

Model Discretization

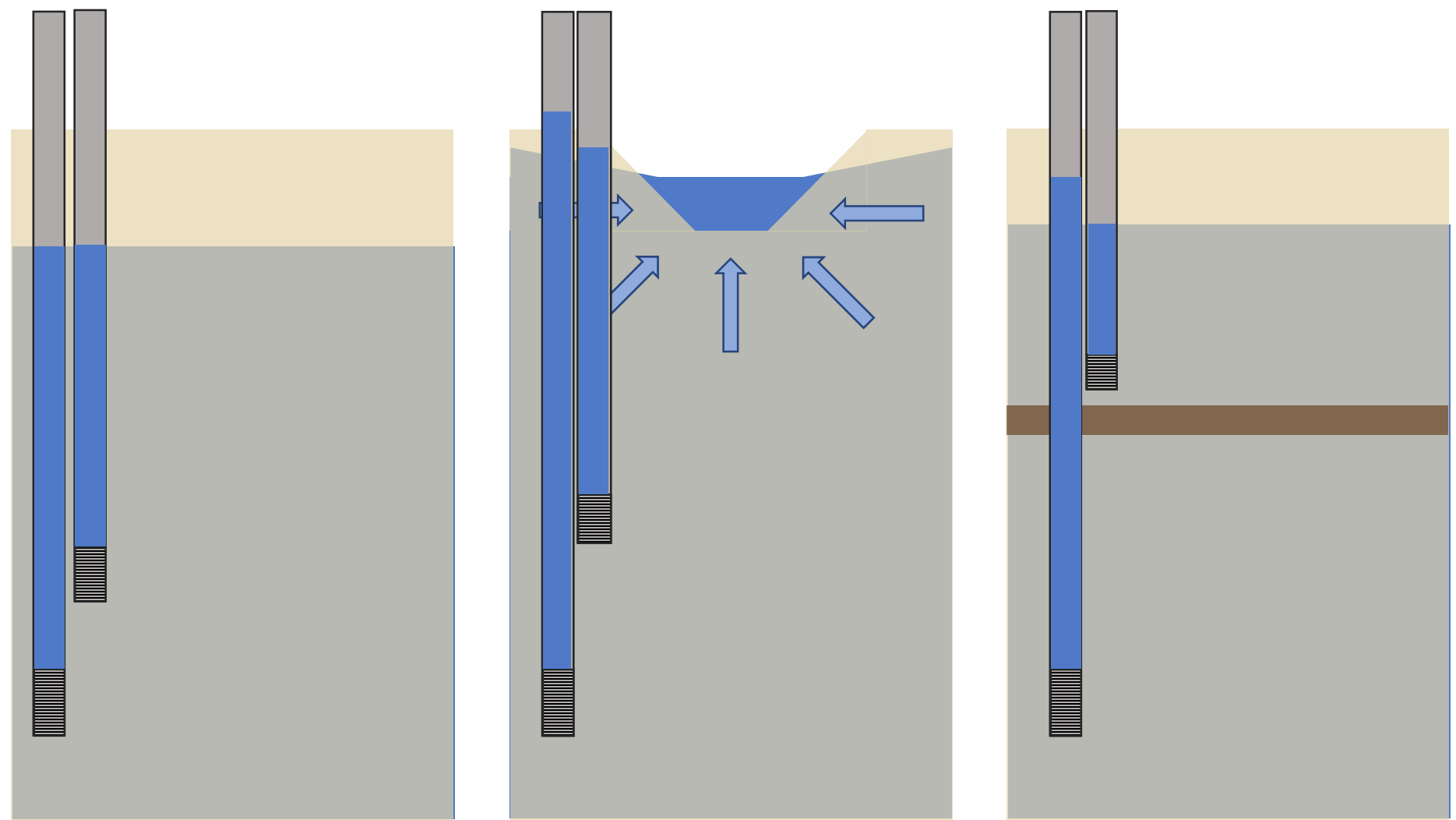
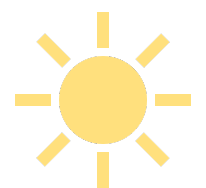
Stephen Hundt

In a nutshell:

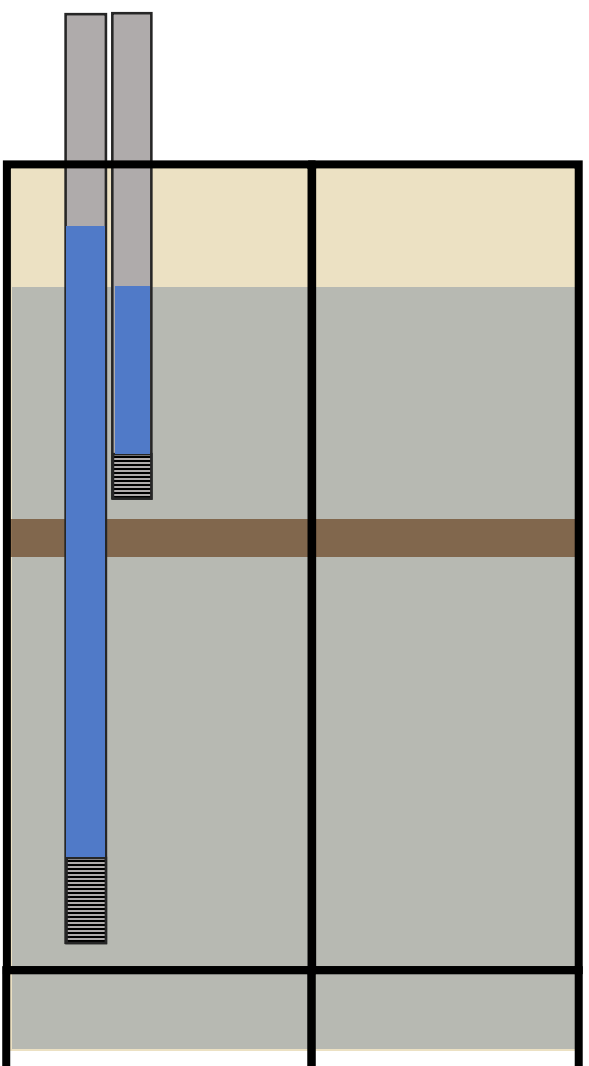
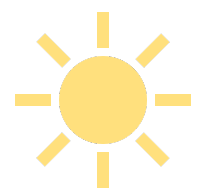
- Modelling in space and time
- Reality is infinitely detailed and continuously varying
- Models simplify: cut reality into *discrete* bins
- Decide based upon objectives, data, and computing power

Vertical: layers

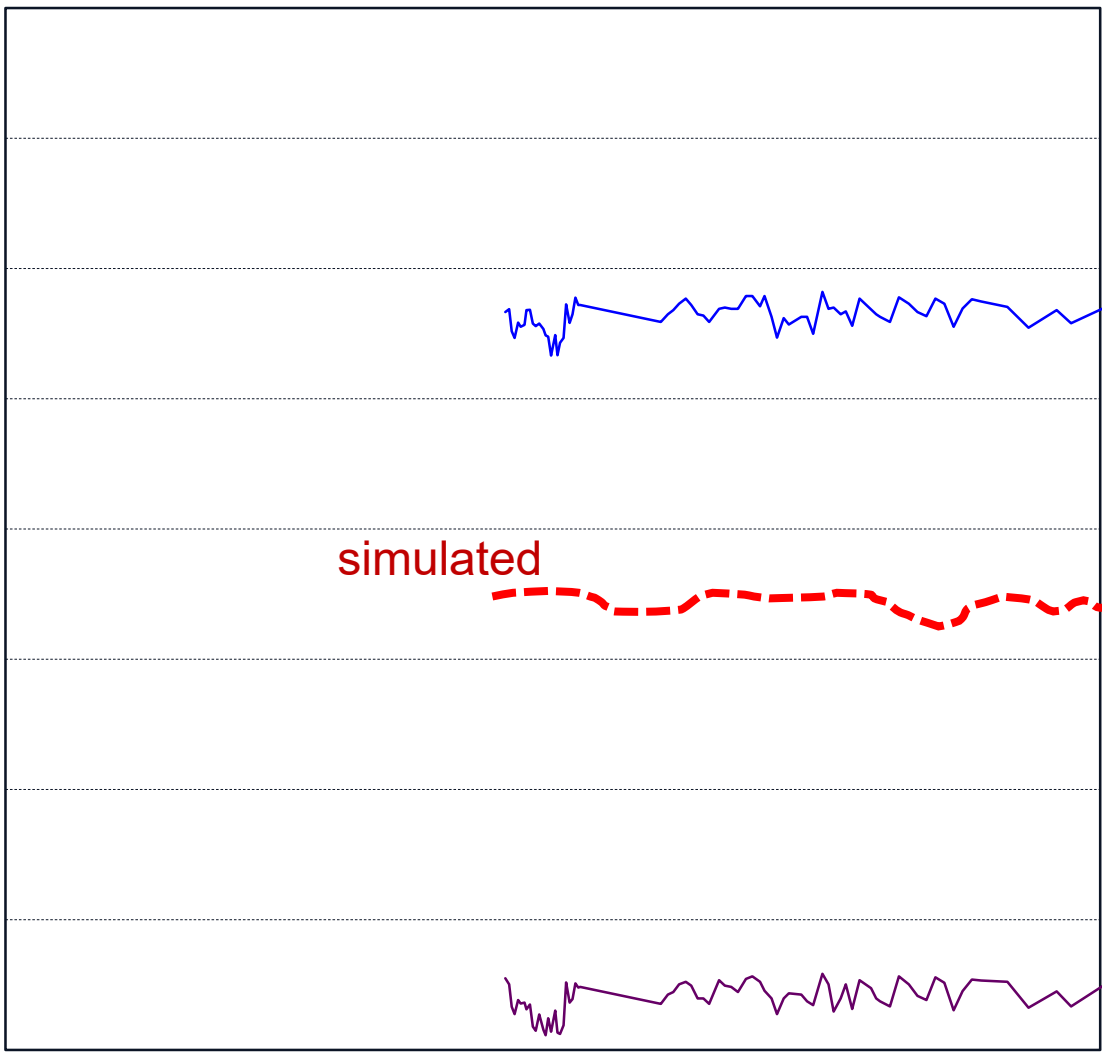
Multilevel wells



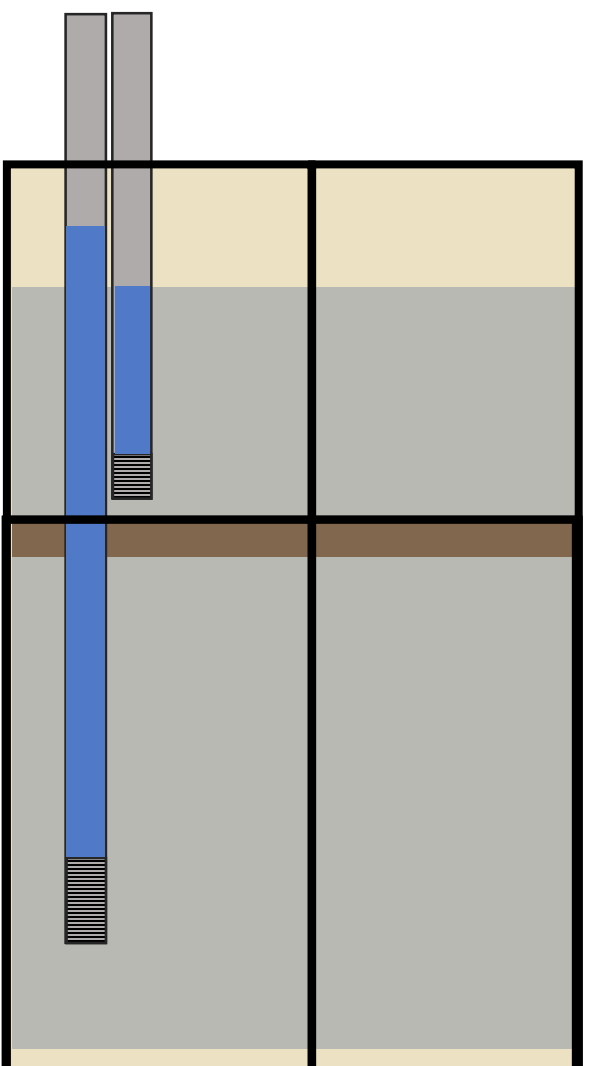
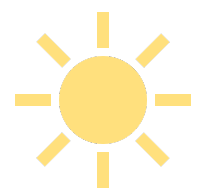
Multilevel wells



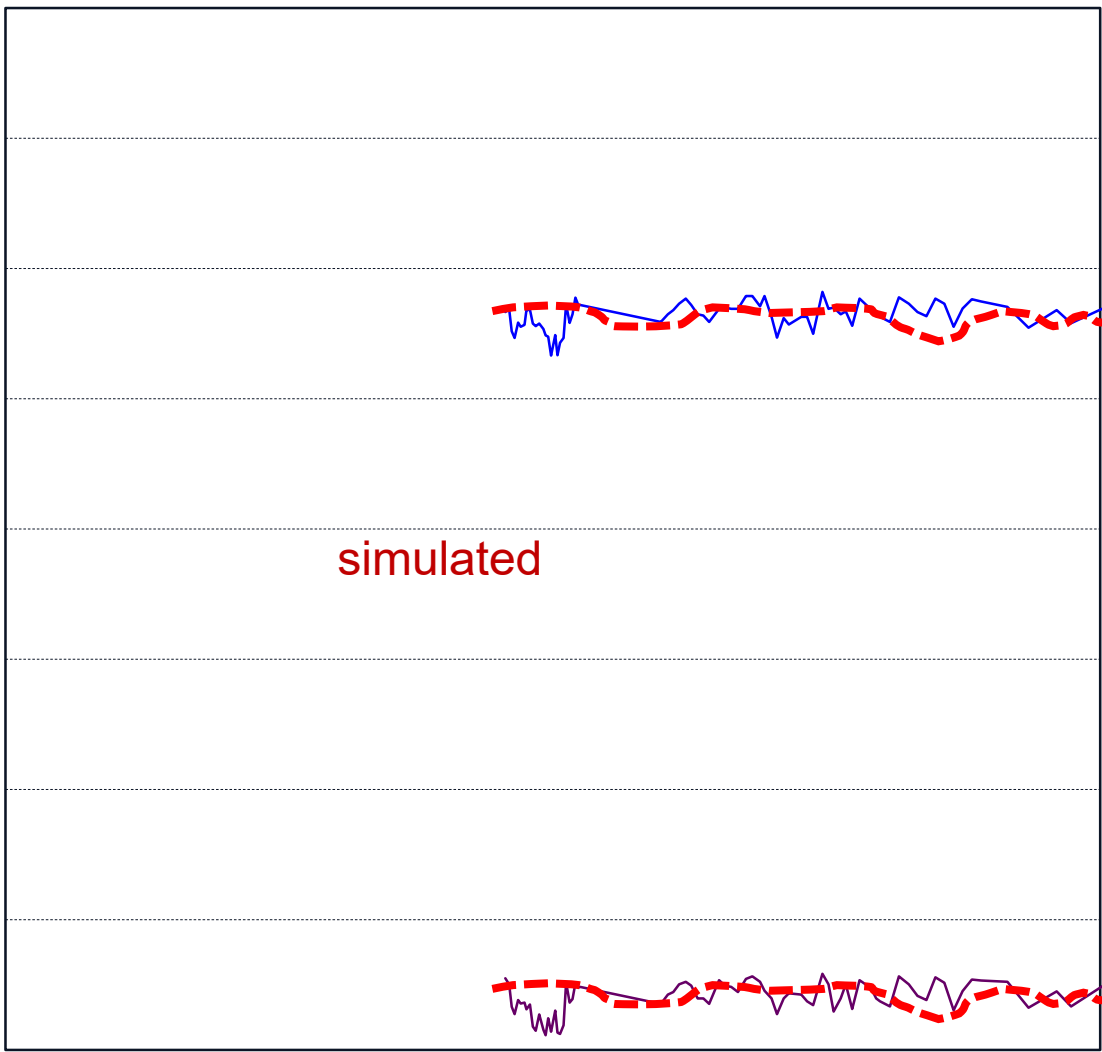
Water-level altitude, ft (NAVD88)



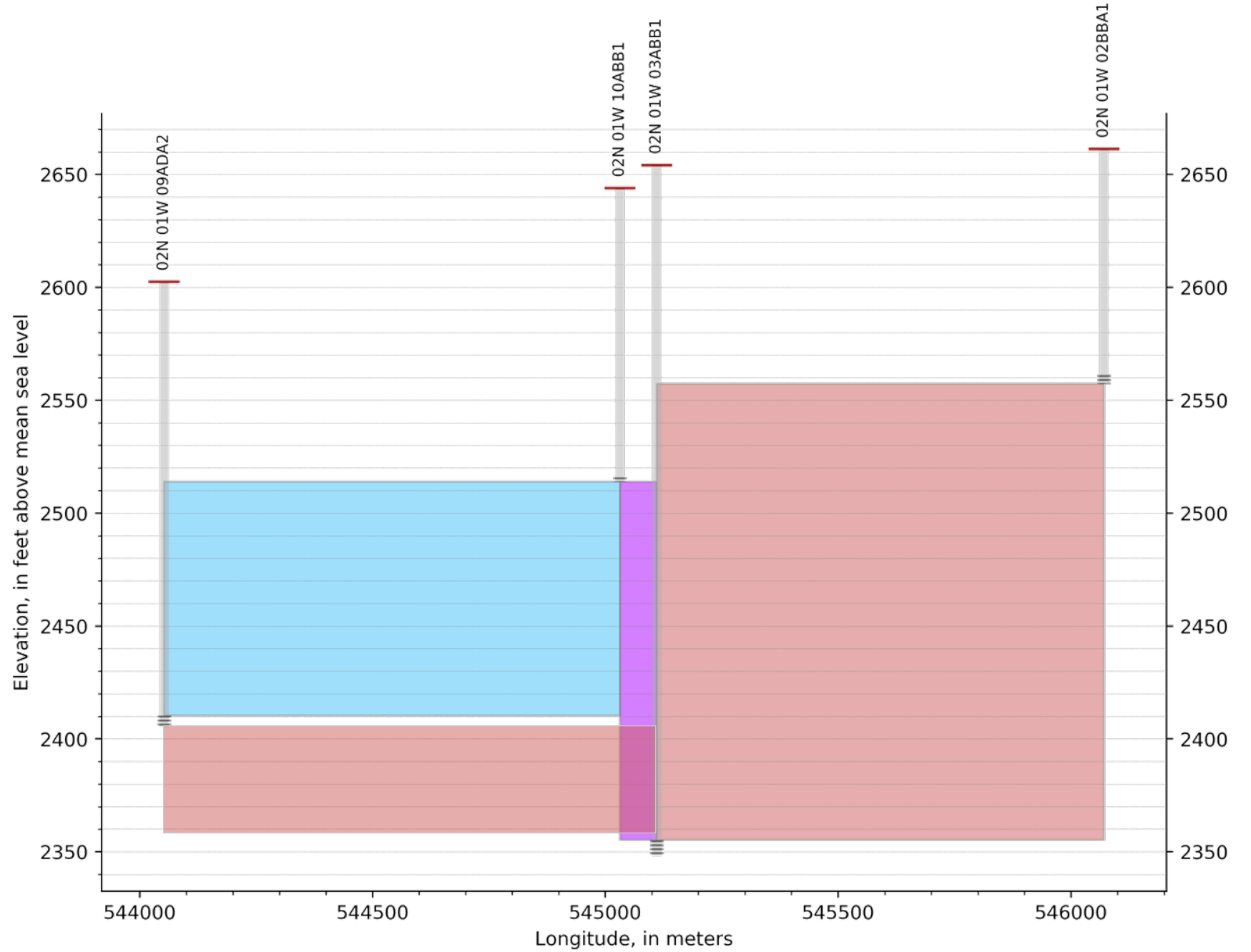
Multilevel wells



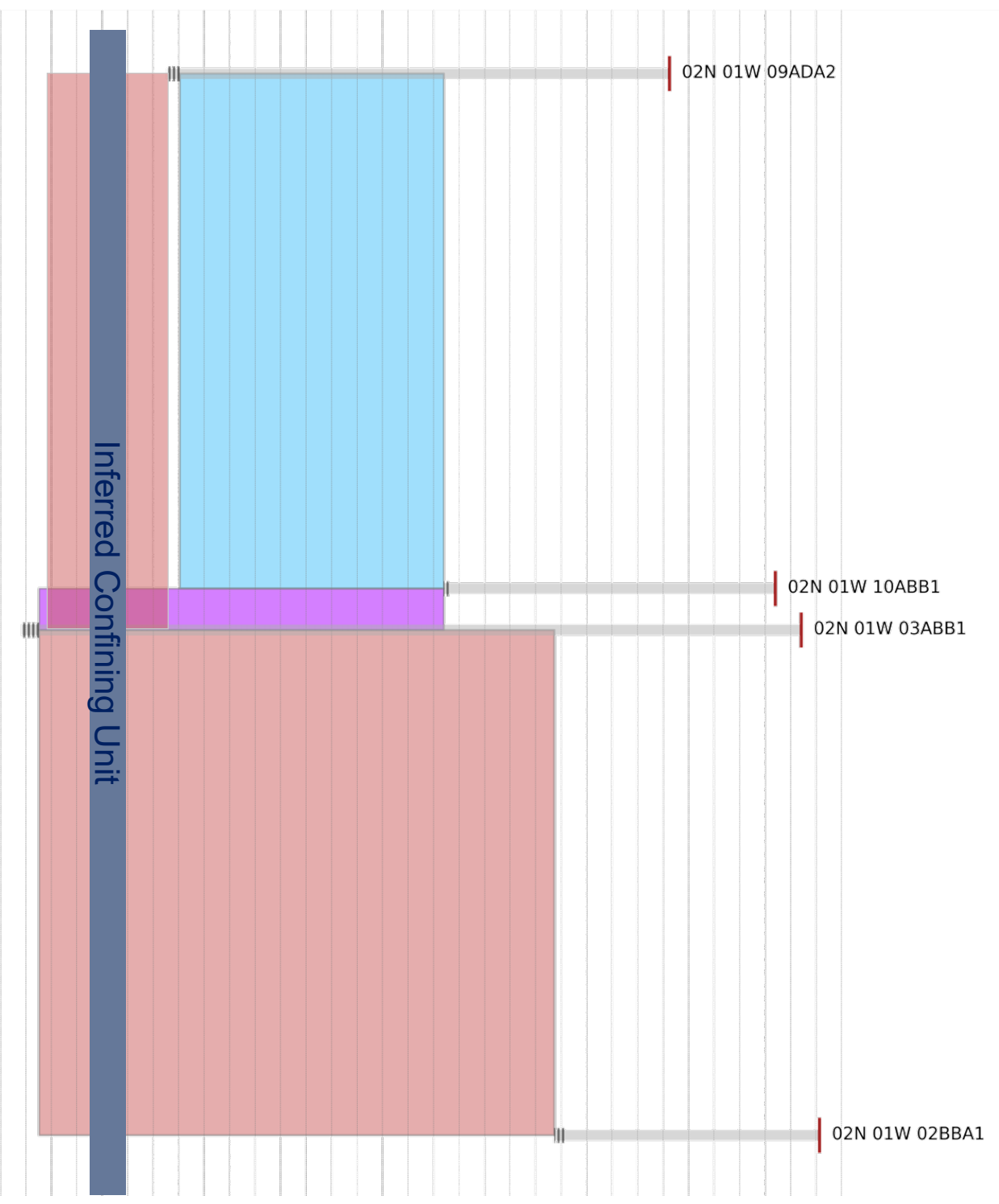
Water-level altitude, ft (NAVD88)



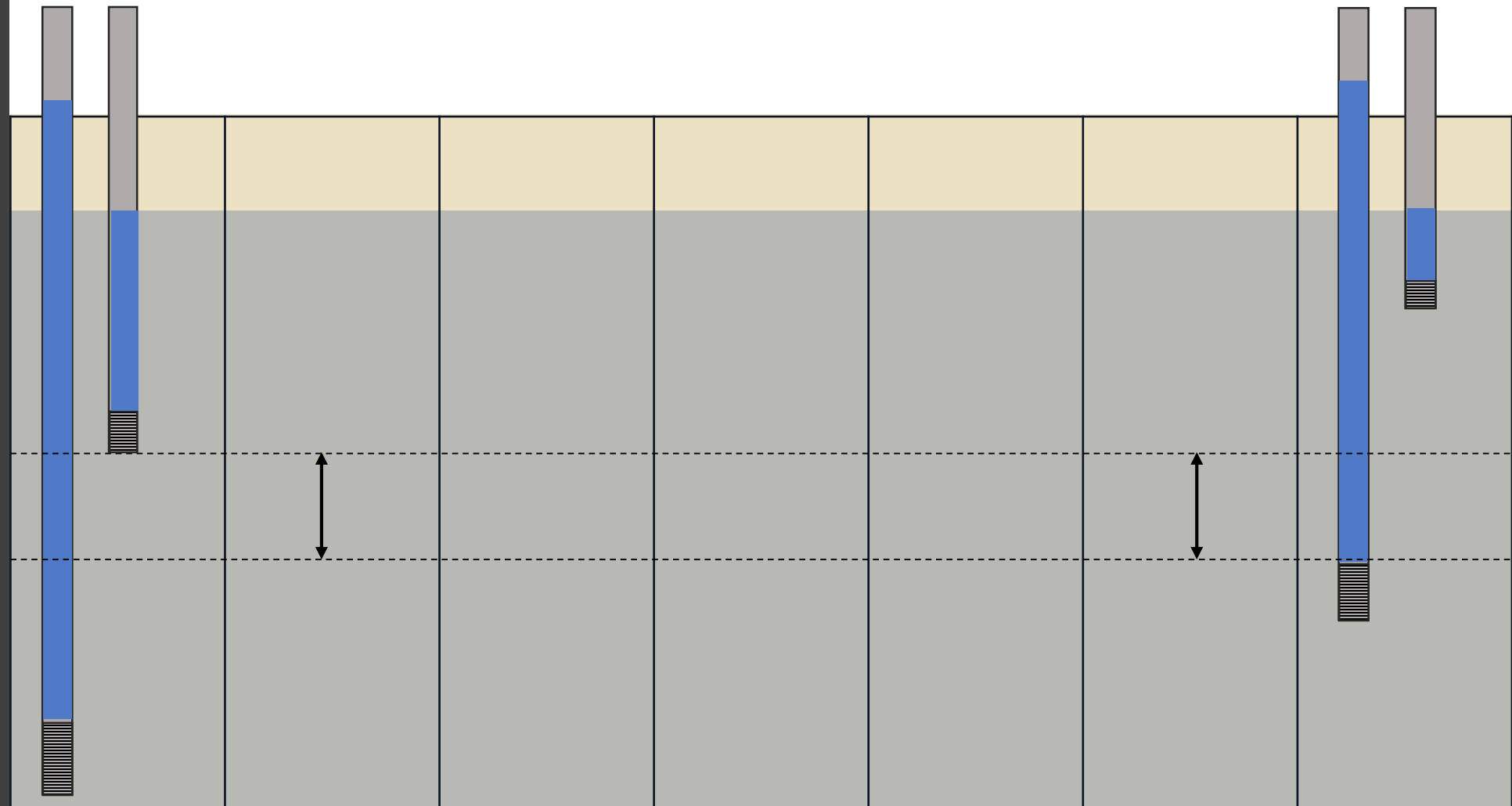
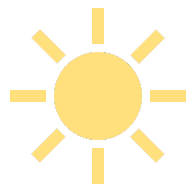
Where to divide?



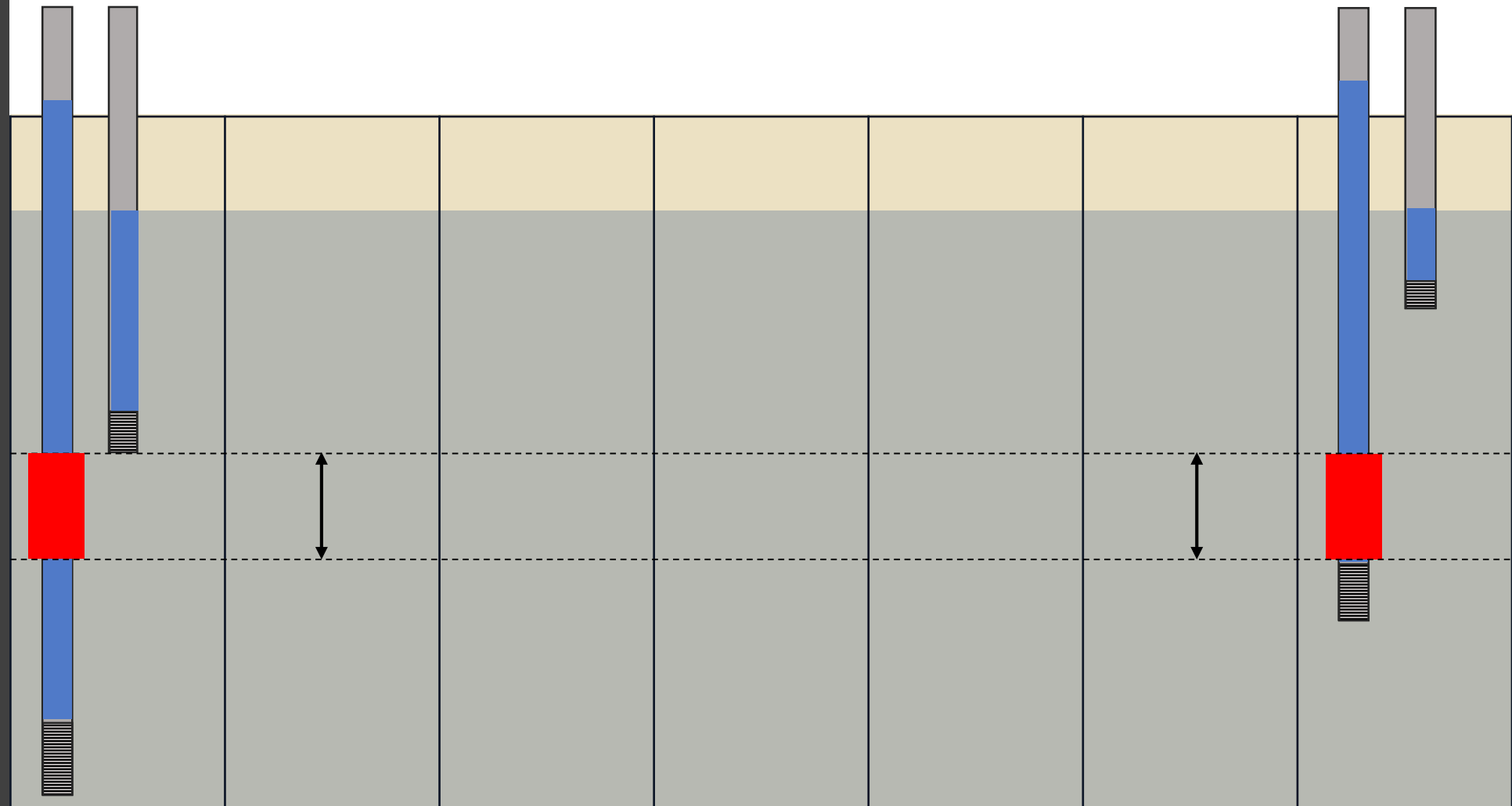
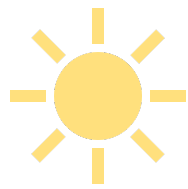
Where to divide?



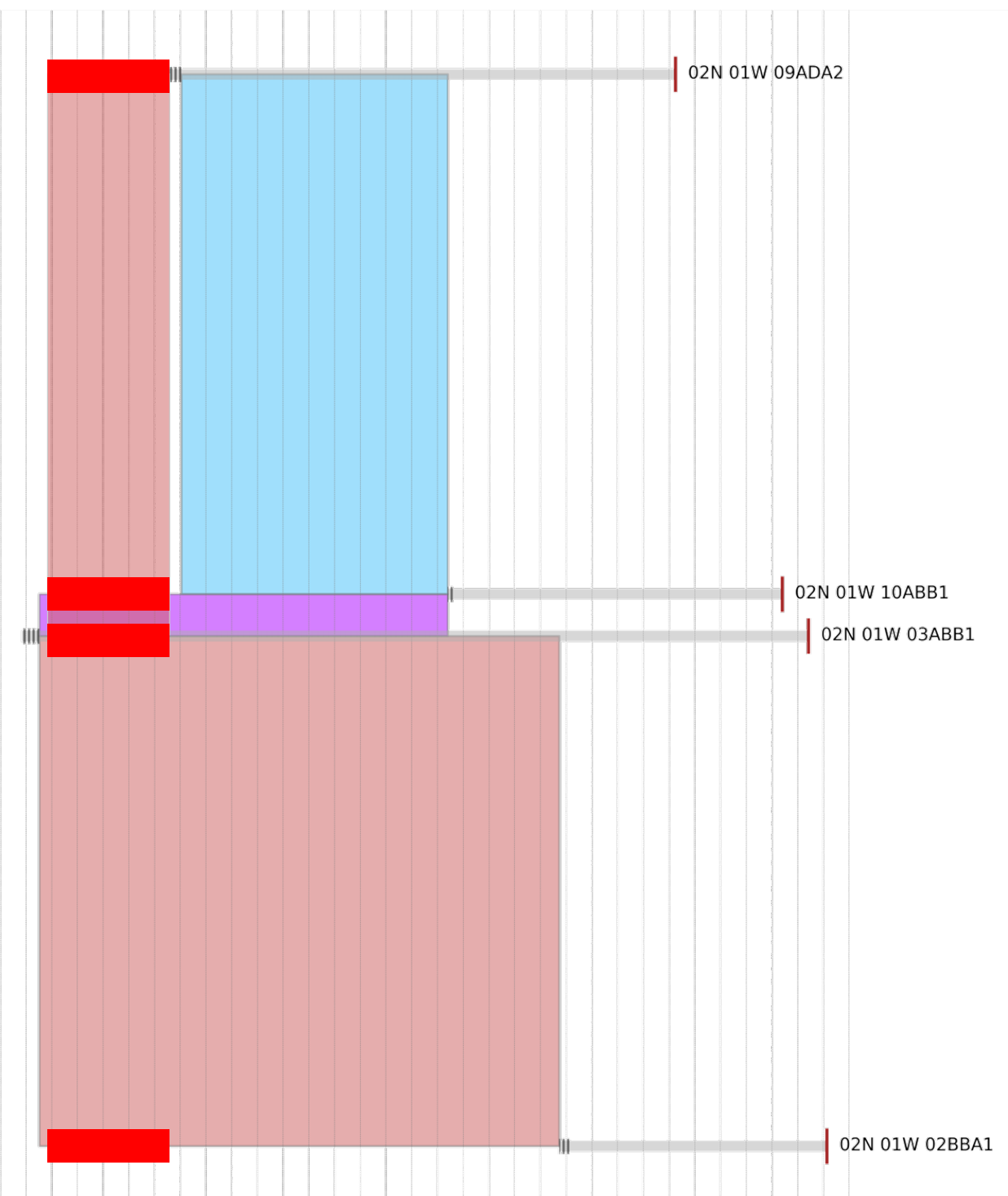
Where to divide?



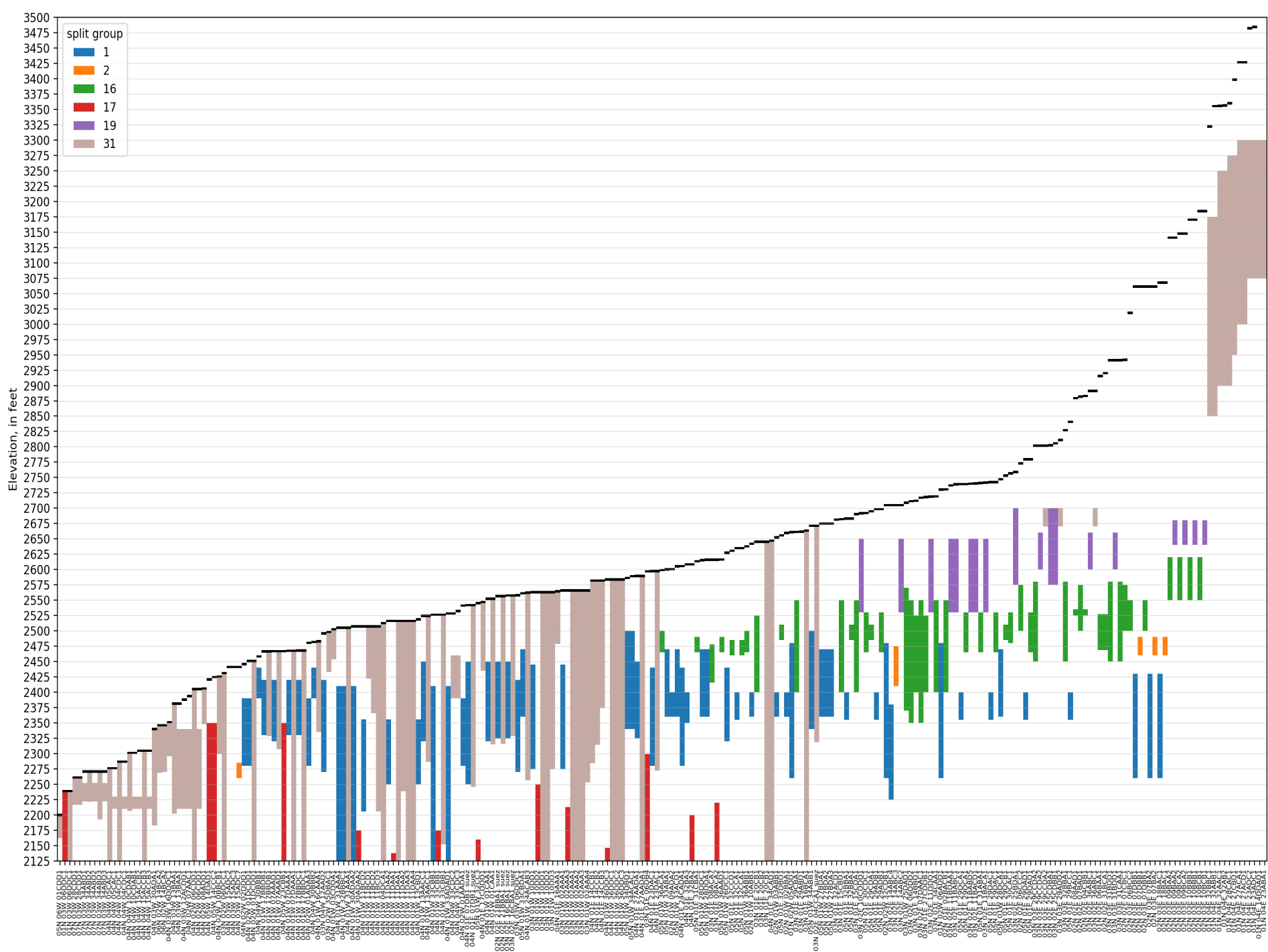
Where to divide?



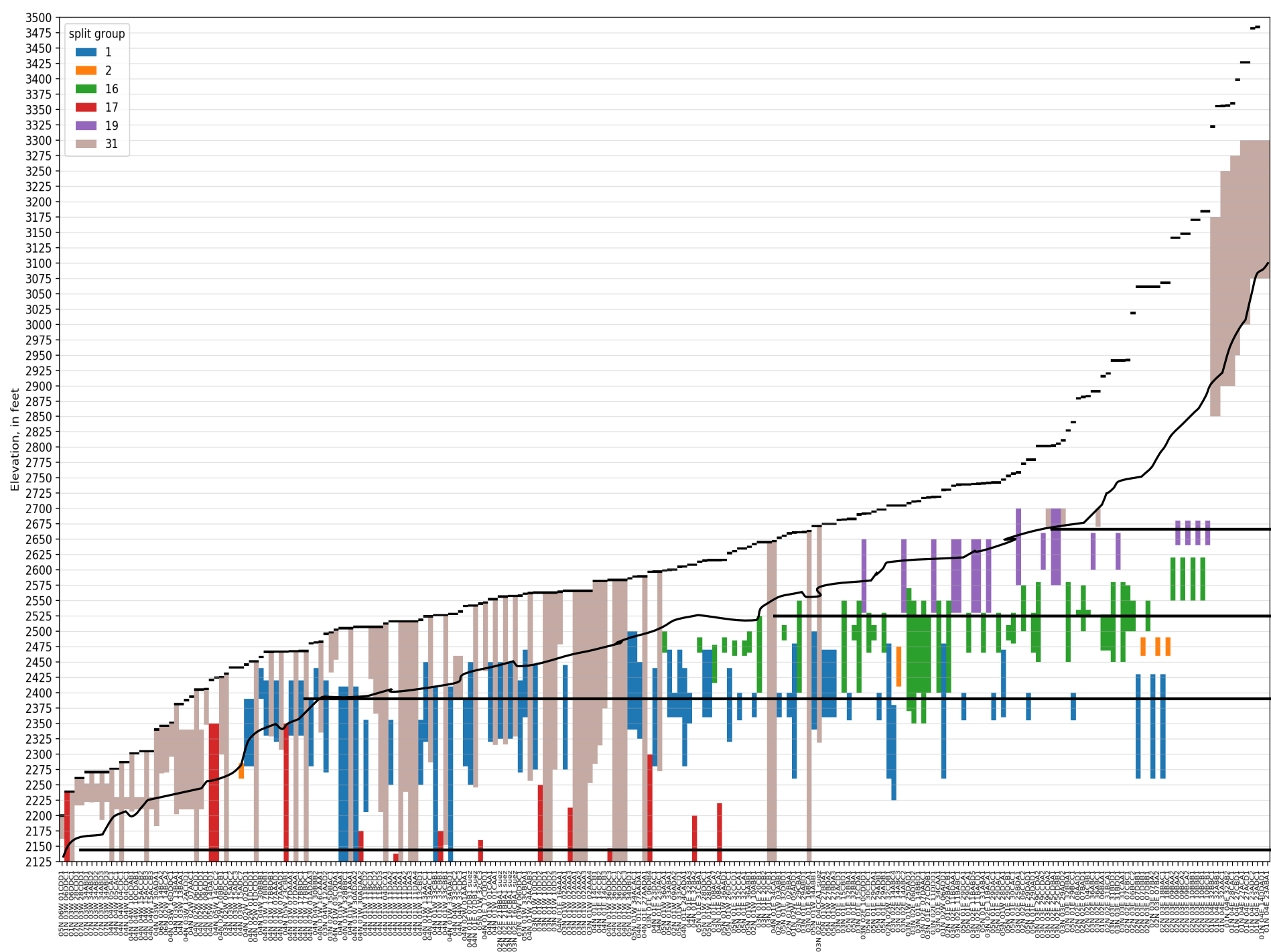
Where to divide?



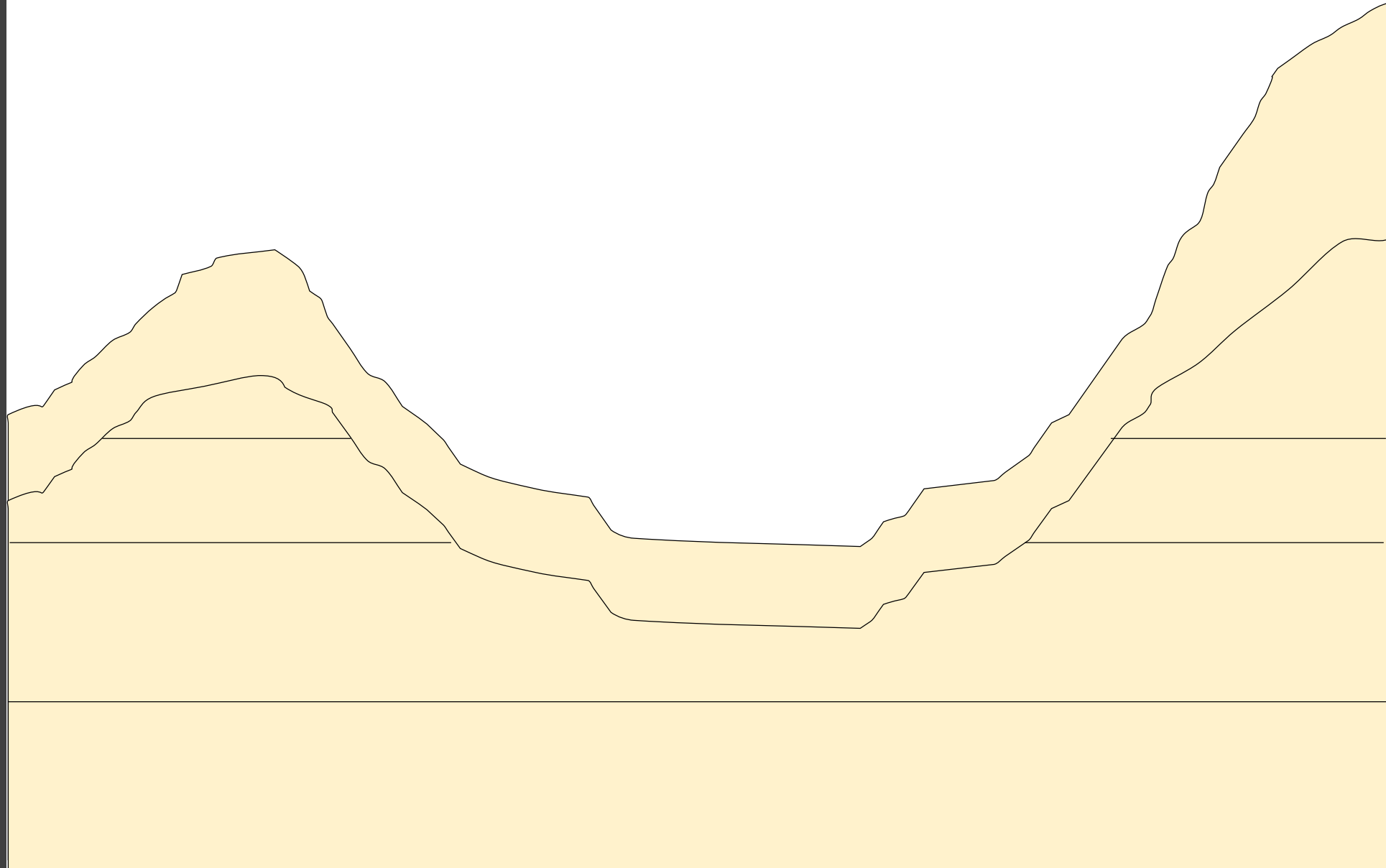
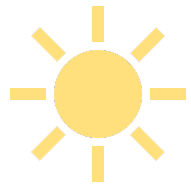
Layering - shallow



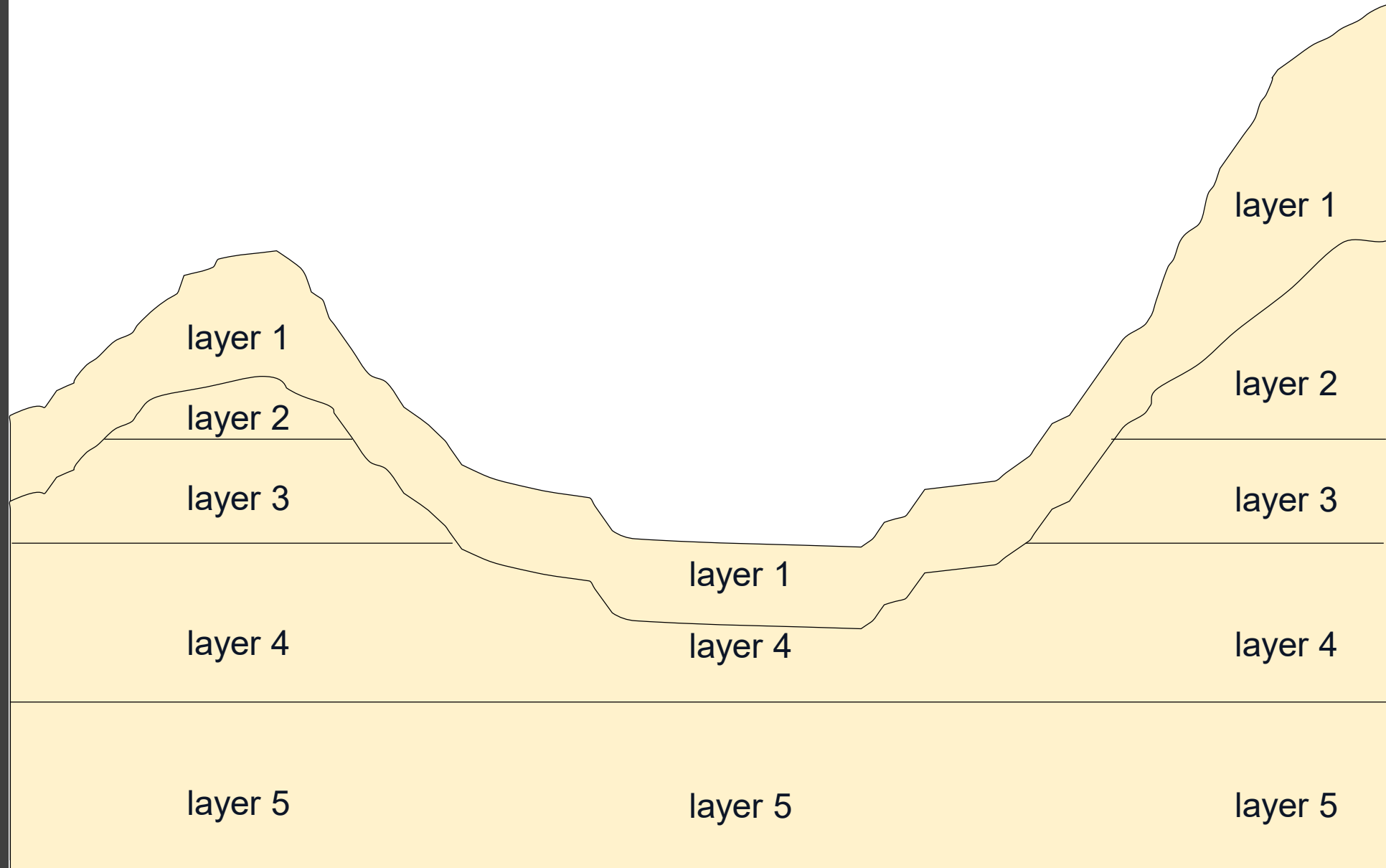
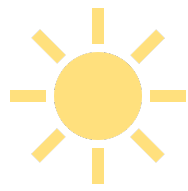
Layering - shallow



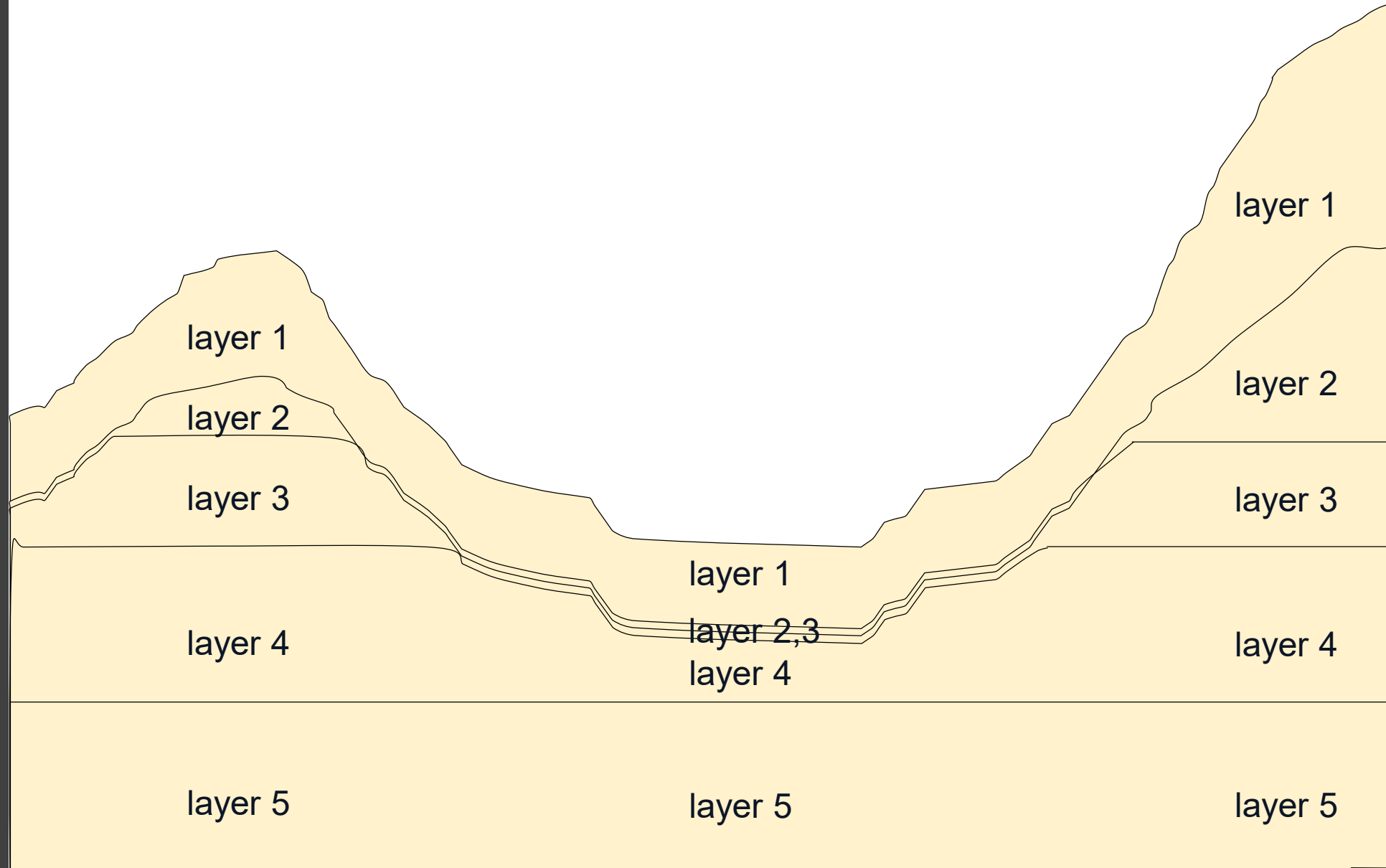
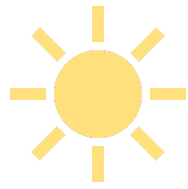
Layering - shallow



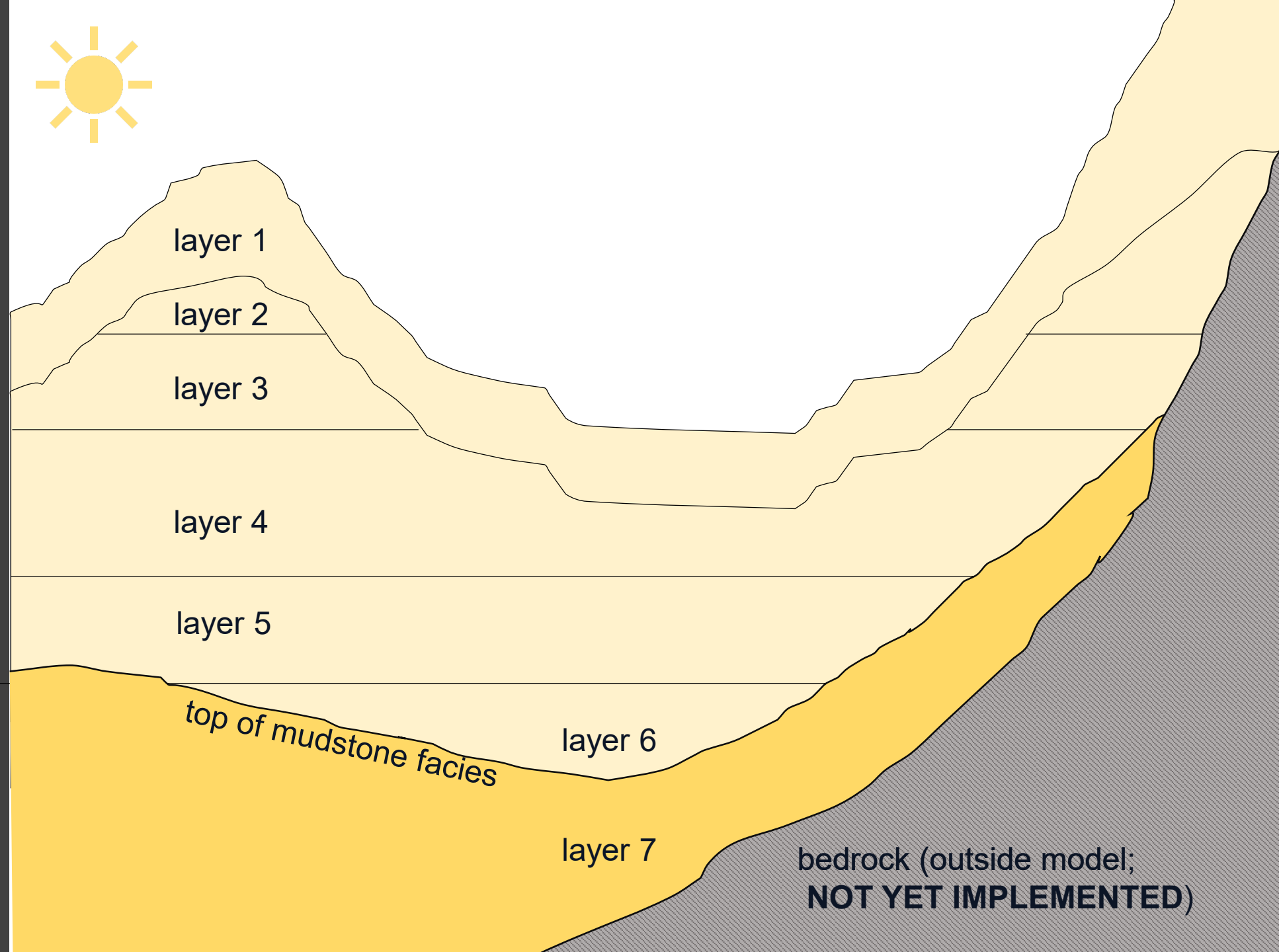
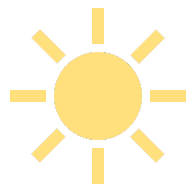
Layering - shallow



Layering - shallow



Layering – shallow and deep





Thickness: Layer 1

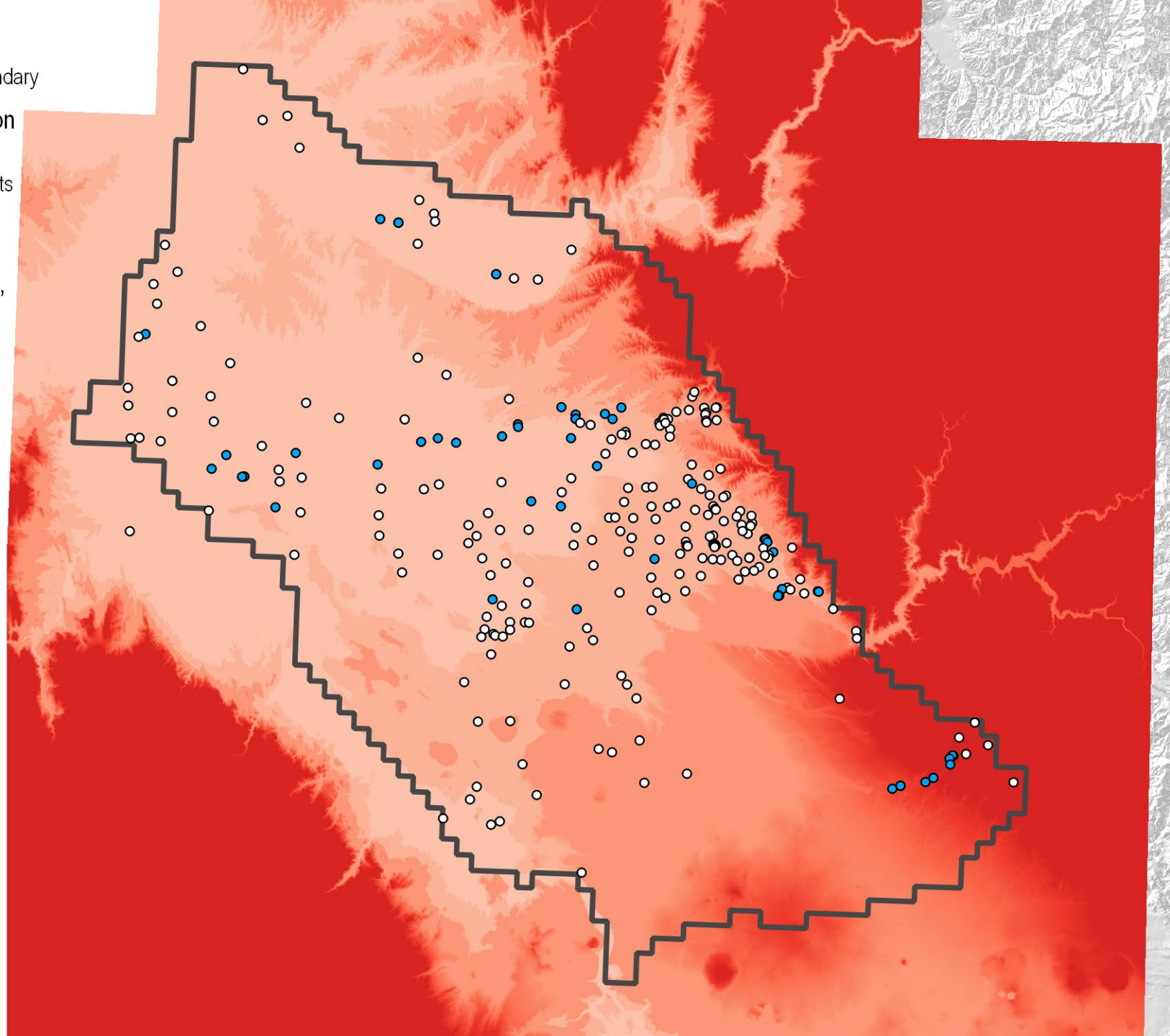
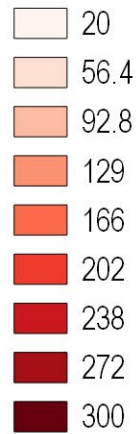
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 1,
in feet AMSL



Thickness: Layer 2

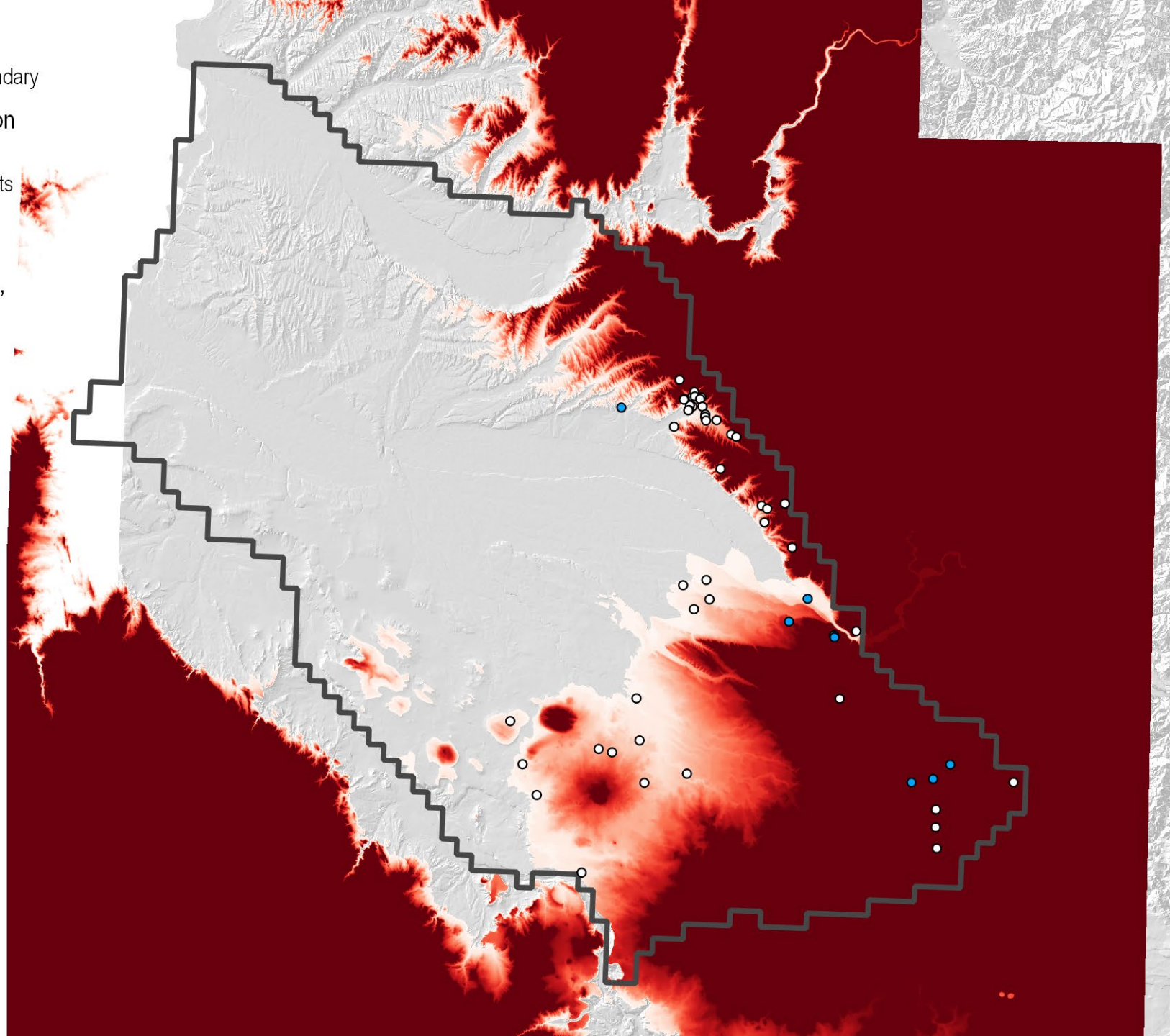
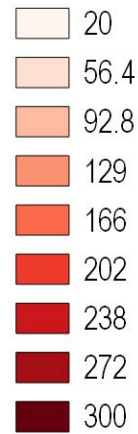
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 2,
in feet AMSL




Thickness: Layer 3

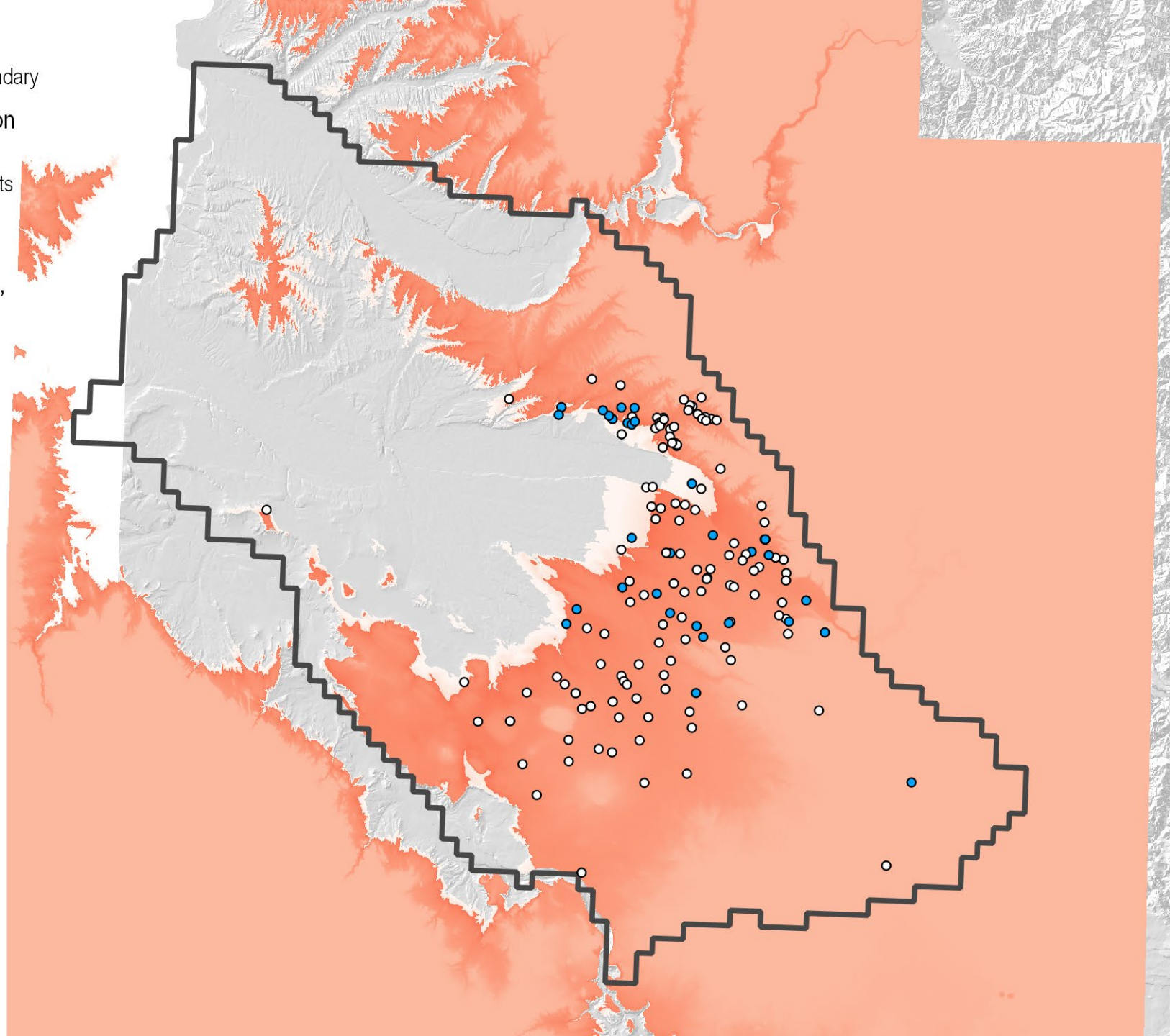
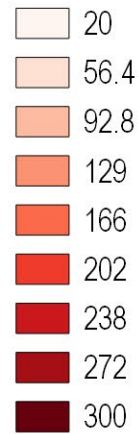
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 3,
in feet AMSL



Thickness: Layer 4

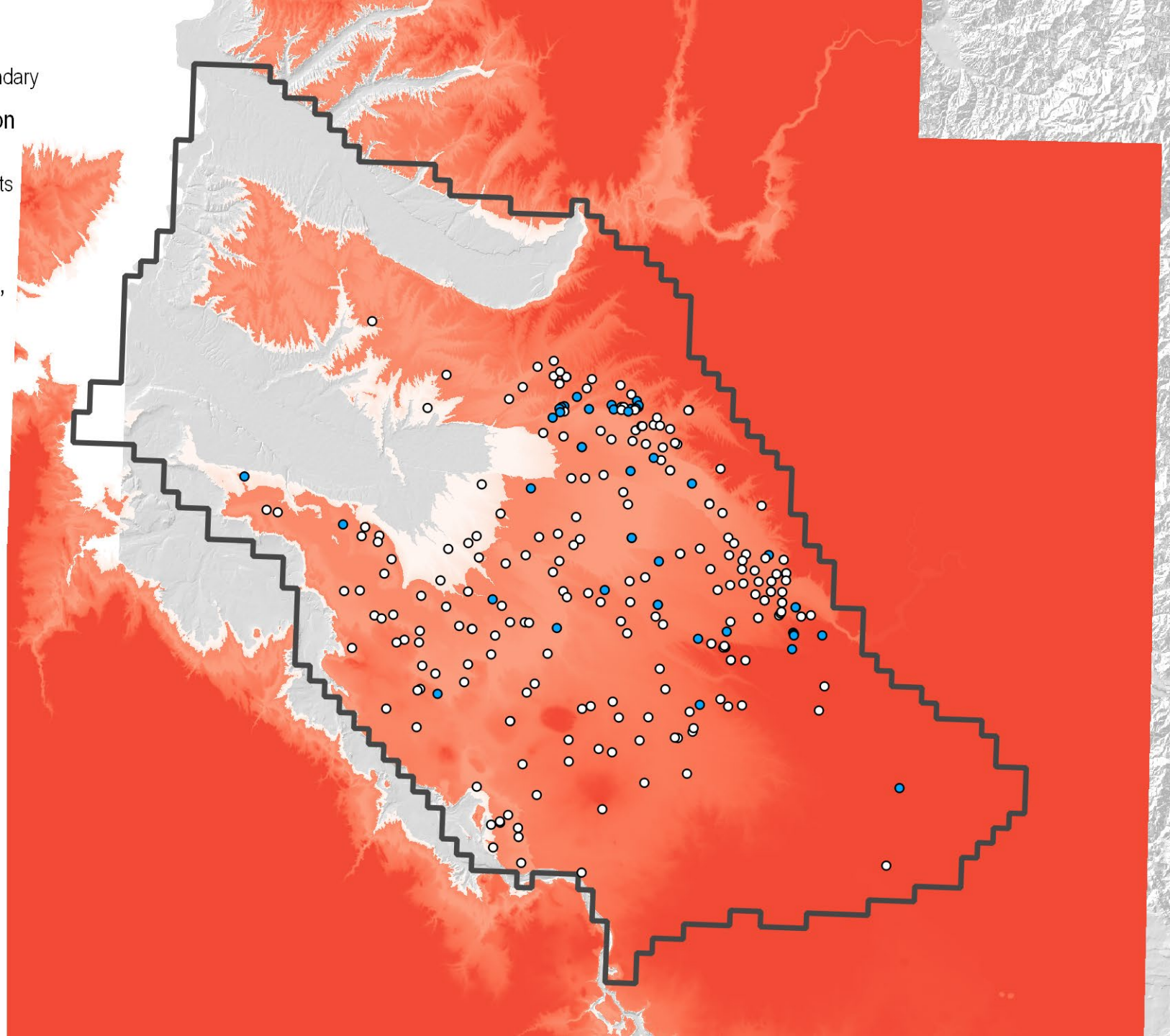
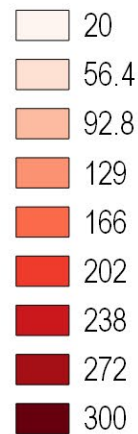
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 4,
in feet AMSL



Thickness: Layer 5

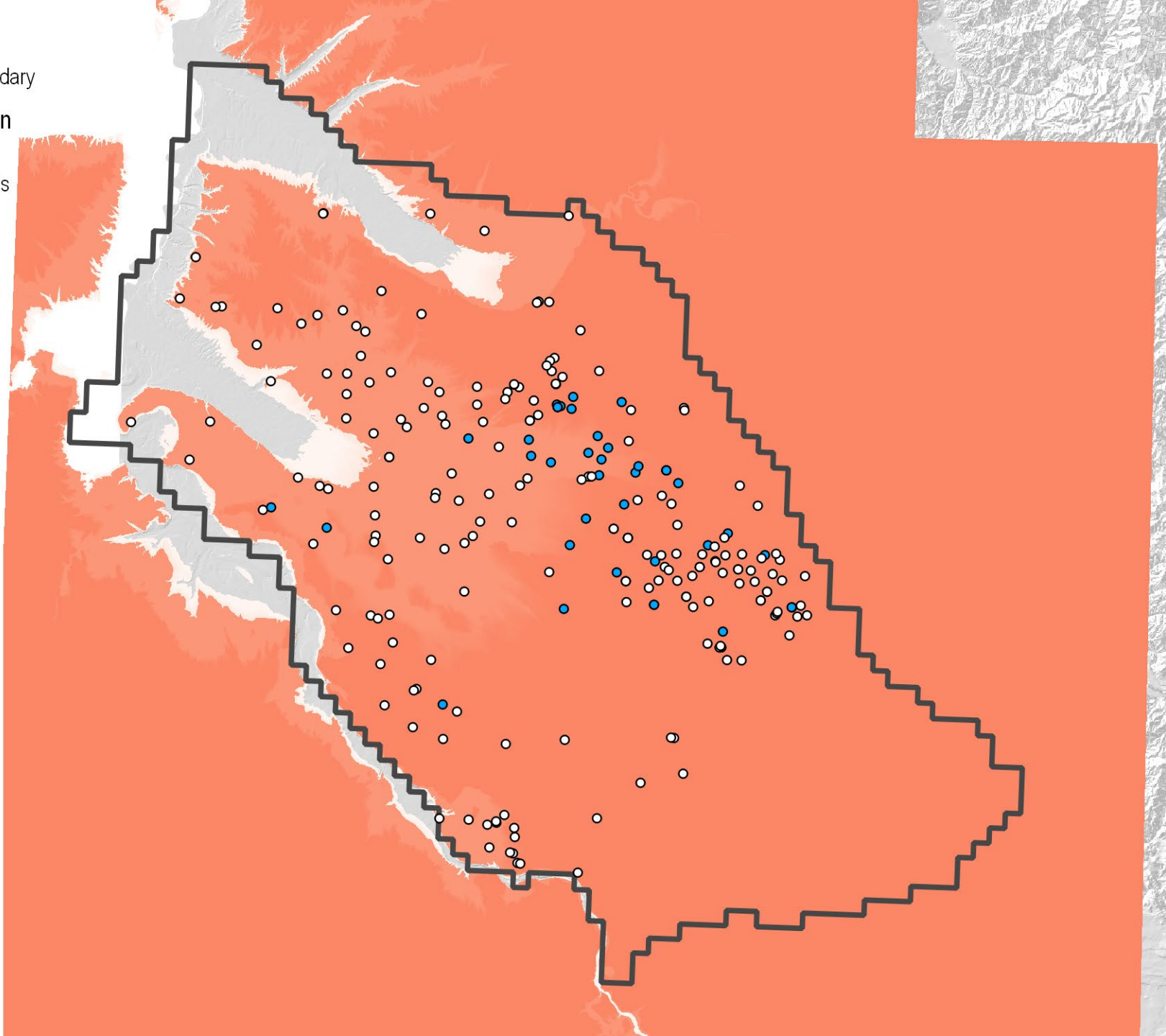
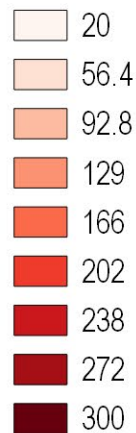
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 5,
in feet AMSL



Thickness: Layer 6

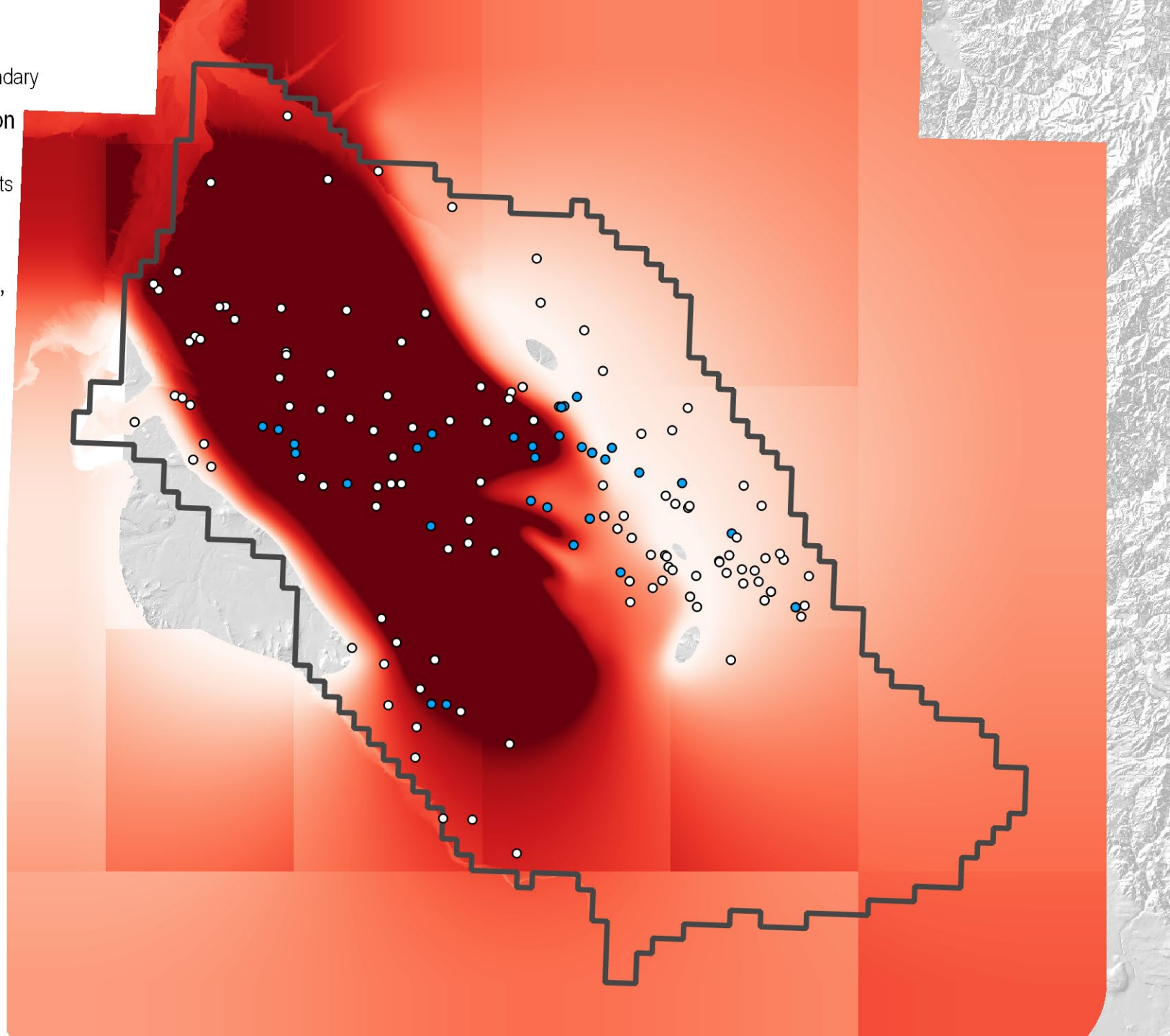
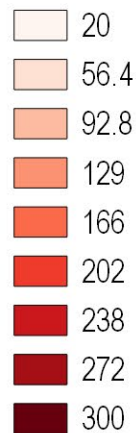
EXPLANATION

 Approximate Boundary

Wells with observation data

-  Used for layer splits
-  Not used for layer splits

Thickness of Layer 6,
in feet AMSL



Layer 7

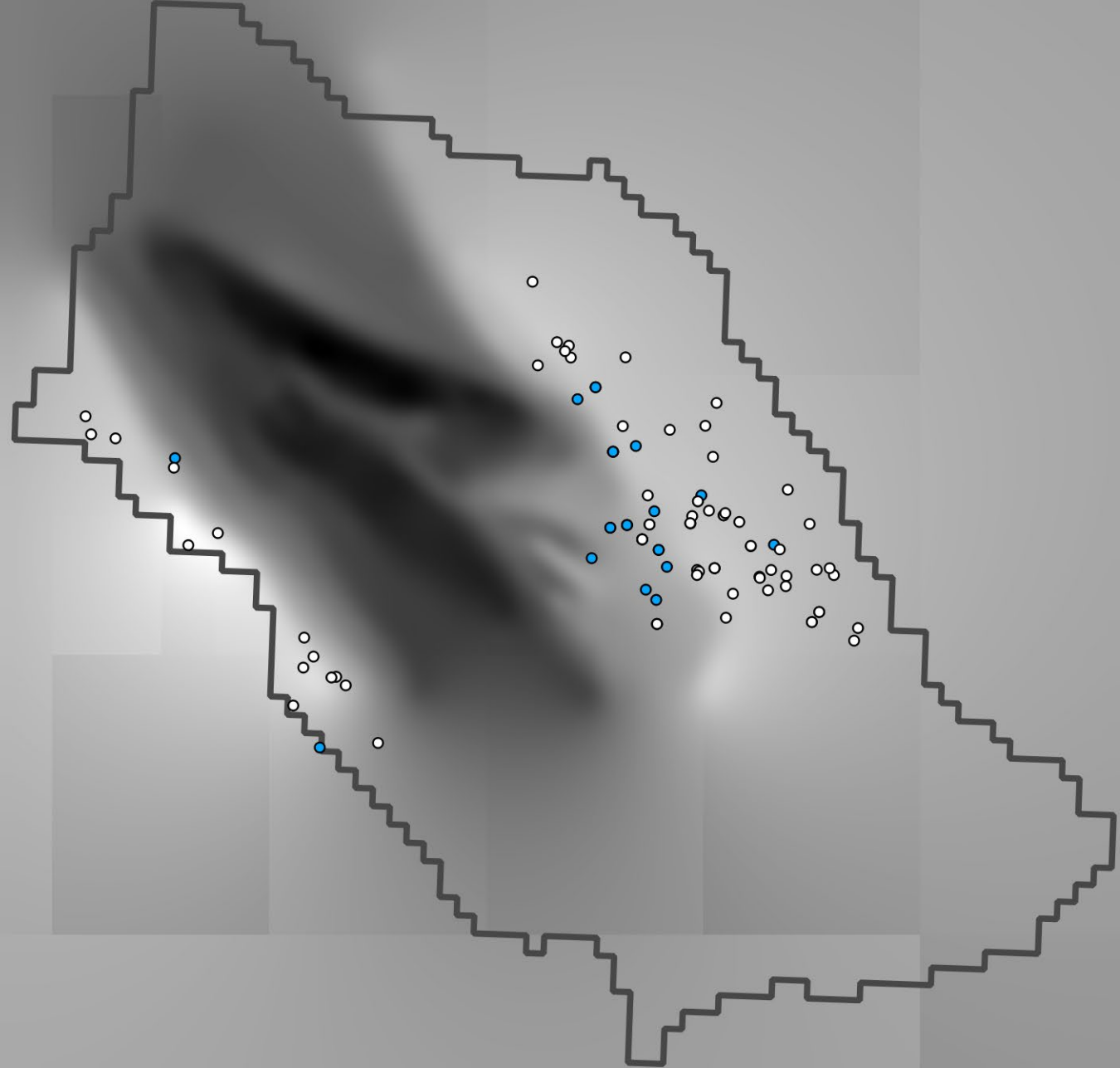
COMING
SOON...

EXPLANATION

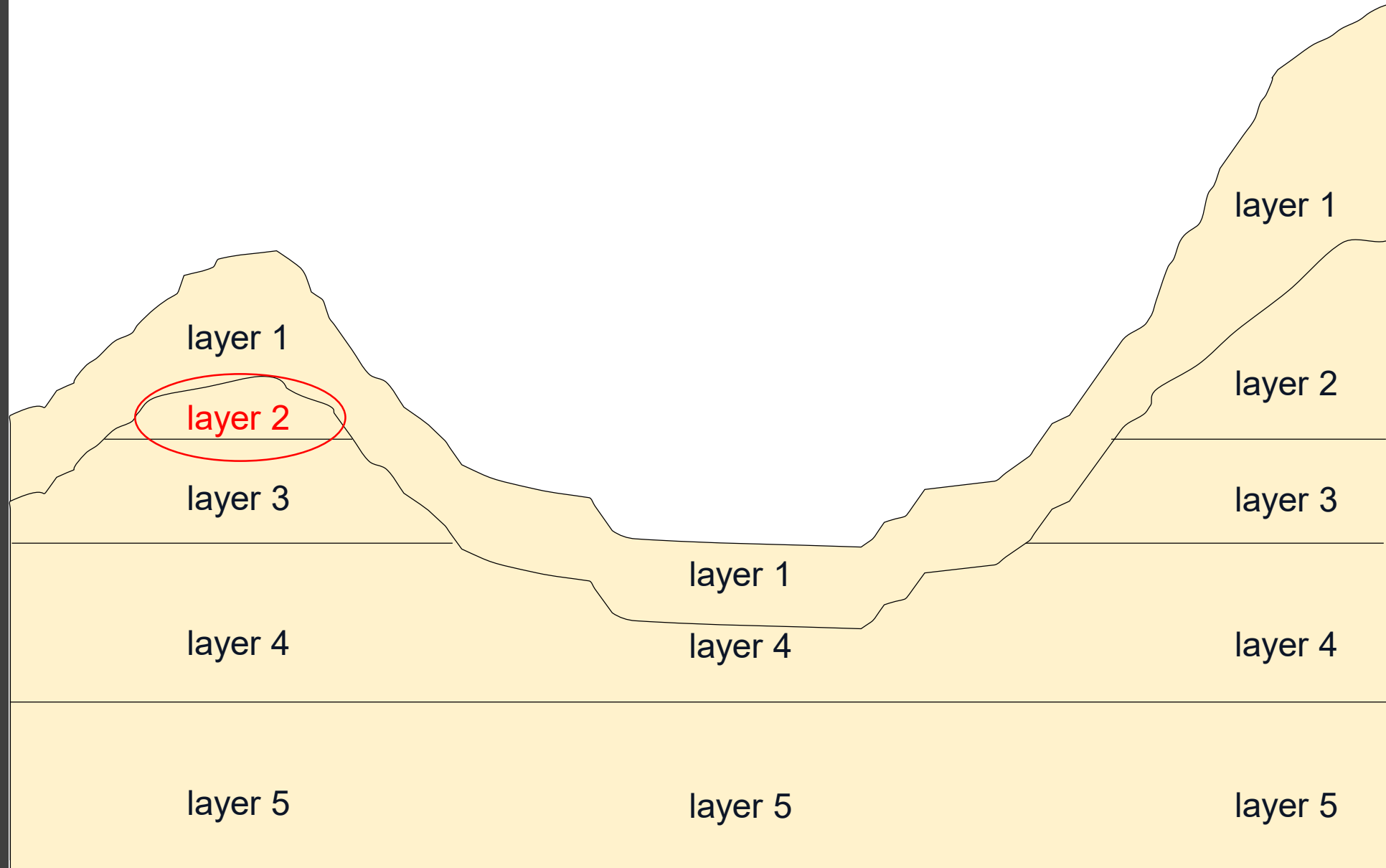
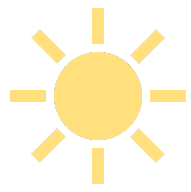
□ Approximate Boundary

Wells with observation
data

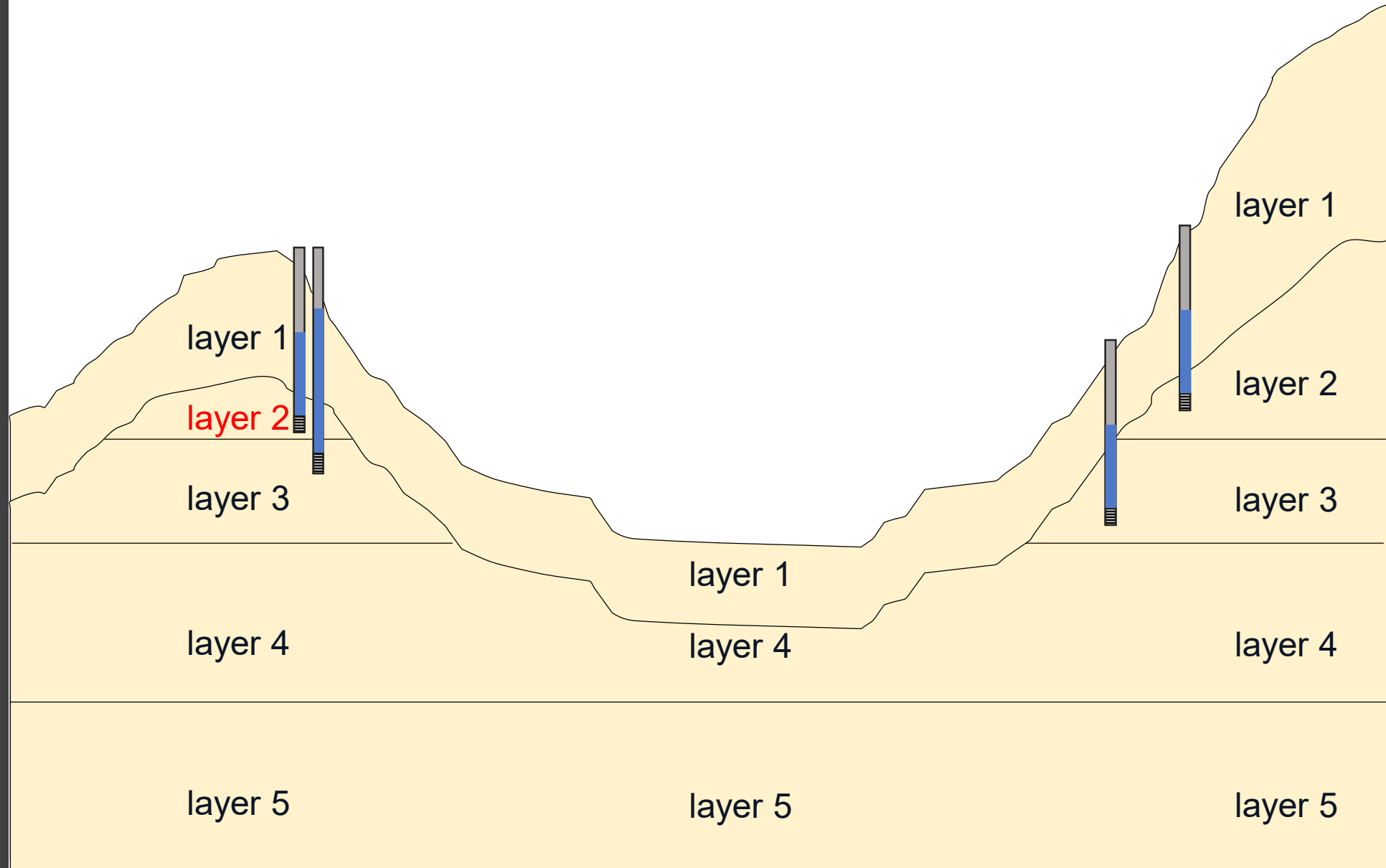
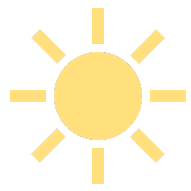
- Used for layer splits
- Not used for
layer splits



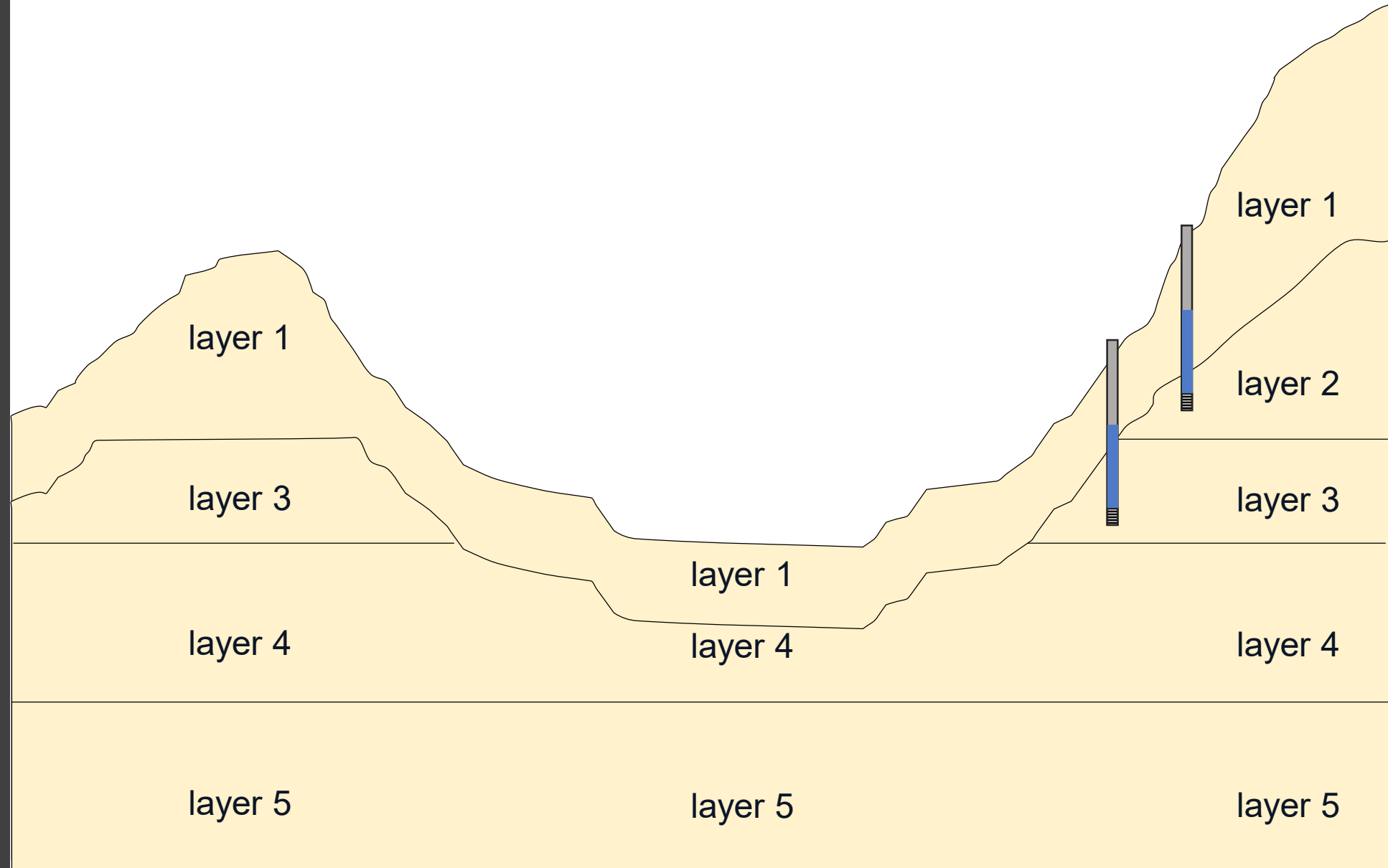
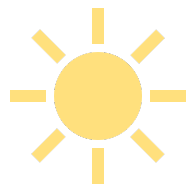
'Islands' within layers



'islands' within layers



'islands' within layers



'islands' within layers

For example:

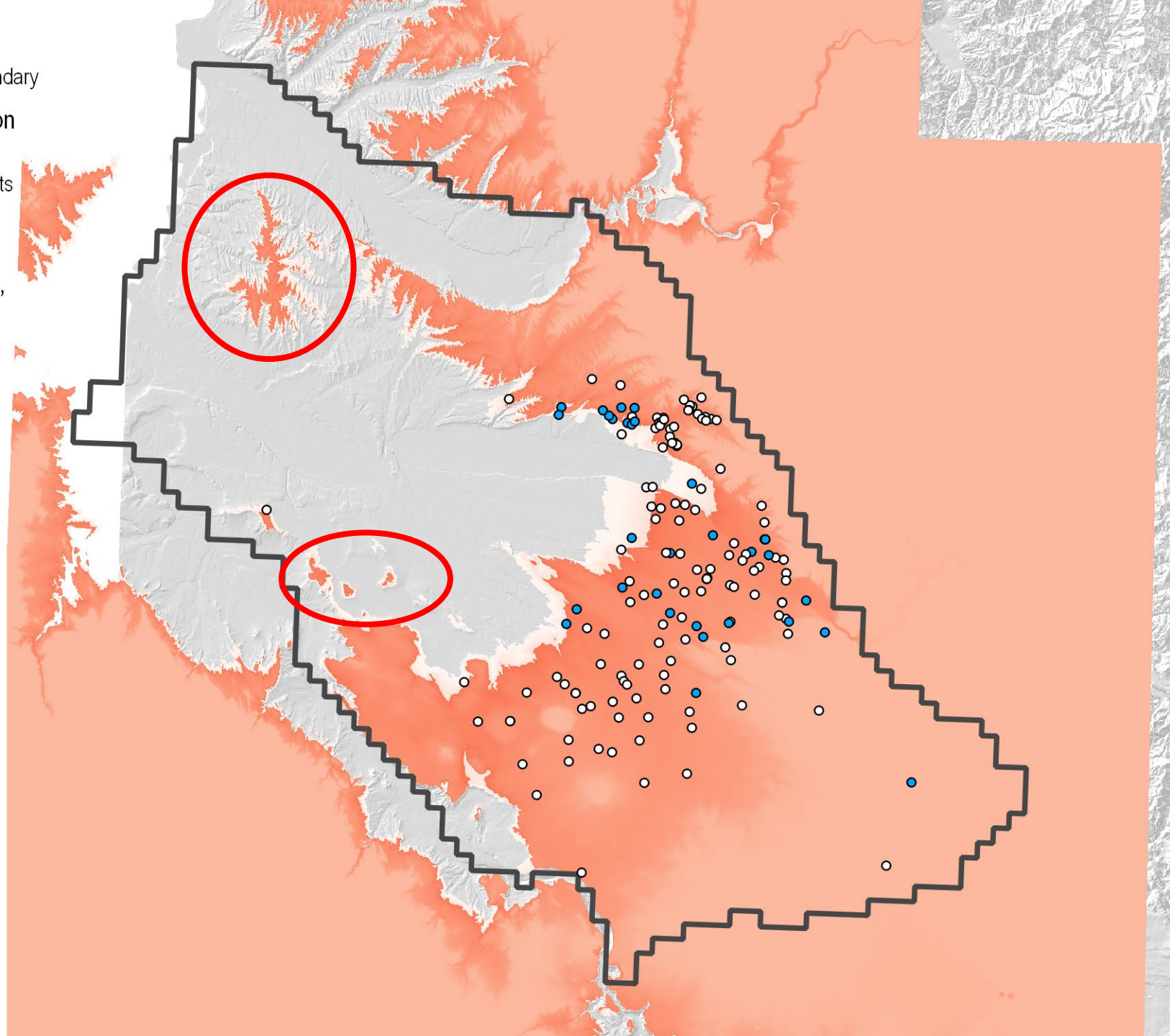
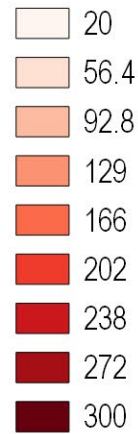
EXPLANATION

□ Approximate Boundary

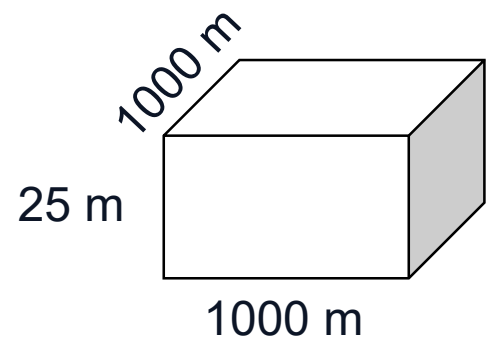
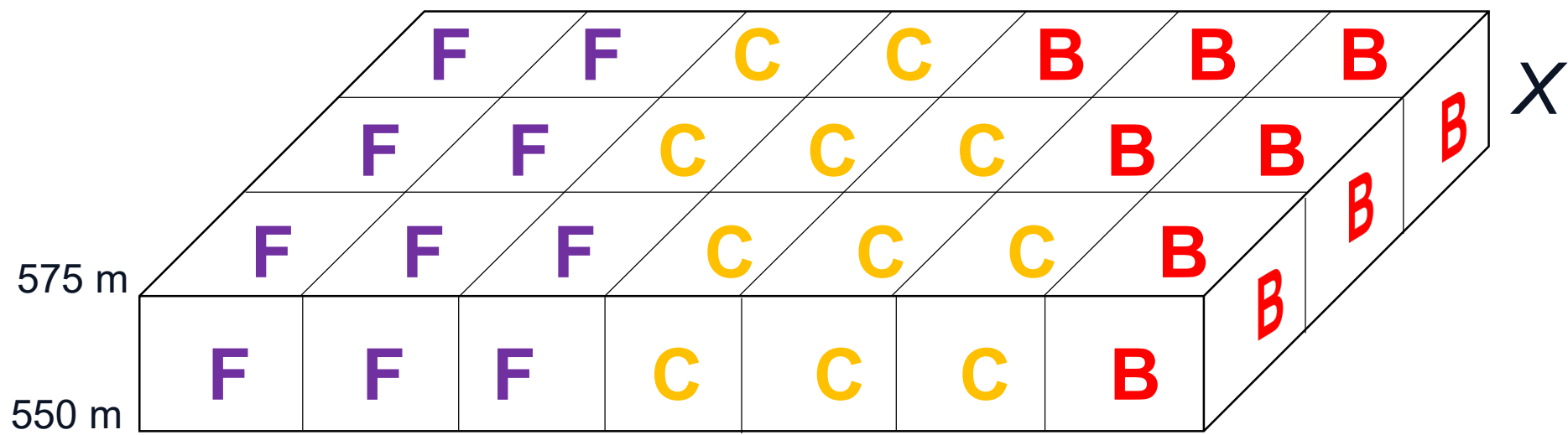
Wells with observation data

- Used for layer splits
- Not used for layer splits

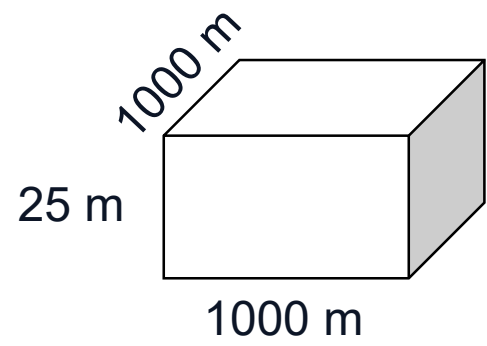
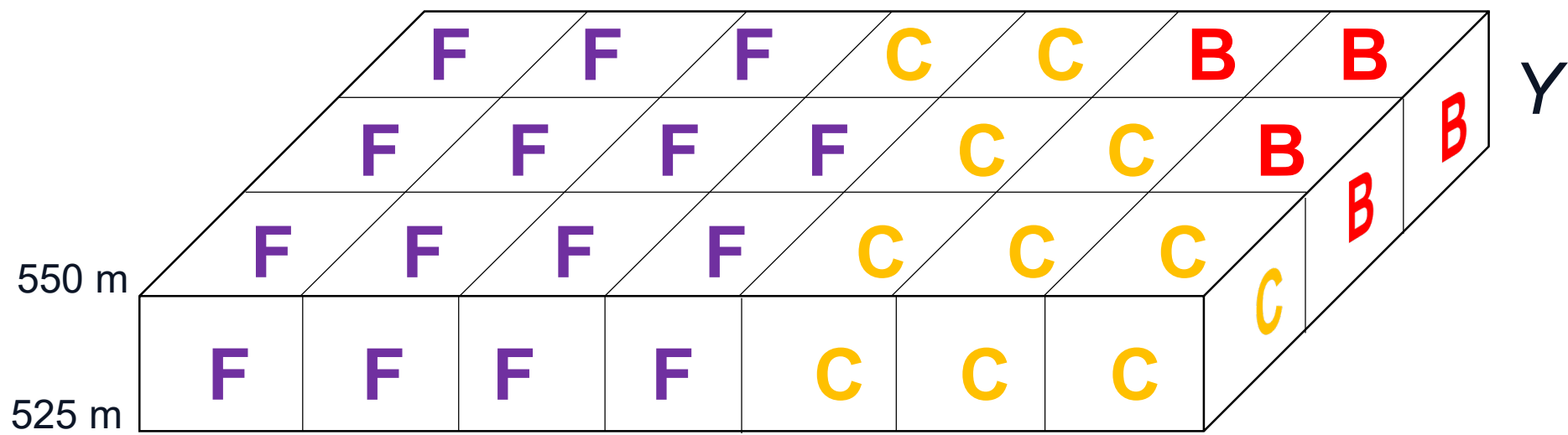
Thickness of Layer 3, in feet AMSL



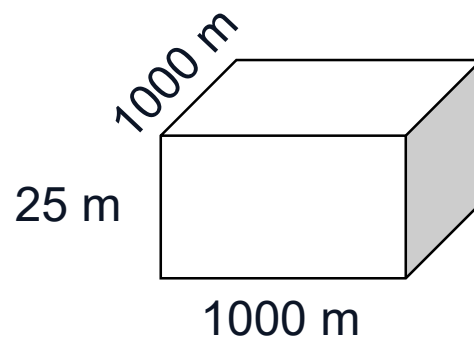
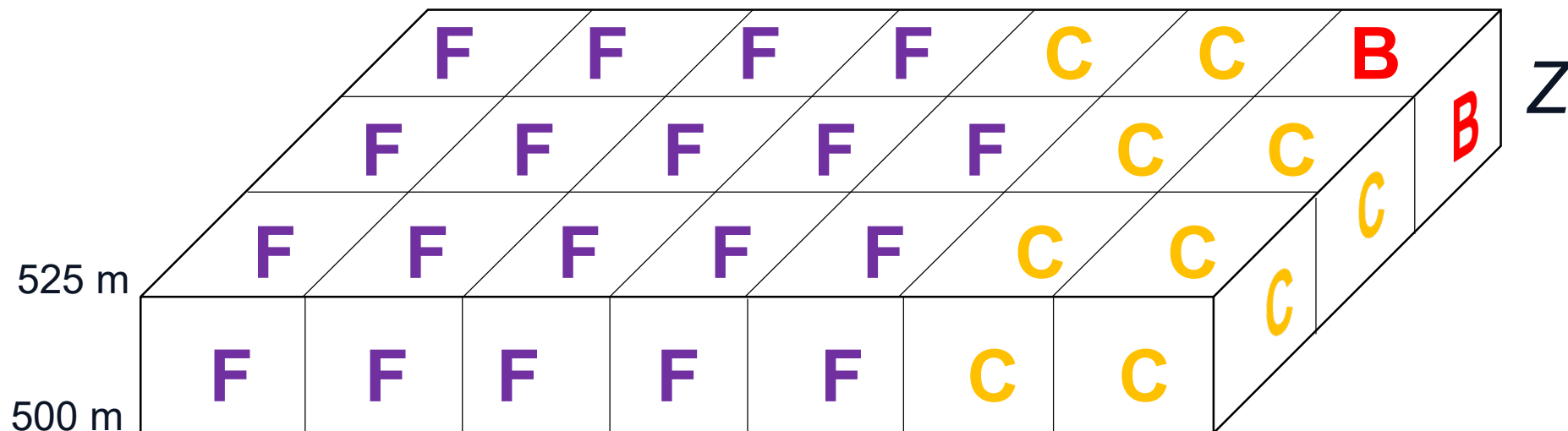
Rockworks hydrogeologic framework model "layer X"



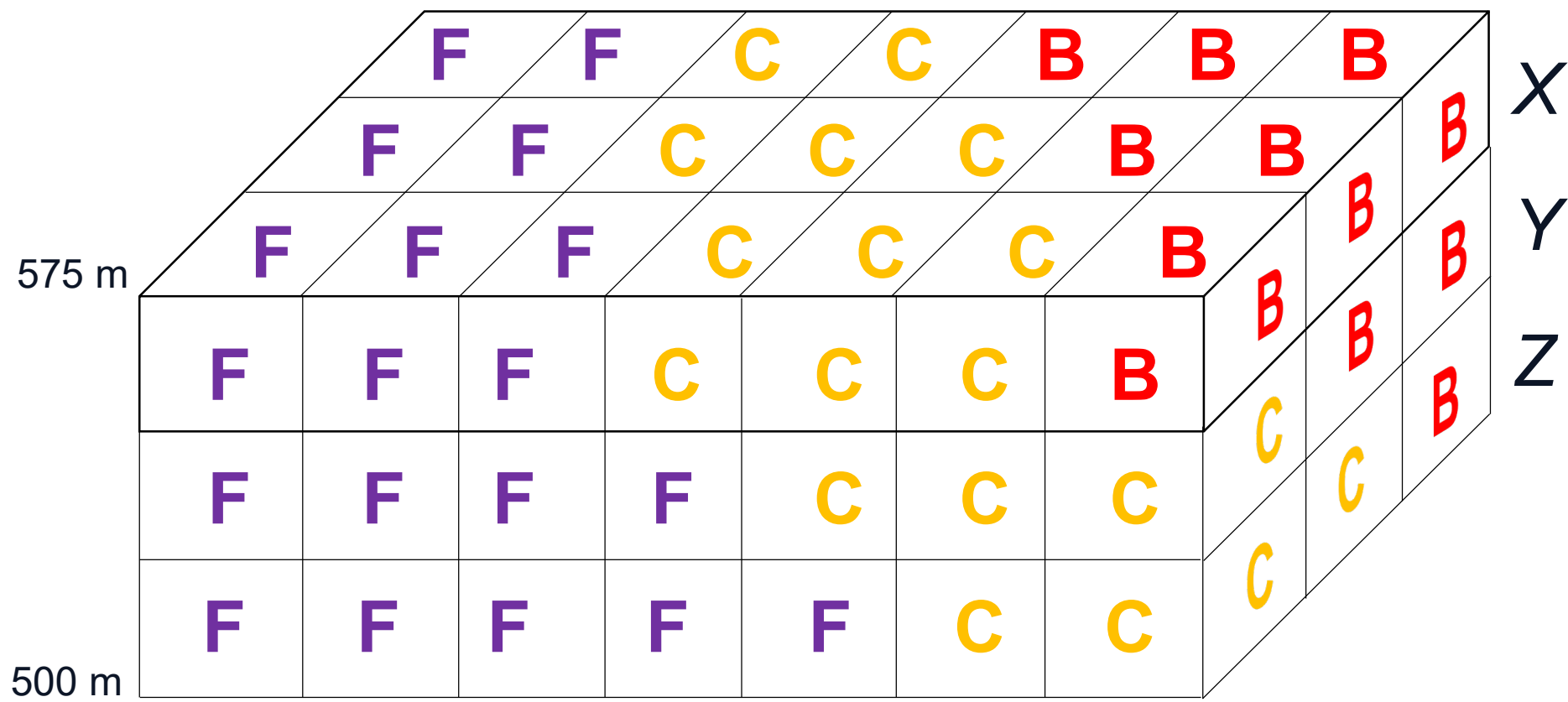
Rockworks hydrogeologic framework model “layer Y”



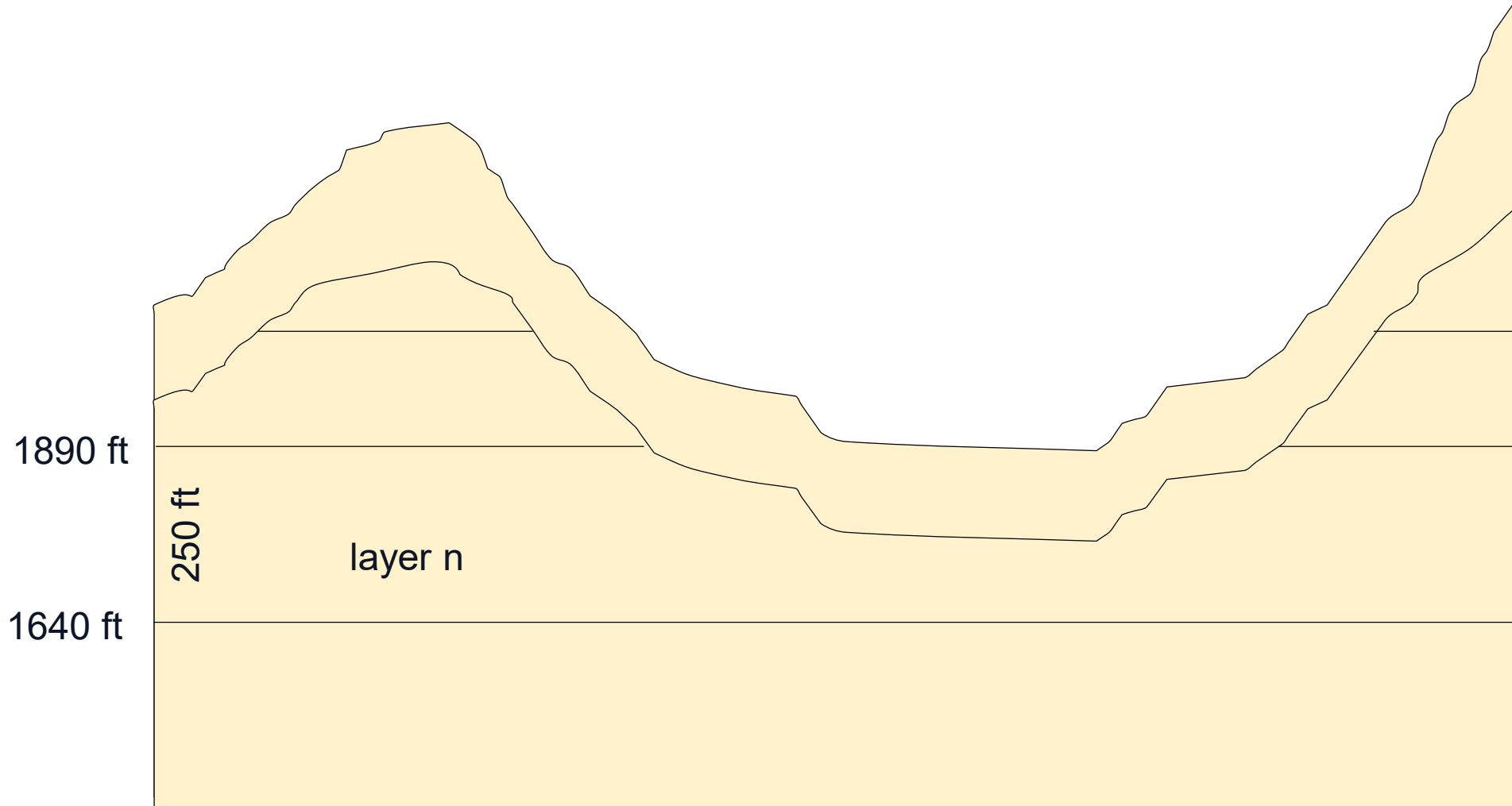
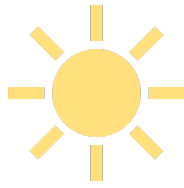
Rockworks hydrogeologic framework model “layer Z”



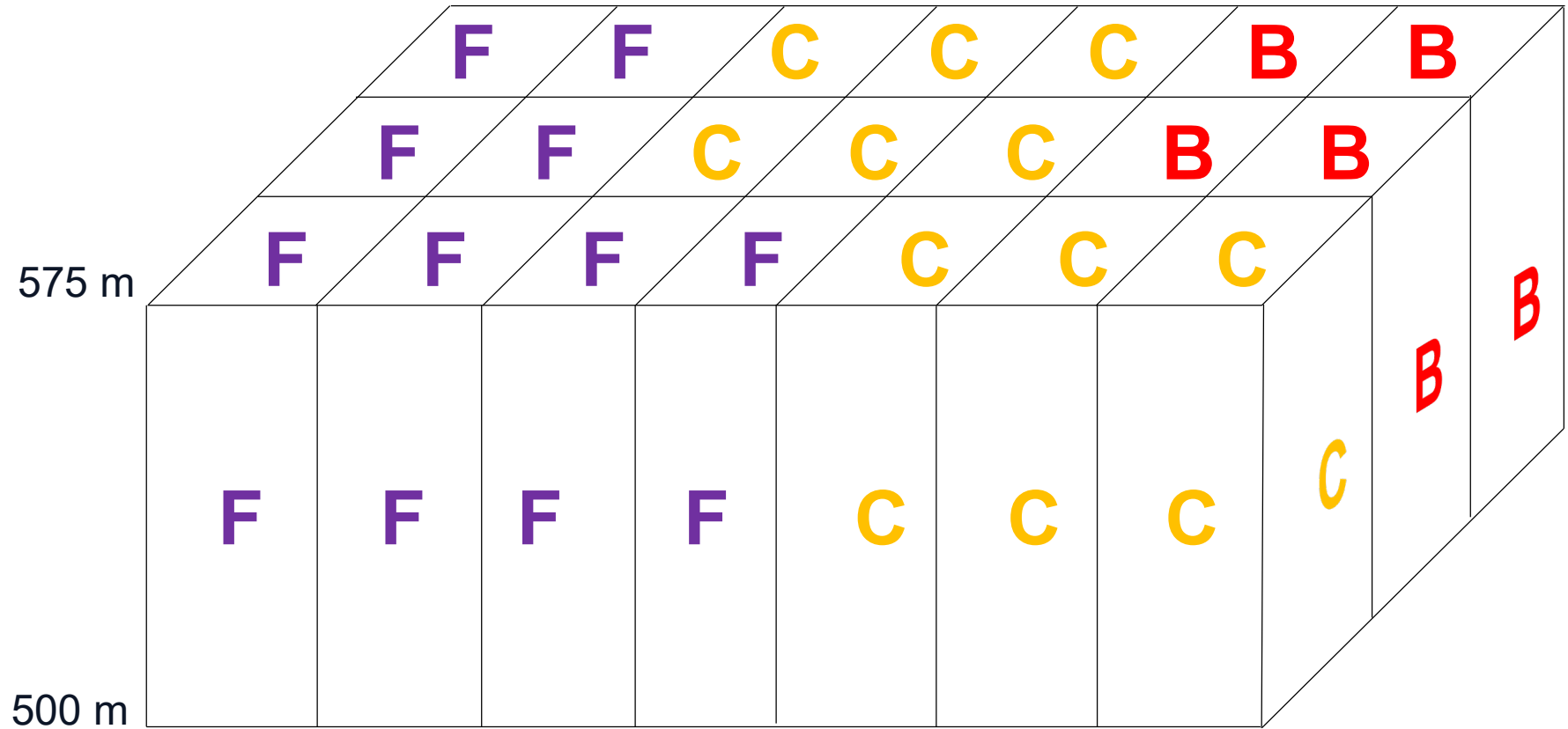
Rockworks hydrogeologic framework model



Flow model layer



Lithology for the flow model layer (several options for determining average)







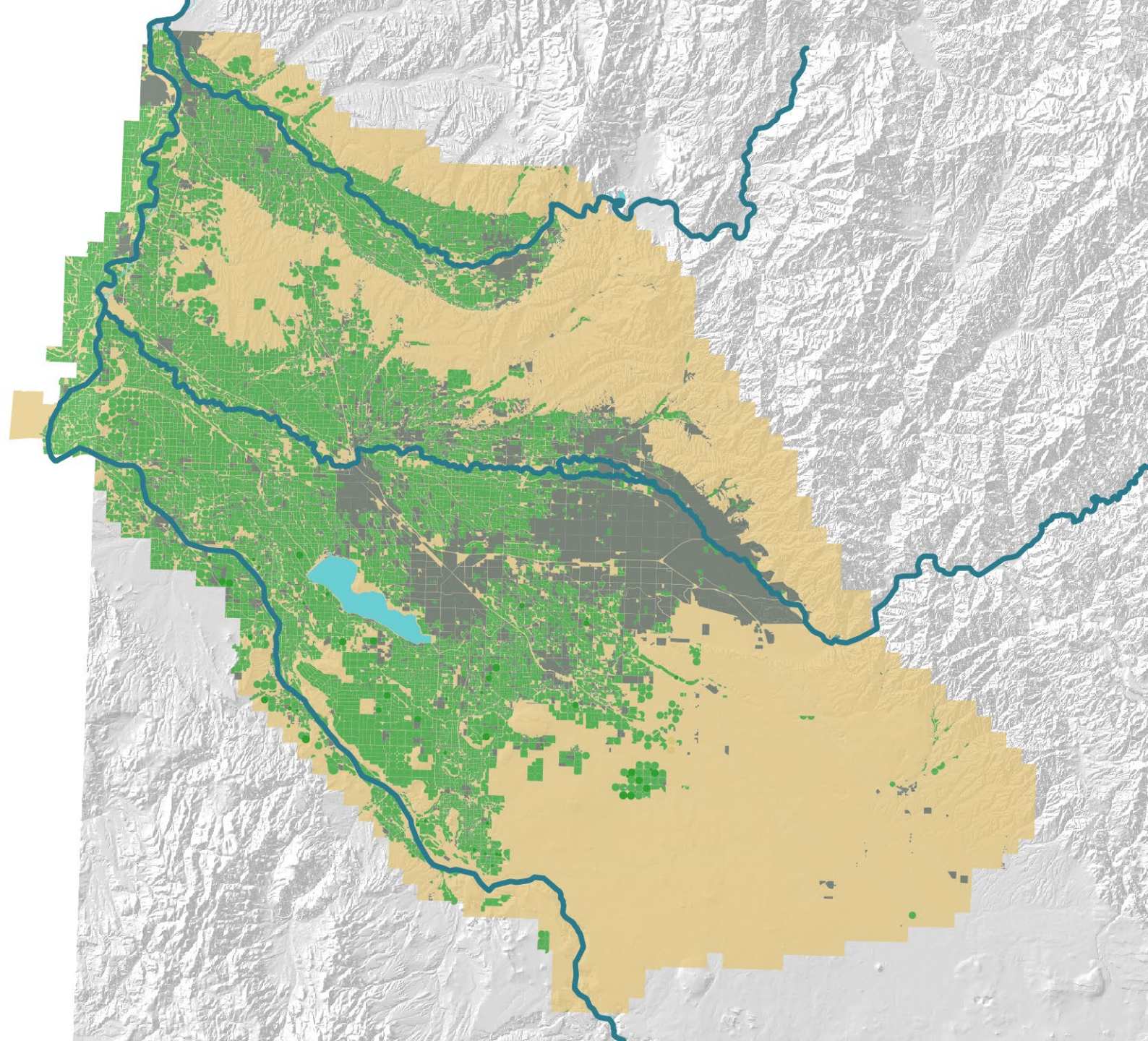
Horizontal: grid and cells

How to grid?

EXPLANATION

Irrigated Lands 2015

-  irrigated
-  non-irrigated
-  semi-irrigated
-  Major Rivers








1 mile X 1 mile cells

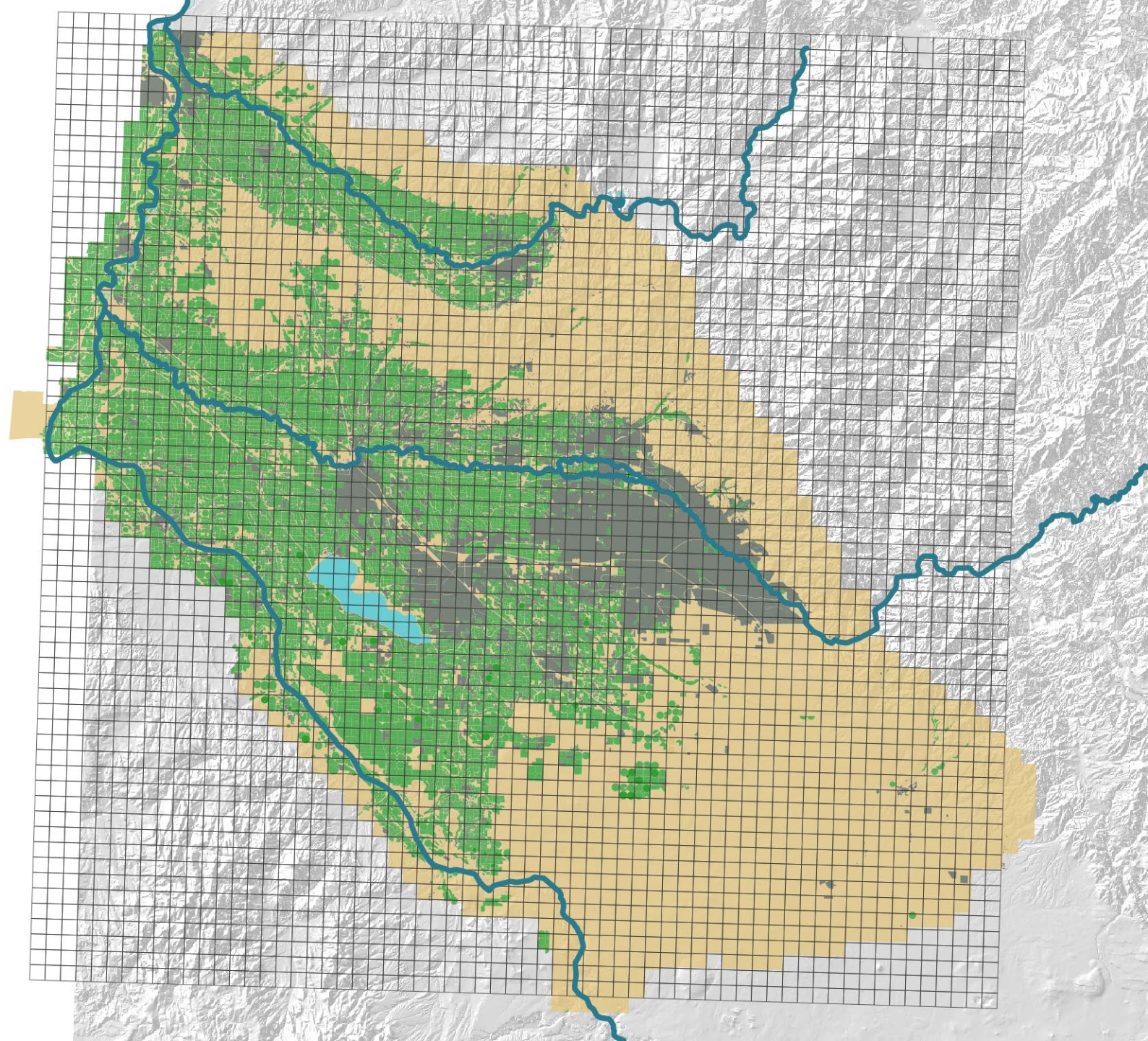
FACTORS:

- Resolution of input and calibration data
- Regional-scale management objectives
- Computation time

EXPLANATION




Irrigated Lands 2015

-  irrigated
-  non-irrigated
-  semi-irrigated
-  1 mi X 1 mi grid
-  Major Rivers













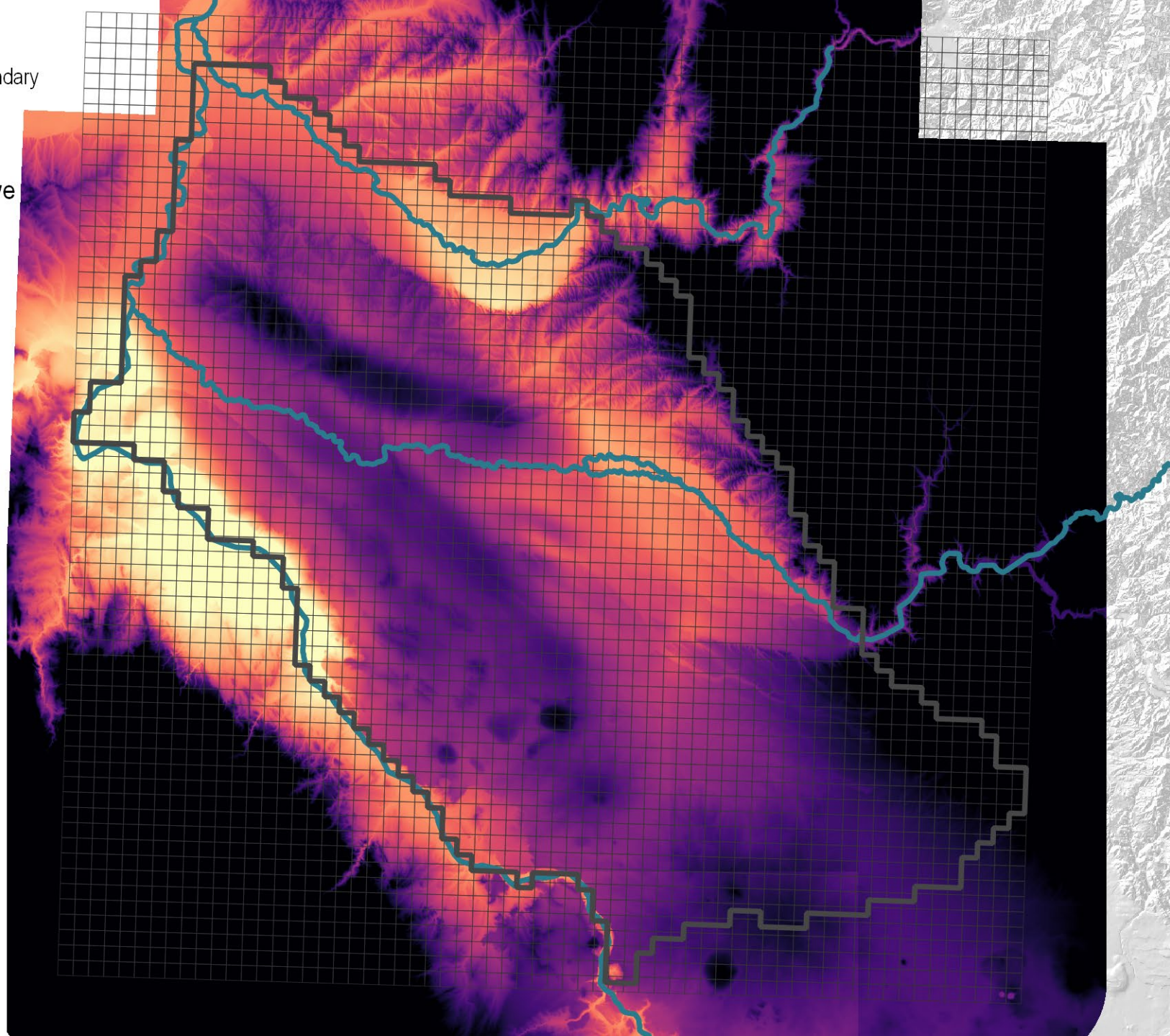
Properties to grid

EXPLANATION

-  Approximate Boundary
-  Major Rivers
-  1 mi X 1 mi grid

Total Thickness above Mudstone, in feet

-  85
-  242.2
-  399.4
-  556.7
-  713.9
-  871.1
-  1028
-  1186
-  1343
-  1500



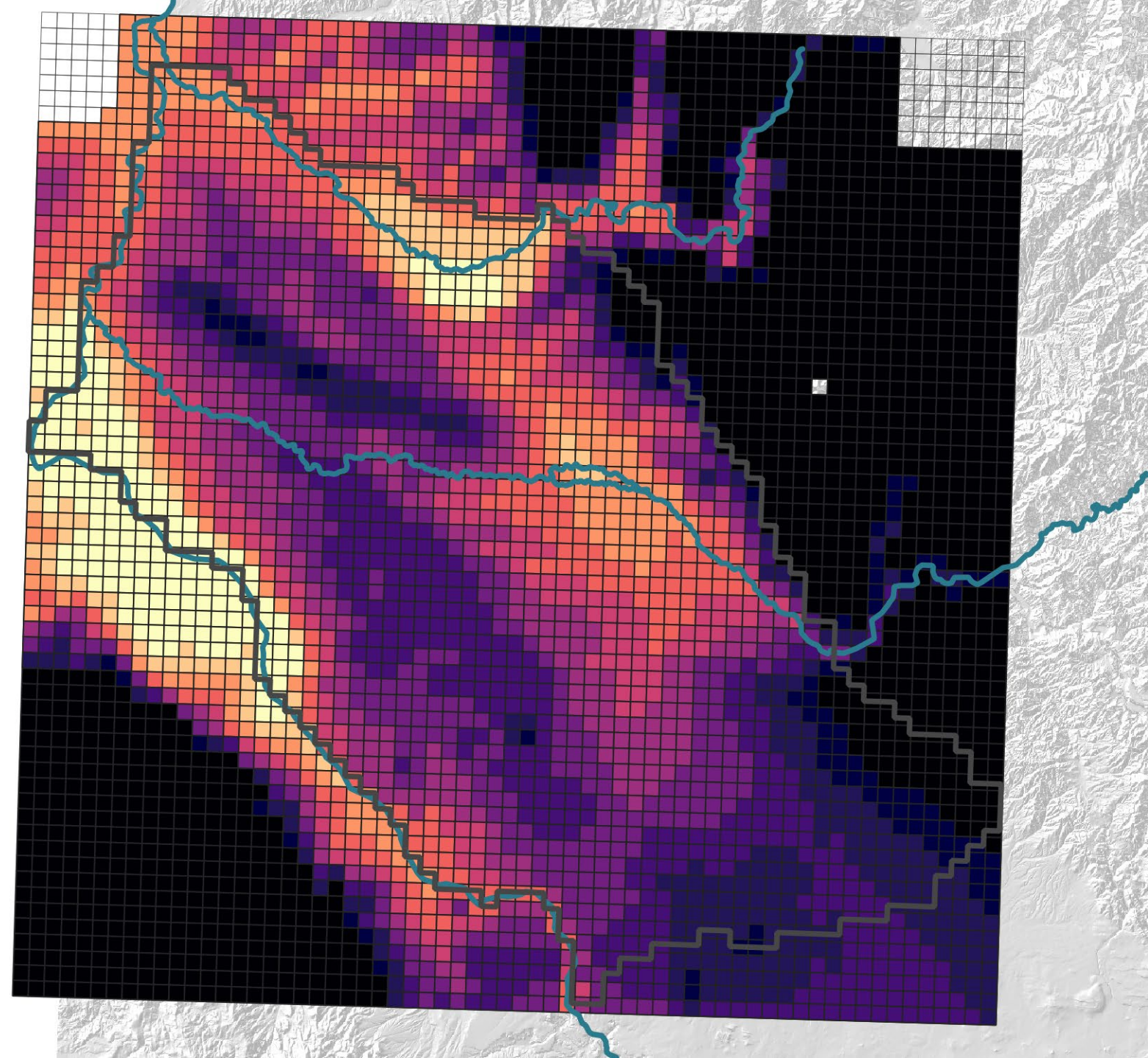
Properties to grid

EXPLANATION

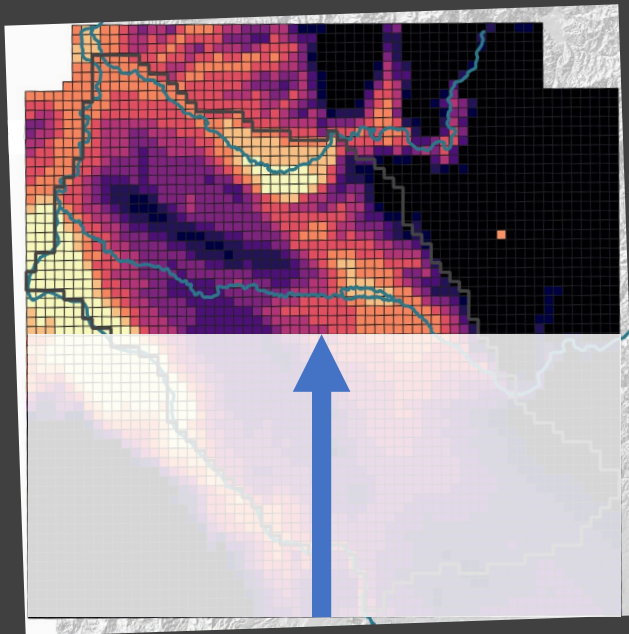
- Approximate Boundary
- Major Rivers
- 1 mi X 1 mi grid

Total Thickness above Mudstone, in feet

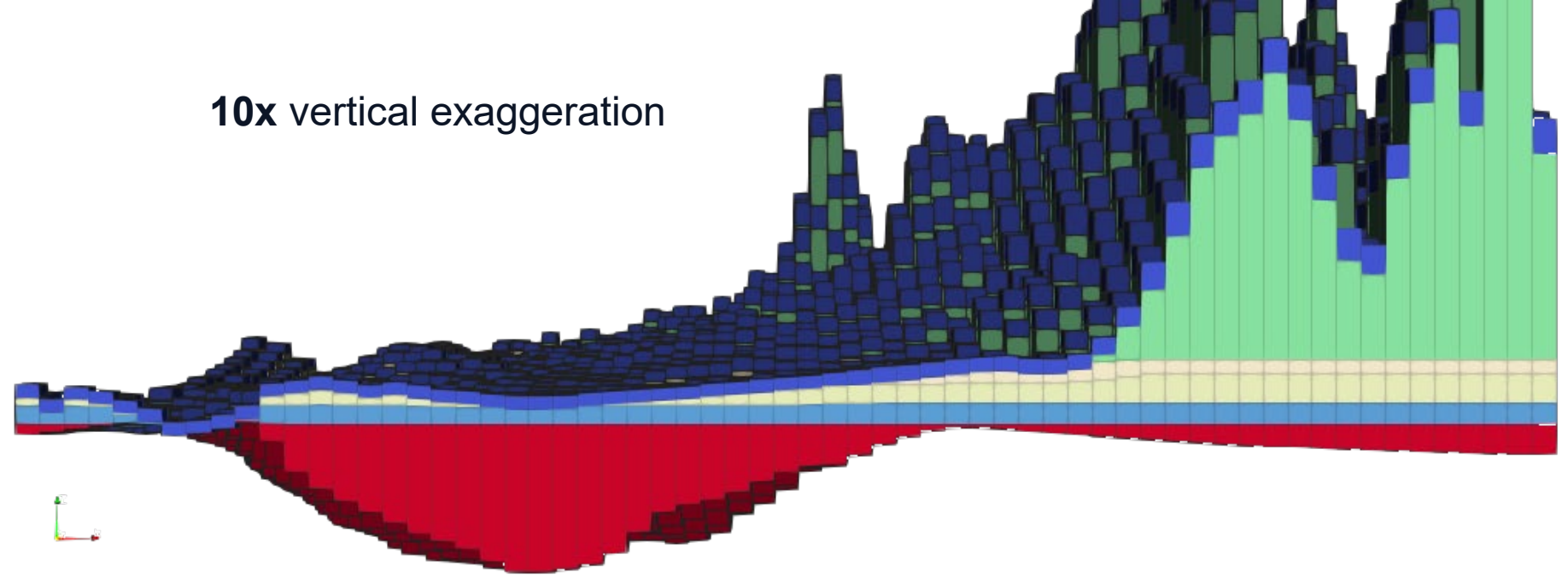
- 85
- 242.2
- 399.4
- 556.7
- 713.9
- 871.1
- 1028
- 1186
- 1343
- 1500



Cross section Looking North



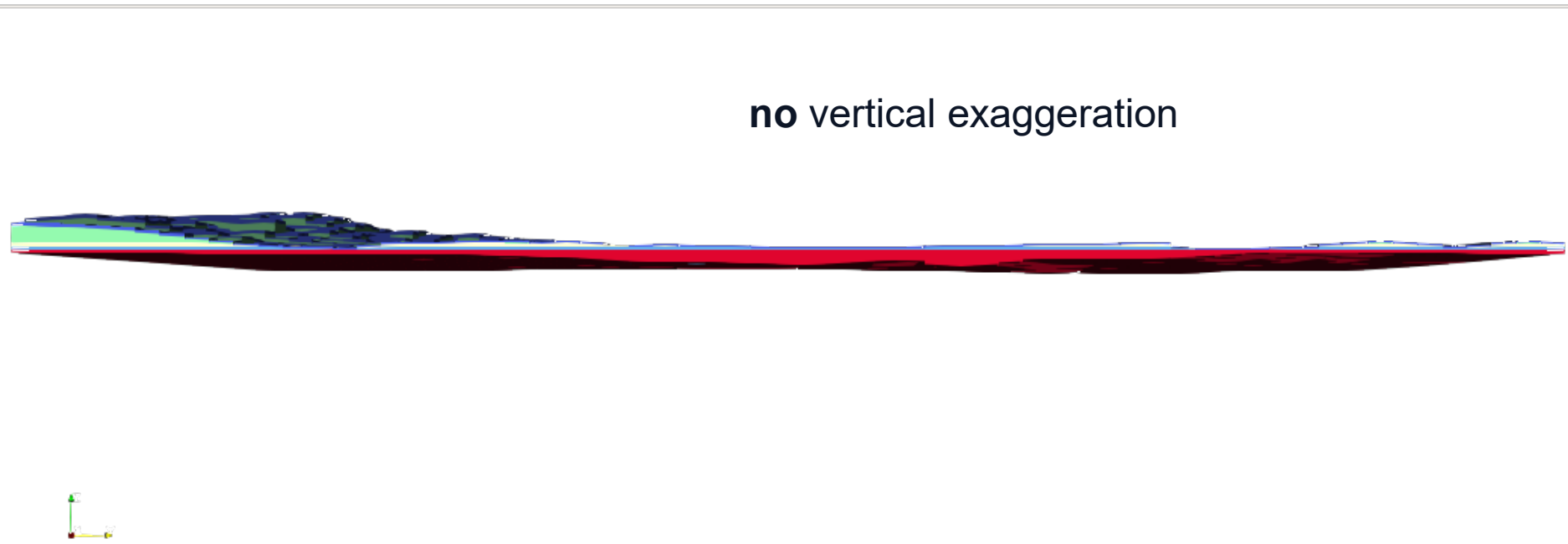
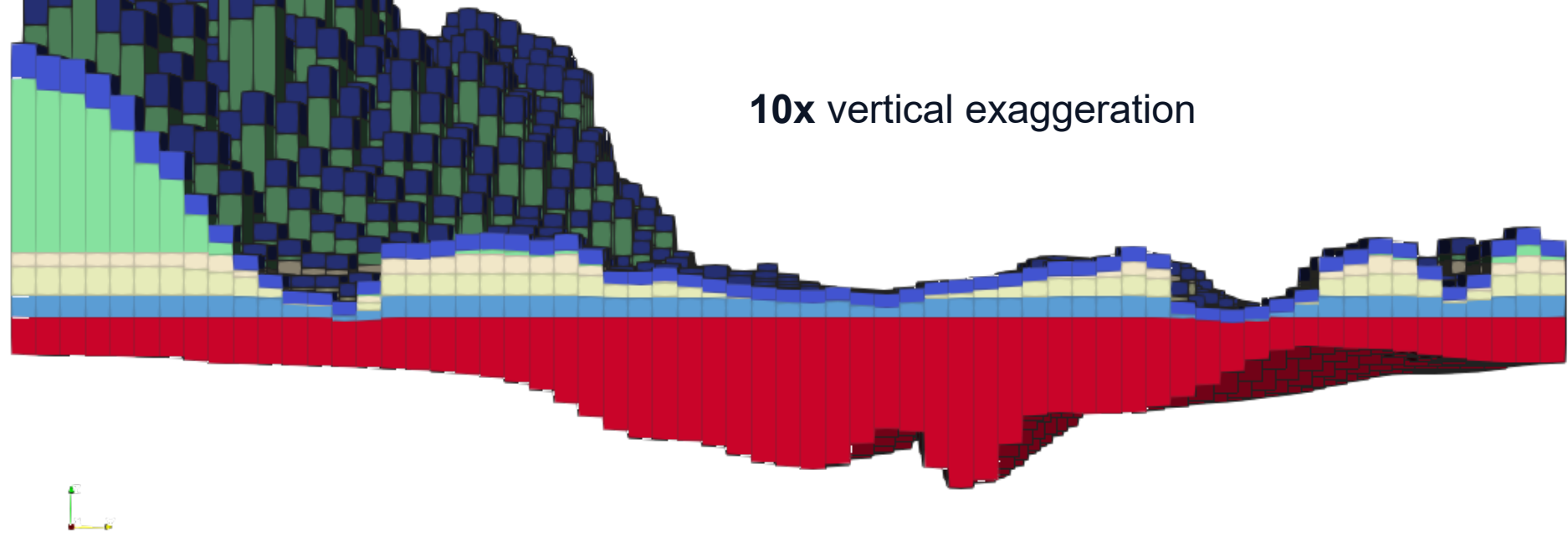
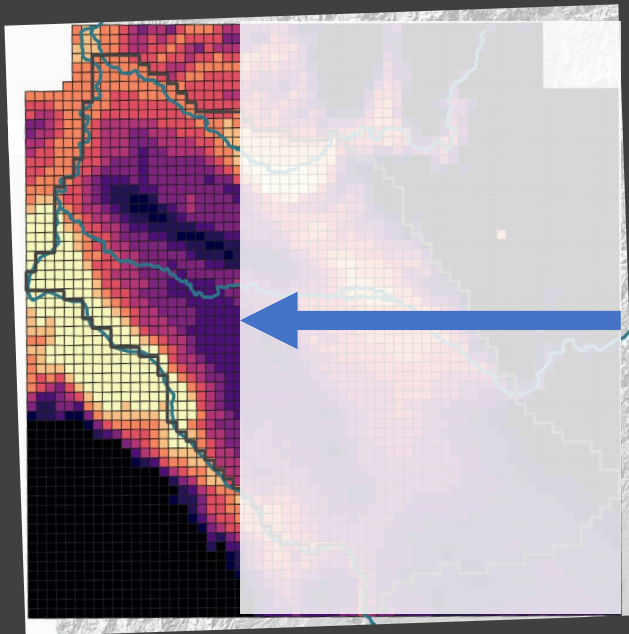
10x vertical exaggeration



no vertical exaggeration



Cross section Looking West



Time:
stress periods and time steps

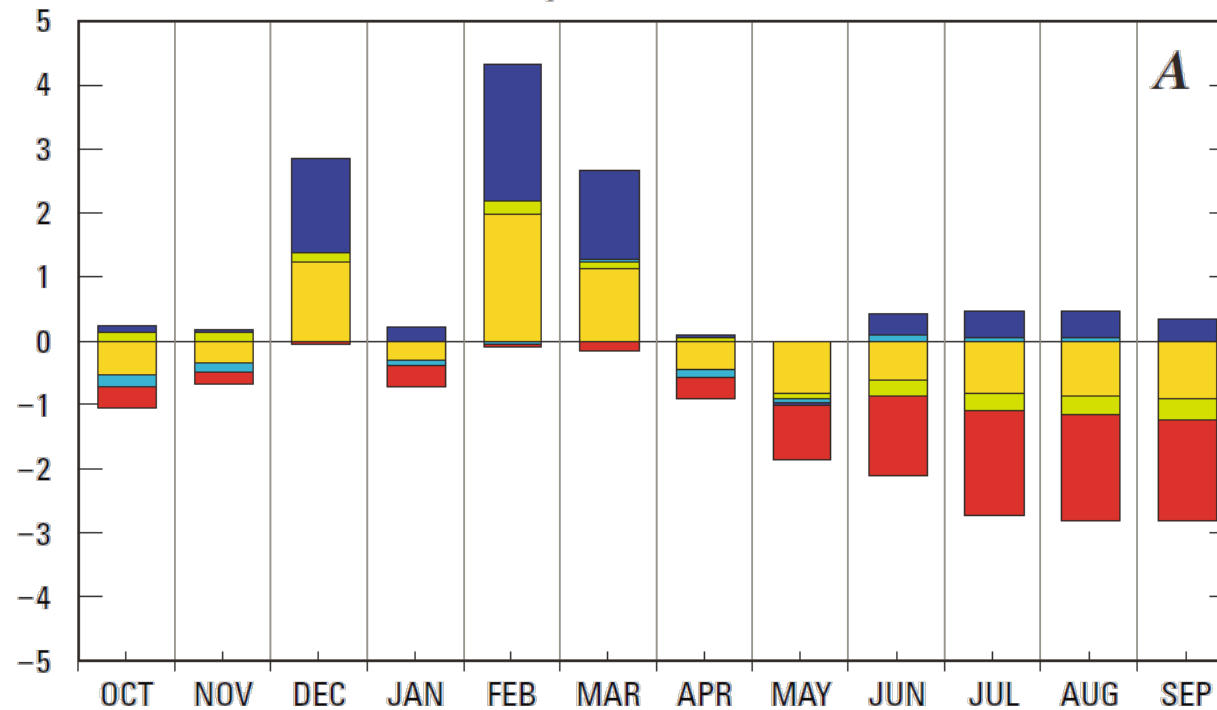
Time

Monthly Stress Periods

- Inputs are constant for each month
- 360 total (12 months * 30 years)

Time Steps:

- Numerical issue
- How many times the system of equations are solved for each stress period
- TBD (1 step per period if possible)



(Faunt, 2009)

EXPLANATION

Net groundwater budget

- Specific yield and compressibility of water
- Elastic and inelastic matrix storage
- Groundwater recharge from landscape
- Stream interaction
- Pumpage

Thanks for listening!