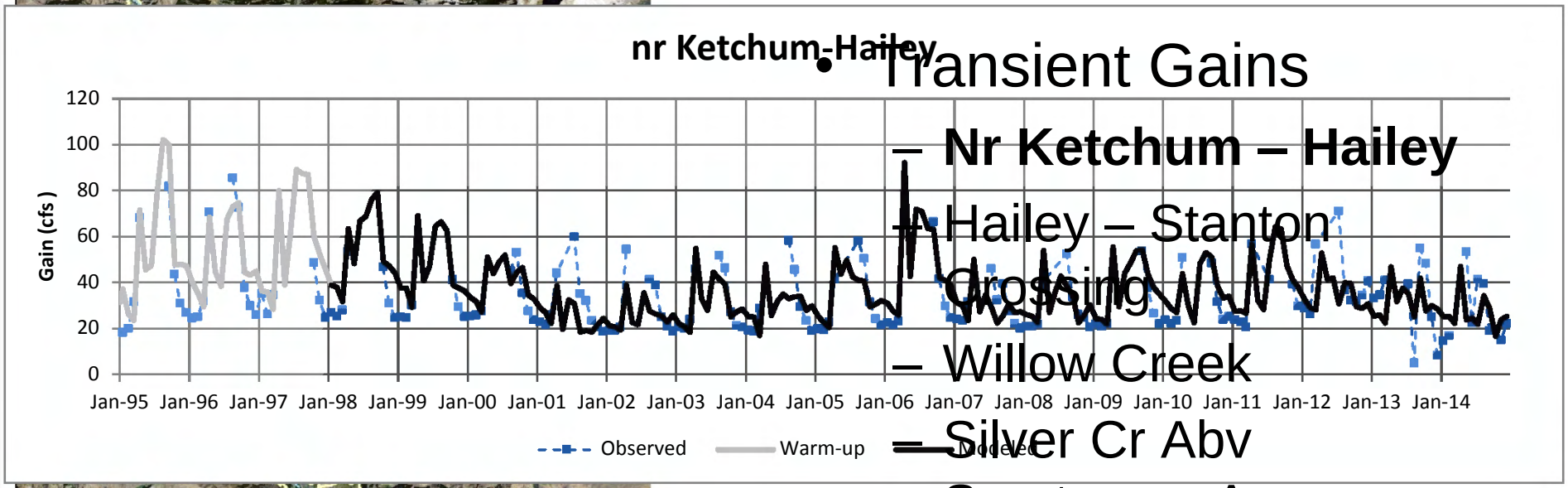
- Wells located by hand held GPS or address
- Measured by driller
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$

Why the Geolocated Wells are Important



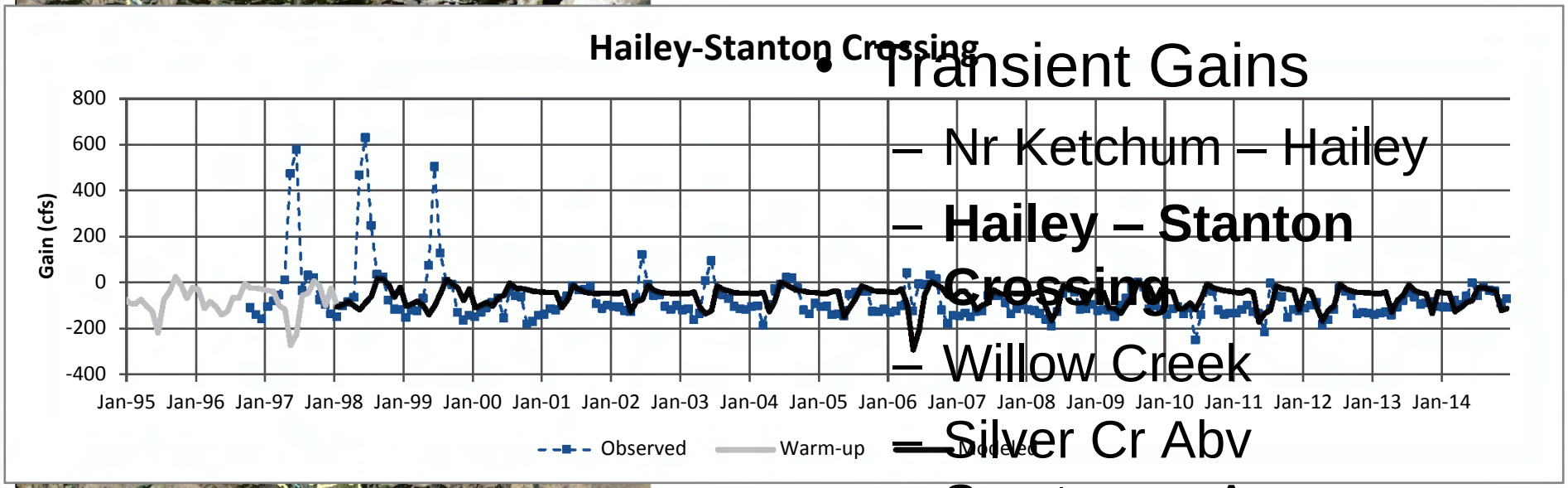


River Gains and Losses



- Transient Gains
  - **Nr Ketchum – Hailey**
  - Hailey – Stanton Crossing
  - Willow Creek
  - Silver Cr Abv Sportsman Access
  - Silver Cr Blw Sportsman Access

River Gains and Losses



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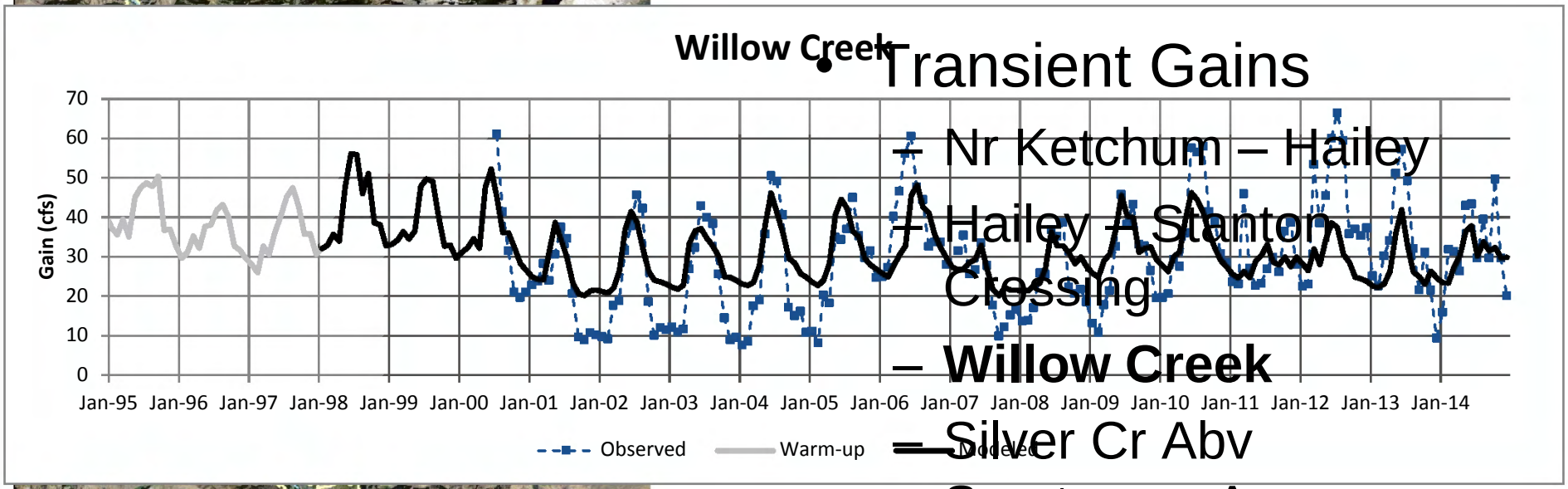
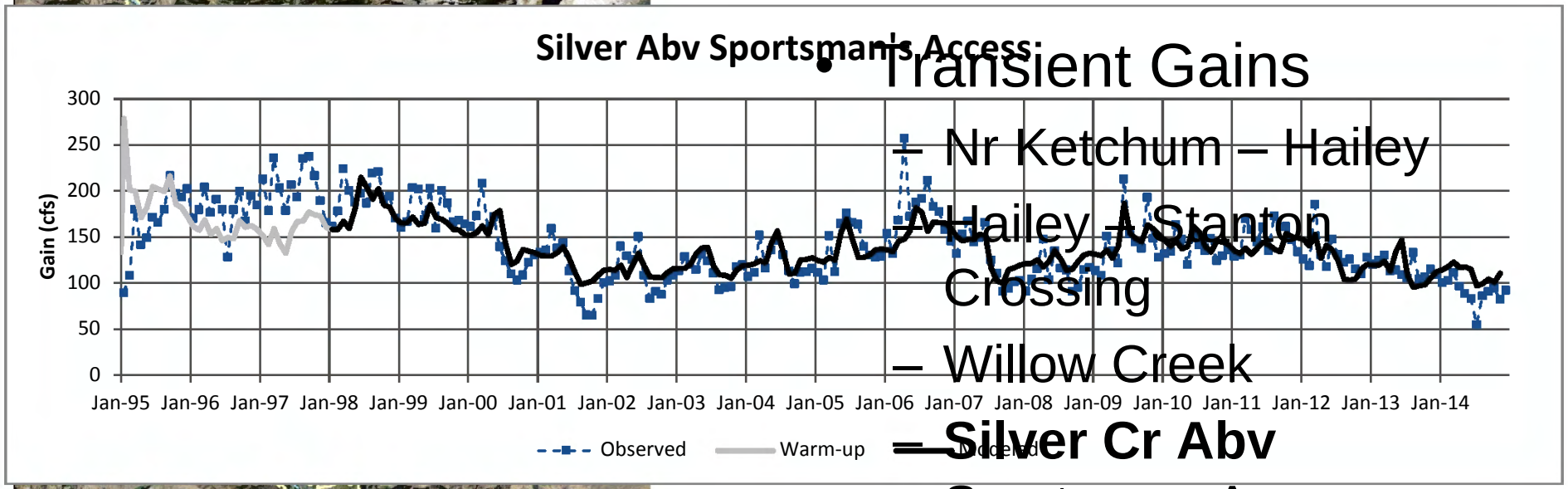
River Gains and Losses



- Transient Gains
  - Nr Ketchum – Hailey
  - Hailey – Stanton Crossing
  - **Willow Creek**
  - Silver Cr Abv Sportsman Access
  - Silver Cr Blw Sportsman Access

River Gains and Losses



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  - Nr Ketchum – Hailey
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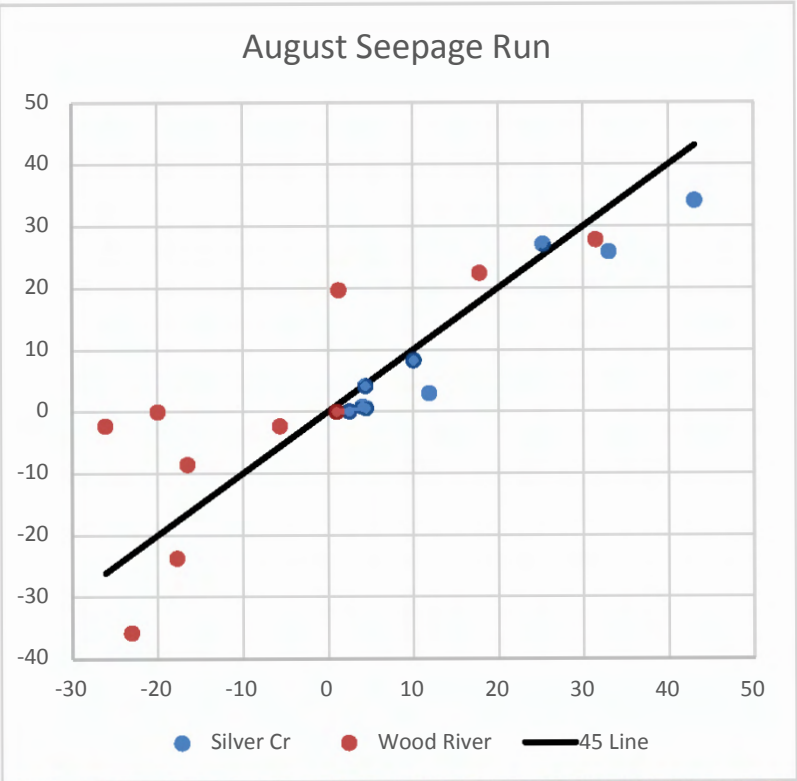
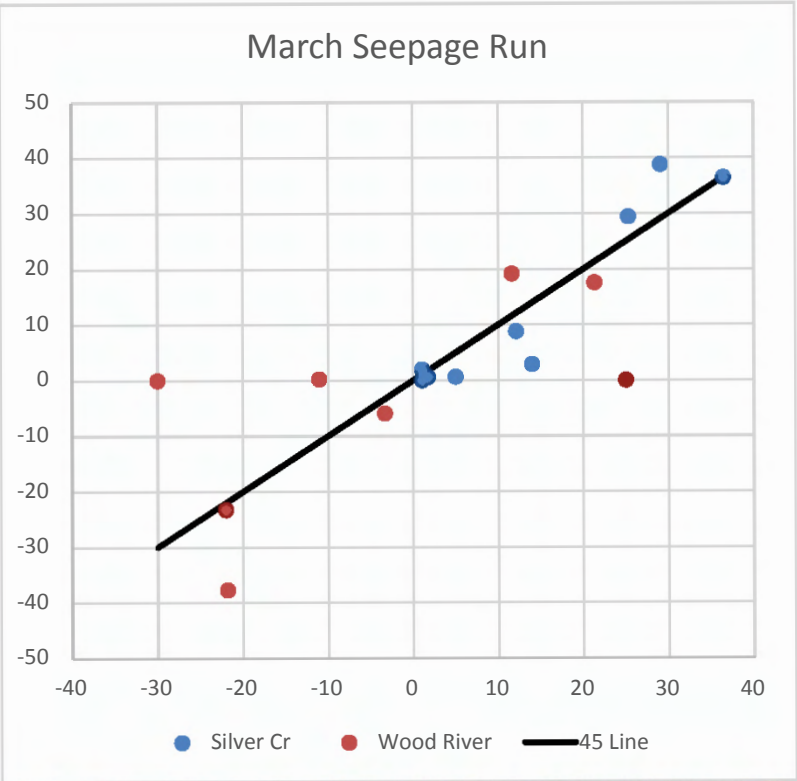
River Gains and Losses



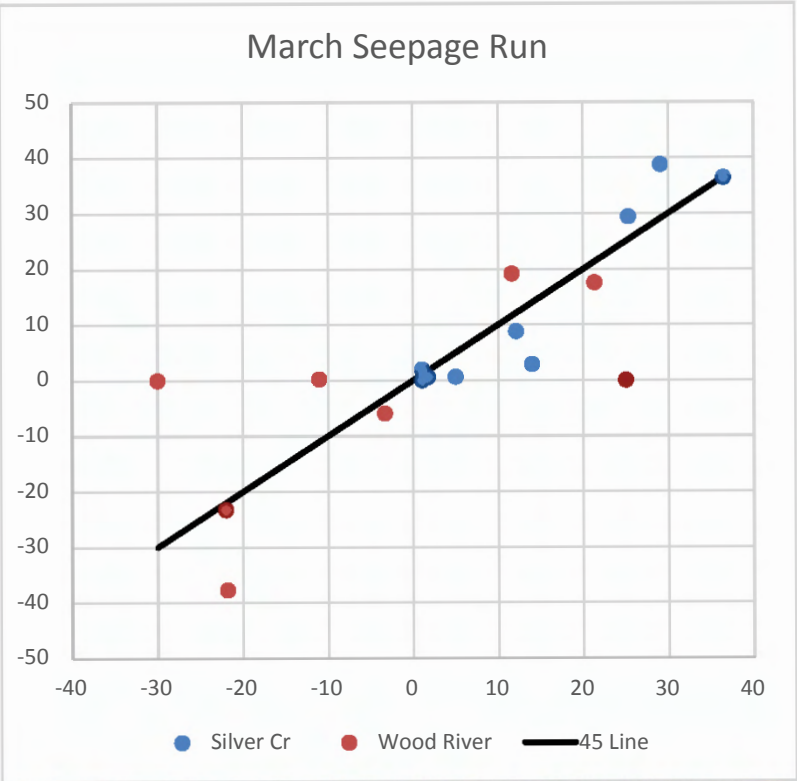
- August 2012 Seepage Run

River Gains and Losses



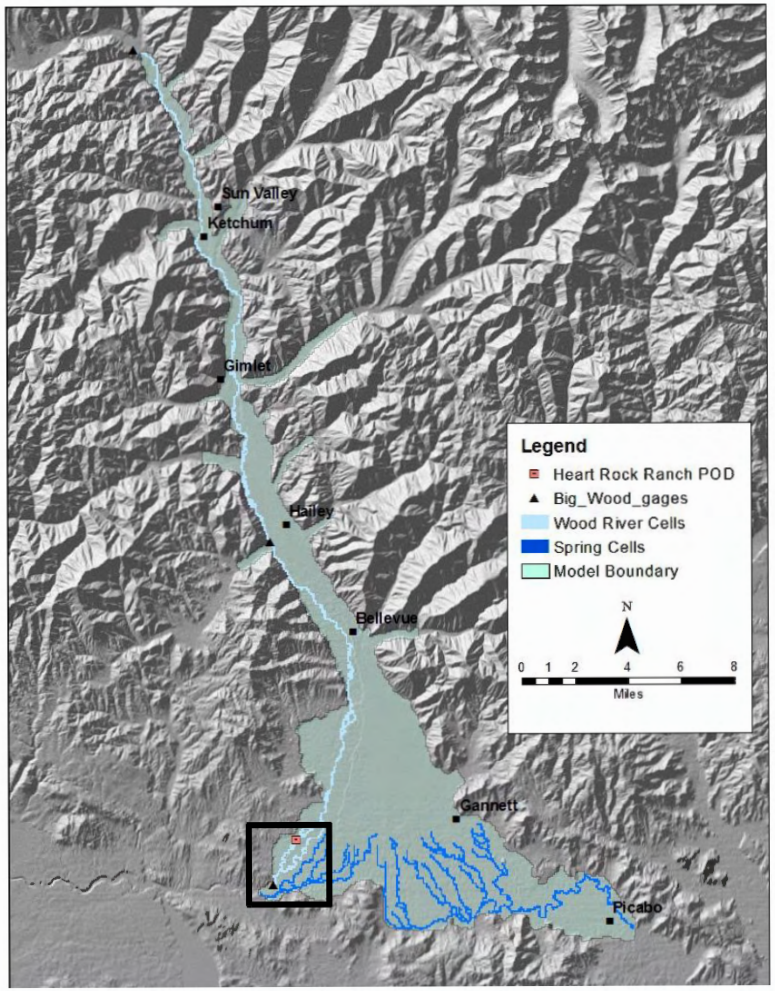
- October 2012 Seepage Run

River Gains and Losses



- March 2013 Seepage Run

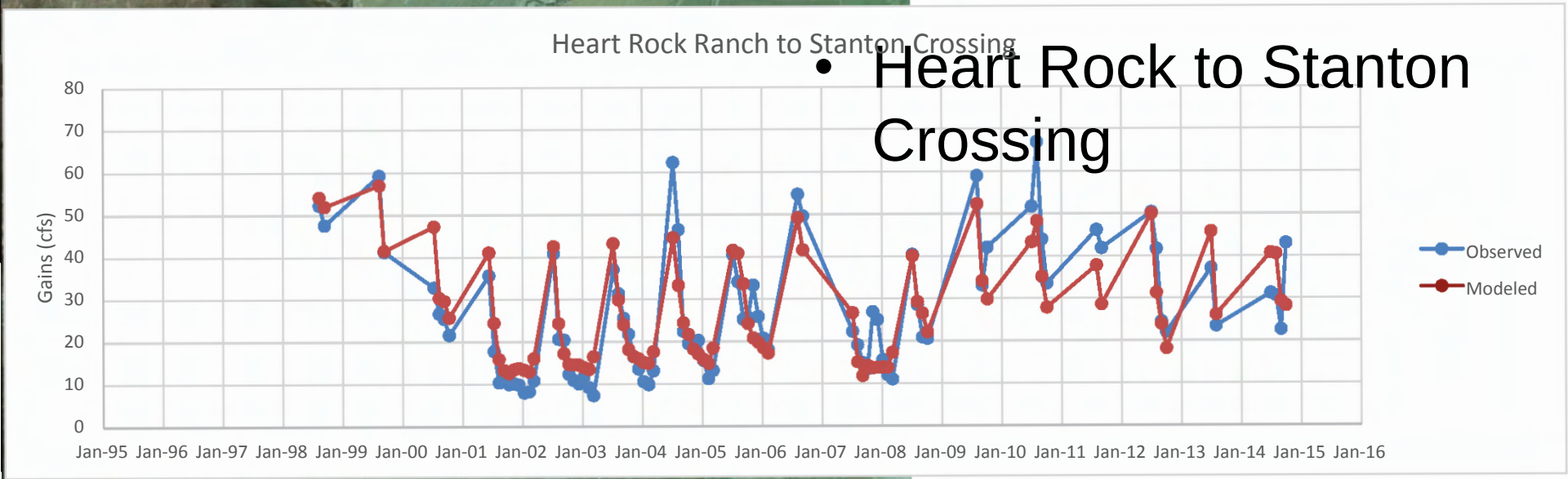
River Gains and Losses



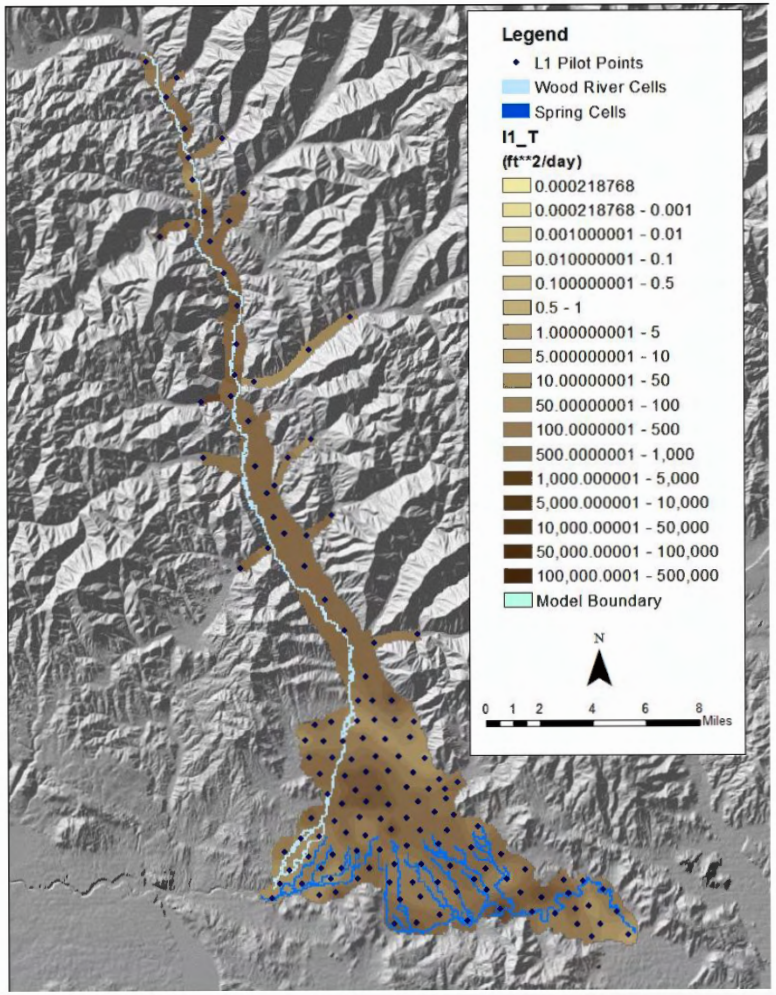
- Heart Rock Ranch to Stanton Crossing

River Gains and Losses

- Heart Rock to Stanton Crossing



Layer 1 Transmissivity



- 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 = 0.05 ft/day
  - Max = 1,965 ft/day
  - Mean = 30 ft/day

Layer 1 Hydraulic Conductivity

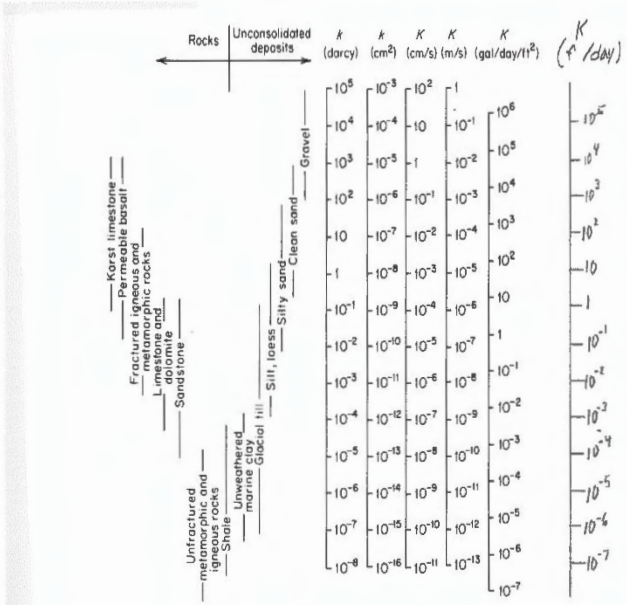


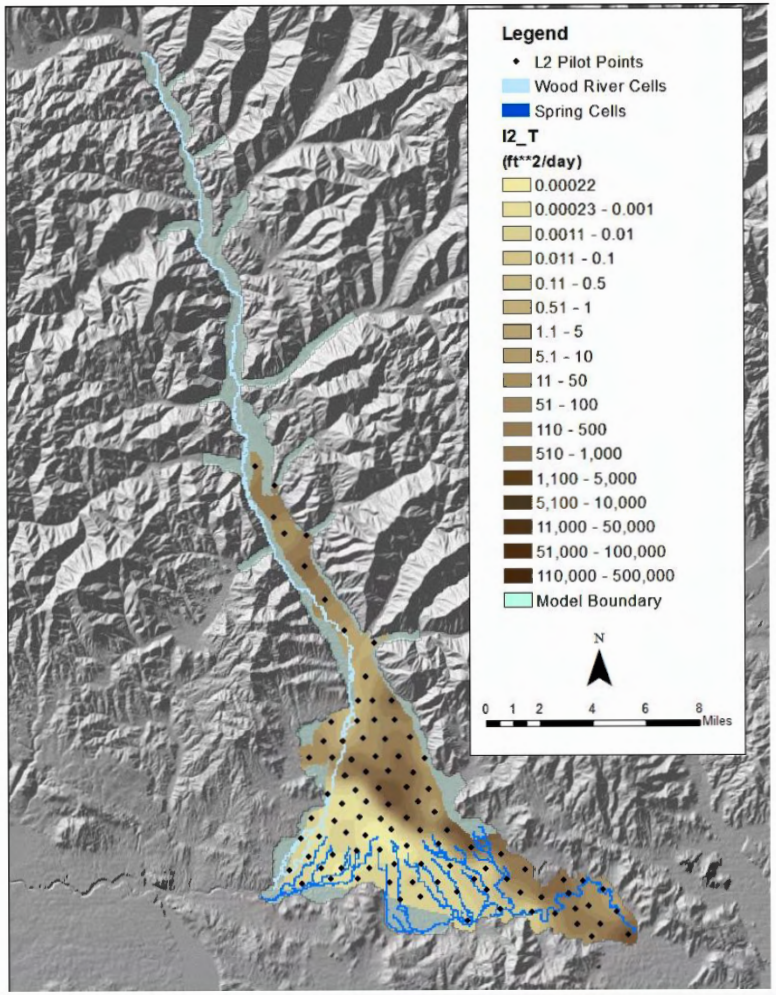
Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm²	ft²	darcy	m/s	ft/s	U.S. gal/day/ft²
cm²	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft²	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

Groundwater, Freeze & Cherry, 1979

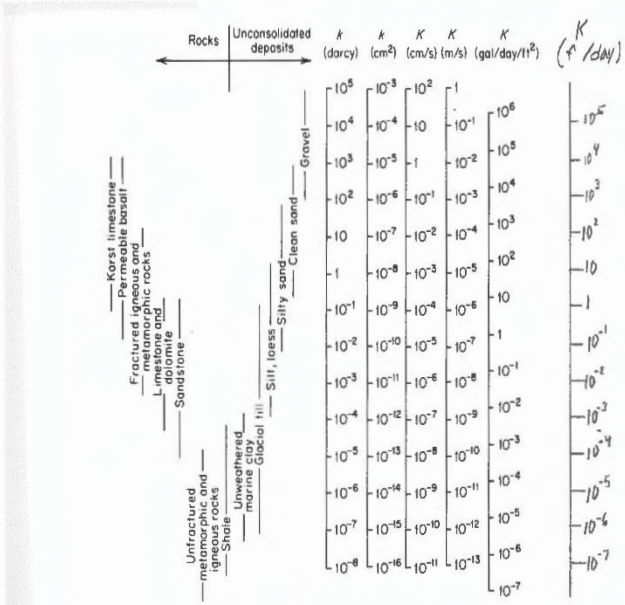
- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 0.05 ft/day
  - Max = 1,965 ft/day
  - Mean = 30 ft/day

Layer 2 Hydraulic Conductivity



- Layer 2 modeled as confined
- No zones, allows PEST to select values
- Includes basalt in east
- Includes confining layer
- Sand and gravel aquifer in valley and triangle
  - Min = 0.001 ft/day
  - Max = 103 ft/day
  - Mean = 74 ft/day

Layer 2 Hydraulic Conductivity



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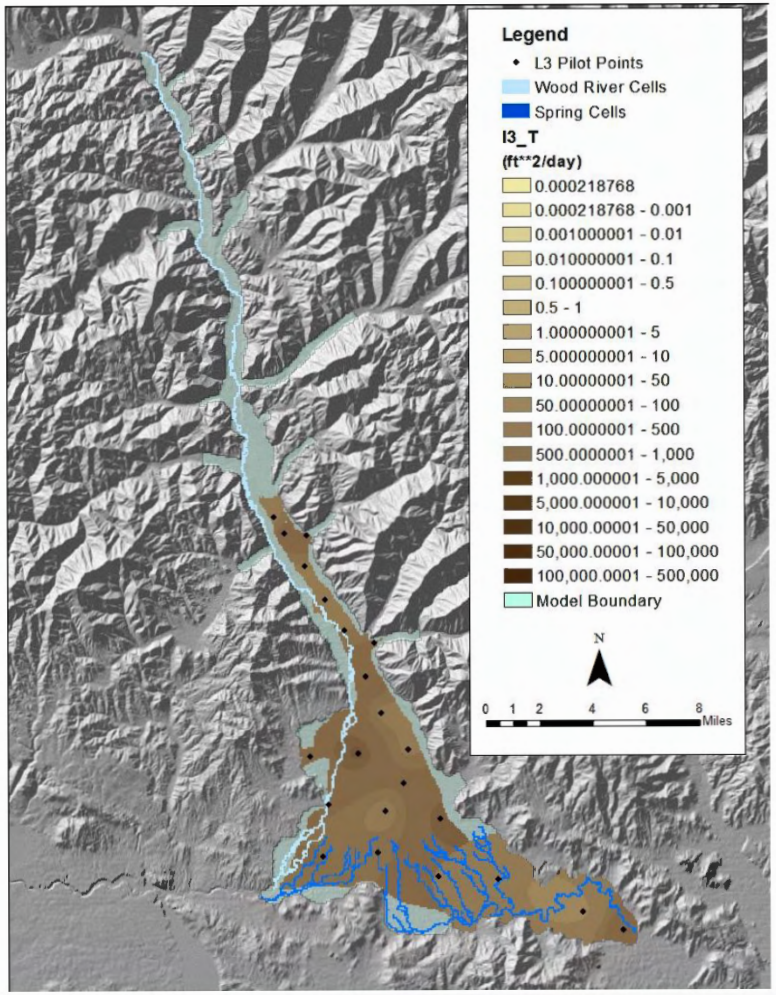
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	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

Groundwater, Freeze & Cherry, 1979

- Low hydraulic conductivity in confining layer
  - Min = 0.00001 ft/day
  - Max = 0.007 ft/day
- Basalt
  - Min = 0.0004 ft/day
  - Max = 213 ft/day
- Sand and gravel In valley and triangle
  - Min = 0.001 ft/day
  - Max = 103 ft/day
  - Mean = 74 ft/day

Layer 3 Hydraulic Conductivity



- Layer 3 modeled as confined
- Basalt
  - Min = 185 ft/day
  - Max = 3,123 ft/day
- Sand and gravel aquifer in valley and triangle
  - Min = 53.2 ft/day
  - Max = 12,170 ft/day
  - Mean = 1,441 ft/day

Layer 3 Hydraulic Conductivity

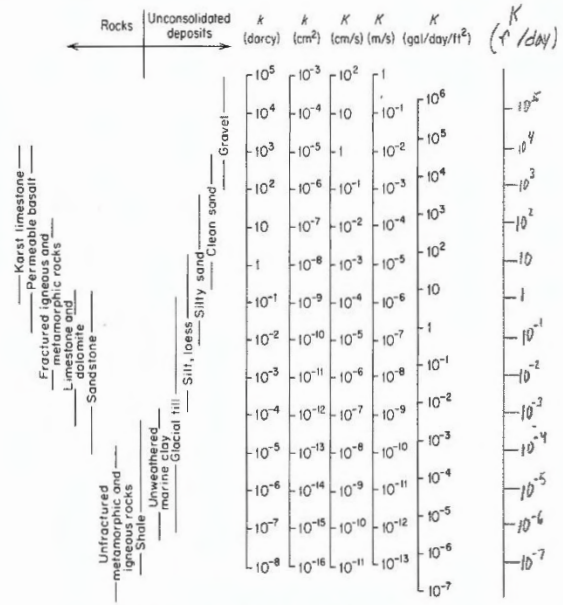


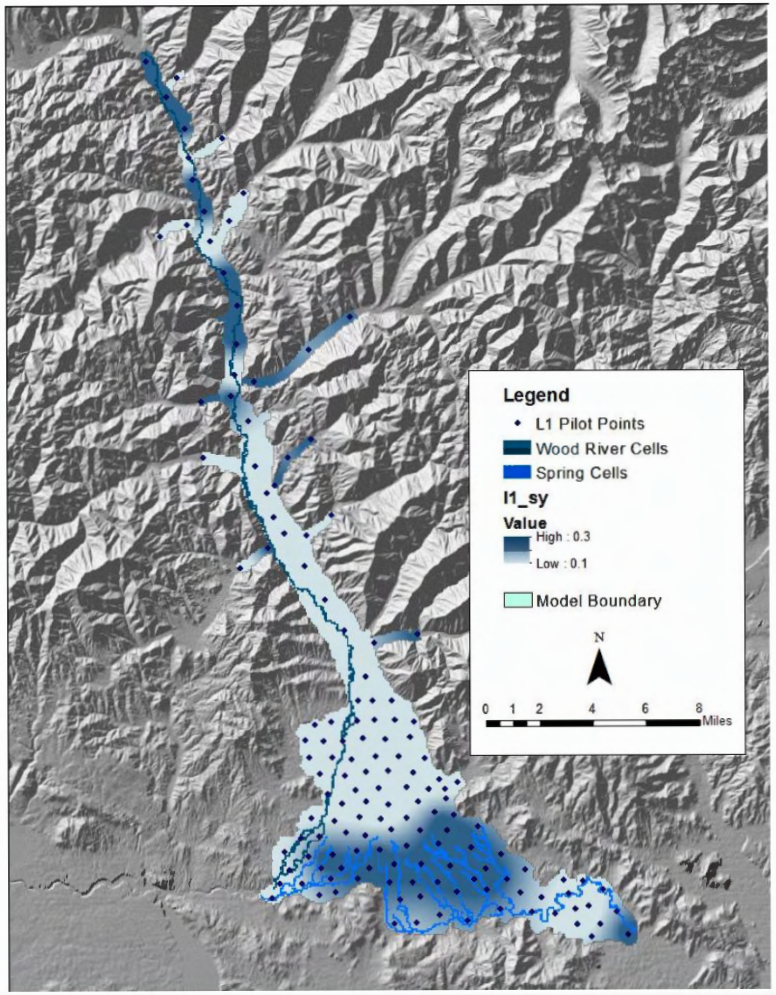
Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k			Hydraulic conductivity, K		
	cm²	ft²	darcy	m/s	ft/s	U.S. gal/day/ft²
cm²	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft²	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

Groundwater, Freeze & Cherry, 1979

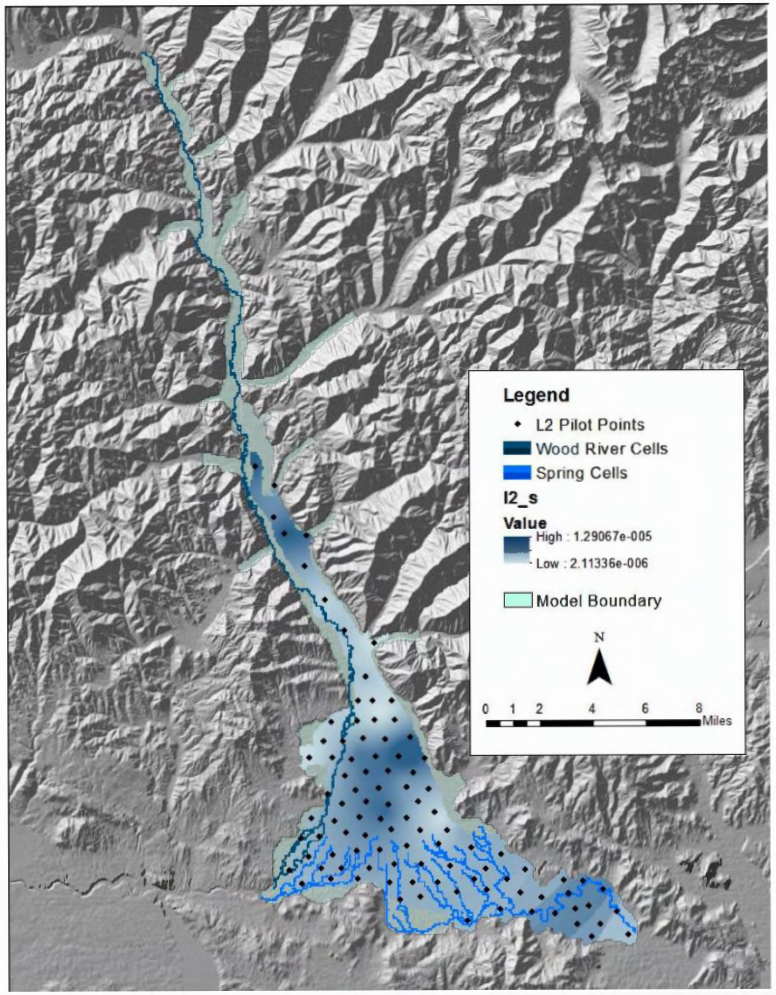
- Basalt
  - Min = 185 ft/day
  - Max = 3,123 ft/day
- Sand and gravel aquifer in valley and triangle
  - Min = 53.2 ft/day
  - Max = 12,170 ft/day
  - Mean = 1,441 ft/day

Layer 1 Storage



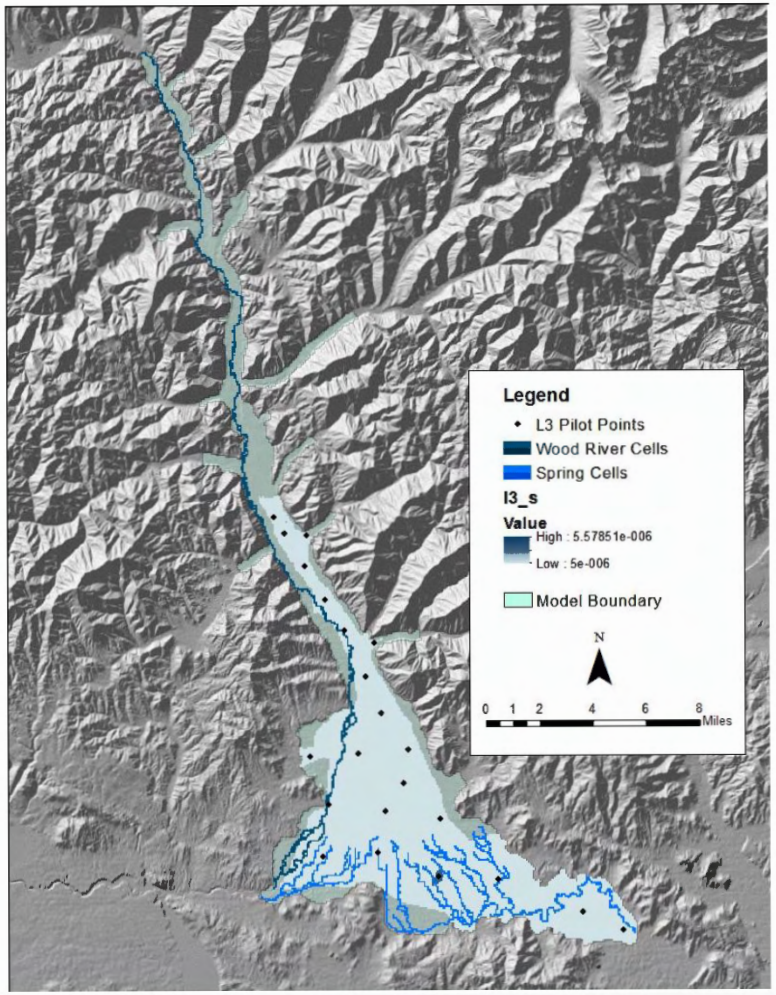
- Layer 1 modeled as non-time varying thickness
- Pilot points can be moved
- Number of pilot points not fixed

Layer 2 Storage



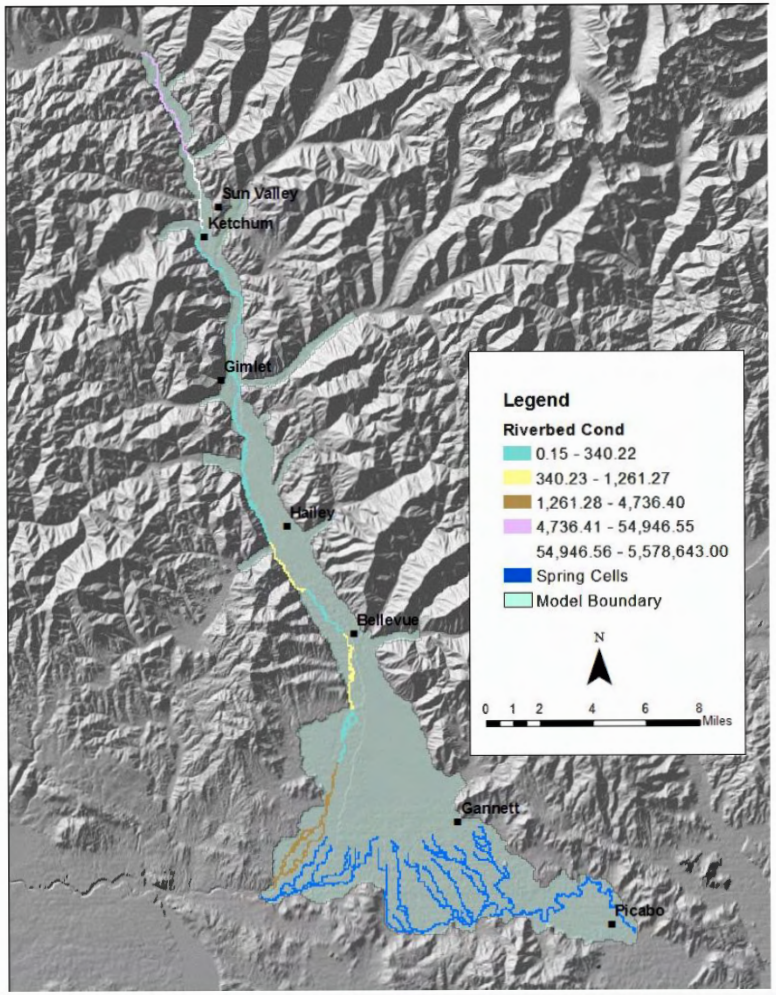
- Layer 2 modeled as storage
- Includes basalt in east
- Includes confining layer
- Pilot points can be moved
- Number of pilot points can be changed

Layer 3 Storage



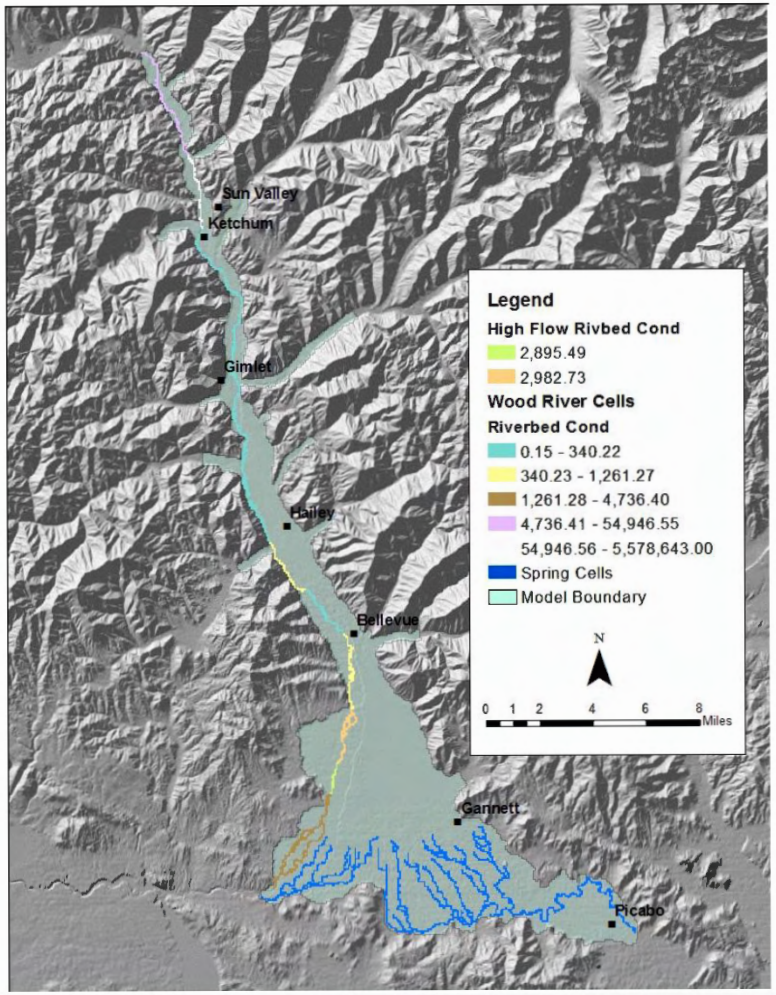
- Layer 3 modeled as storage
- Includes basalt in east
- Pilot points can be moved
- Number of pilot points can be changed

Riverbed Conductance



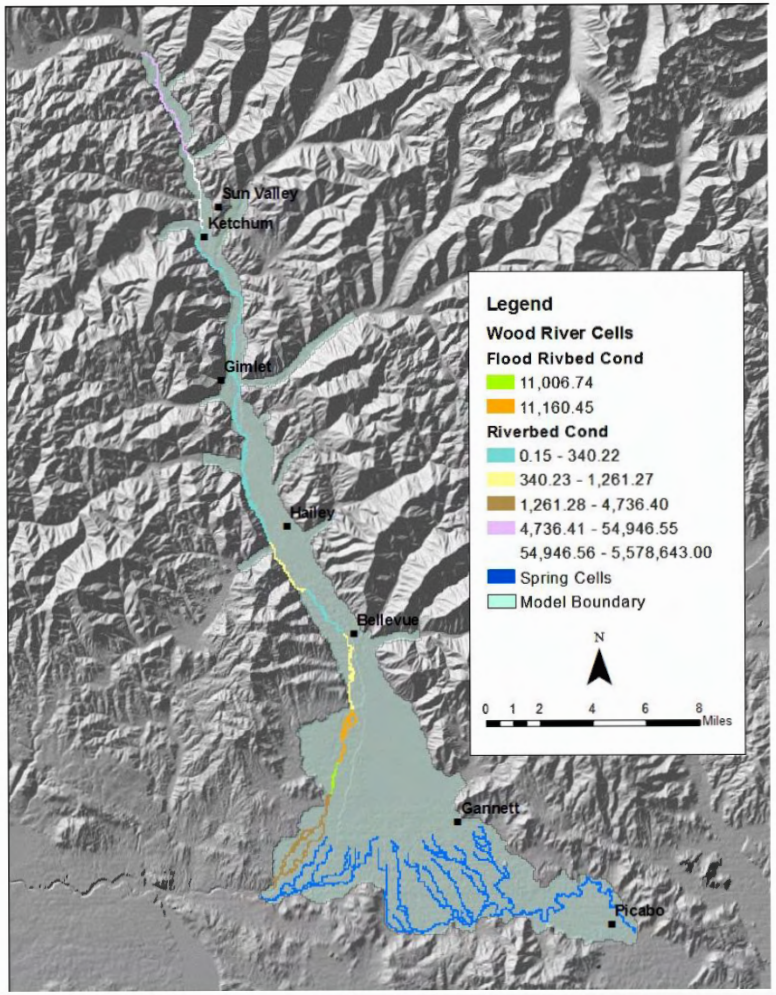
- Riverbed Conductance
  - limped parameter
  - KLW/M

Riverbed Conductance



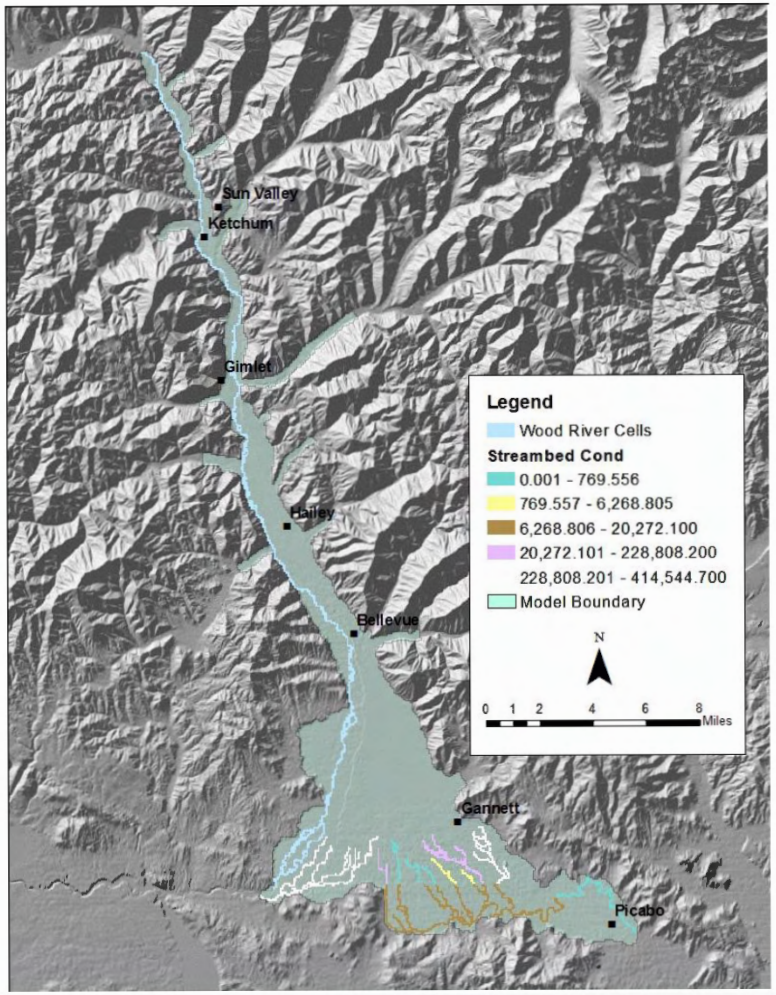
- High Flow Riverbed Conductance
  - lumped parameter
  - KLW/M

Riverbed Conductance



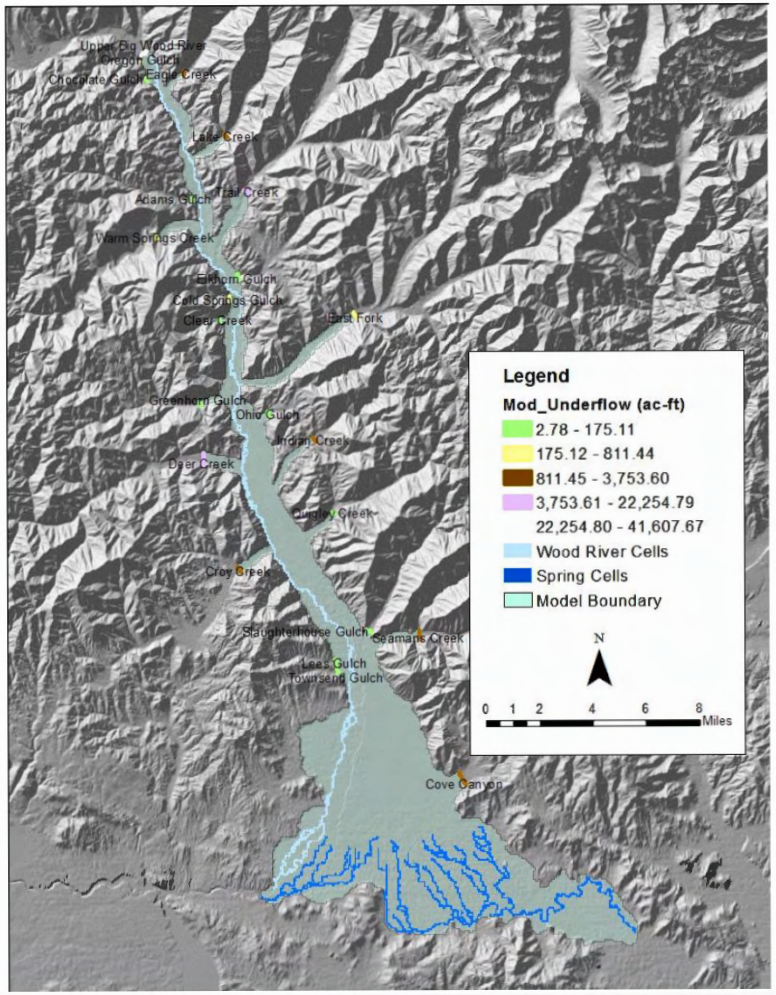
- Riverbed Conductance
  - lumped parameter
  - KLW/M

Streambed Conductance



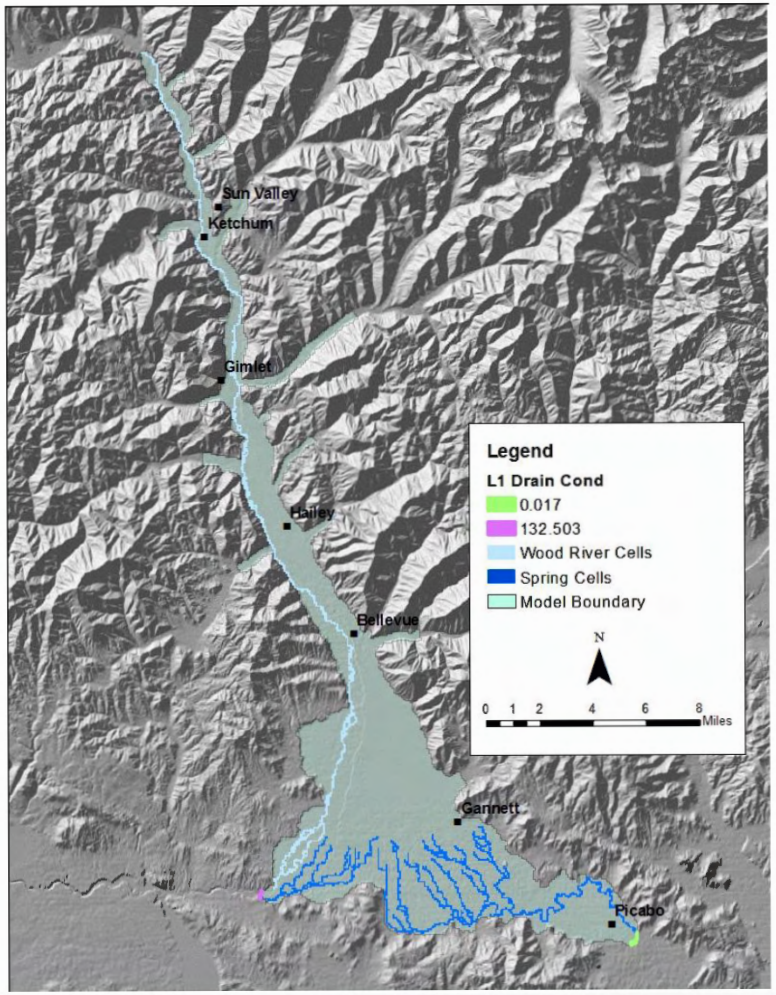
- Willow Creek
- Silver Creek

Tributary Underflow



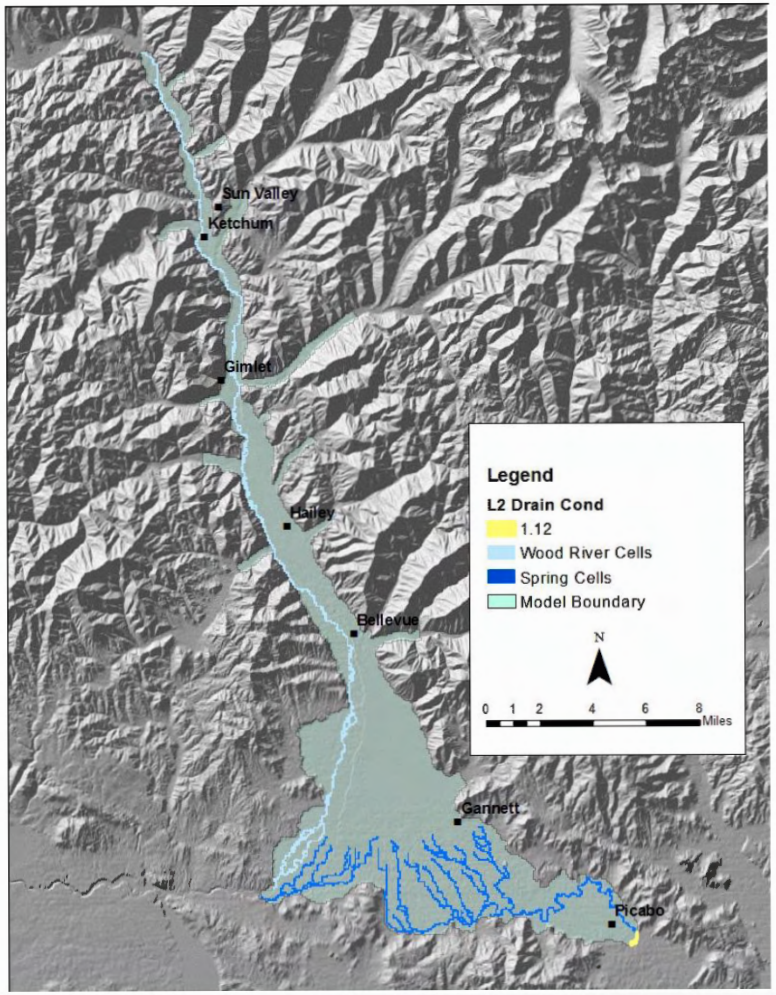
Tributary	Avg Precip AcFt	Underflow AcFt	EstUnd/AvgPpt
Adams Gulch	17600	9	0.05%
Chocolate Gulch	864	173	20.00%
Cold Springs Gulch	3,341	396	11.86%
Clear Creek	2,288	175	7.65%
Cove Canyon	11,200	2240	20.00%
Croy Creek	23,595	2068	8.77%
Deer Creek	74,213	11796	15.89%
Eagle Creek	17,248	3450	20.00%
Elkhorn Gulch	12,757	3	0.02%
East Fork	120,629	647	0.54%
Greenhorn Gulch	30,464	7	0.02%
Indian Creek	10,149	2030	20.00%
Lake Creek	17,280	3456	20.00%
Lees Gulch	2,240	15	0.68%
Ohio Gulch	4,270	39	0.92%
Oregon Gulch	6,919	456	6.59%
Quigley Creek	15,504	172	1.11%
Seamans Creek	18,768	3754	20.00%
Slaughterhouse Gulch	11,509	5	0.04%
Trail Creek	111,274	22255	20.00%
Townsend Gulch	960	12	1.27%
Upper Big Wood River	313,278	41608	13.28%
Warm Springs Creek	180,735	811	0.45%

Drains



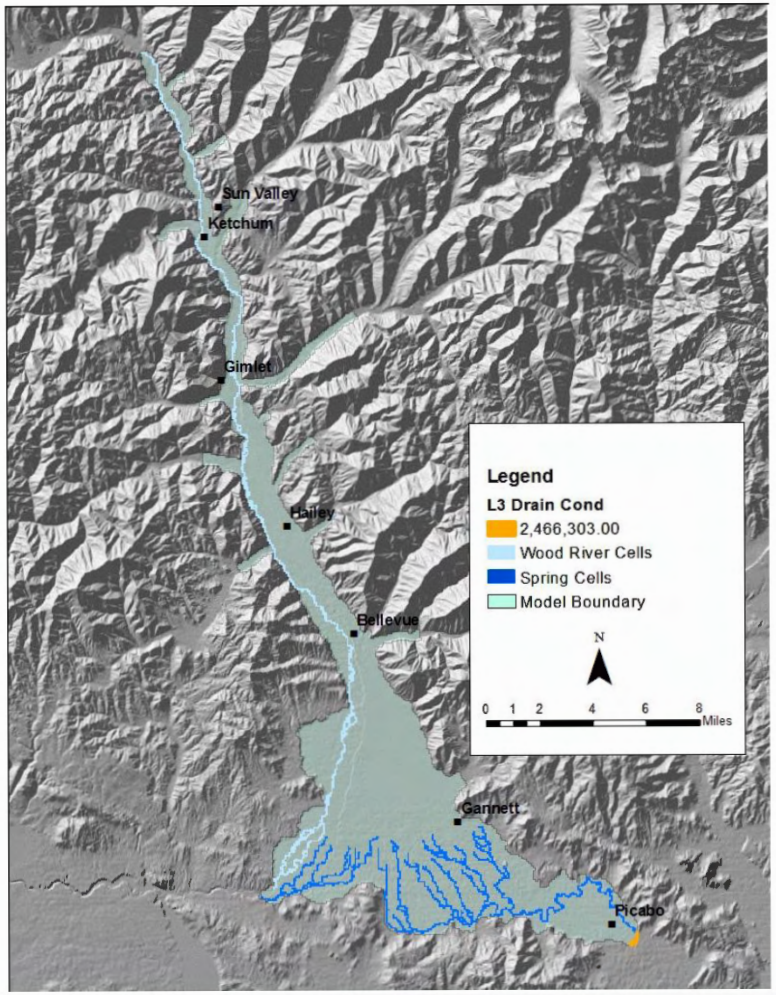
- Layer 1 drains

Drains



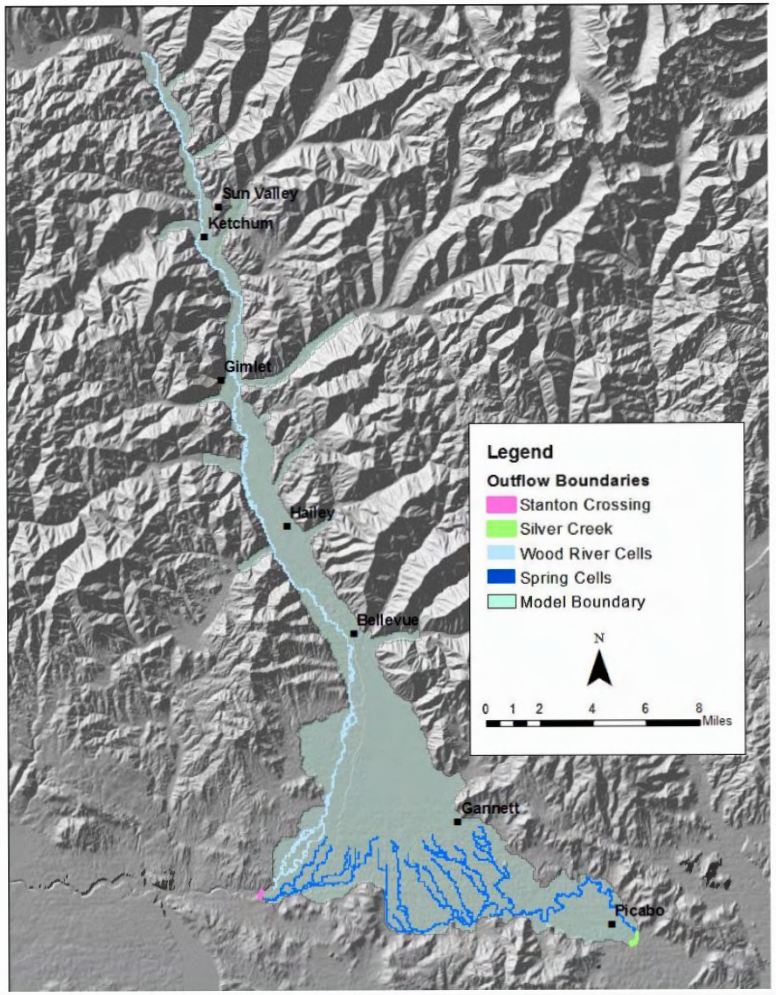
- Layer 2 drains

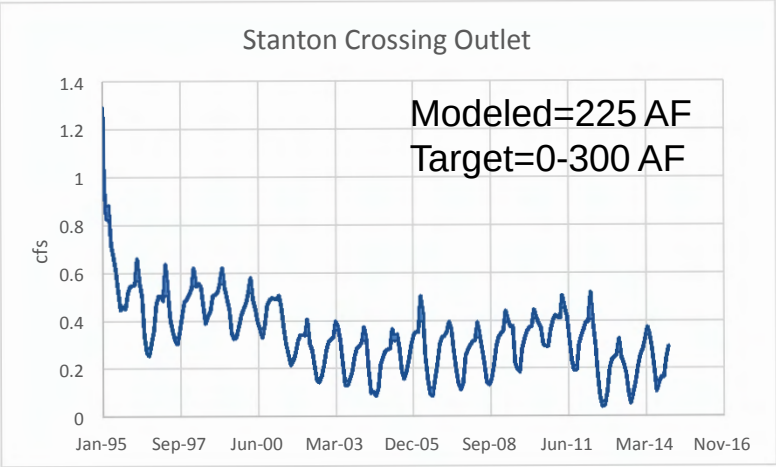
Drains

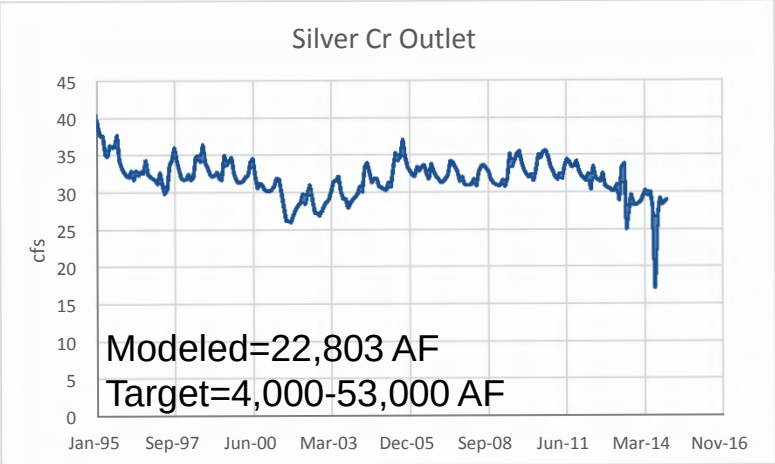


- Layer 2 drains

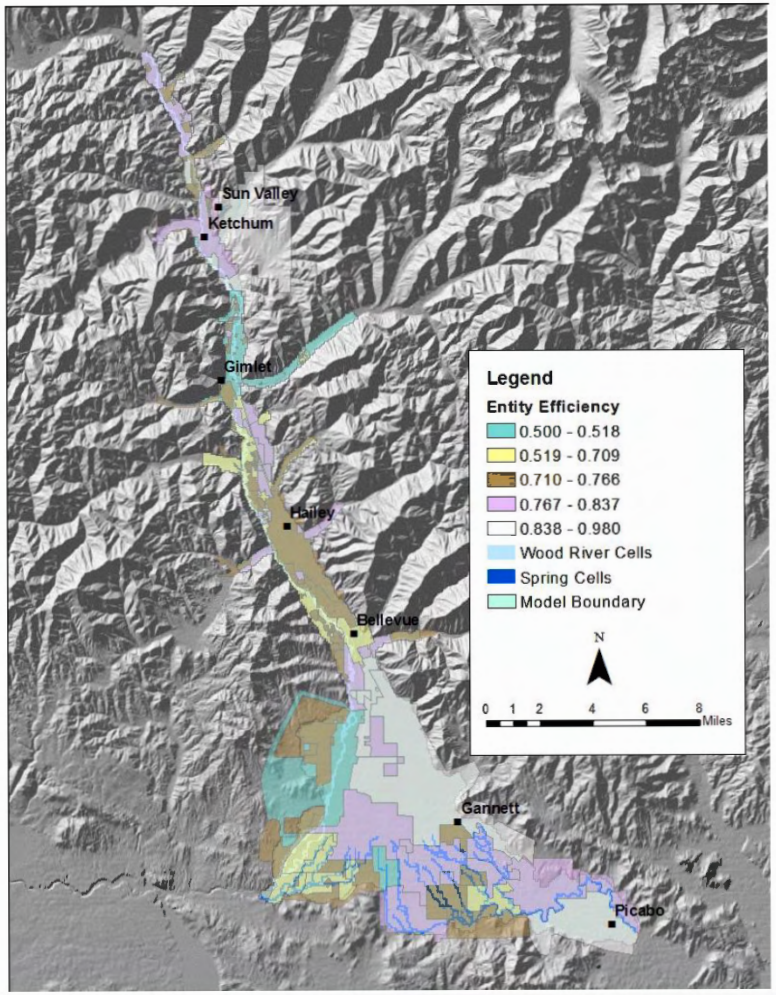
Aquifer Discharge



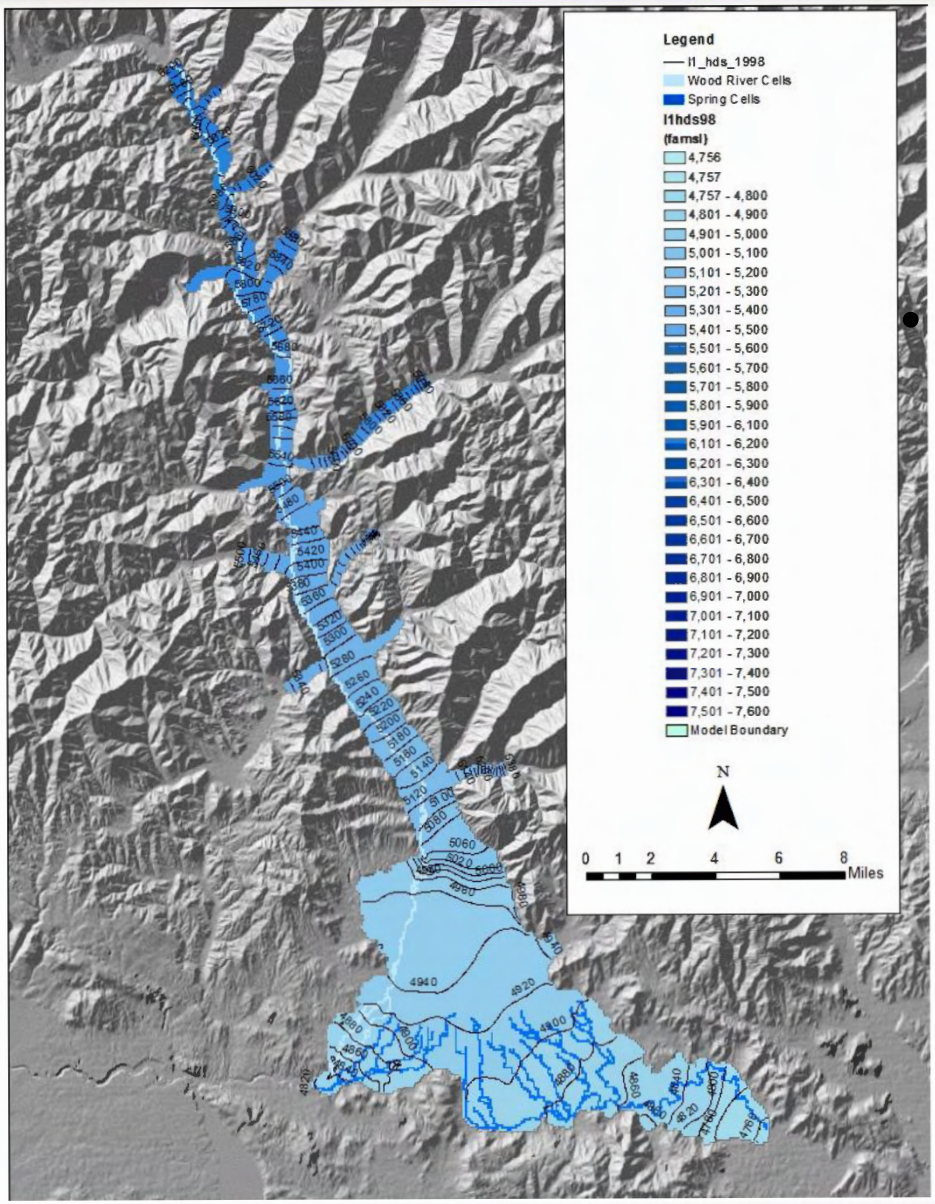




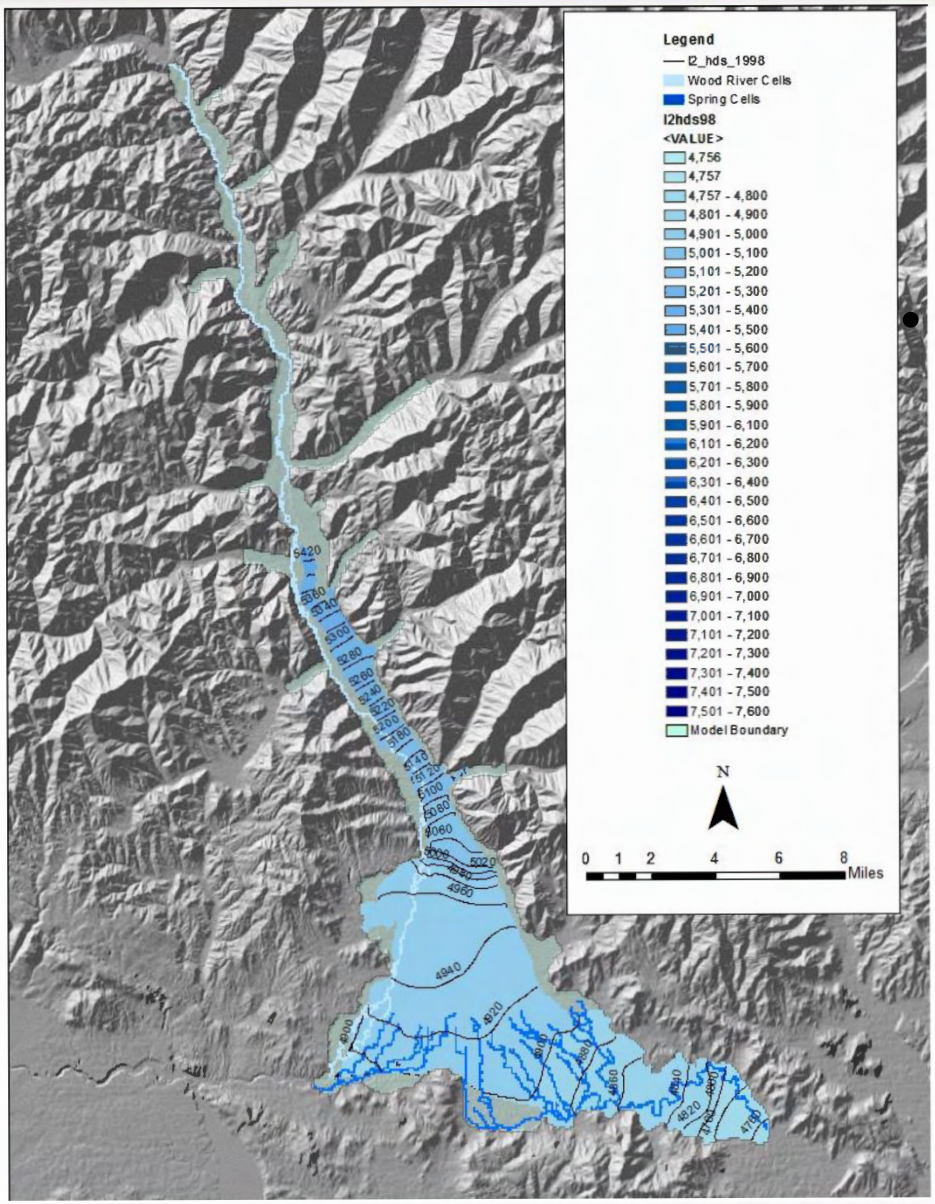
Irrigation Entity Efficiency



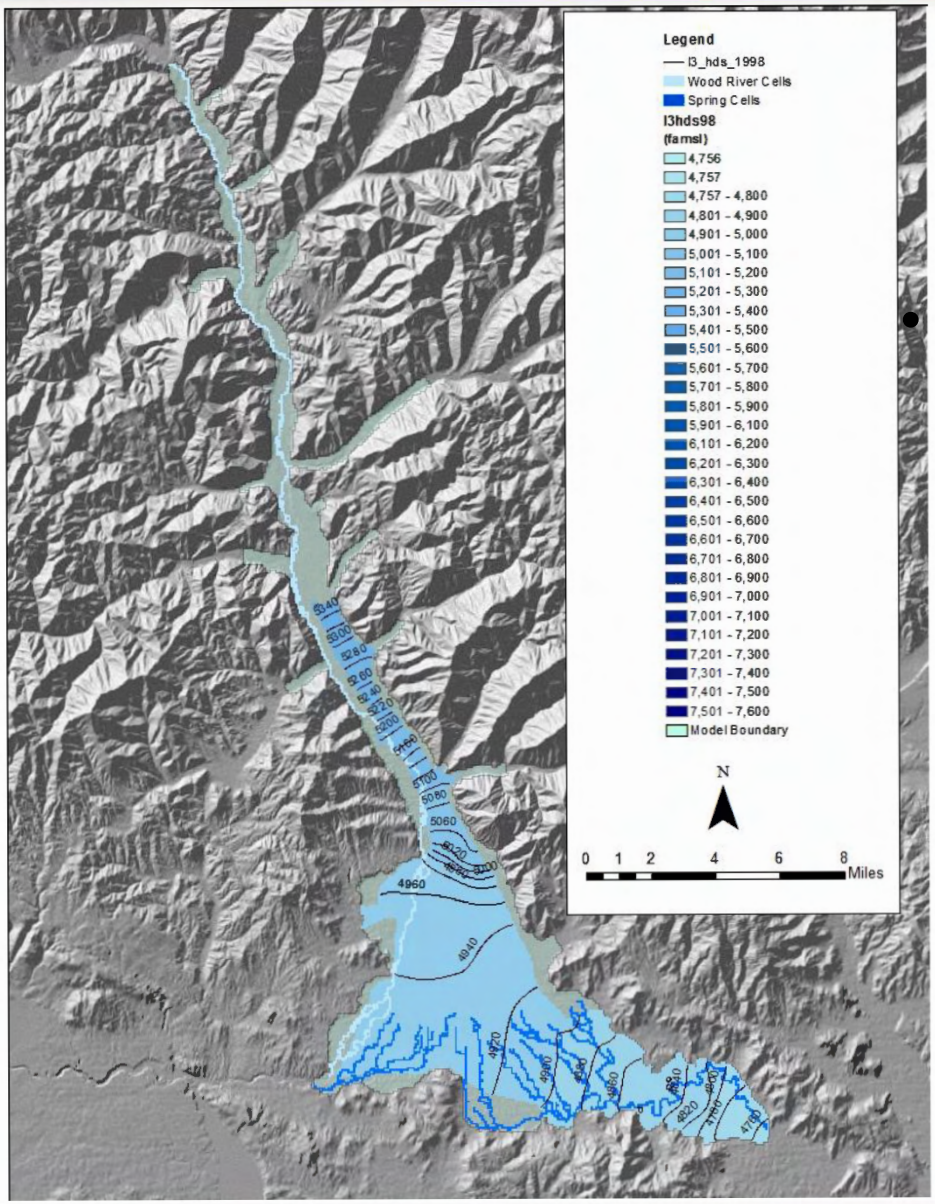
- Percent of diversion applied to crop consumptive use



- Layer 1 Head January 1998

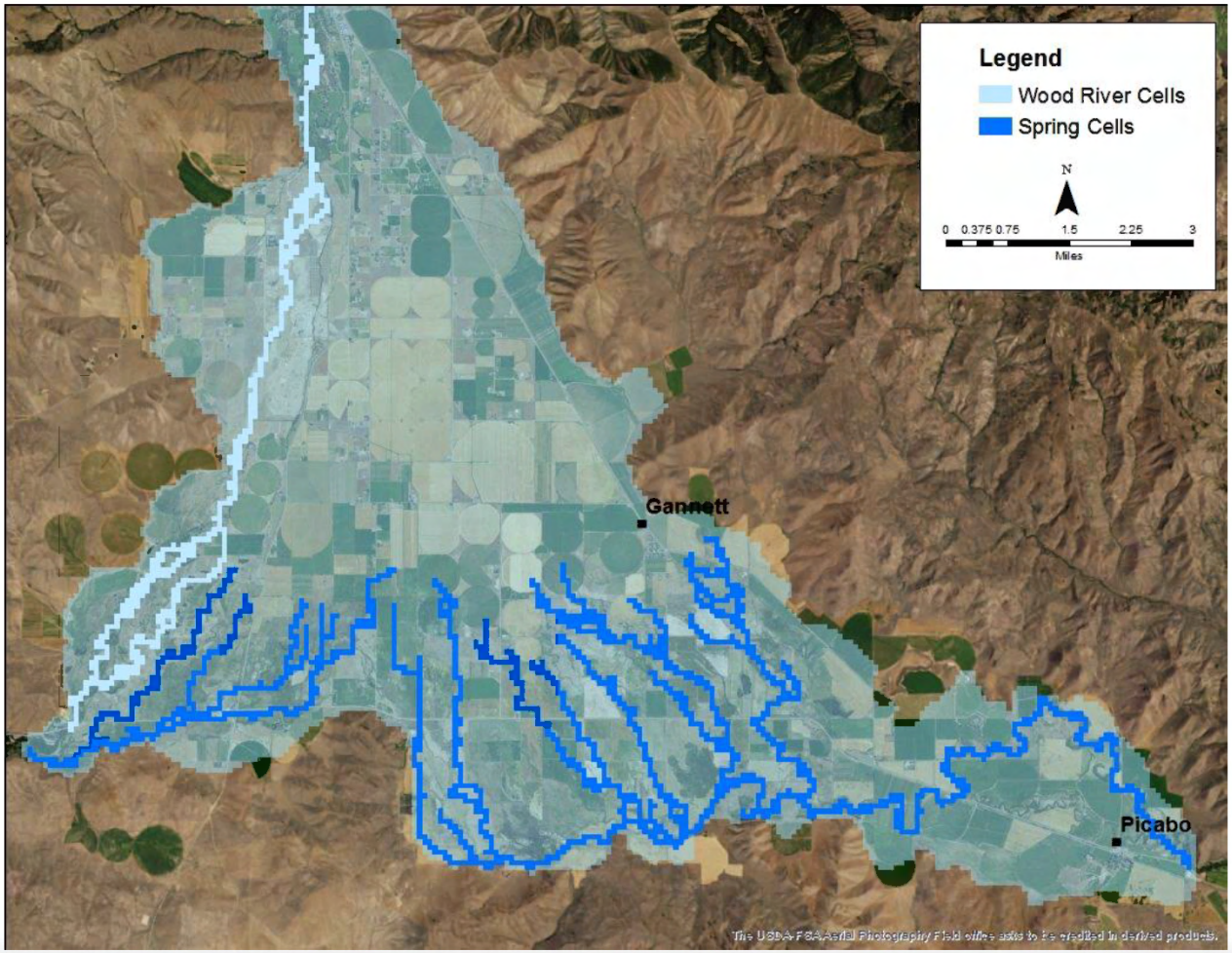


- Layer 2 Head January 1998

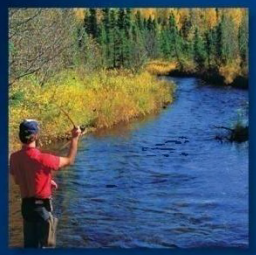


- Layer 3 Head January 1998

Considering Adding a Few Cells

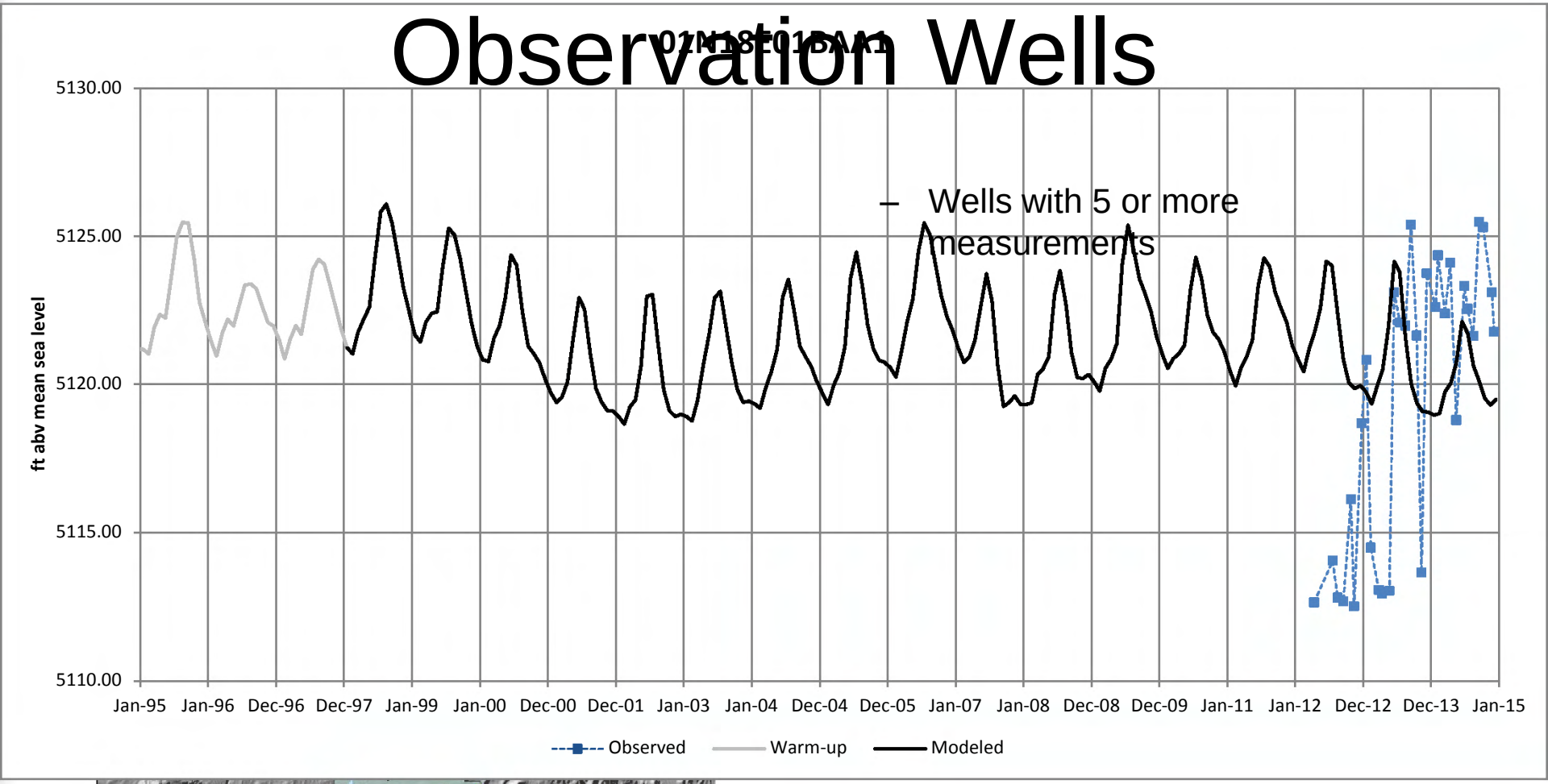


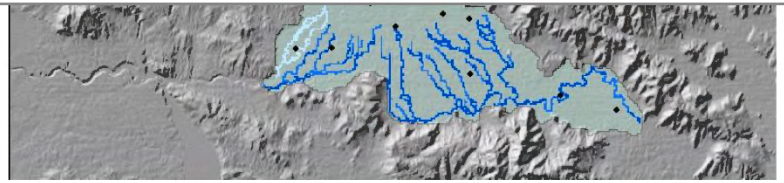
IDAHO Department of Water Resources



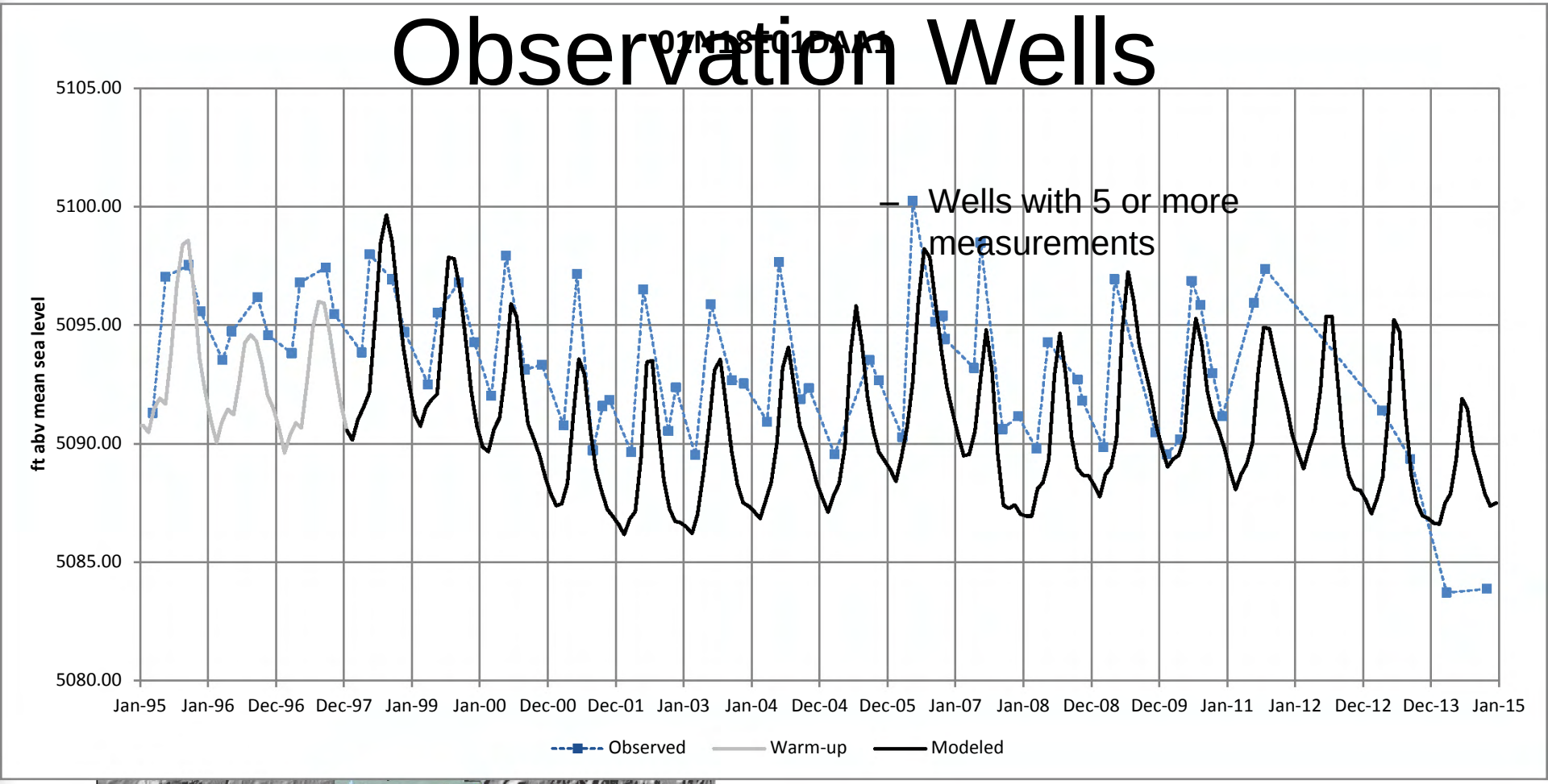
End

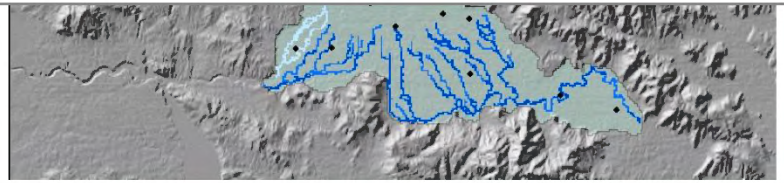
Observation Wells



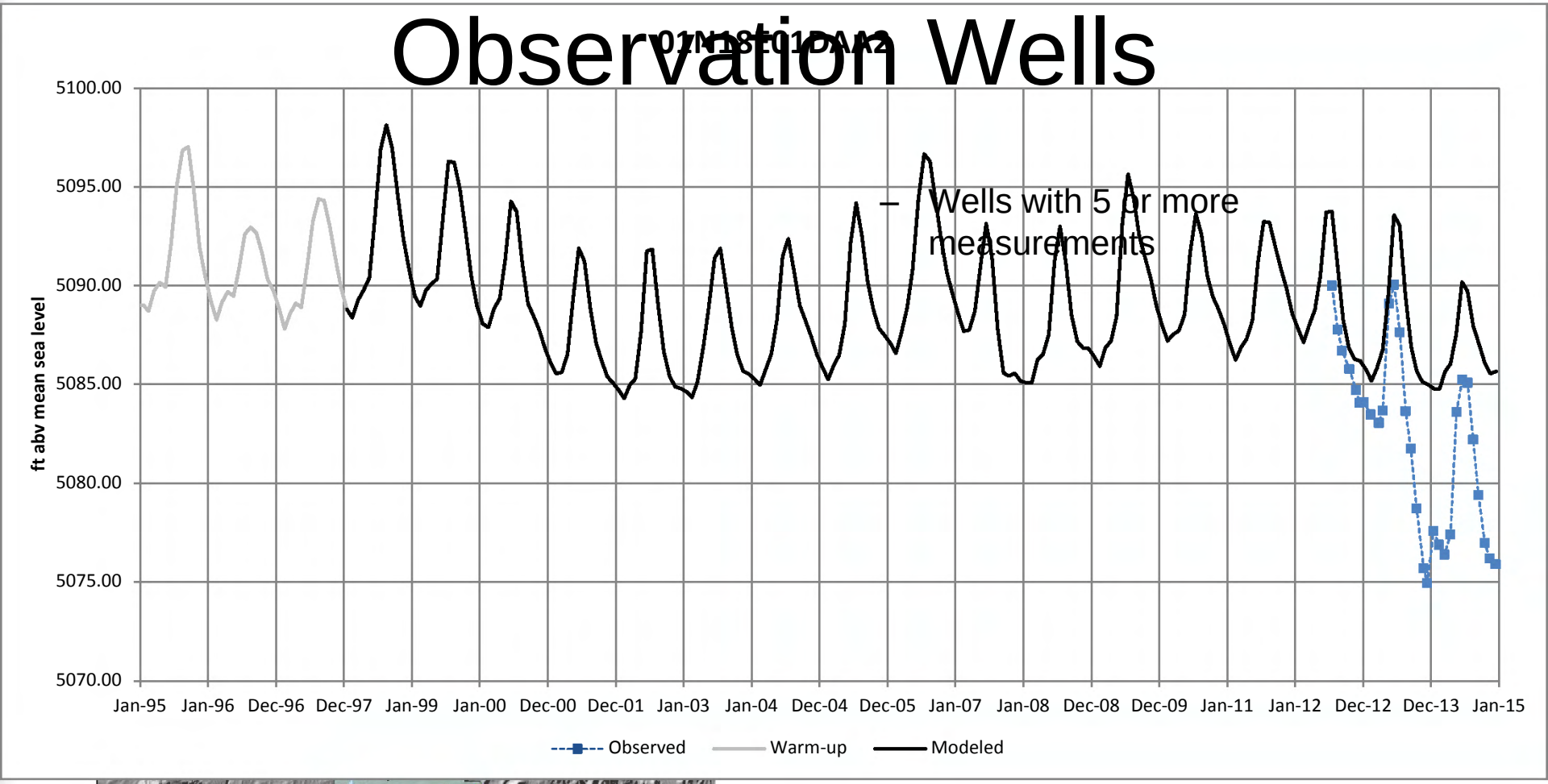


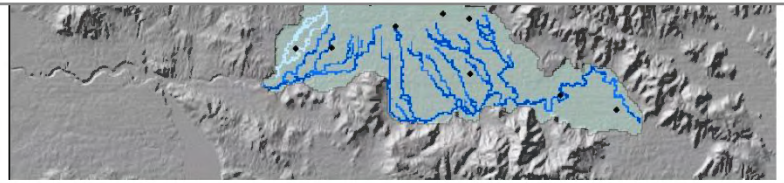
Observation Wells



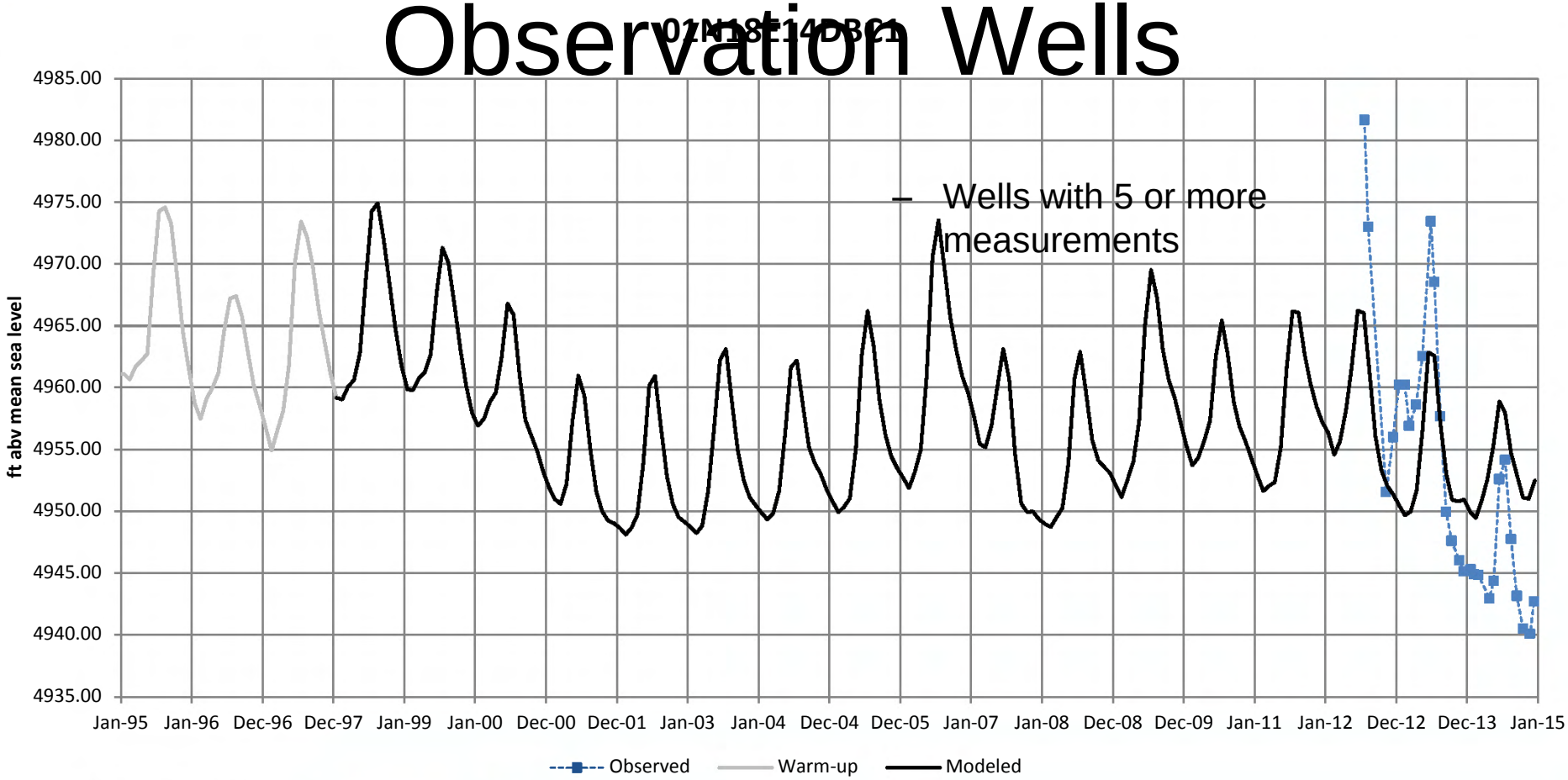


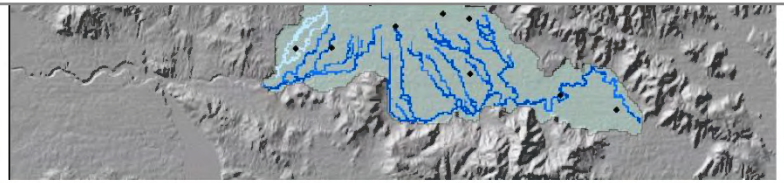
Observation Wells





Observation Wells





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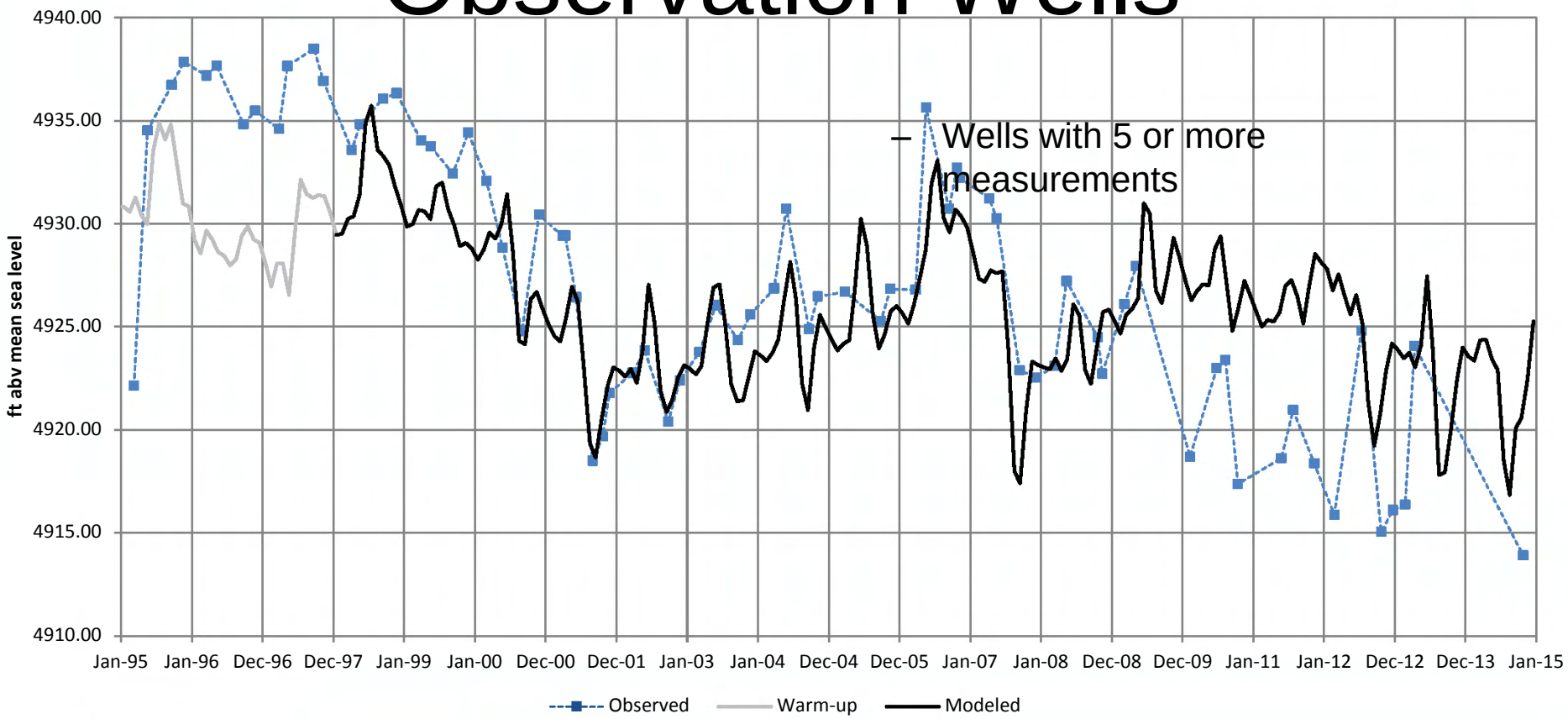
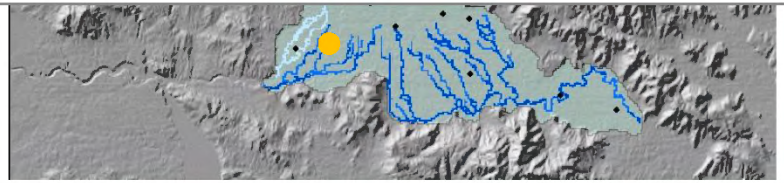
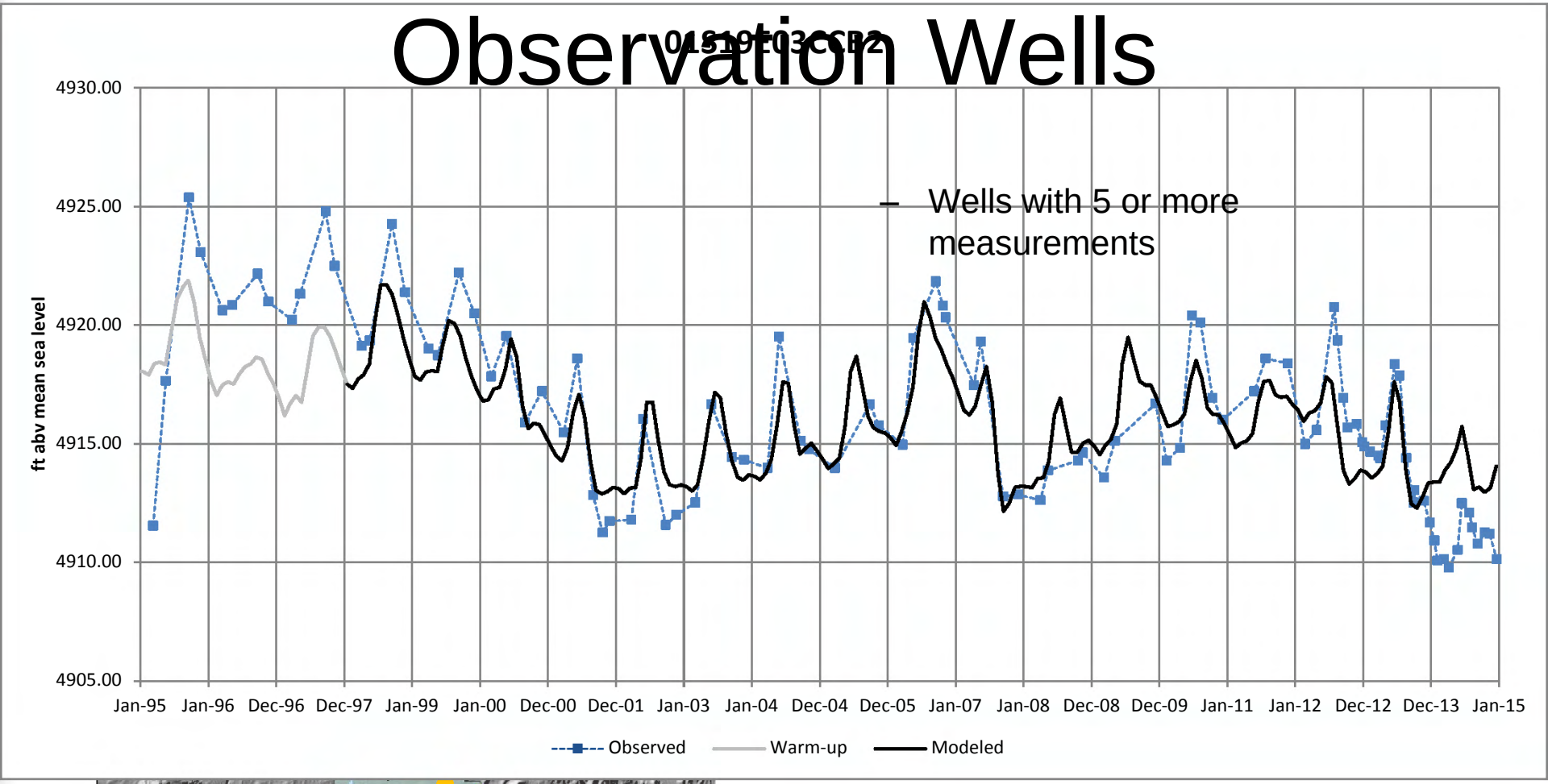
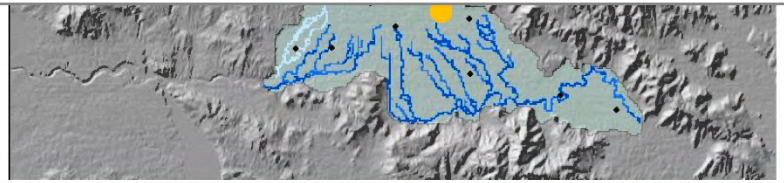


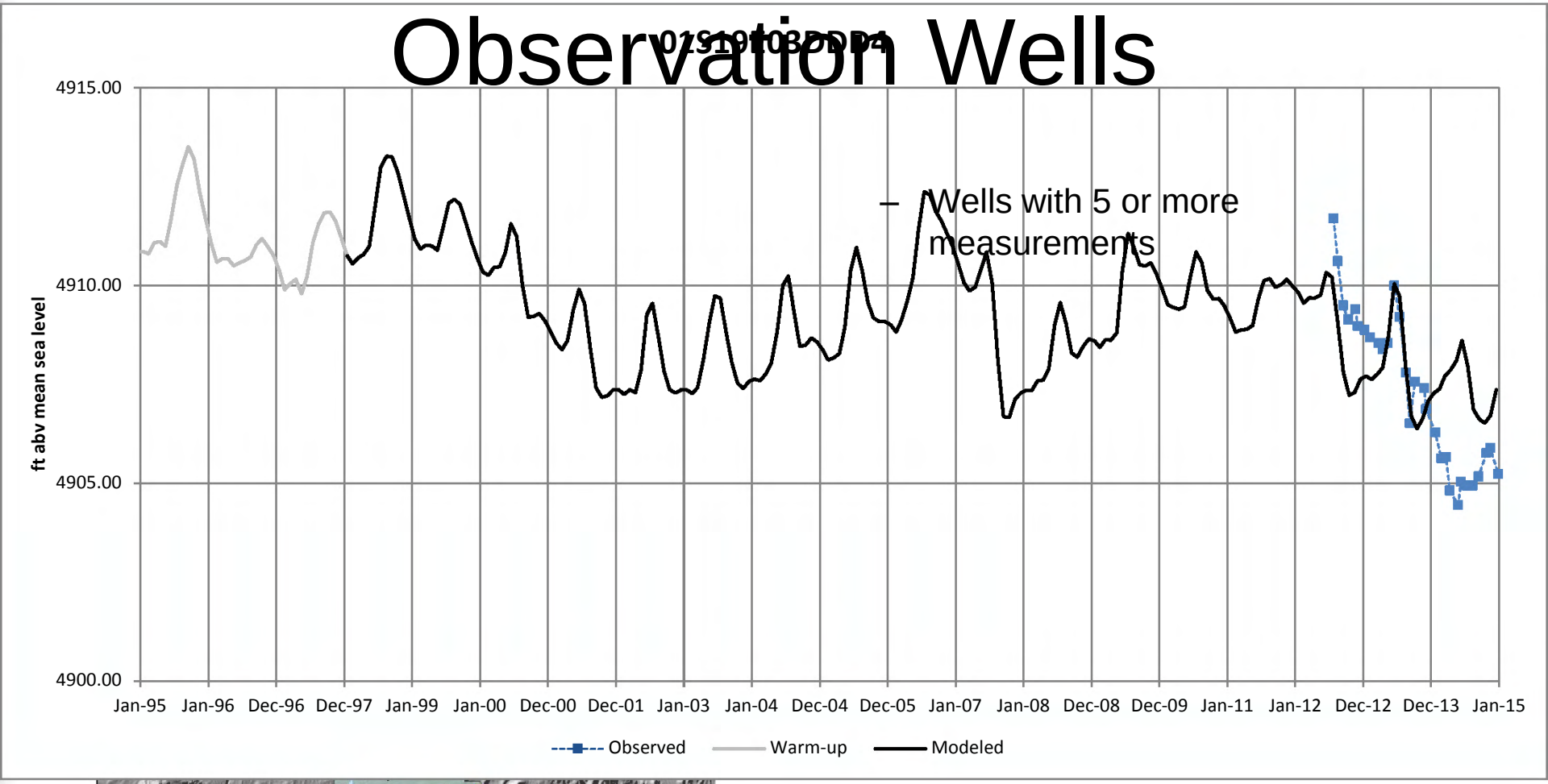


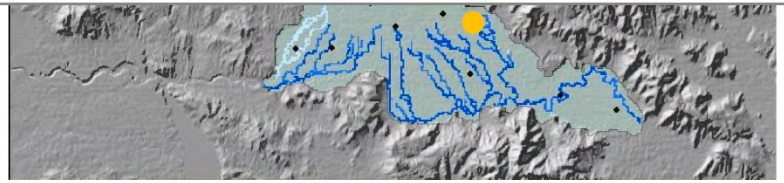
Observation Wells



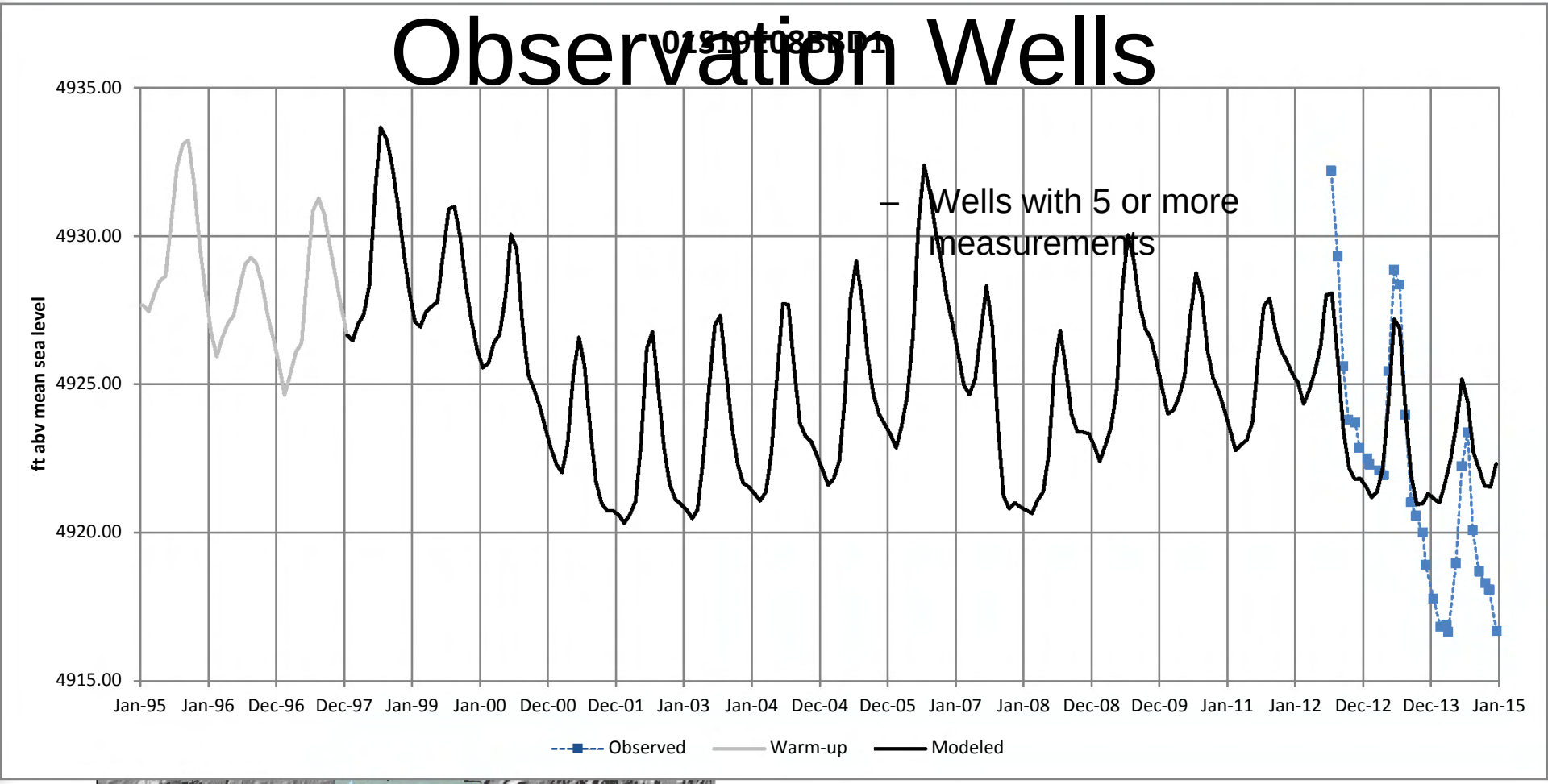


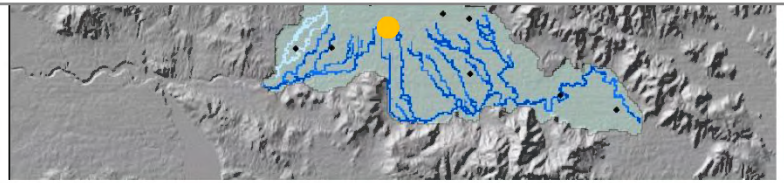
Observation Wells



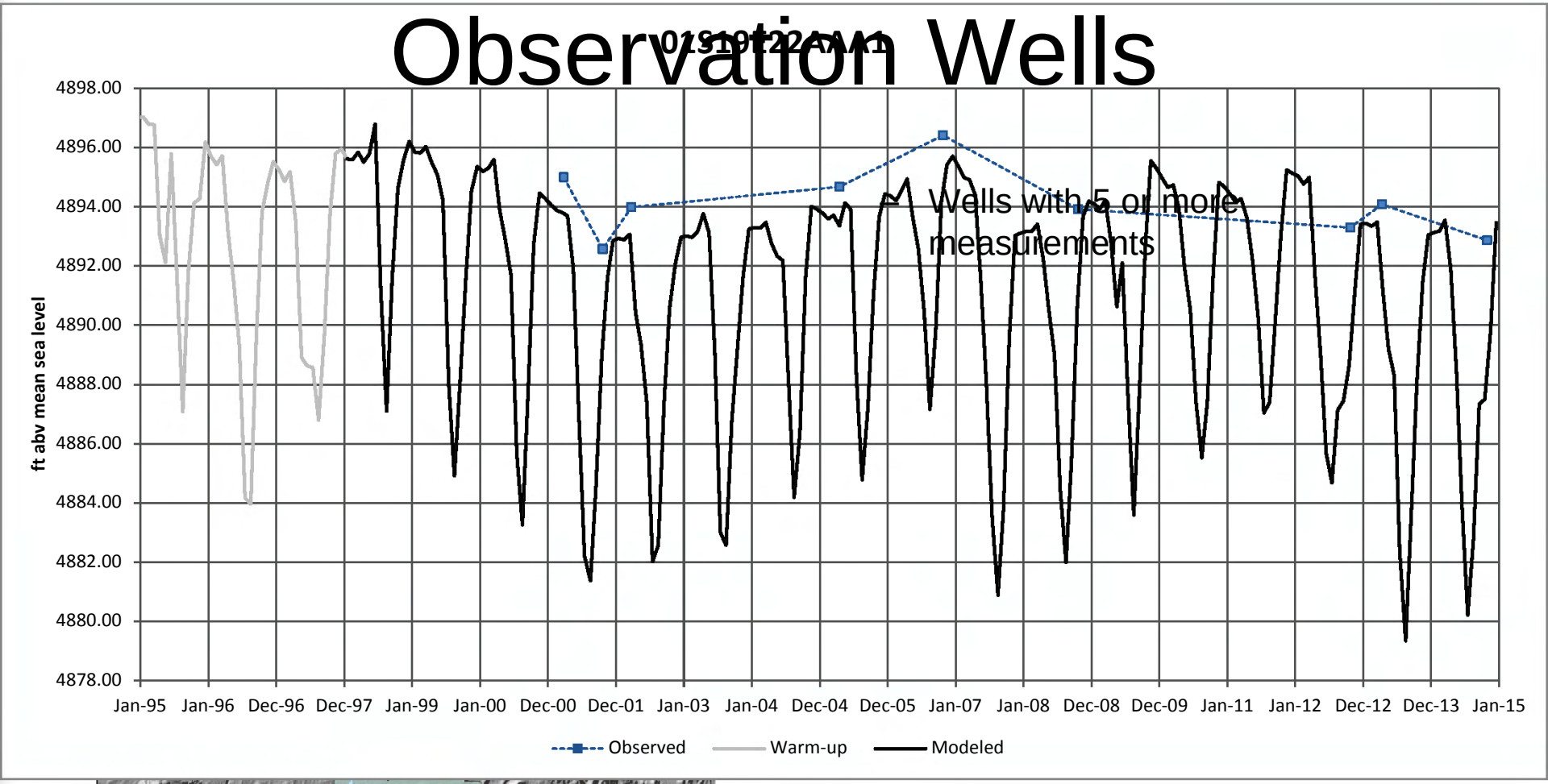


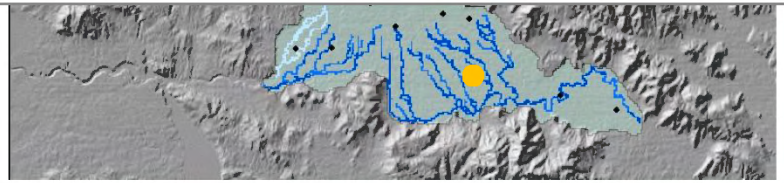
Observation Wells



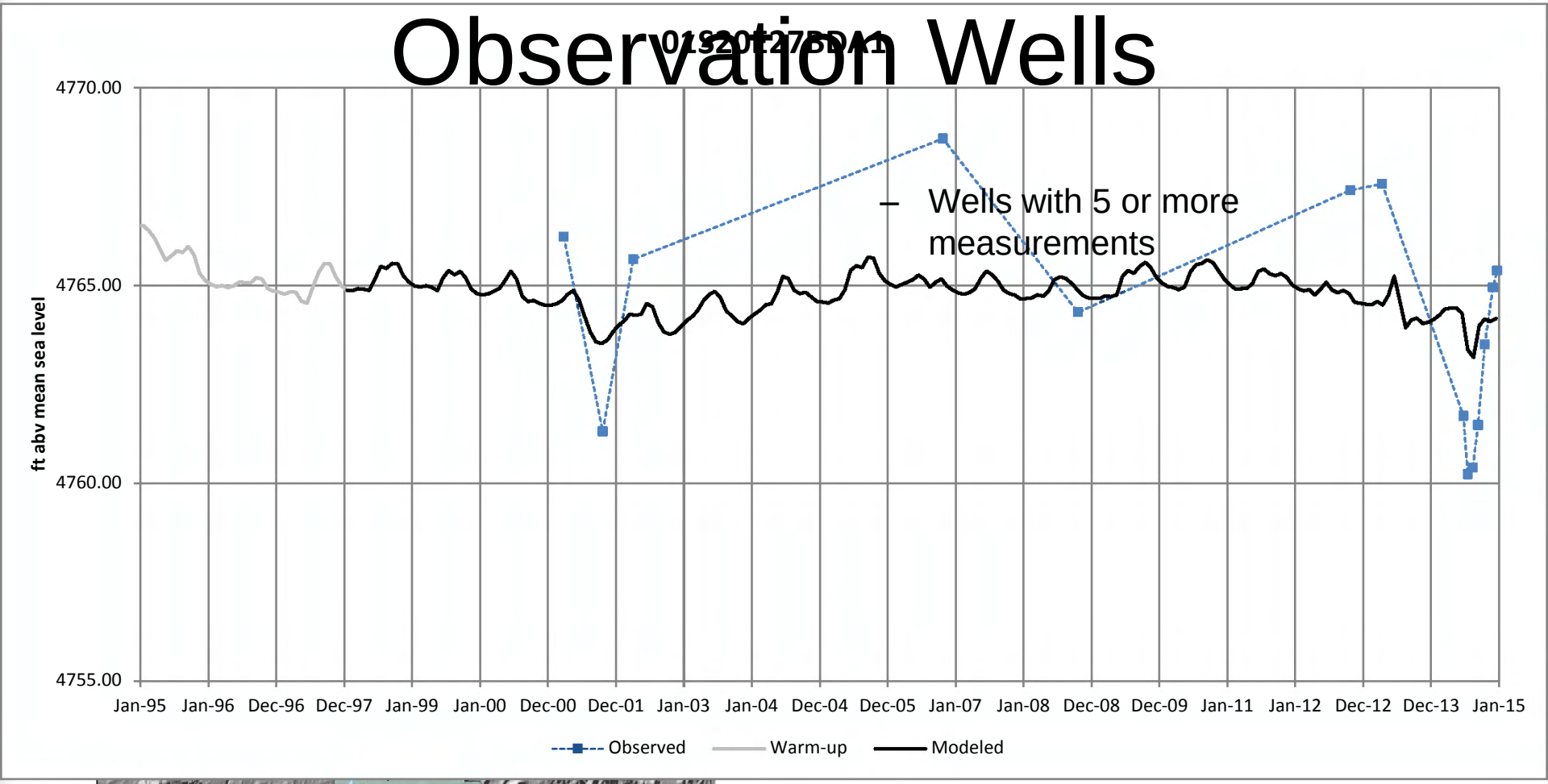


Observation Wells

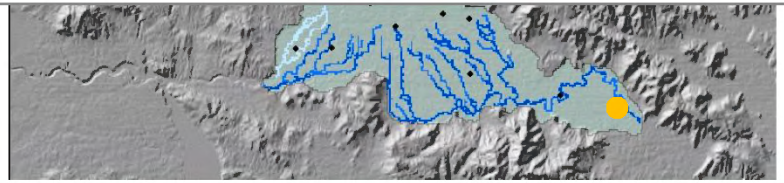




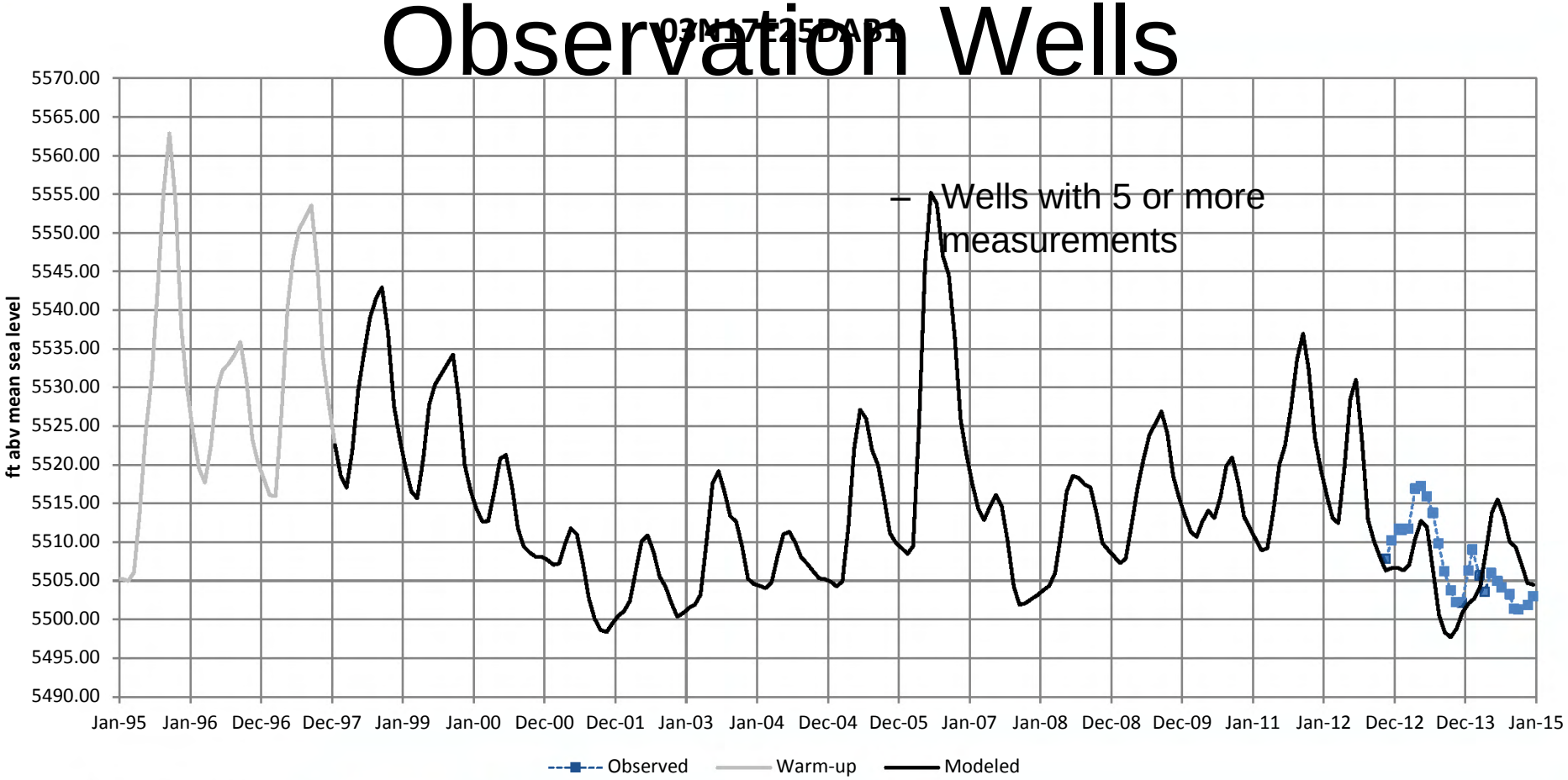
Observation Wells

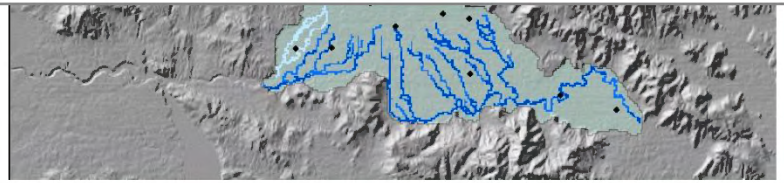


– Wells with 5 or more measurements

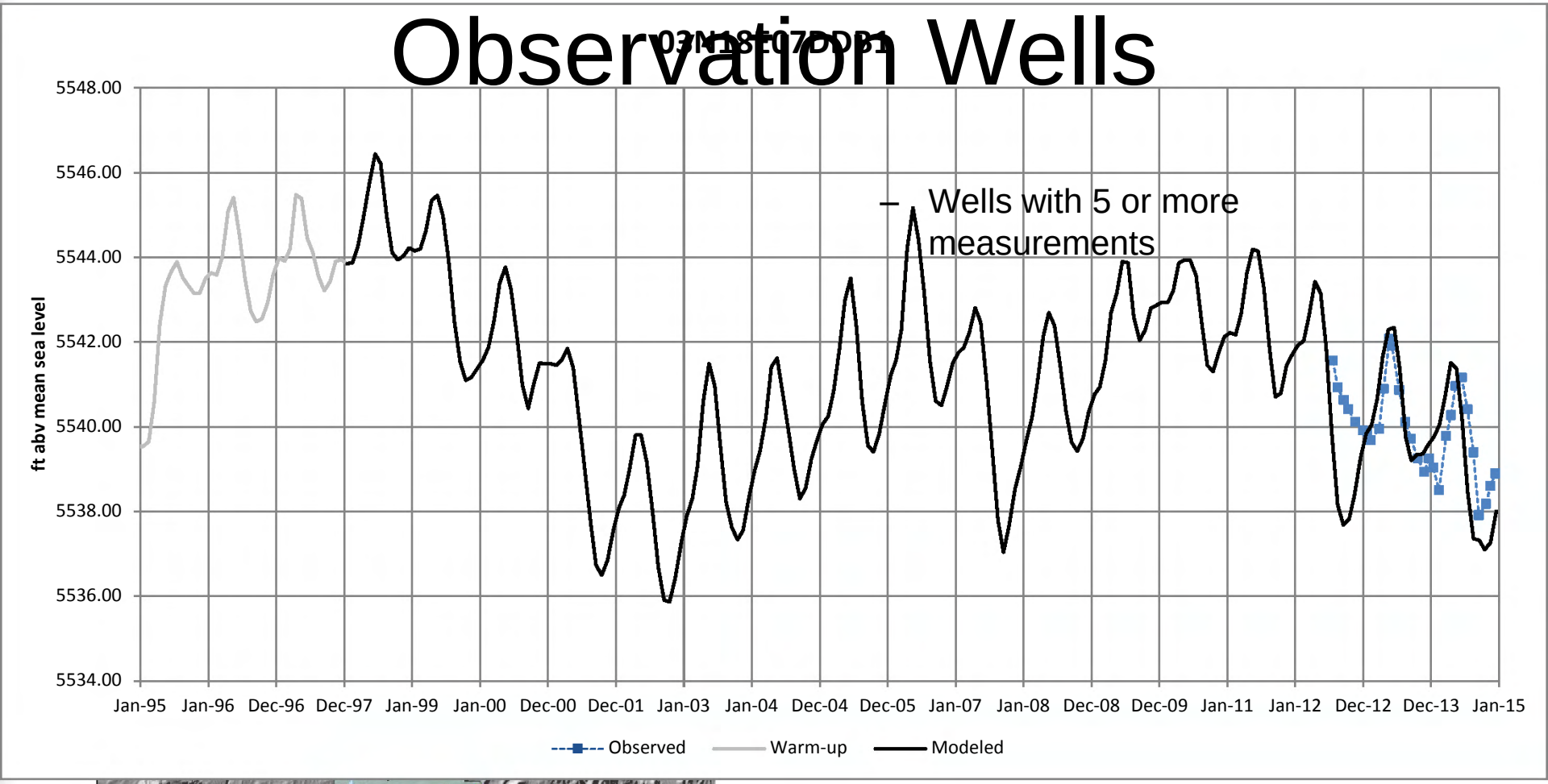


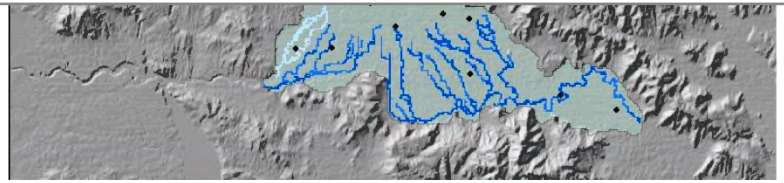
Observation Wells





Observation Wells





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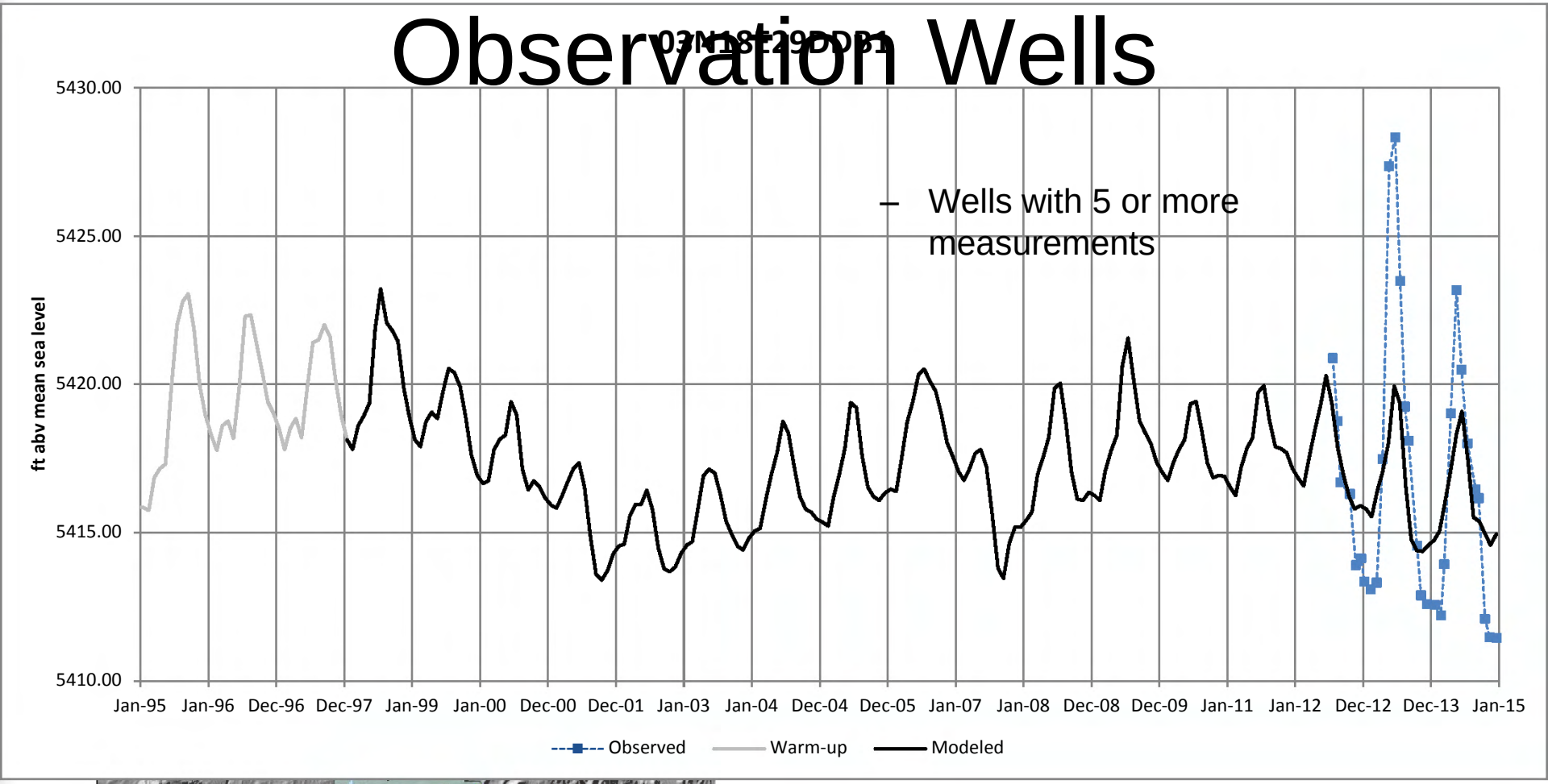
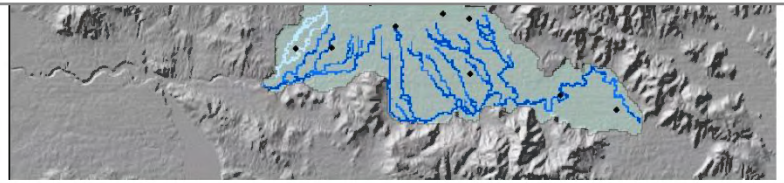


– Wells with 5 or more measurements



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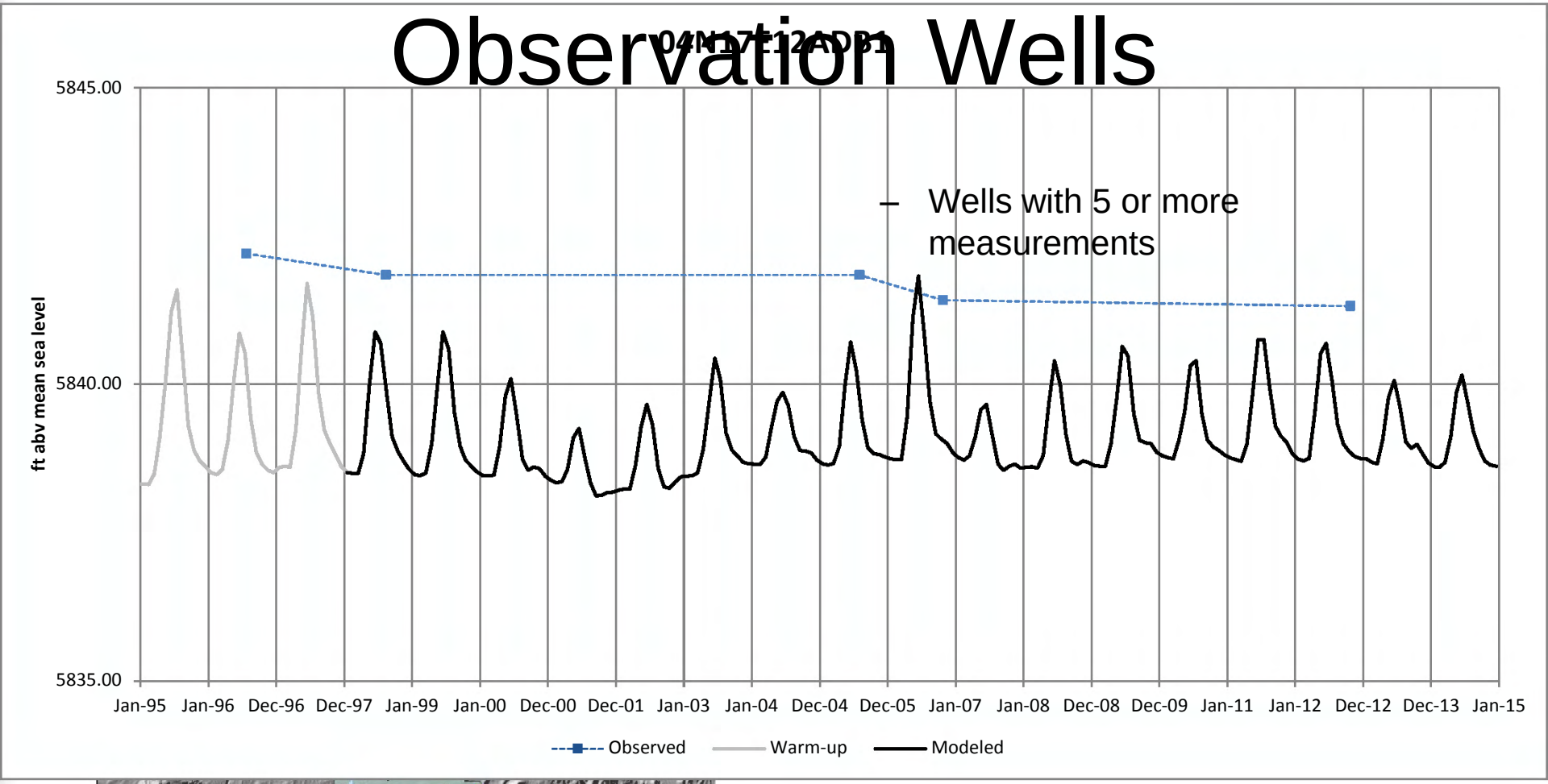
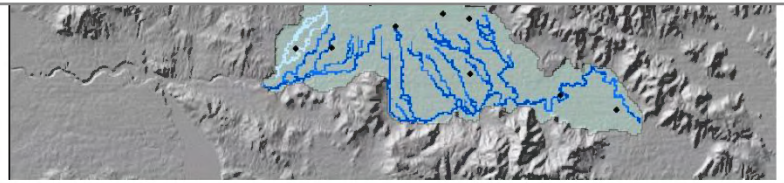


– Wells with 5 or more measurements



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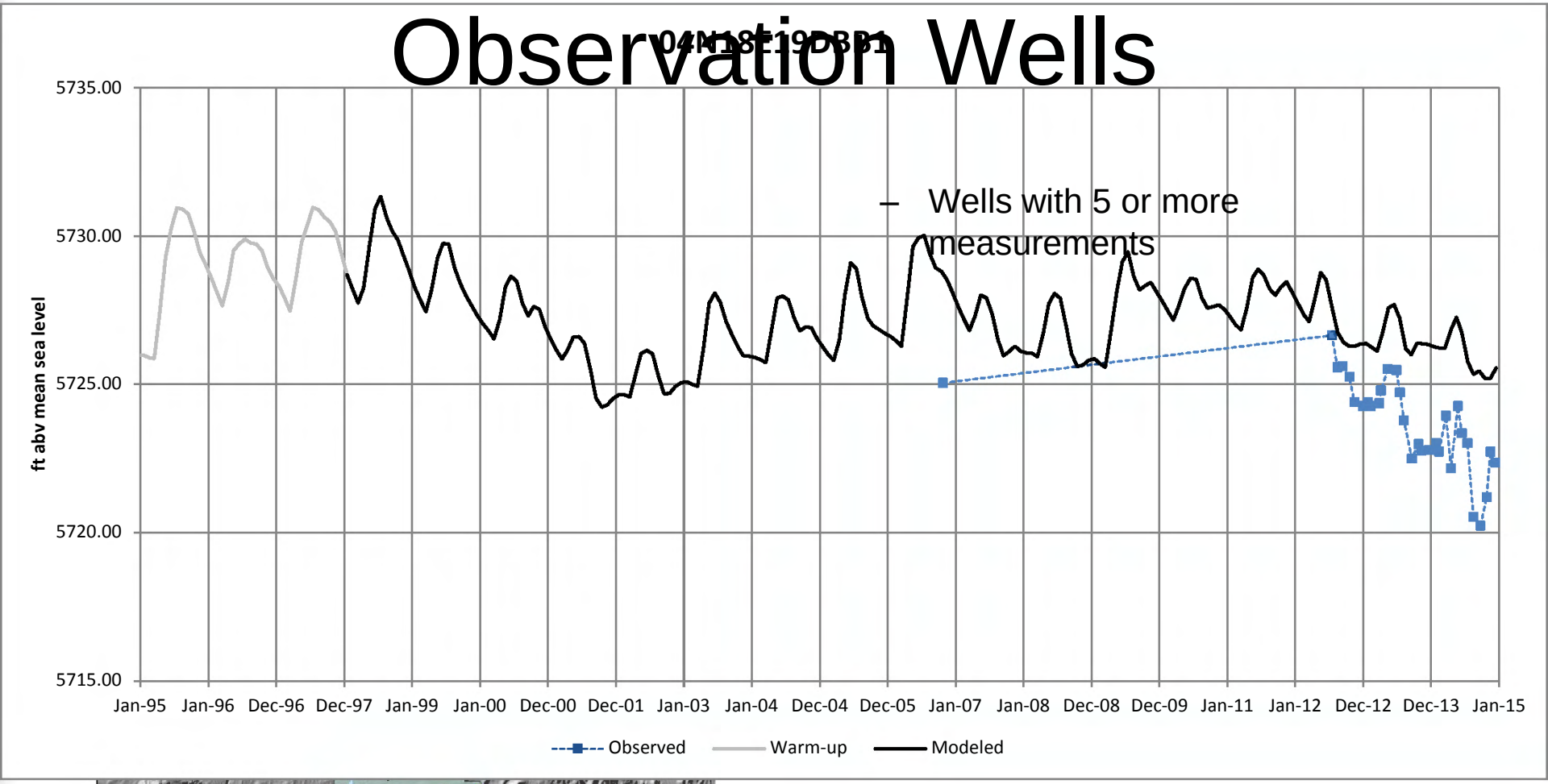
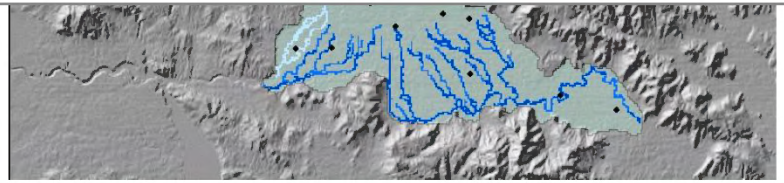


– Wells with 5 or more measurements



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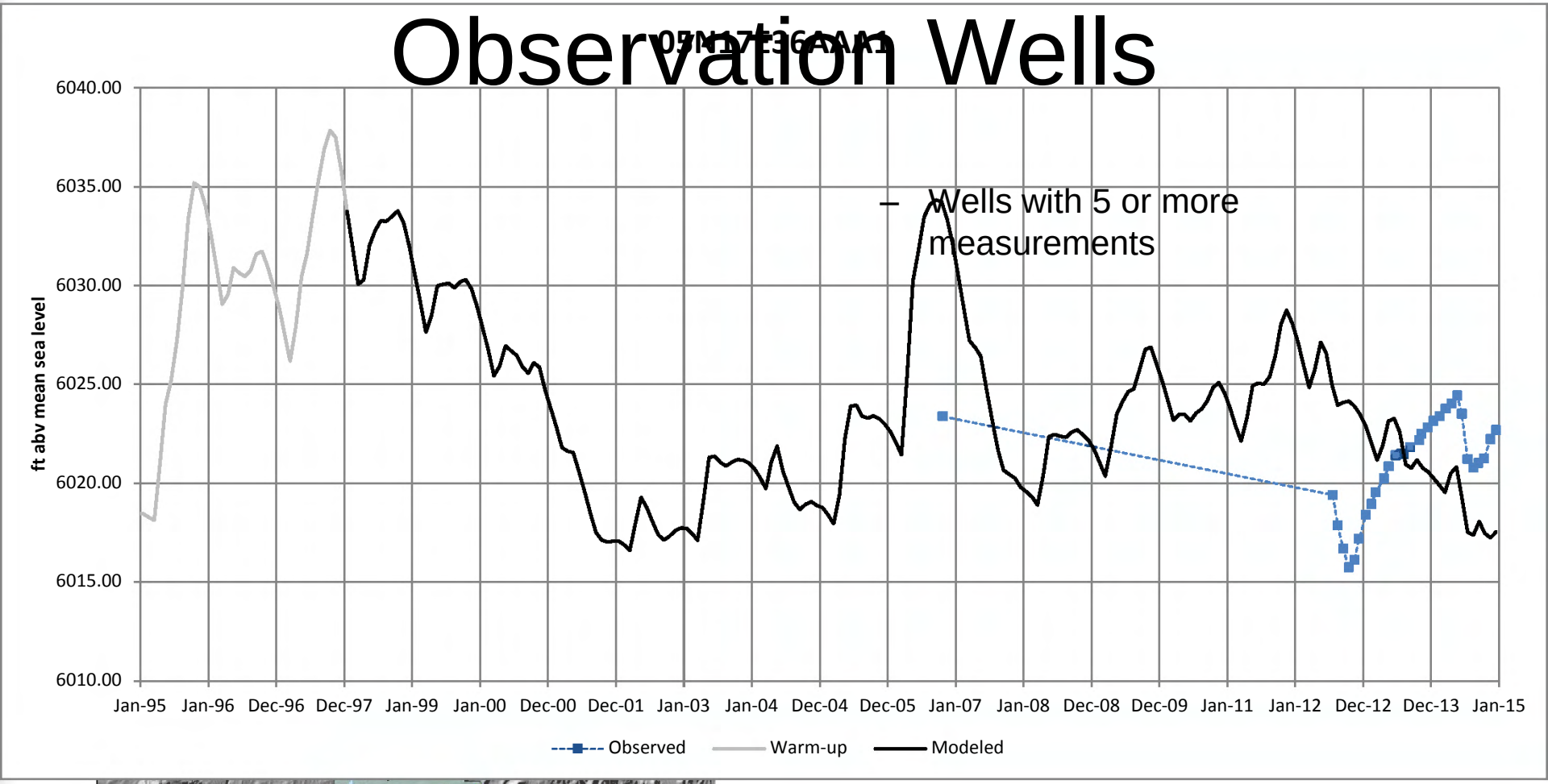
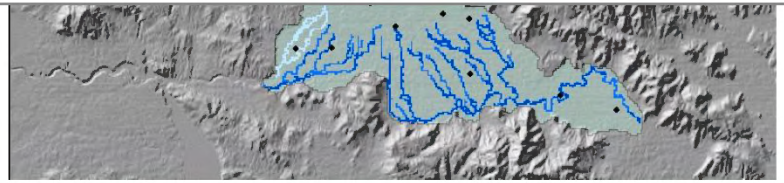
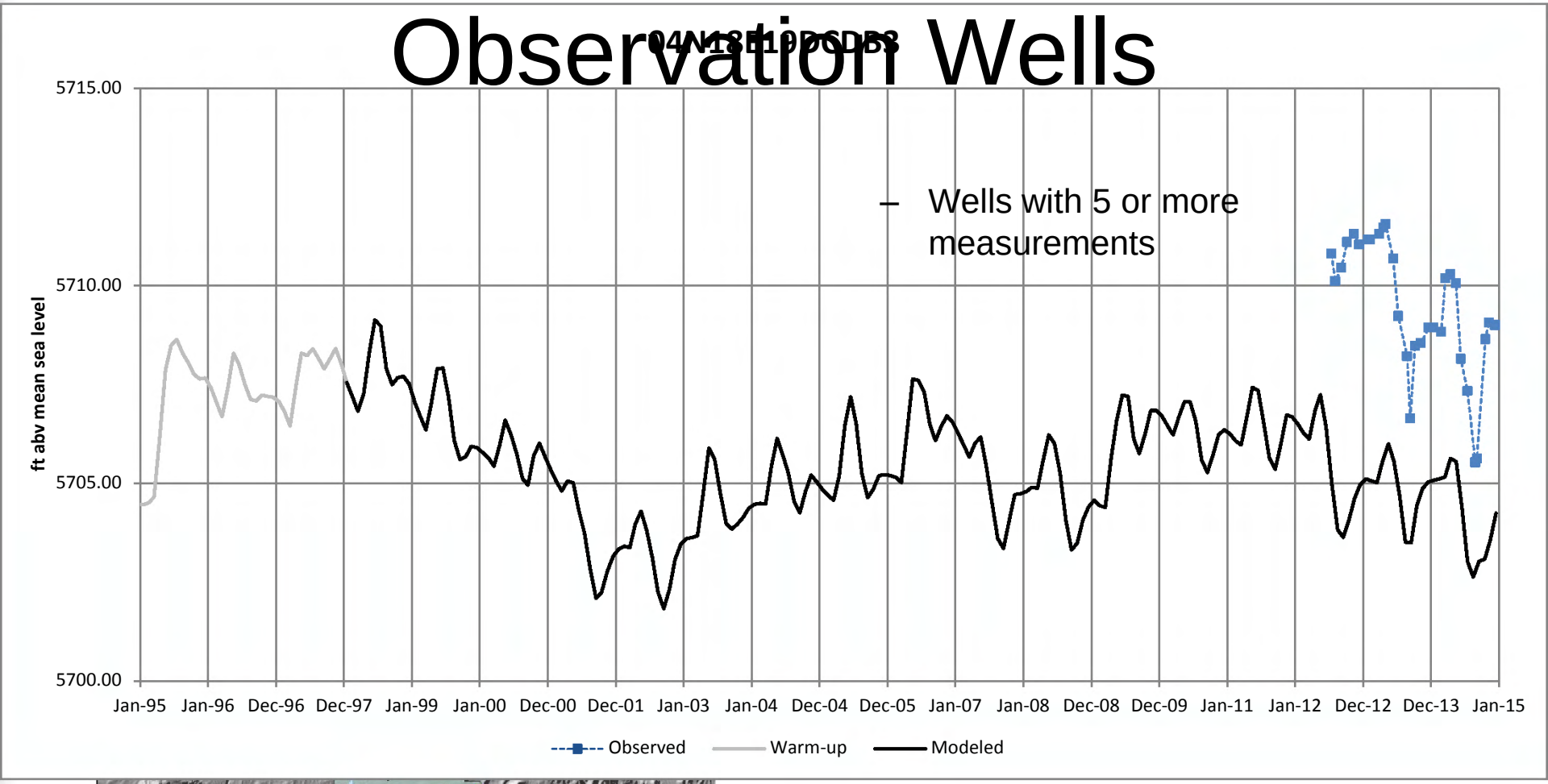
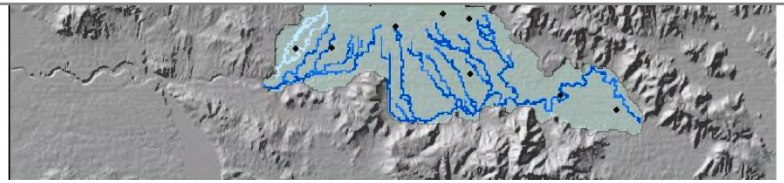




Observation Wells



– Wells with 5 or more measurements



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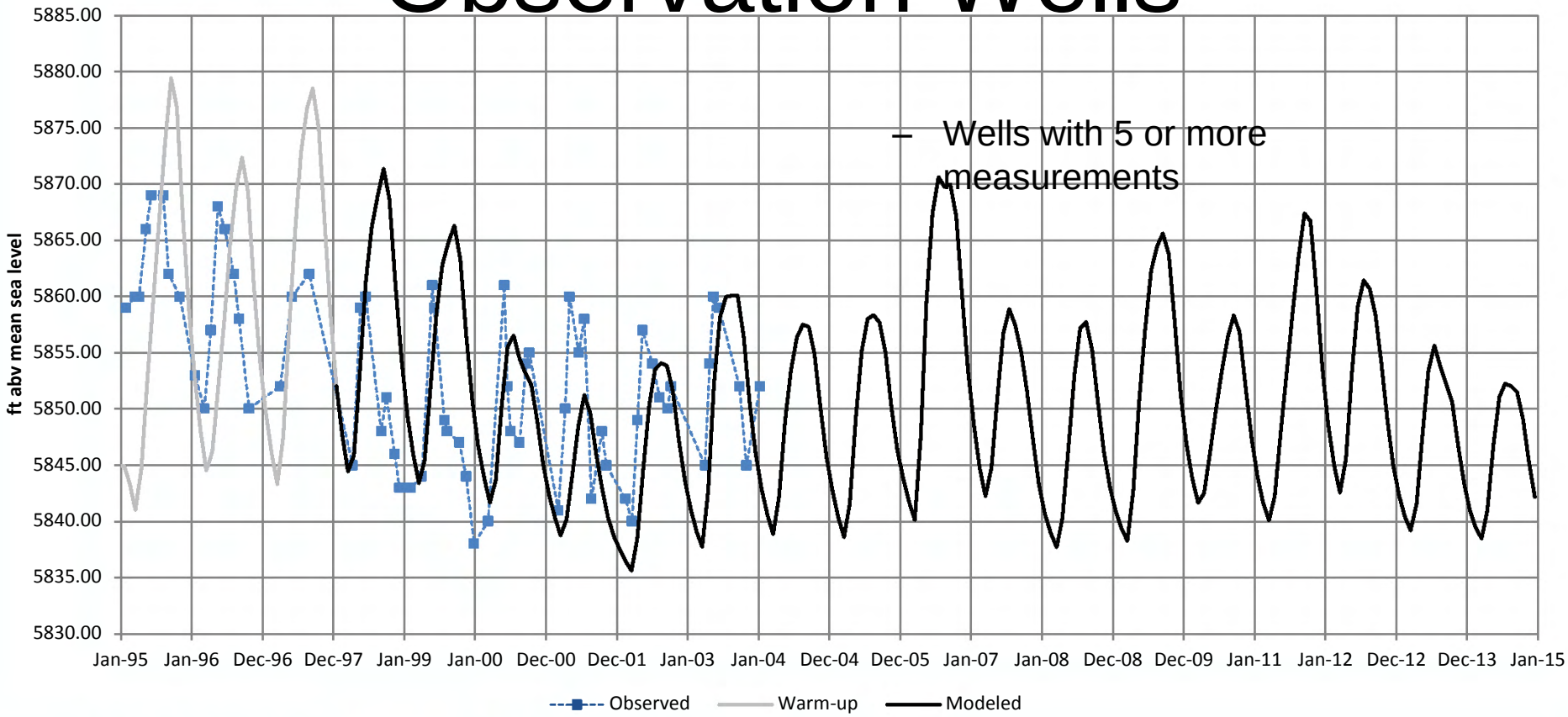

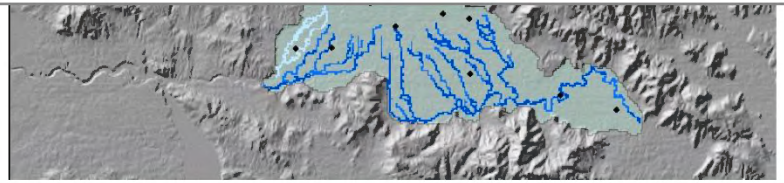

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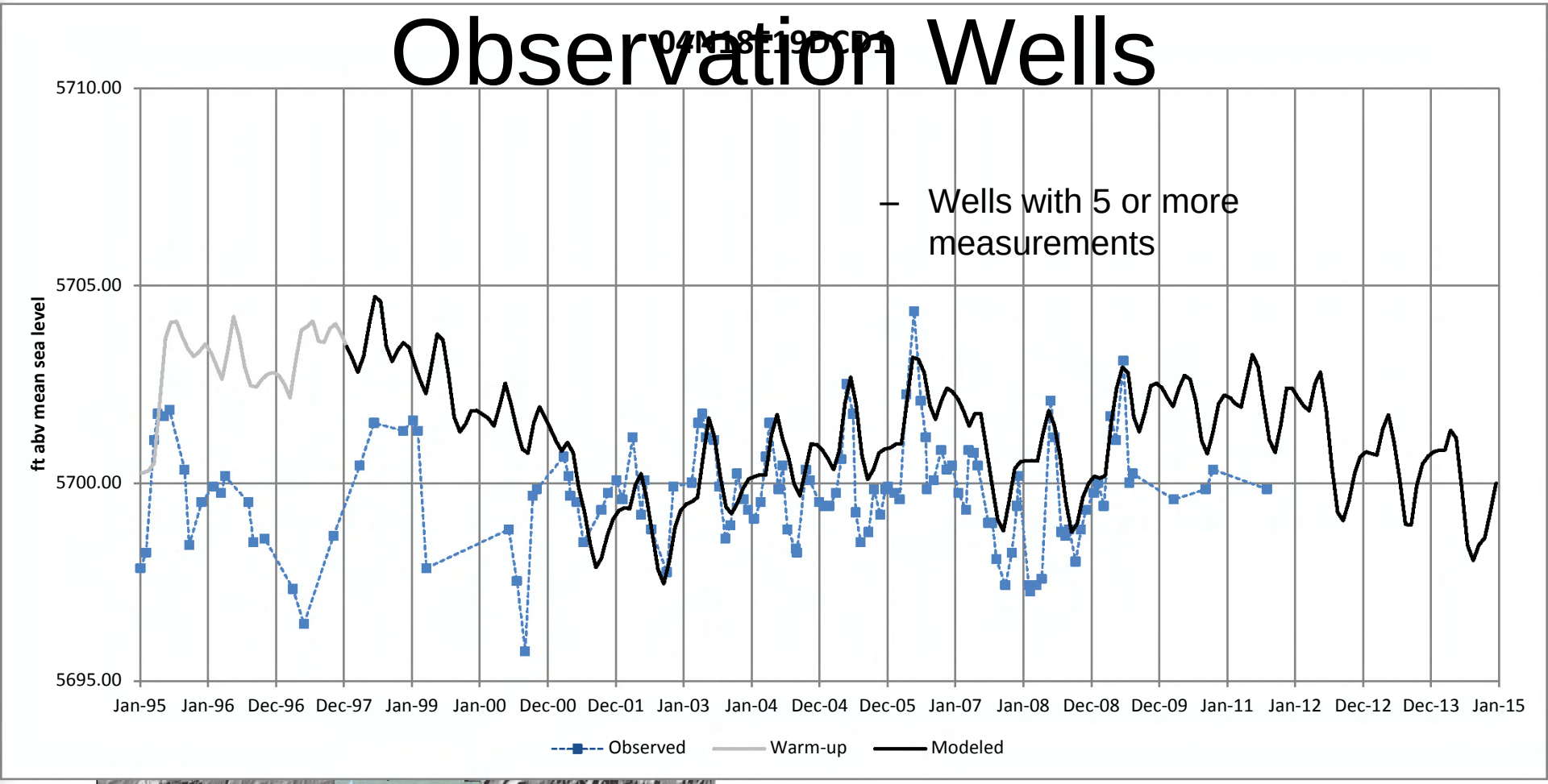

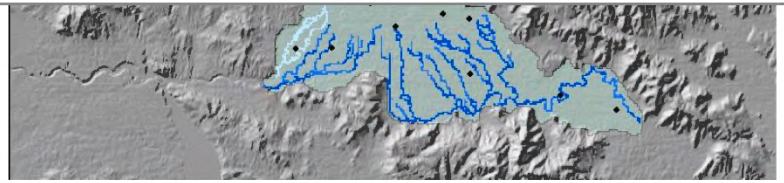

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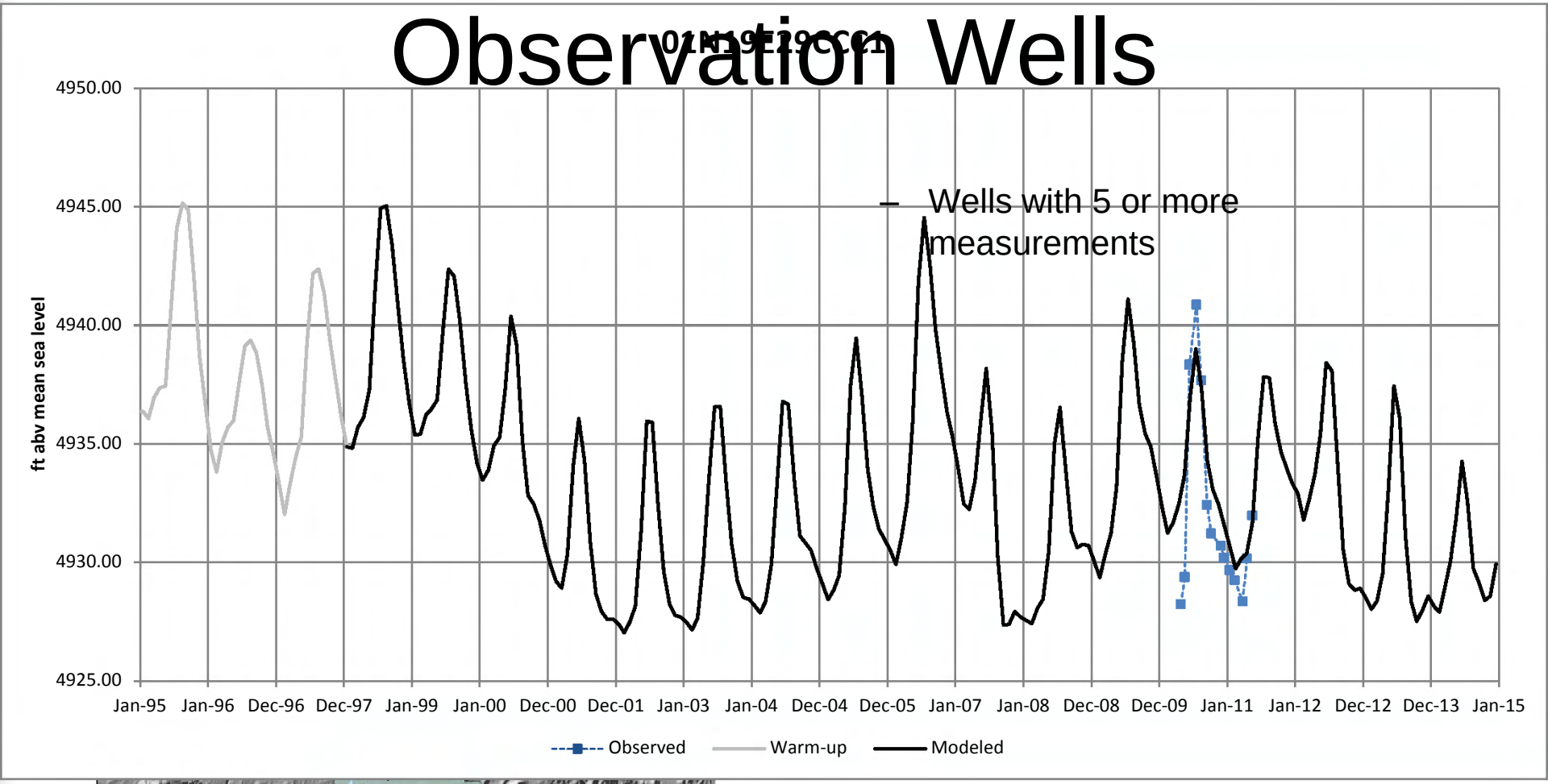

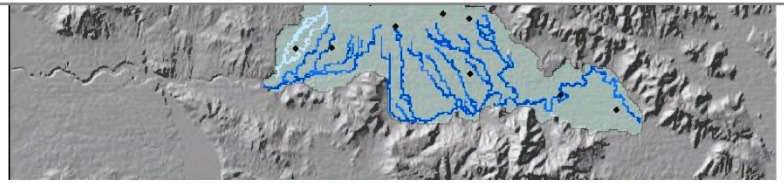

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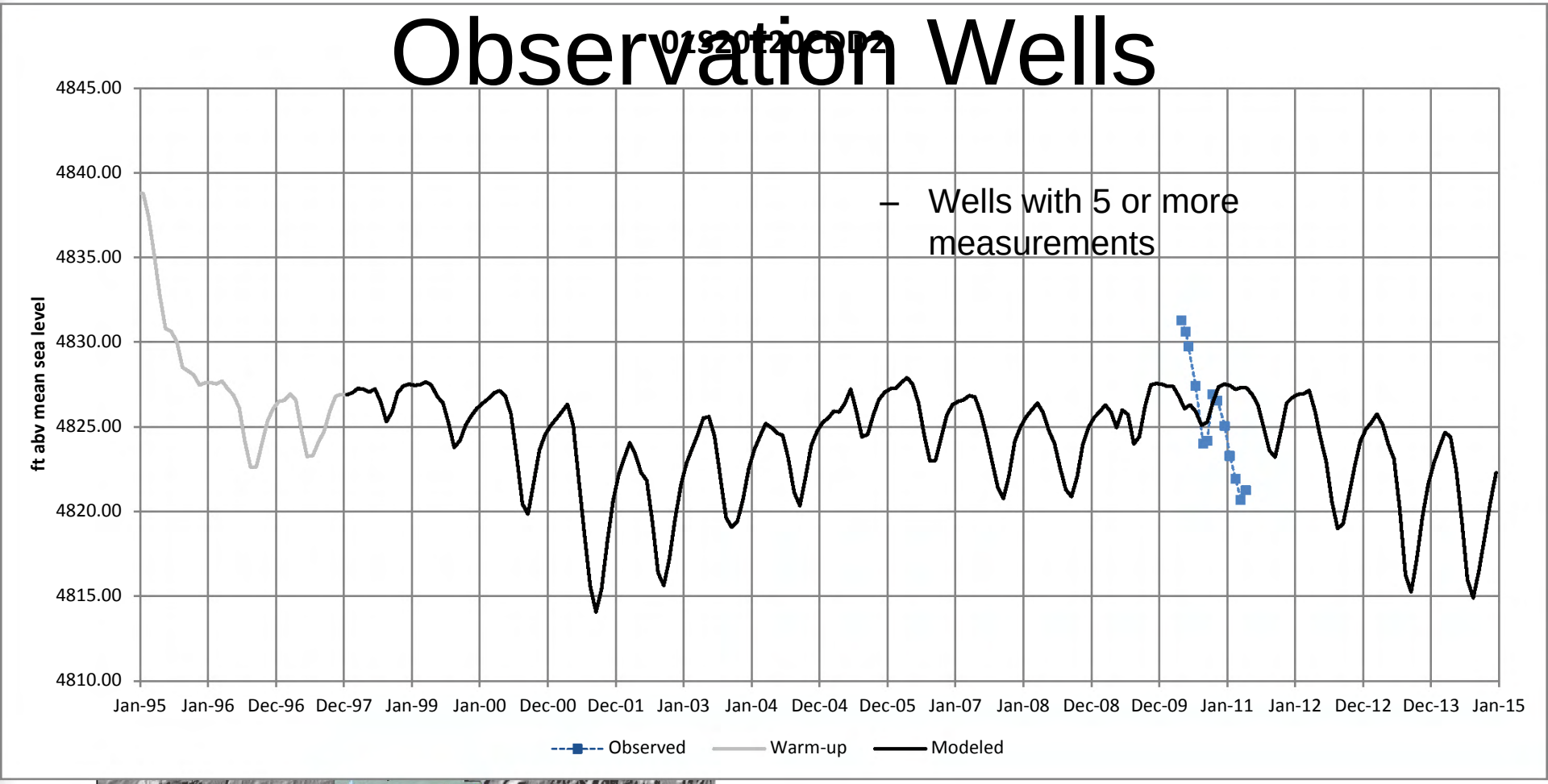

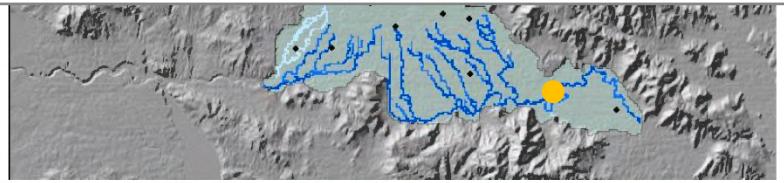

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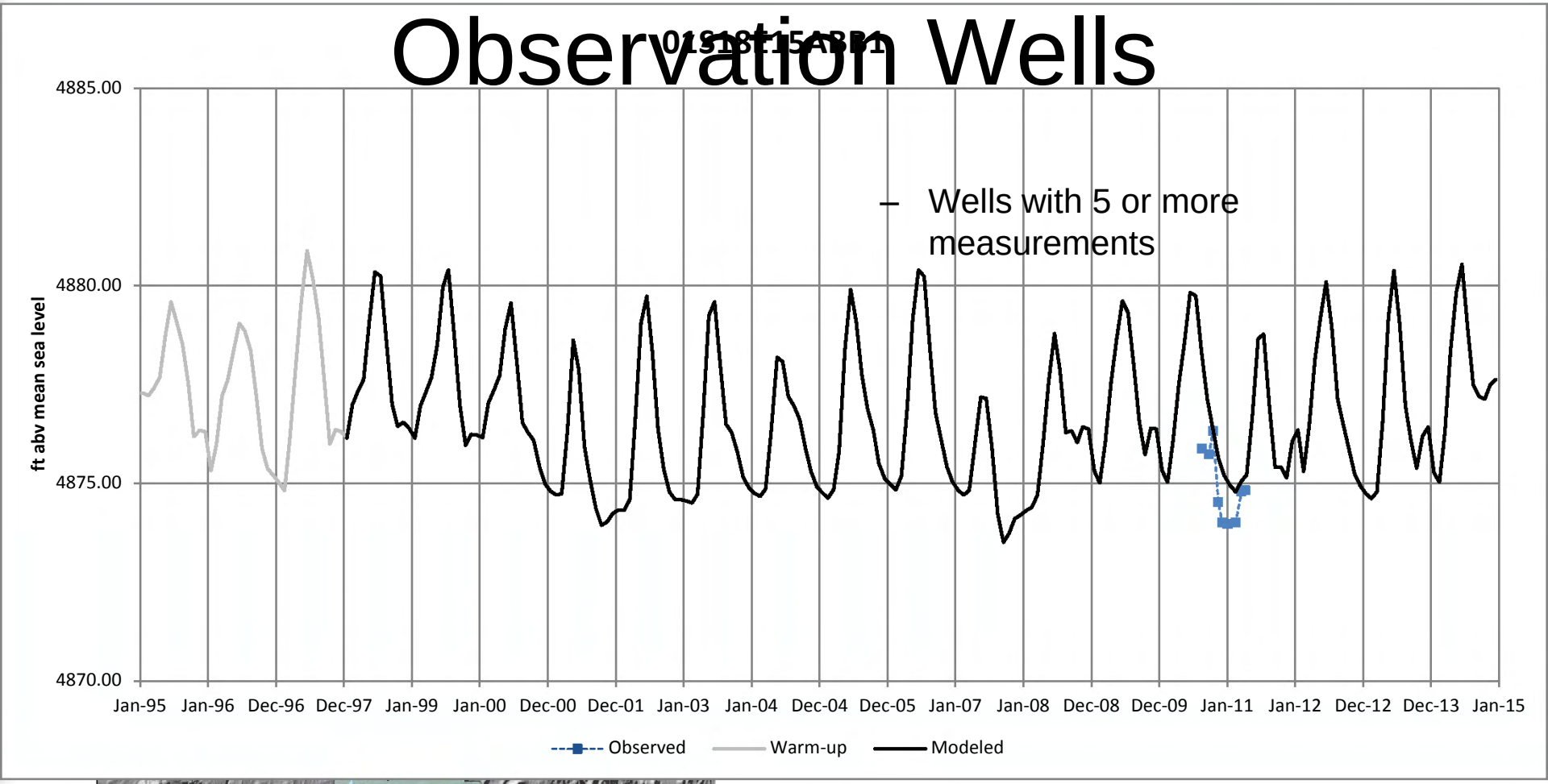
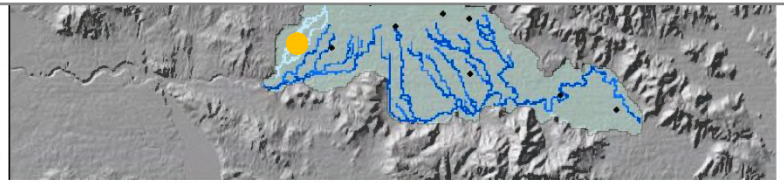


– Wells with 5 or more measurements



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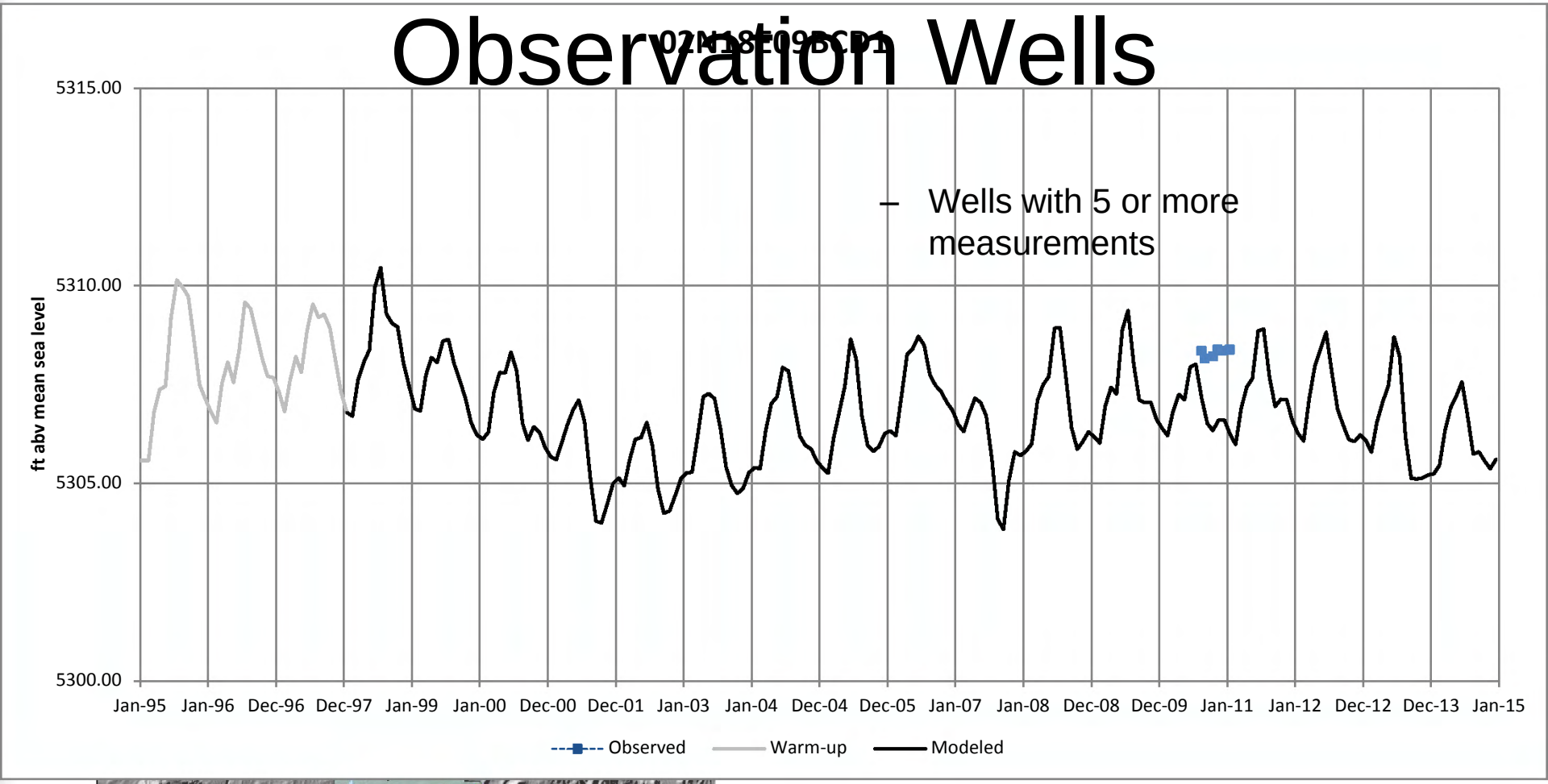
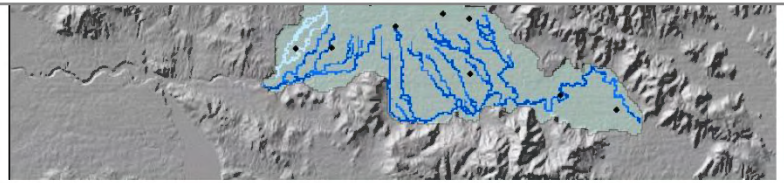


– Wells with 5 or more measurements



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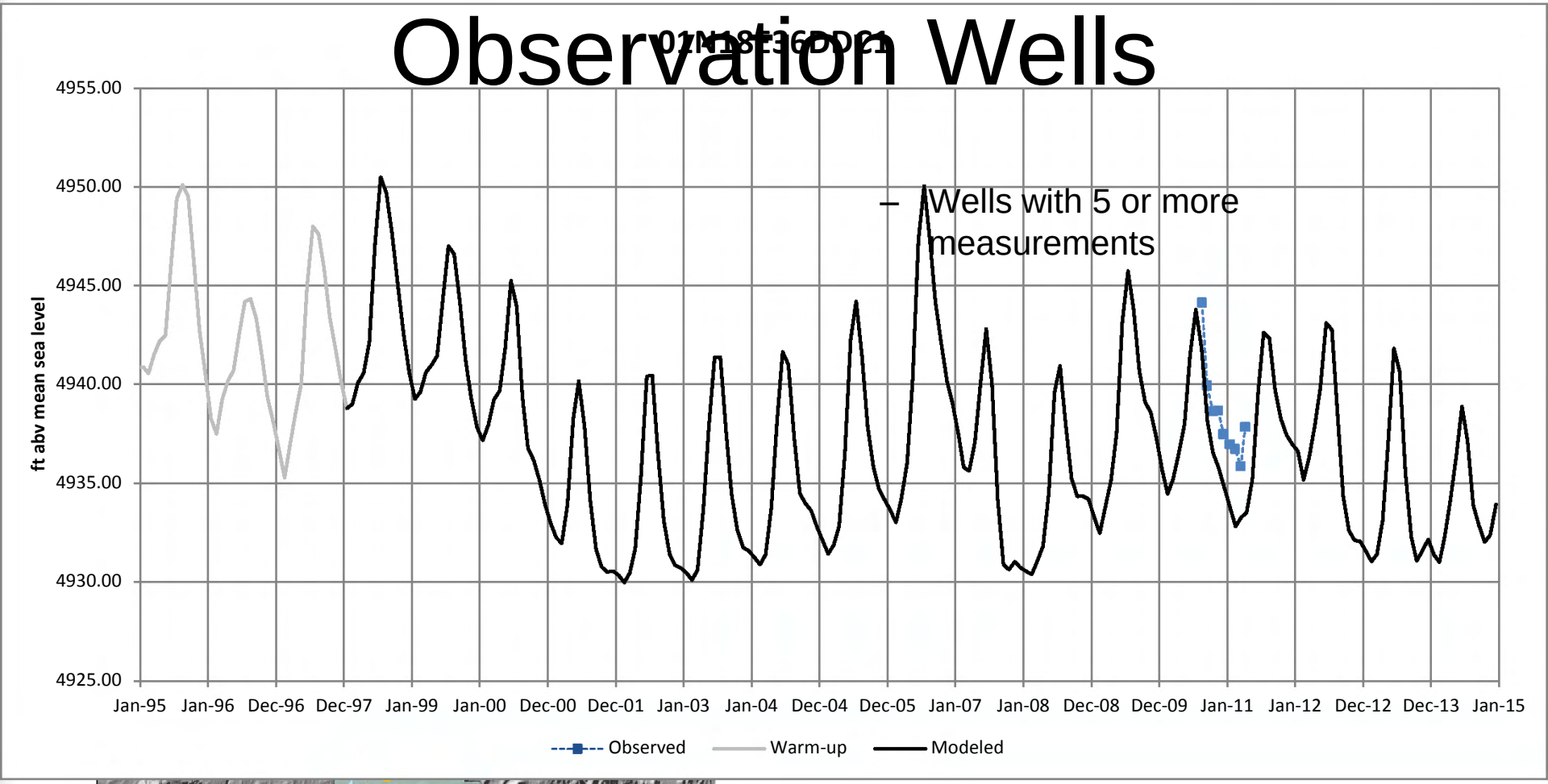
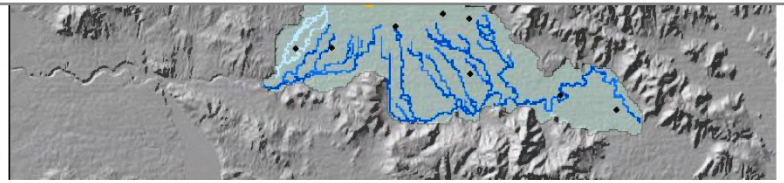
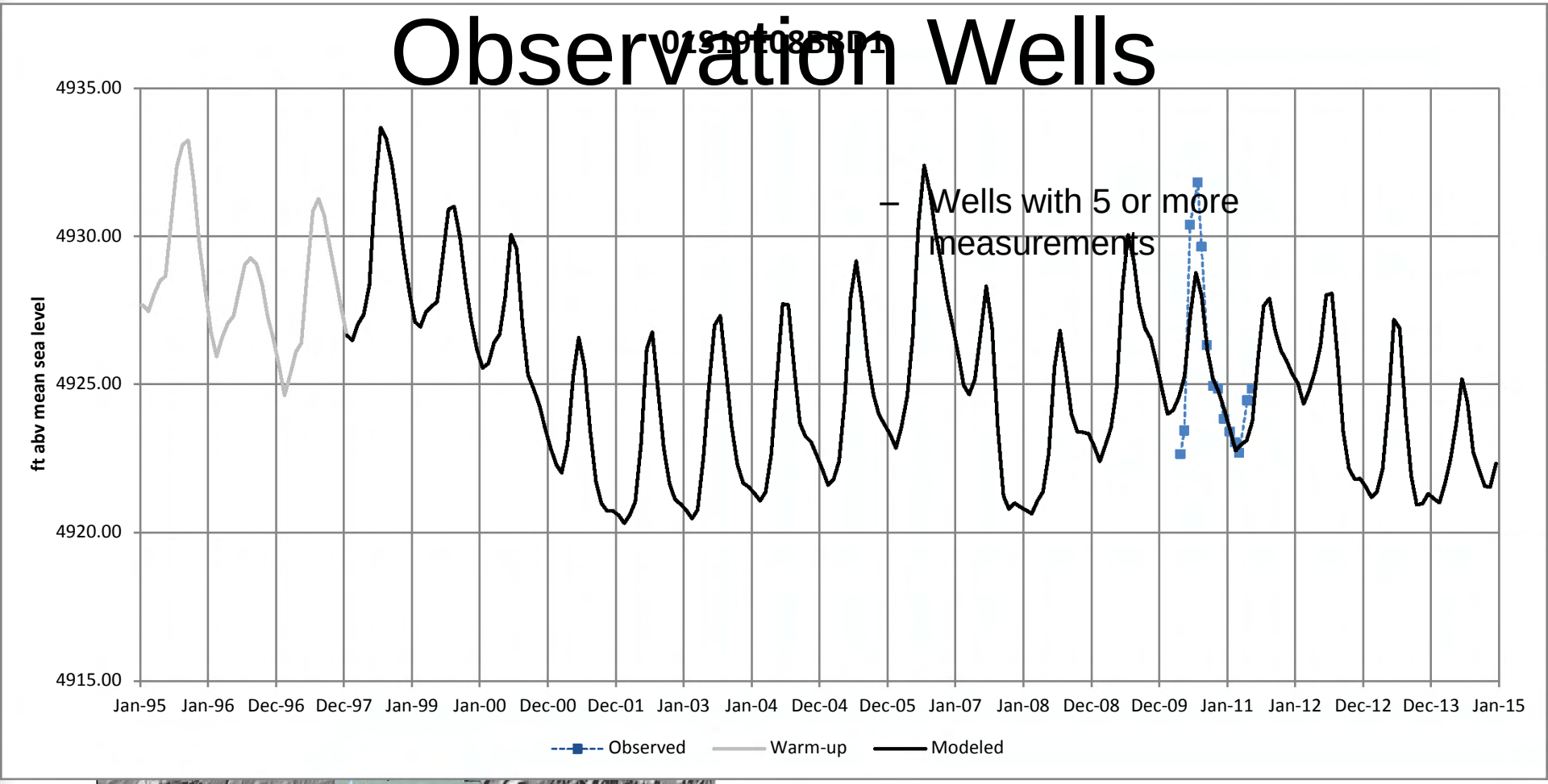
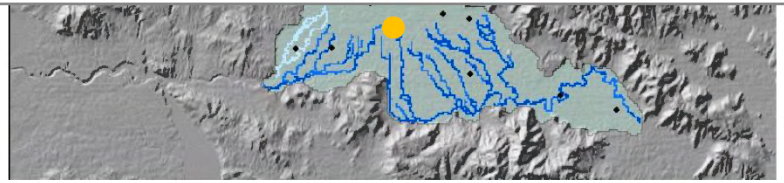


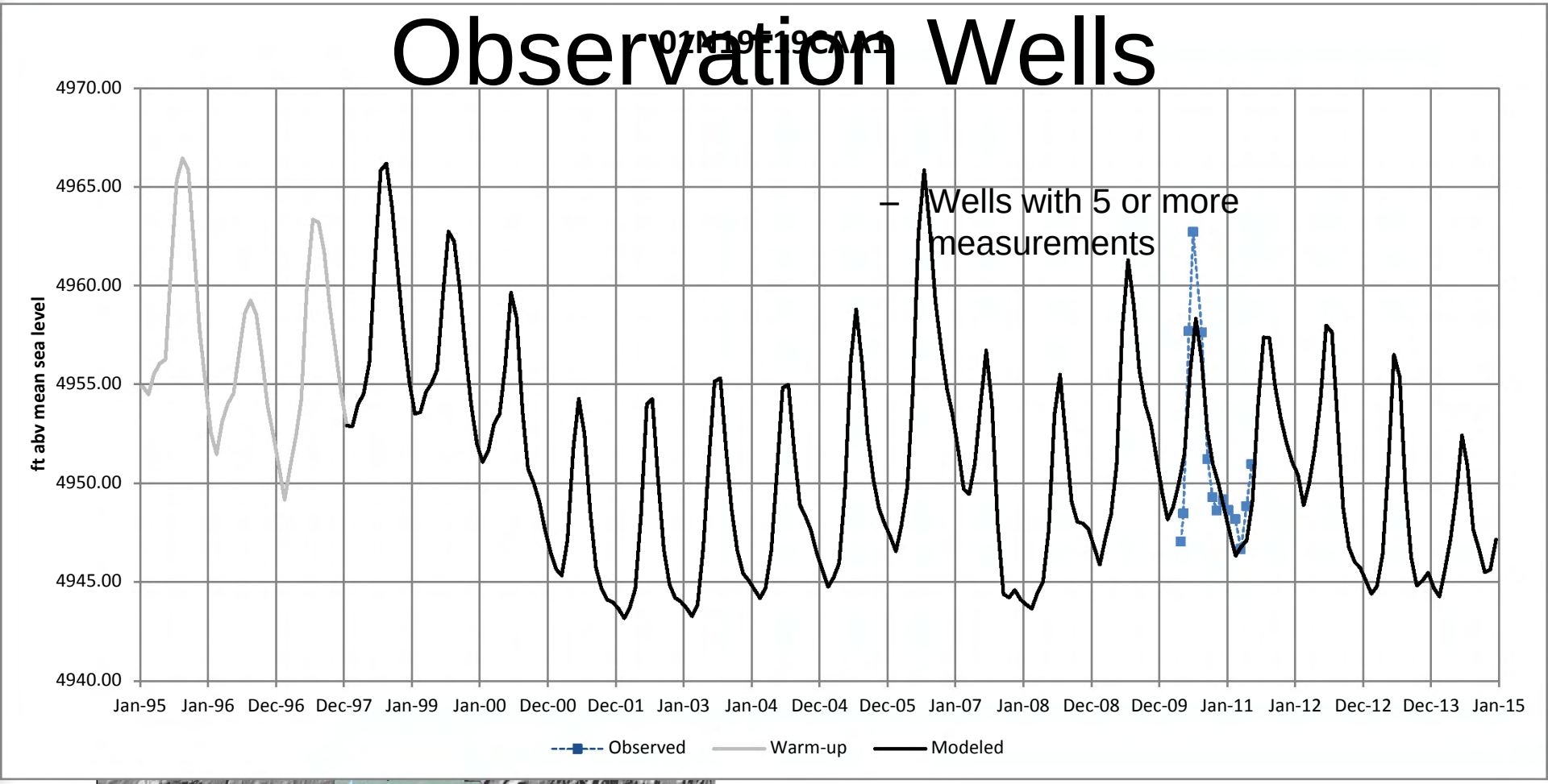


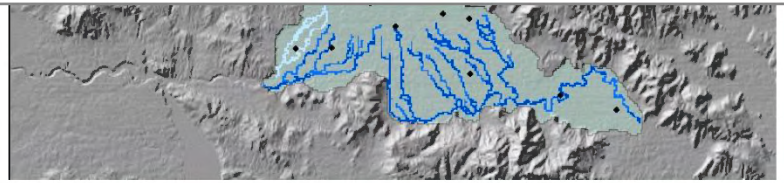
Observation Wells





Observation Wells





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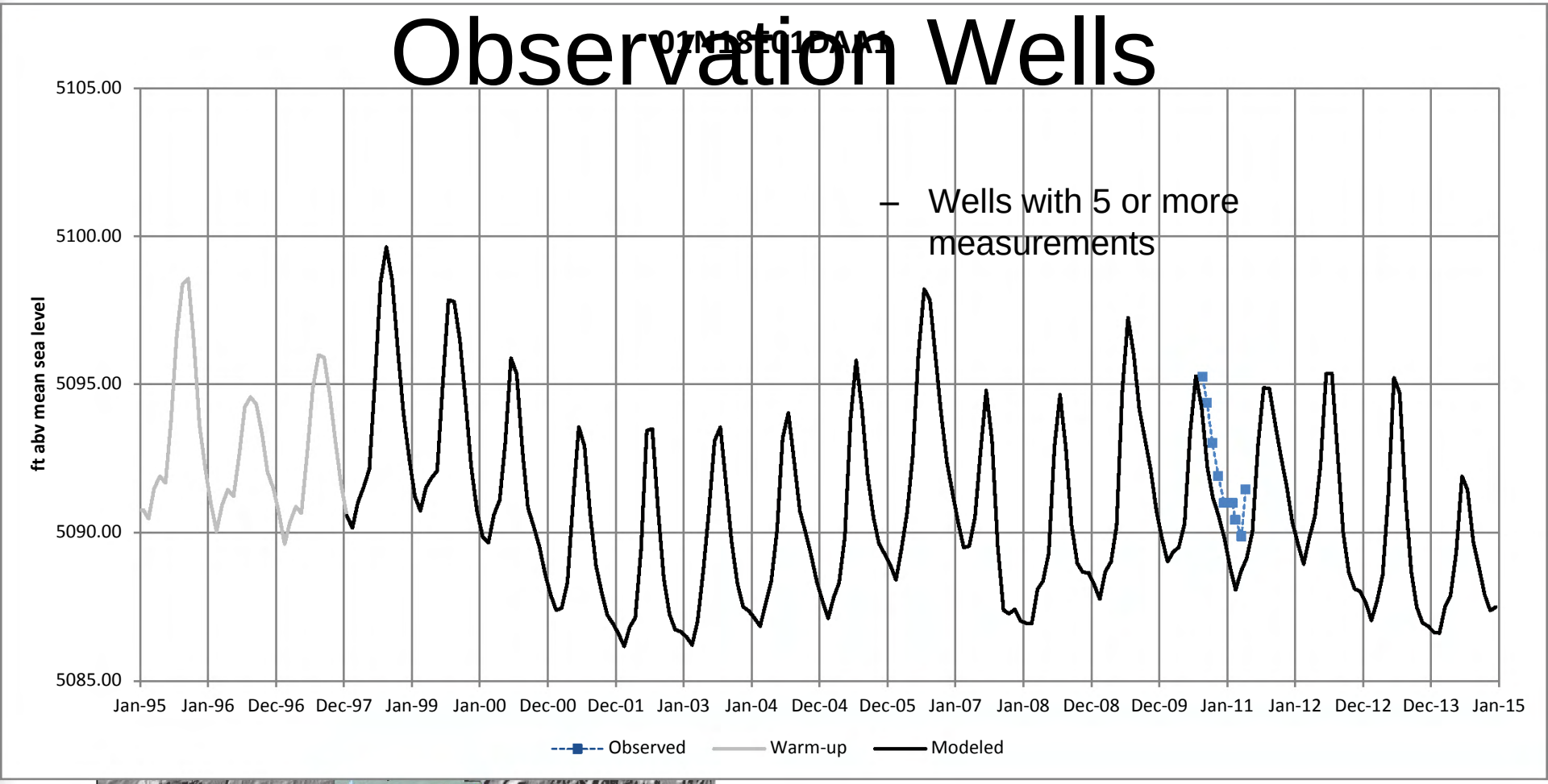
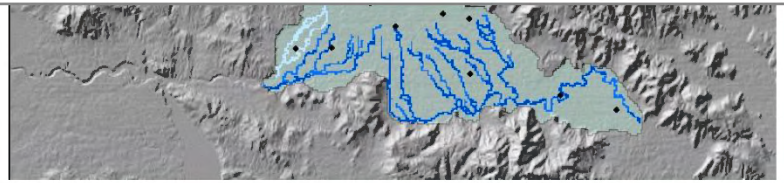
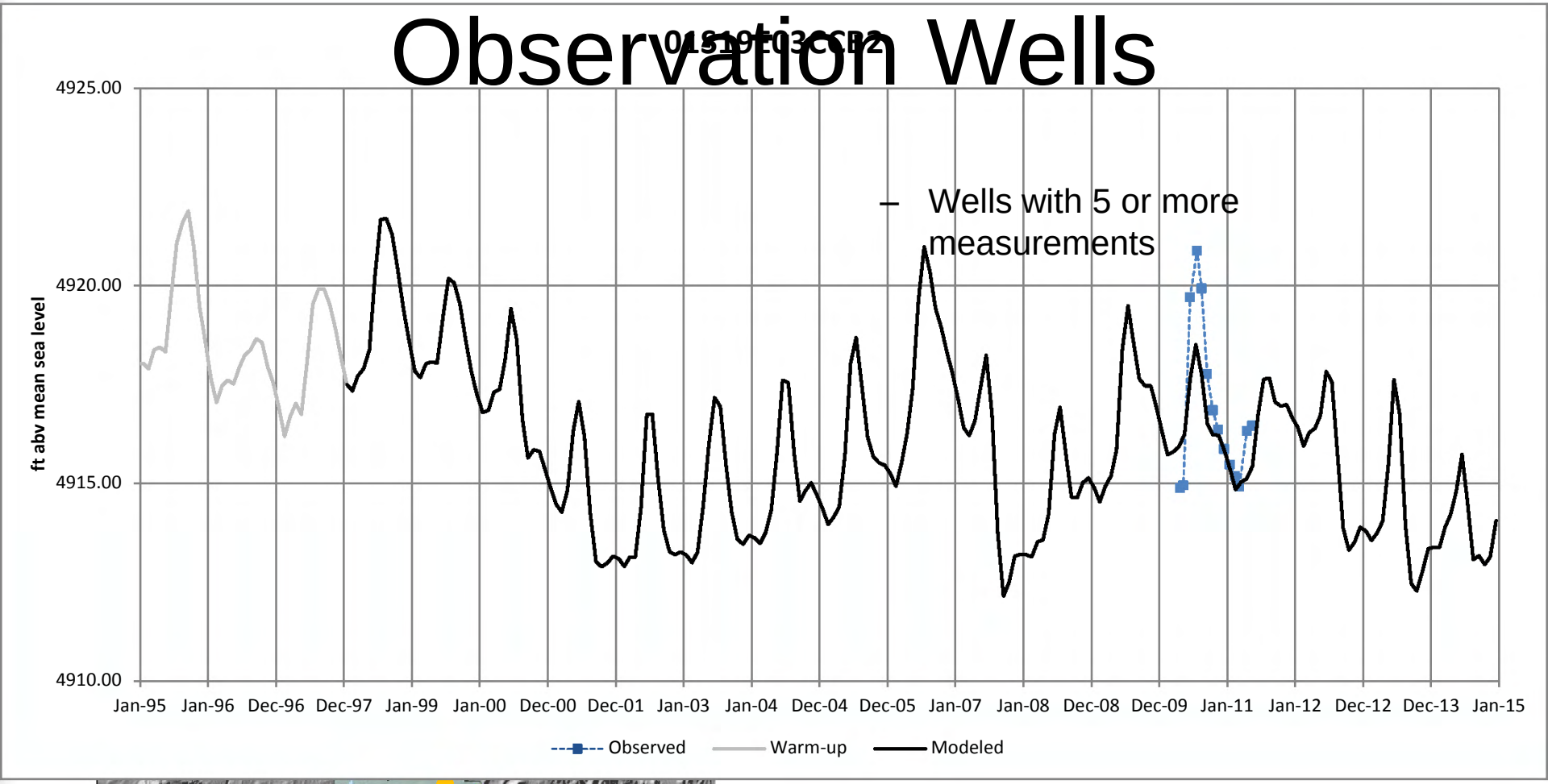


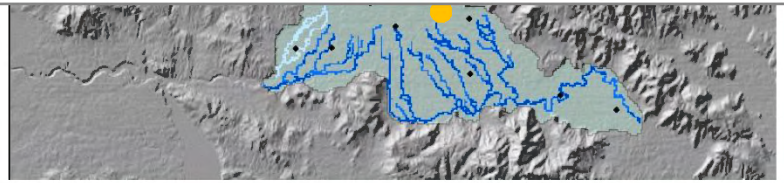
- Wells with 5 or more measurements



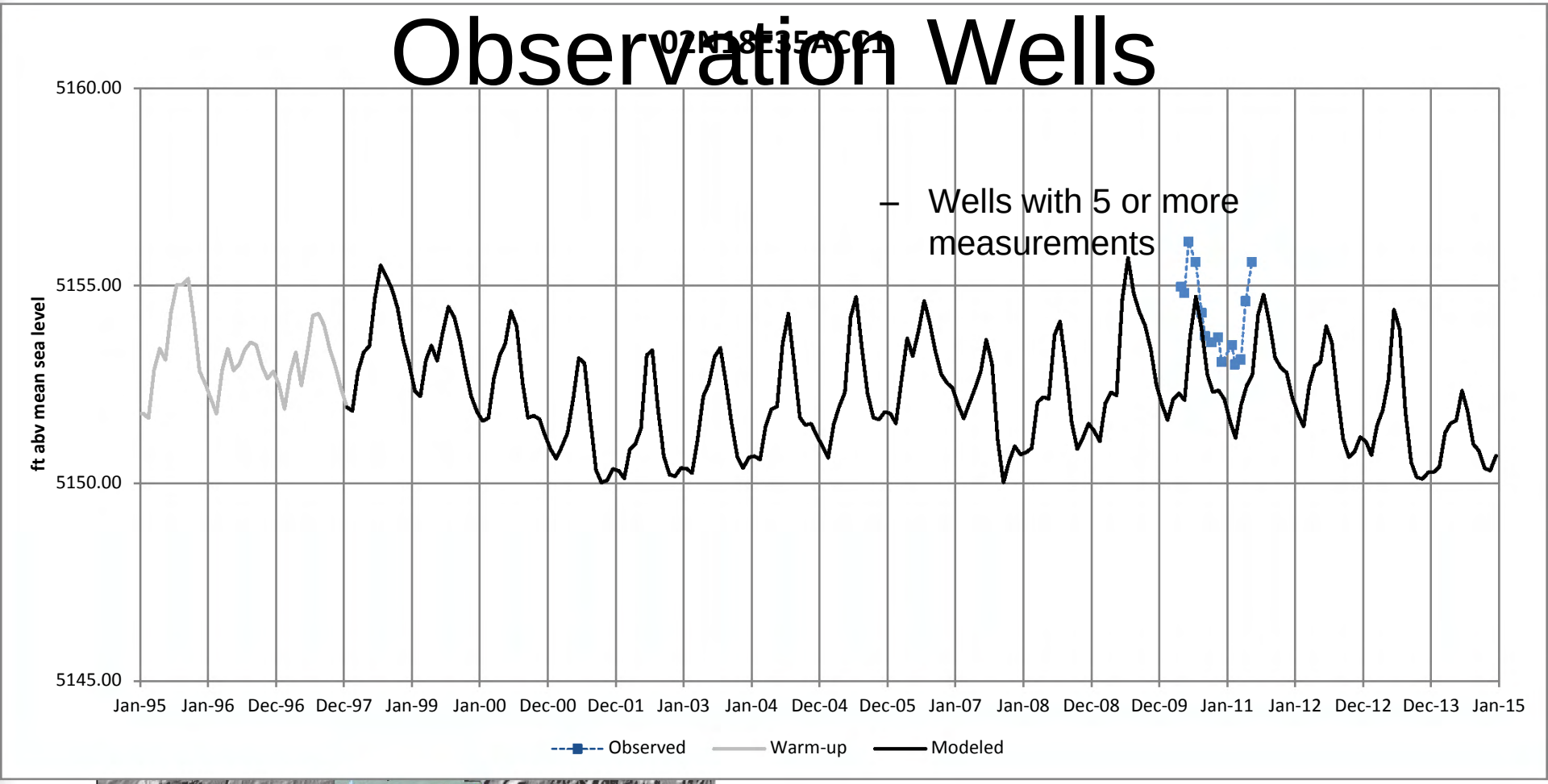
Observation Wells



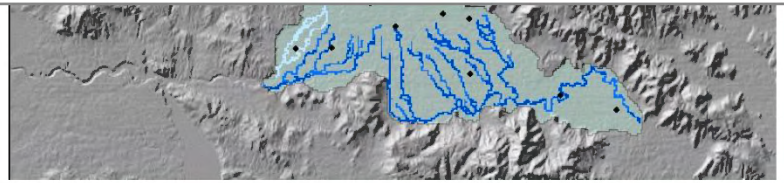
– Wells with 5 or more measurements



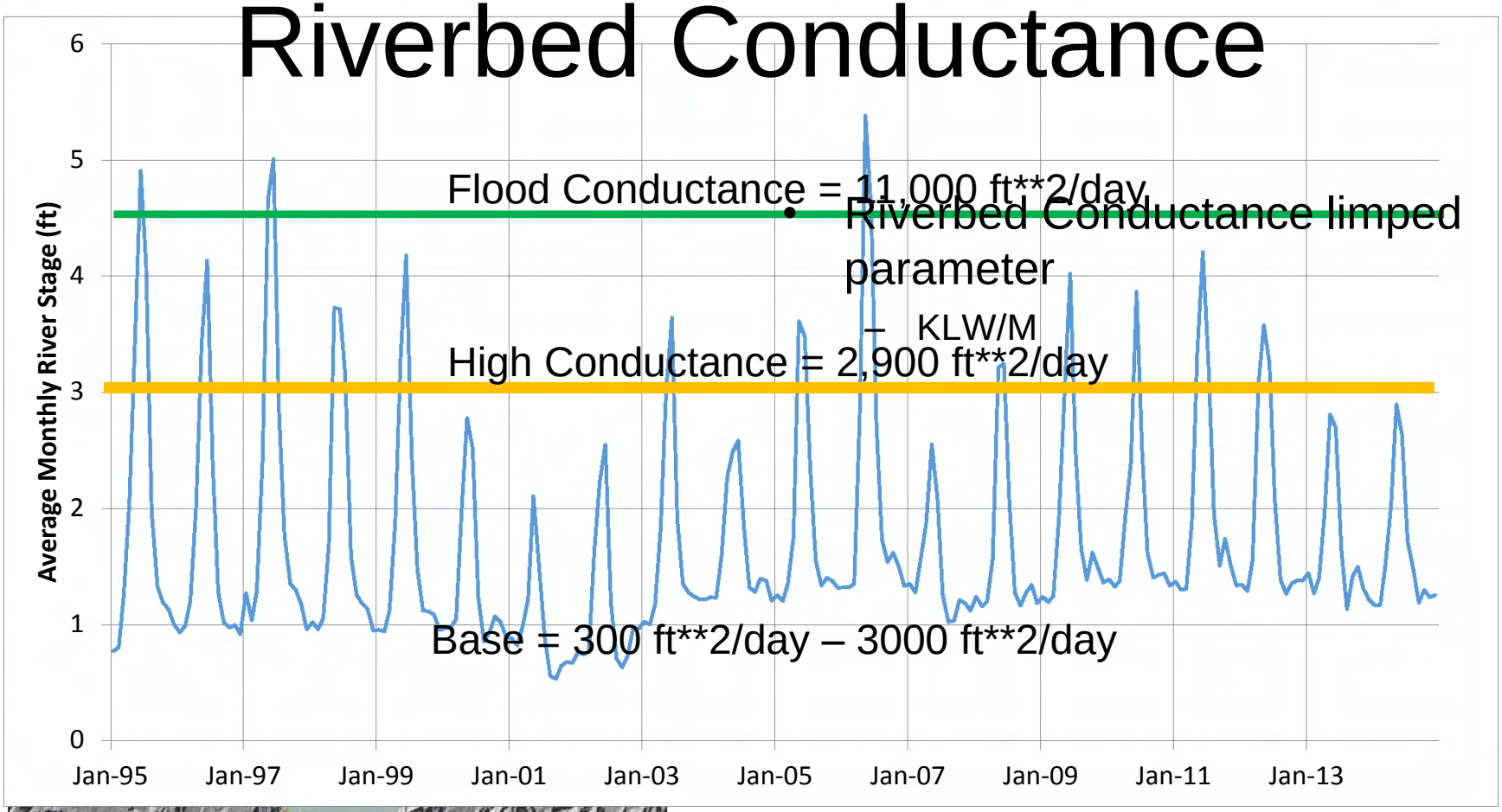
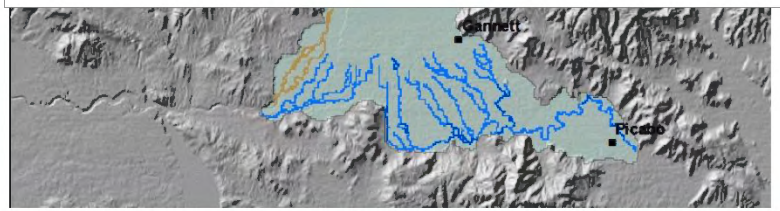
Observation Wells



– Wells with 5 or more measurements



Riverbed Conductance



- Riverbed Conductance limped parameter
  - KLW/M