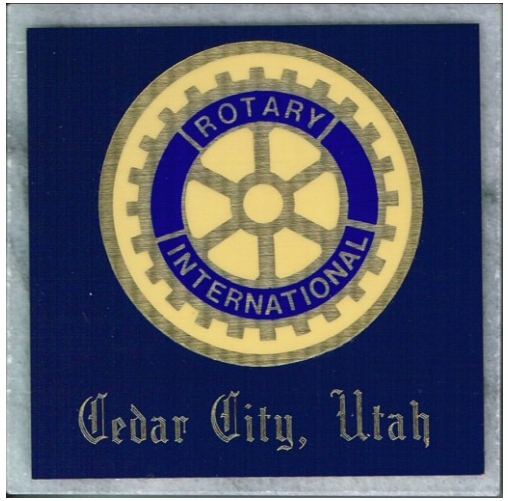
The Cedar Valley Aquifer
and
The Cedar Valley Drainage Basin

06 August 2016



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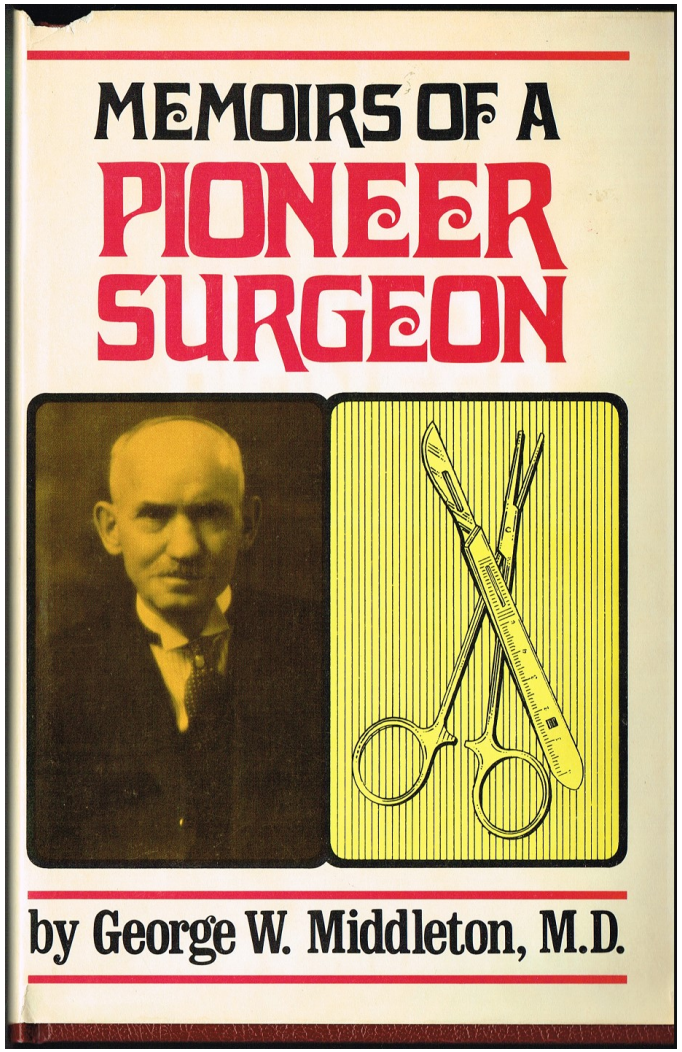
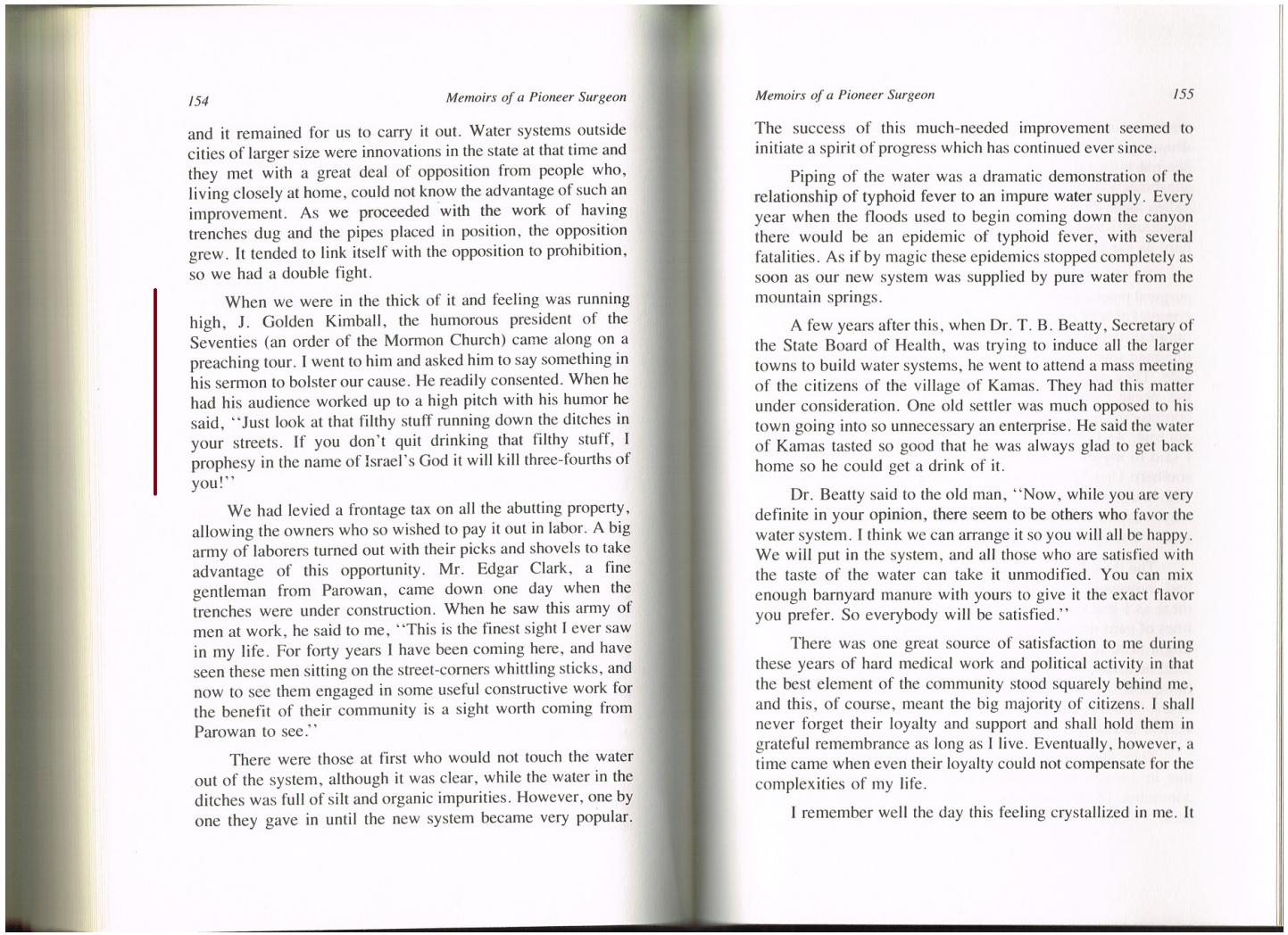
Historical Water Issue in Cedar City





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and it remained for us to carry it out. Water systems outside cities of larger size were innovations in the state at that time and they met with a great deal of opposition from people who, living closely at home, could not know the advantage of such an improvement. As we proceeded with the work of having trenches dug and the pipes placed in position, the opposition grew. It tended to link itself with the opposition to prohibition, so we had a double fight.

When we were in the thick of it and feeling was running high, J. Golden Kimball, the humorous president of the Seventies (an order of the Mormon Church) came along on a preaching tour. I went to him and asked him to say something in his sermon to bolster our cause. He readily consented. When he had his audience worked up to a high pitch with his humor he said, ''Just look at that filthy stuff running down the ditches in your streets. If you don't quit drinking that filthy stuff, I prophesy in the name of Israel's God it will kill three-fourths of you!''

We had levied a frontage tax on all the abutting property, allowing the owners who so wished to pay it out in labor. A big army of laborers turned out with their picks and shovels to take advantage of this opportunity. Mr. Edgar Clark, a fine gentleman from Parowan, came down one day when the trenches were under construction. When he saw this army of men at work, he said to me, ''This is the finest sight I ever saw in my life. For forty years I have been coming here, and have seen these men sitting on the street-corners whittling sticks, and now to see them engaged in some useful constructive work for the benefit of their community is a sight worth coming from Parowan to see.''

There were those at first who would not touch the water out of the system, although it was clear, while the water in the ditches was full of silt and organic impurities. However, one by one they gave in until the new system became very popular.

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The success of this much-needed improvement seemed to initiate a spirit of progress which has continued ever since.

Piping of the water was a dramatic demonstration of the relationship of typhoid fever to an impure water supply. Every year when the floods used to begin coming down the canyon there would be an epidemic of typhoid fever, with several fatalities. As if by magic these epidemics stopped completely as soon as our new system was supplied by pure water from the mountain springs.

A few years after this, when Dr. T. B. Beatty, Secretary of the State Board of Health, was trying to induce all the larger towns to build water systems, he went to attend a mass meeting of the citizens of the village of Kamas. They had this matter under consideration. One old settler was much opposed to his town going into so unnecessary an enterprise. He said the water of Kamas tasted so good that he was always glad to get back home so he could get a drink of it.

Dr. Beatty said to the old man, ''Now, while you are very definite in your opinion, there seem to be others who favor the water system. I think we can arrange it so you will all be happy. We will put in the system, and all those who are satisfied with the taste of the water can take it unmodified. You can mix enough barnyard manure with yours to give it the exact flavor you prefer. So everybody will be satisfied.''

There was one great source of satisfaction to me during these years of hard medical work and political activity in that the best element of the community stood squarely behind me, and this, of course, meant the big majority of citizens. I shall never forget their loyalty and support and shall hold them in grateful remembrance as long as I live. Eventually, however, a time came when even their loyalty could not compensate for the complexities of my life.

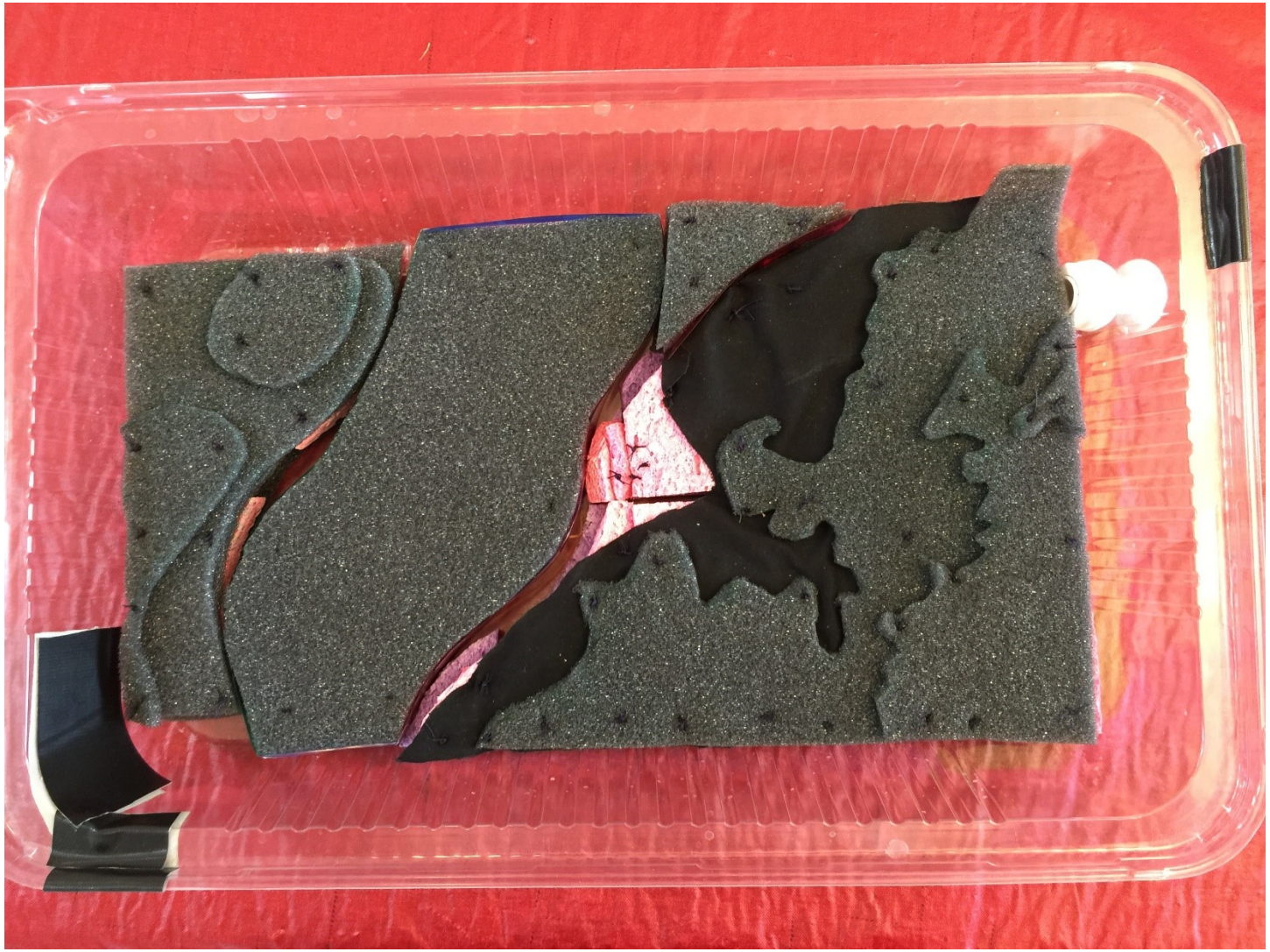
I remember well the day this feeling crystallized in me. It

Water Issues

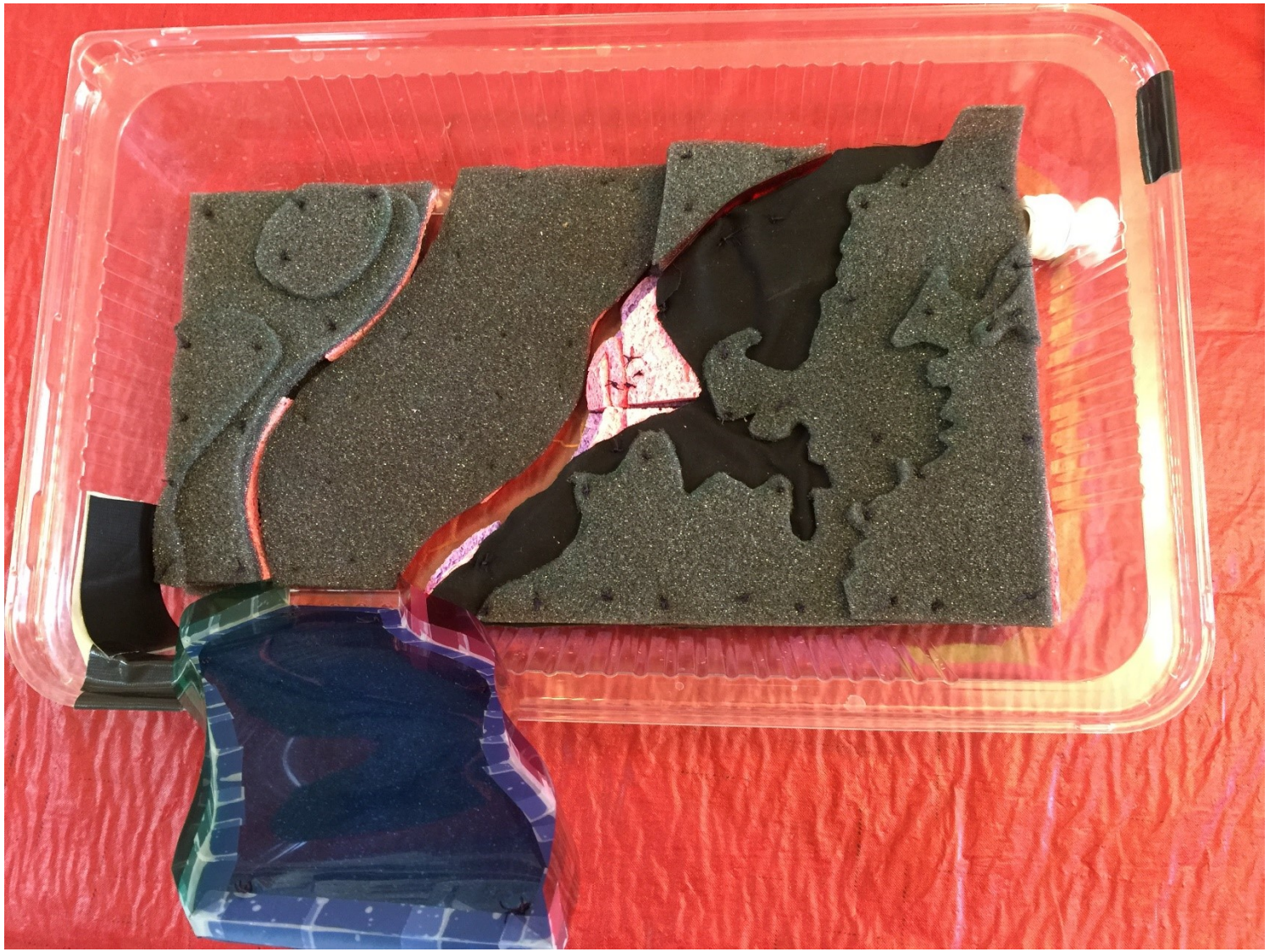
- Water is THE big deal in Iron County!
- Access to water means the difference between growth and stagnation!
- On Jan 7th of this year Kent Jones, State Water Engineer, announced probable regulation of water rights in Cedar Valley, as is starting to be implemented in Beryl Valley, beginning with most recently issued water rights!
- Cedar Valley has somewhere between 50-76,000 acre-feet of water rights, (this is a 34%-52% error in known water rights) and needs to be reduced to the 20-24,000 acre-feet "safe yield" that goes back into the aquifer each year!
- James Greer: "Unfortunately the list of existing water rights has inaccuracies" (People who do not know what rights are issued will regulate precisely?)!
- The CICWCD has been working to find ways to import water to the valley (Not including tapping resources within the Cedar Valley Drainage Basin!)

Map of Model Area

Sponge Model



Sponge Model – Isolated Cedar Valley Aquifer



Presentation Outline

1. The value of water in Iron County.
2. Sources of water for Iron County.
3. The age of water in the Cedar Valley Drainage Basin.
4. Three Distinct Aquifers in the Cedar Valley Drainage Basin.
5. Summary.

1. The value of water in Iron County.

- 5 gallons of water in 80 8 fluid ounce bottles costs $3.84
- At 325,000 gallons per acre-foot - a factor of 65,000 - the cost is $249,600 per acre-foot

Home › United States › Utah › Southwest Utah › Iron County › Enoch ›

1 acres in Iron County, Utah

Water Rights - $4000 - 1 AF, Enoch, Utah 84721 - Iron County

This property is no longer available.

Search for Available Property.

Details for Water Rights - $4000 - 1 AF

County:	Iron	Type:	River Property	Acres:	1
Address:	Water Rights - $4000 - 1 AF	City:	Enoch	State:	Utah
Zip:	84721	Price:	Inactive	Status:	Unavailable

Property ID: 935205

Description of Water Rights - $4000 - 1 AF

THESE ARE WATER RIGHTS!!! Great deal for water rights, priced at only $4000 for a full 1 acre foot of water, evidenced by water right # 73-2552 which includes a domestic right and .137 irrigation water. This right is for water use West of Cedar City and North of Hwy 56. TITLE INSURANCE FOR WATER IS AVAILABLE IF BUYER DESIRES TO INCLUDE IT, IT WILL BE AT THE BUYERS OWN EXPENSE! SELLER WILL NOT PAY FOR OR PROVIDE TITLE INS.

Water in Iron County sells for
$1,800 to $10,000 per acre-foot

Enoch, Iron County, Utah Land For Sale - 35.98 Acres

PHOTOS

Property type:	Land
Parcel Size:	35.98 Acres
Price:	$480,050
MLS or other ID:	16-175426

Check your free credit score

Agent: DANIEL S ROBERTS

Email DANIEL S ROBERTS

Click for phone number

Visit website

35.98 acres located just North of Dairy Glen Subdivision. This land will become Dairy Glen Phase II. Purchase price includes 45 AF Underground Water Right. Prime residential development property annexed into city with city water, natural gas, electric, and sewer. Sewer trunk goes through subject property and diagonals to the West through adjacent 80 acre parcel to the North.

45 ac-ft water + 35.98 acres for $480,060

@$10,000/ac-ft this values the land at $835/acre

CICWCD Recently Purchased 31 acre-feet

- CICWCD paid $3,000 per acre-foot, or $93,000 for 31 acre-feet of water.
- The current plan is to build a pipeline from the West Desert for $150 million, initially 9,000 acre-feet, then up to15,000 acre-feet from Pine Valley, then expanding the pipeline for about $50 million, and adding 12,000 acre-feet from Wah Wah Valley.
- This means:
  - 15,000 acre-feet of water from Pine Valley has a value of $45 million
  - 12,000 acre-feet of water from Wah Wah Valley has a value of $36 million
  - 10,000 acre-feet of water from Hamlin Valley has a value of $30 million
- Total Value, with first water from Pine Valley 6-7 years out: $111 million
- For “ruled on water” from Pine Valley and Wah Wah Valley, 27,000 acre feet has a value of $11,111 per acre foot based on a $300 million pipeline (time-value-of $200 million over six years at a 7% interest rate)
- Paul Cozzens said: “ Lake Powell Water would have cost $20,000 per acre foot.” (25 Feb 2015 IC Today)

2. Historical and Current Sources of Water

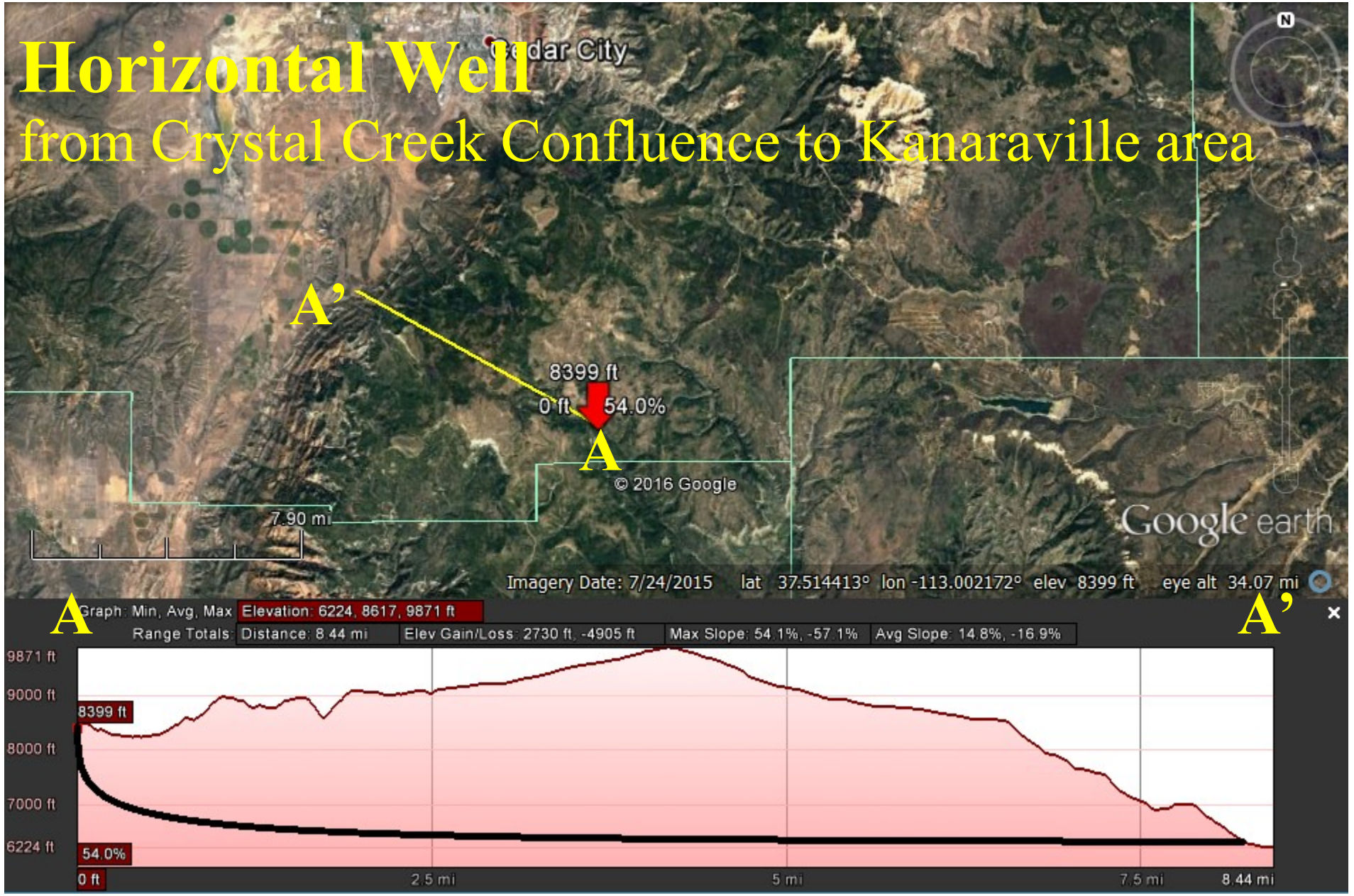
A. Kolob Reservoir
B. Lake Powell Pipeline
C. West Desert Pipeline
D. Cedar Valley Aquifer
E. Cedar Valley Drainage Basin

2. The Importing of Water into Iron County
a. Kolob Reservoir Water

First Inter-Basin Transfer Attempt formalized in 1984 was a 50 year agreement:

"Cedar City Corporation had an interest in water in Kolob Reservoir and had made investments and yearly payments to the tune of $142,000 a year to keep their interest. Mayor Harold Shirley and others made the decision in the mid-1990s to allow the water rights to go to Washington County after the high cost of getting the water to Cedar City residents, and the inevitable impending court battle of taking water from a main tributary of Zion Canyon, deemed the water too expensive and even impossible to utilize. … In addition, it was reported in the "Deseret News" in 1994 that the costs to transfer the water from the Kolob Basin to Cedar City could reach $25 million." 26 Oct 2011 Iron County Today

Horizontal Well
from Crystal Creek Confluence to Kanaraville area

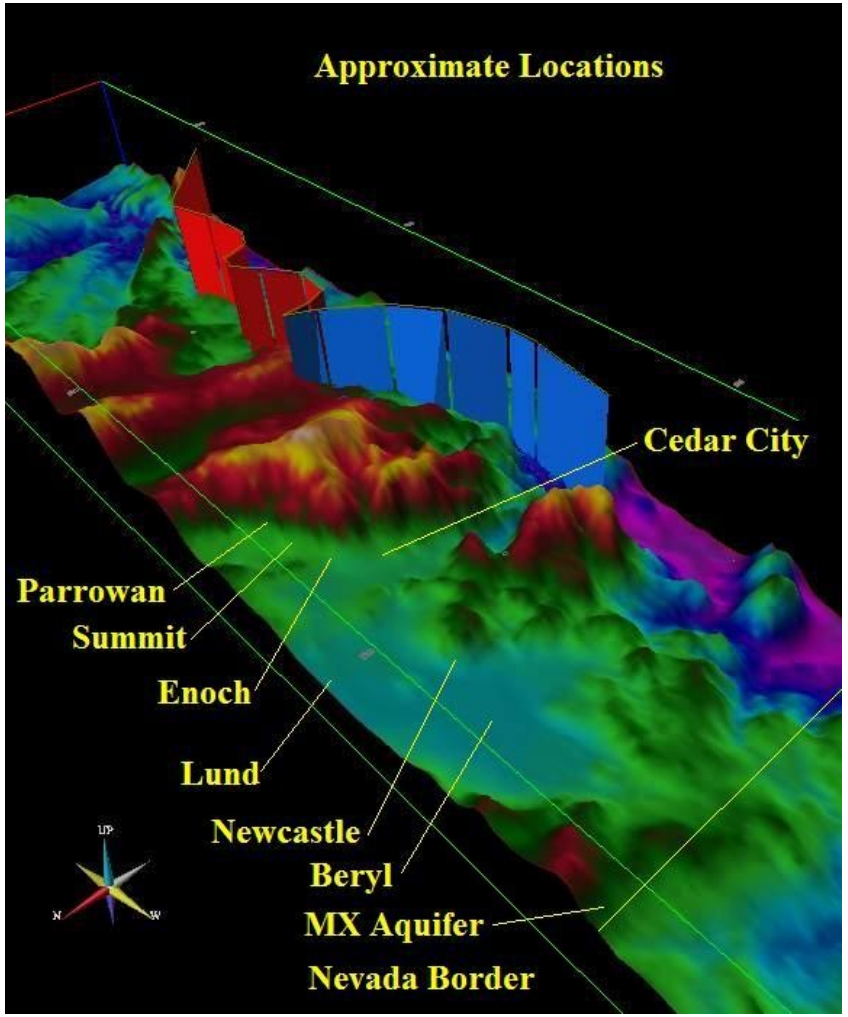


2 . The Importing of Water into Iron County
b. Lake Powell Pipeline

Second Inter-Basin Transfer Attempt :

“Cozzens said the project was simply not financially feasible for Iron County. It was estimated that Lake Powell Pipeline water would cost around $20,000 per acre-foot, require construction of a treatment plant and have the added cost of power to pump it uphill from Washington County, he said. Over 50 years, the cost was estimated at around $1 billion just for the Cedar Valley.” 15 Feb 2015 Iron County Today

Map provided to Eldon Schmutz of CICWCD in 2006, just before the CICWCD filed for West Desert Water



- Cost of pumping water from the Lake Powell Pipeline 3,400+ feet up the Black Ridge to Cedar City did not make sense.
- The MX-Missile site preparation included mapping extensive aquifers in the West Desert Basins.
- The map to the left was provided to Eldon and the CICWCD in 2006 to stress the difference in cost in pumping water up from Lake Powell vs. pumping water 700 feet down from proposed West Desert wells.

2 . The Importing of Water into Iron County
c. West Desert Water

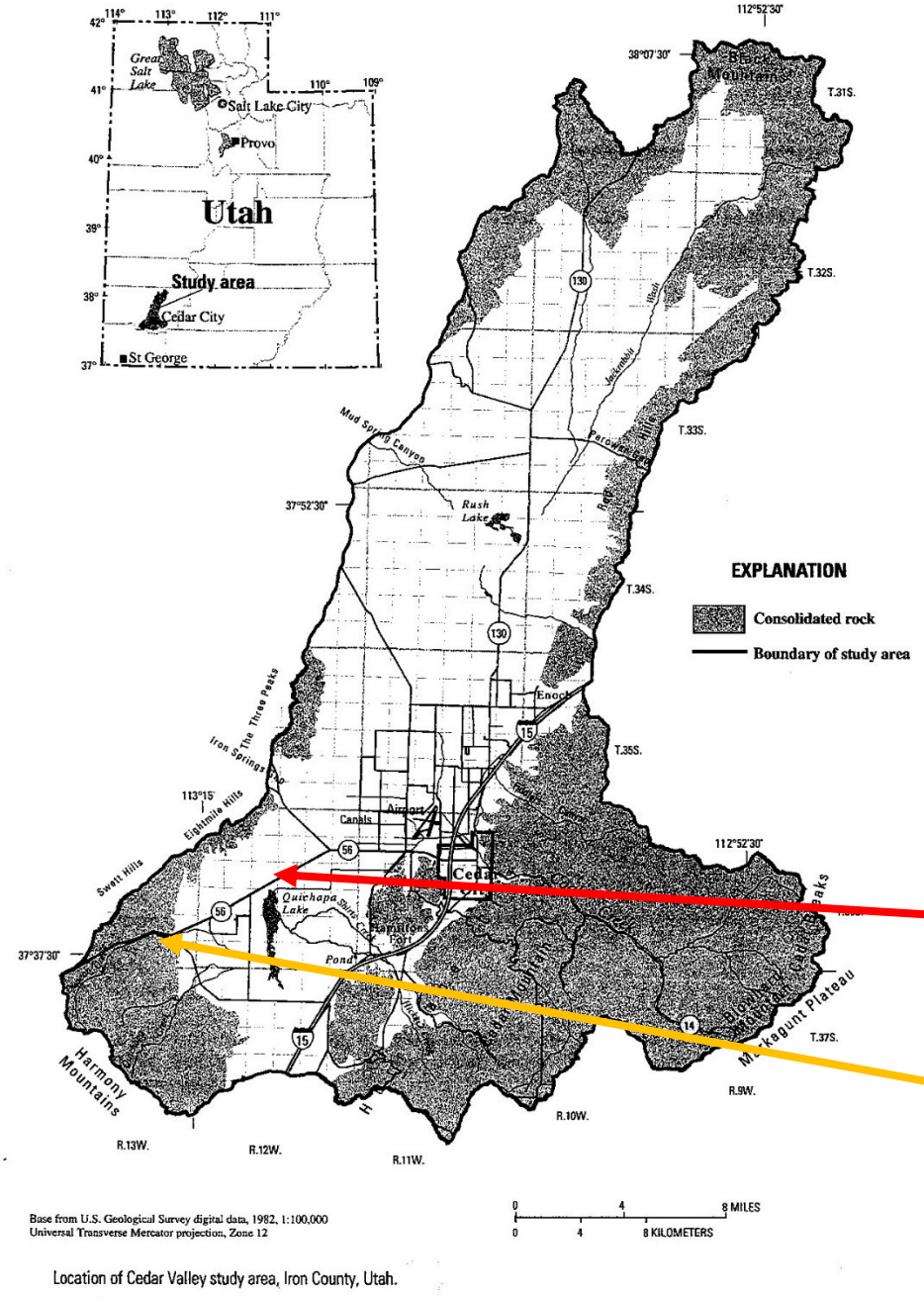
Third Inter-Basin Transfer Plan:

"After rejecting the Lake Powell Pipeline project because of its high cost estimates, the district placed most of its hope for balancing the aquifer and providing for future growth on water rights applications filed in 2006 in three valleys – Pine (for 15,000 acre-feet), Wah Wah (for 12,000 acre-feet) and Hamlin (for 10,000 acre-feet)." 29 Jan 2015 Iron County Today

"The cost to bring water from Pine Valley is estimated at $150 million, with the Wah Wah water tying into that later at maybe around one-third the cost, Crane said. Most funding available would be for a 40- to 50-year period." 04 Mar 2015 Iron County Today

The West Desert Pipeline Summary.

- Six or seven years until first water.
- The pipeline initially provides 9,000 acre-feet of water to match current overdraft of water from Cedar Valley.
- At $10,000 per acre-foot, this water is worth $90 million.
- The Pipeline is expected to cost $150 million, and will most likely be at least $200 million without the pipeline to Wah Wah Valley.
- If the pipeline does cost $200 million, it means the 9,000 acre-feet of water is worth $22,222 per acre-foot, which is more than Lake Powell Pipeline water and does not match current market prices of water.
- Note the water could be sold to the mines without all the pipeline cost.



Location of Cedar Valley study area, Iron County, Utah.

3. The age of water in the Cedar Valley Drainage Basin.

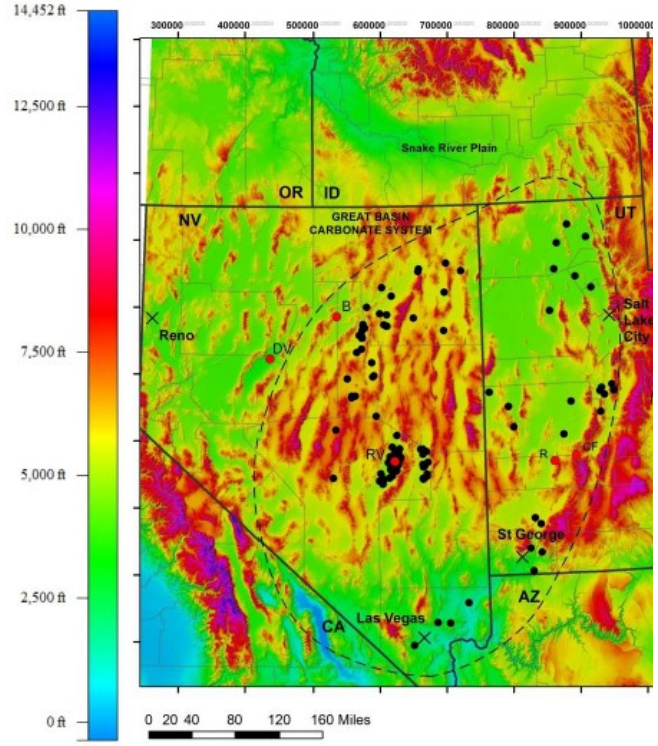
- The map to the left shows the extent of the Cedar Valley Drainage Basin.
- The Cedar Valley Aquifer is basically the white portions of this map.
- White is where the valley fill has been for eons.

- Water in the Cedar Valley Aquifer dates back 16,000 years to the time of Lake Bonneville.
- Water up the canyon dates back 500 years ago, twice as far back in time as Father Escalante's expedition through Southern Utah.

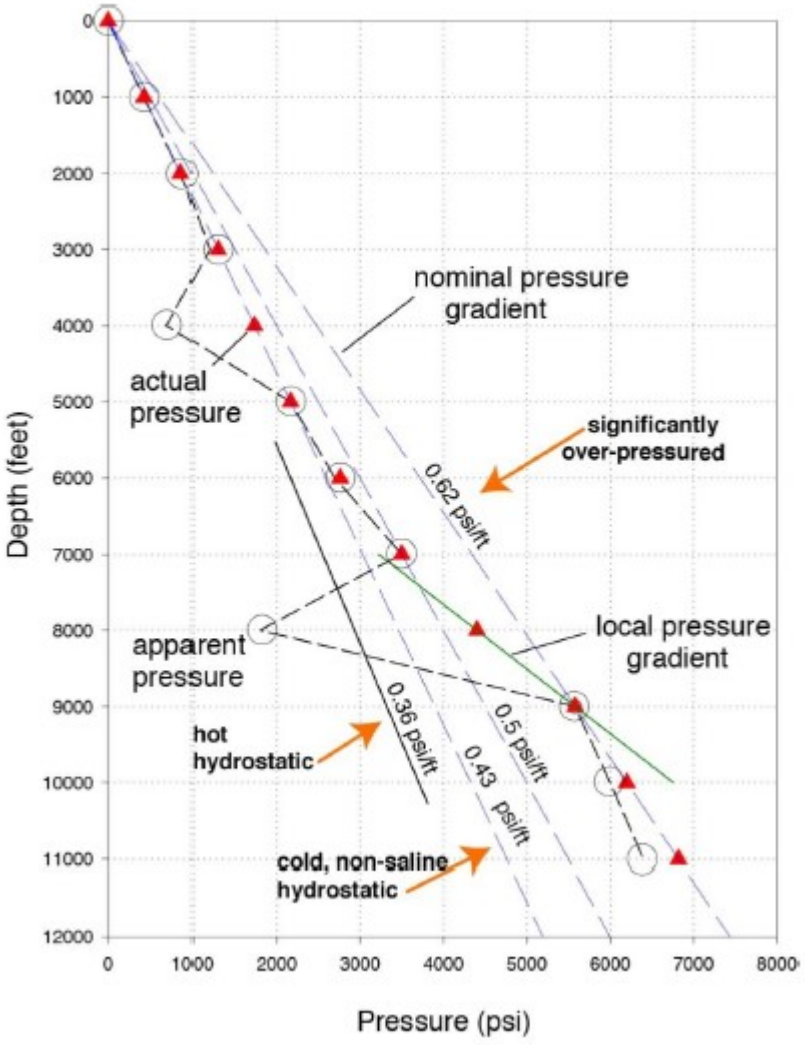
Knowledge of the Age of Water is Important

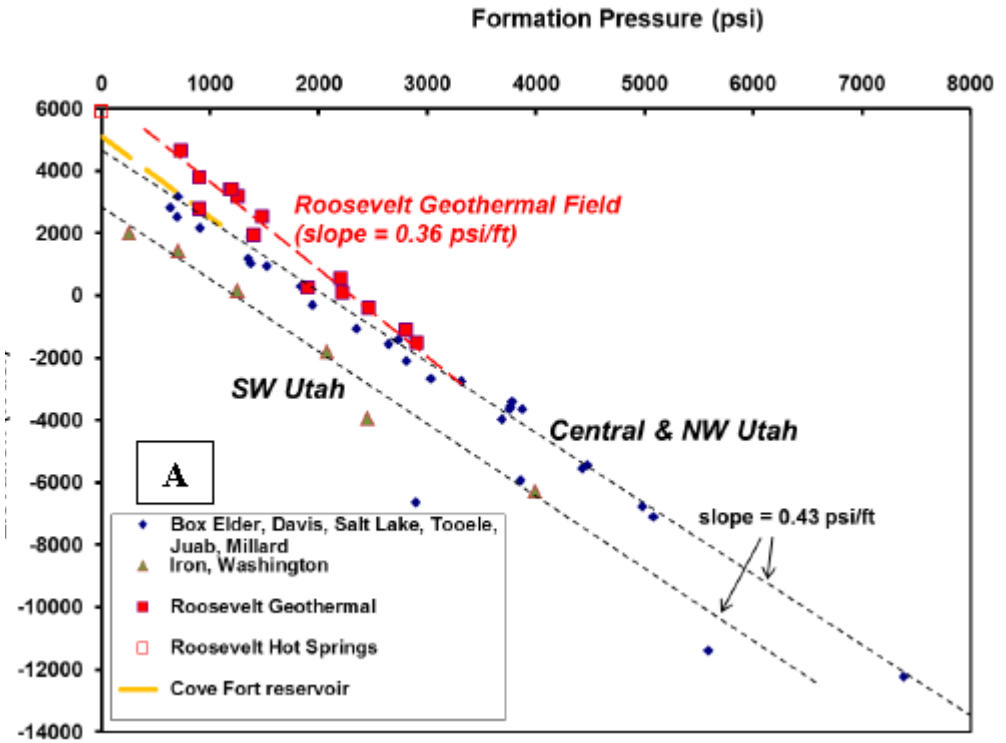
- Water in the springs west of Quichapa entered the geology in the 1500's.
- Water falling on Cedar mountains today will not reach the Grand Canyon or other outlets for thousands of years.
- Science and proper planning imply it would be good to determine the age of the water for all water sources in the Cedar Valley Drainage Basin and to monitor new water production on an on-going basis in order to build a better map of aquifers.
- A great project for Rotary sponsored University or High School Interns

Iron County and the Entire Southern Great Basin: lower than normal hydrostatic pressure



A. Map of wells in Southern Great Basin



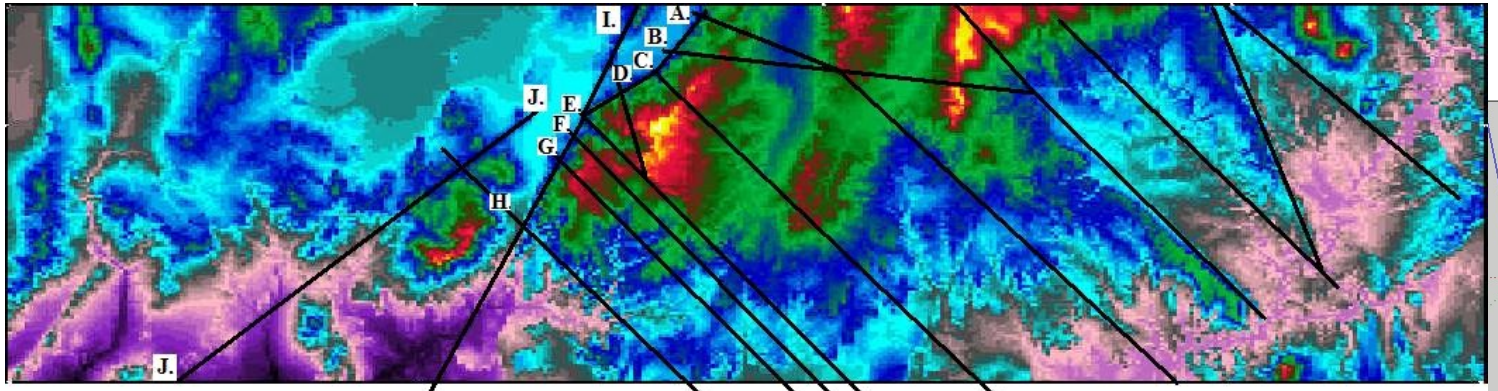


Formation Pressure as a Potential Indicator of High Stratigraphic Permeability

Rick Allis
Utah Geological Survey

B (left) C (above). Depth versus Pressure Plots for Iron and Washington Counties, where wells have lower than normal hydrostatic pressure.

Large Fracture Systems Draining to Grand Canyon Create Lower Hydrostatic Pressure

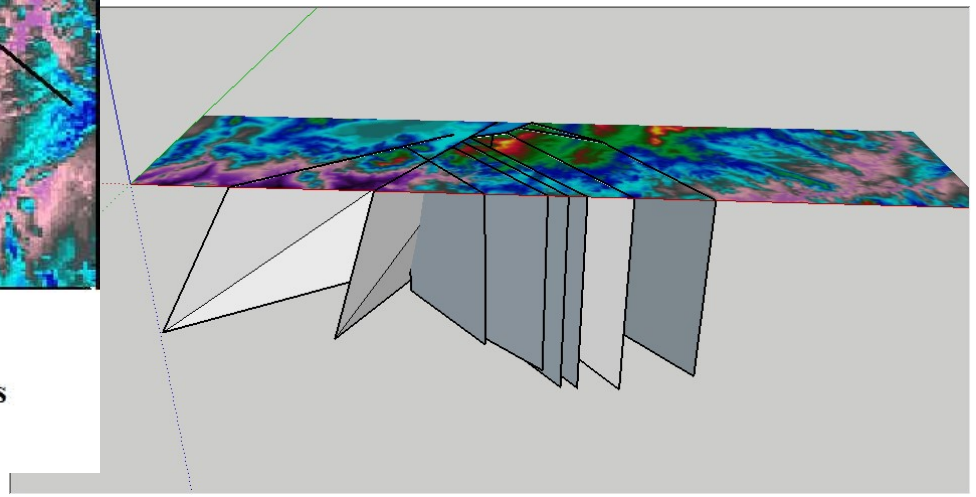


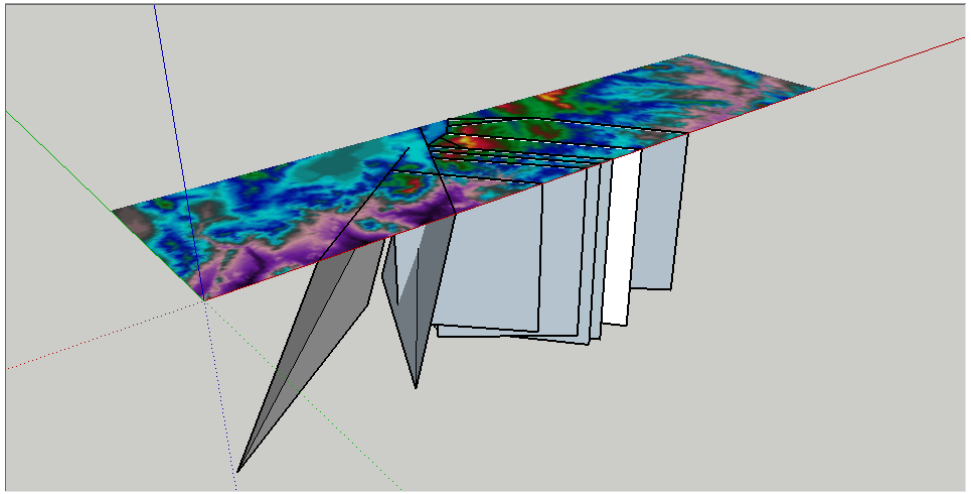
A. Paragonah Canyon
B. Parowan Canyon
C. Summit Canyon
D. Fiddlers Canyon
E. Cedar Canyon
F. Kararaville Canyon

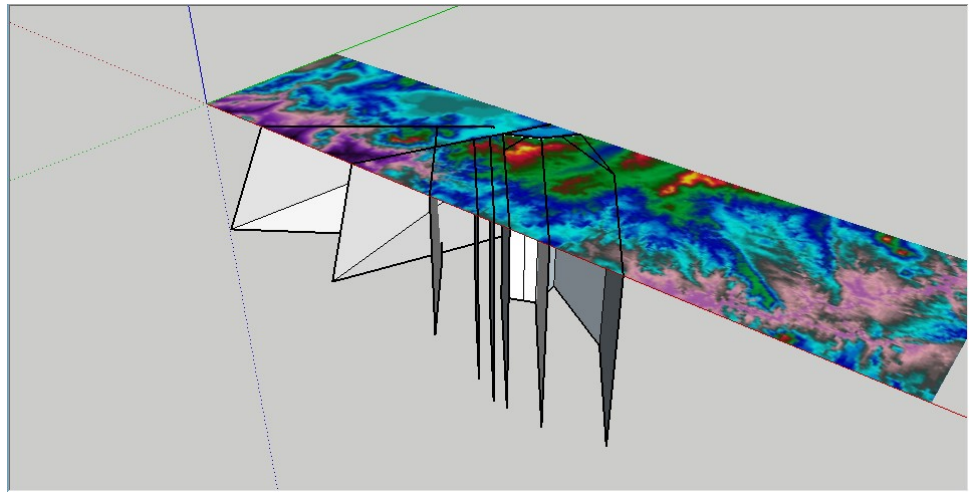
I.

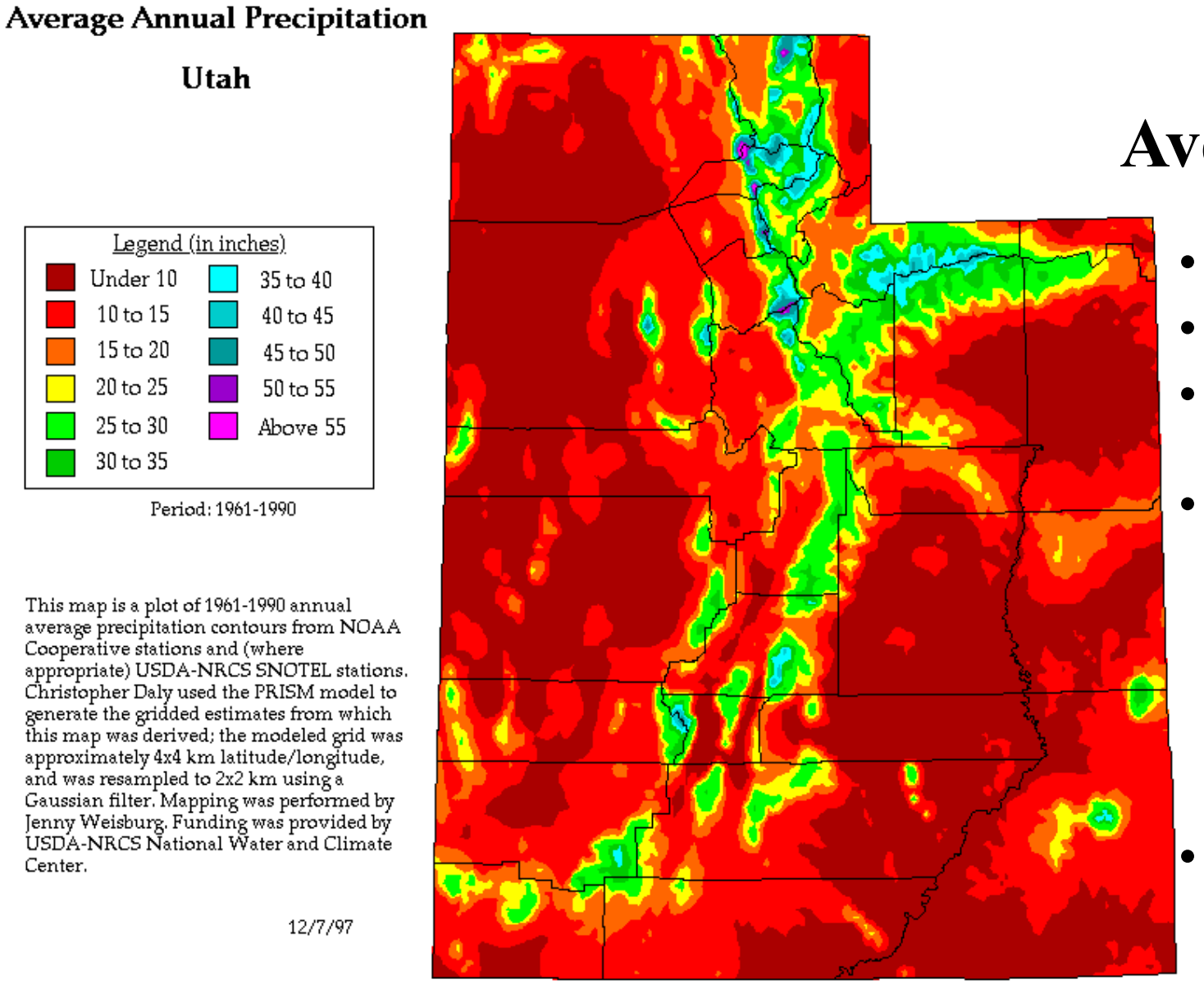
G. Five Fingers
H. New Harmony
I. Hurricane Fault
J. Pinevalley

Possible Fault Geopressure Leak Pathways from Cedar Valley to the Colorado River









Average Annual Precipitation

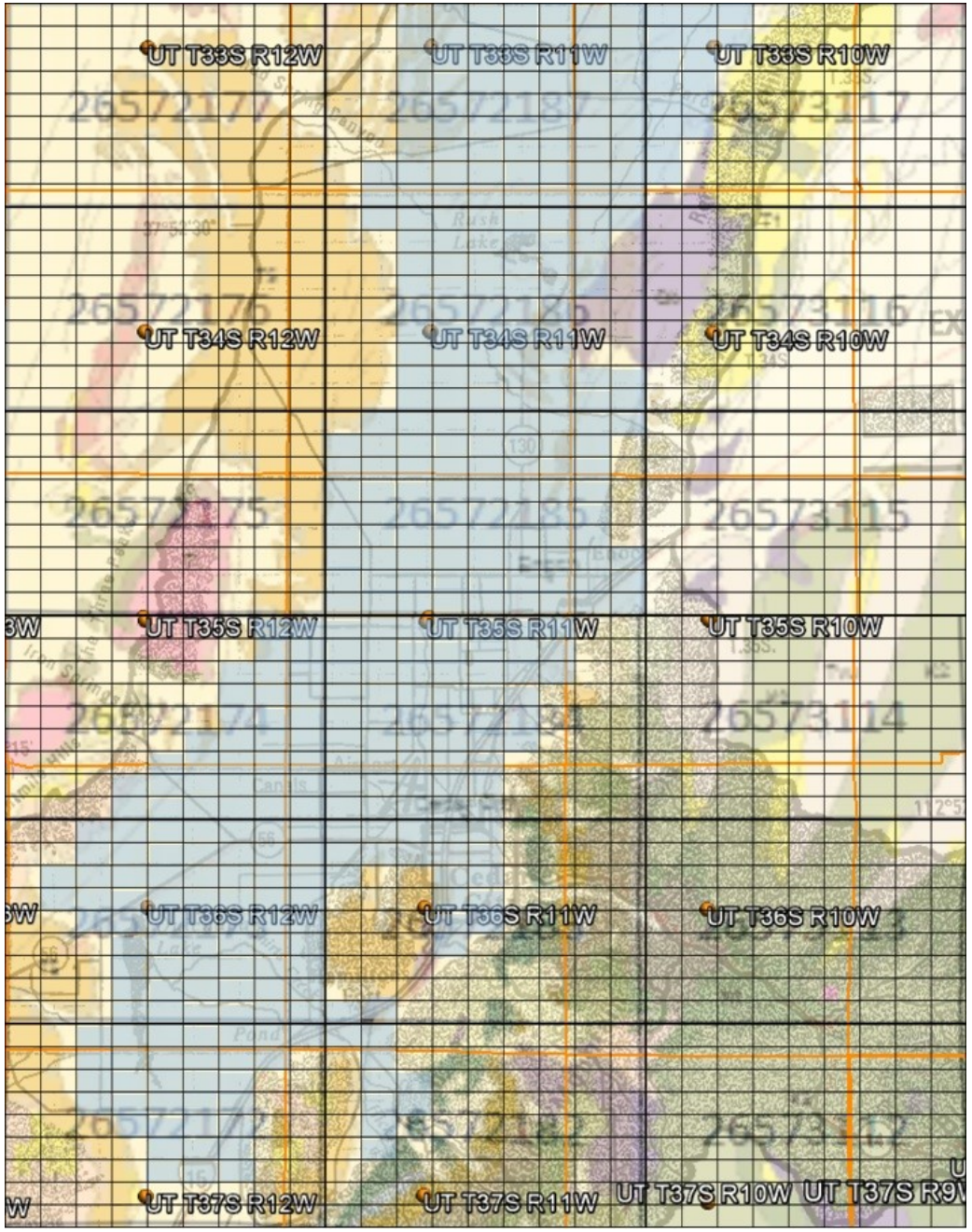
- 1 foot in the valley annually
- 3 feet in the mountains annually
- A good well produces 800 to 3,200 acre-feet of water per year.
- With no drawdown, and a 10% infiltration rate this implies
  - In the valley 12.5 sq mi surface area needed to produce 800 ac-ft , and 50 sq mi needed to produce 3,200 ac-ft; and
  - In the mountain 3.2 sq mi needed to produce 800 ac-ft and 16.3 sq mi needed to produce 3,200 ac-ft in the mountains.
- Much of the annual precipitation escapes Cedar valley through large transform faults.

4. Three Distinct Aquifers
in the Cedar Valley Drainage Basin

A. Cedar Valley Aquifer

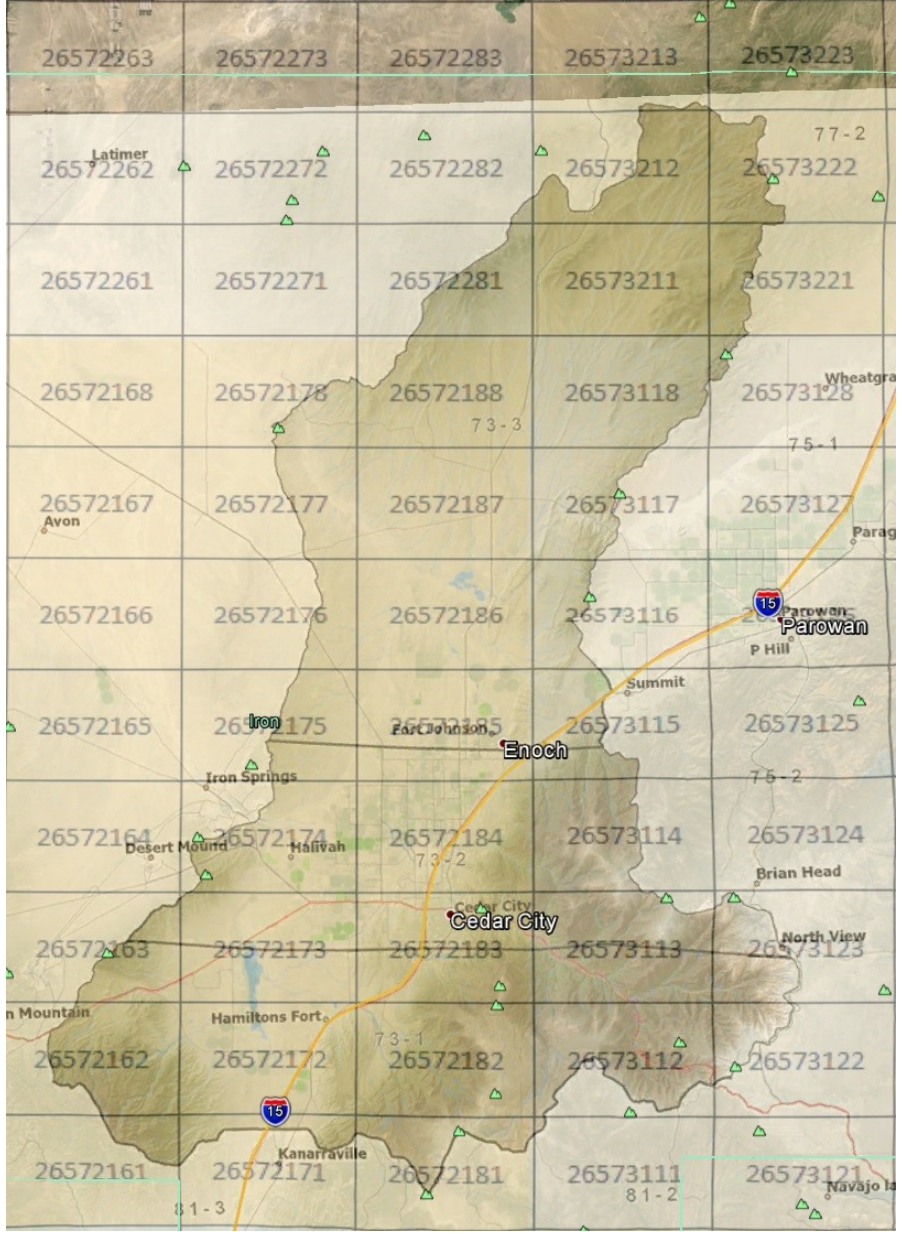
B. The Cretaceous Aquifer

C. The Quartz Monzonite Aquifer



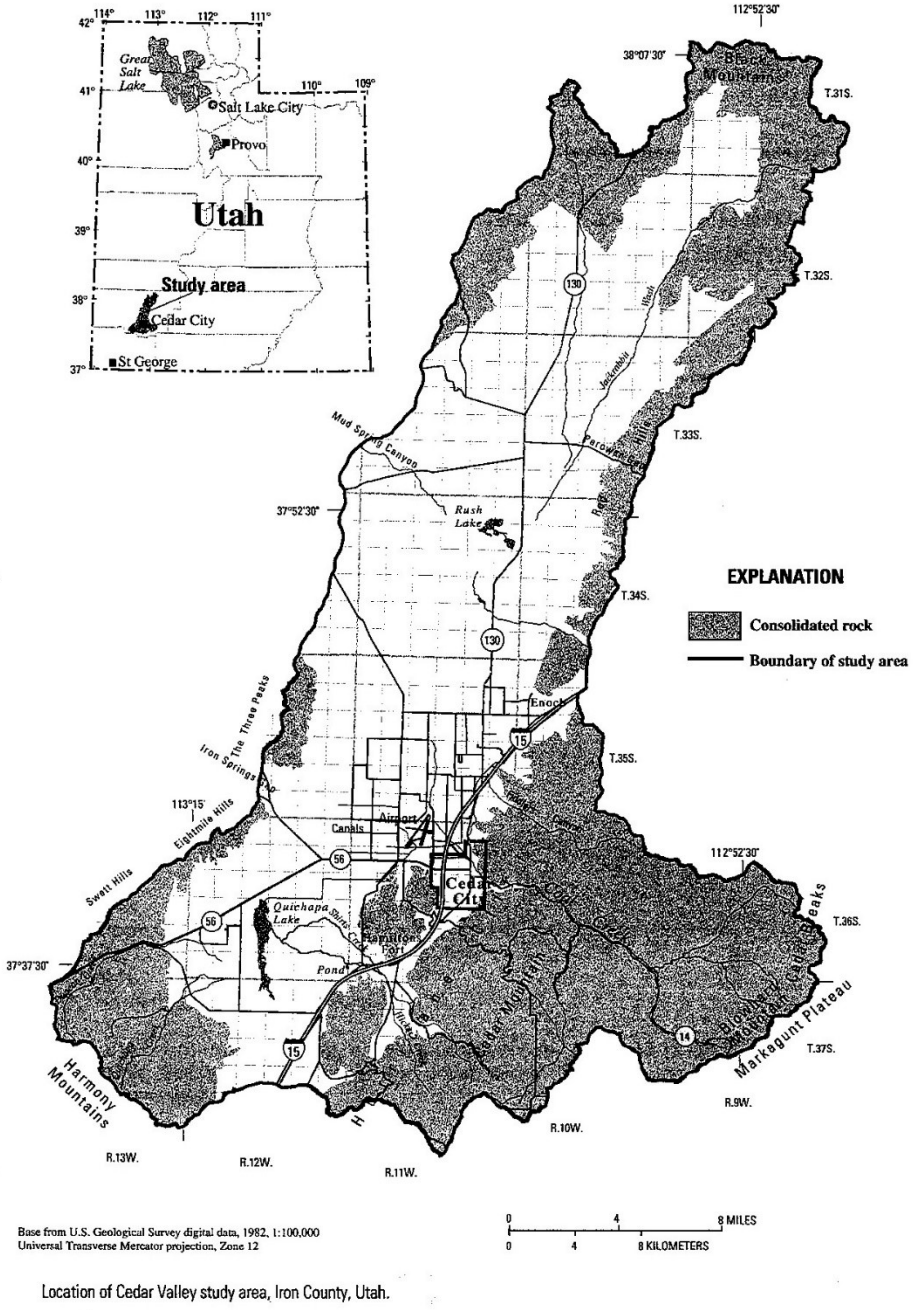
4.A. The water in the Cedar Valley Aquifer.

- The Cedar Valley Aquifer is shown by the blue colored squares on this map.
- Each colored square is an IG-5 cell and is about ~0.36 square miles in size. There are 421 IG5 cells covering the Cedar Valley Aquifer, or 152 sq. miles.
- This is ~97,000 acres, with an average of 12 inches of precipitation per year, implying an average of 10,000 acre-feet of recharge in the aquifer per year with a 10% infiltration rate.



Cedar Valley Drainage Basin

- Water for Cedar Valley is available from anyplace in the Cedar Valley Drainage Basin.
- There are consolidated rocks on either side of the Cedar Valley Aquifer, within the Cedar Valley Drainage Basin, which hold tremendous volumes of water:
  - On the west are fractured quartz monzonite rocks, which have excellent water production in New Harmony;
  - On the east are 20-30% porosity Cretaceous rocks, which have excellent water production at Brian Head.
- These are separate aquifers, isolated from the Cedar Valley Aquifer by faults and clays.

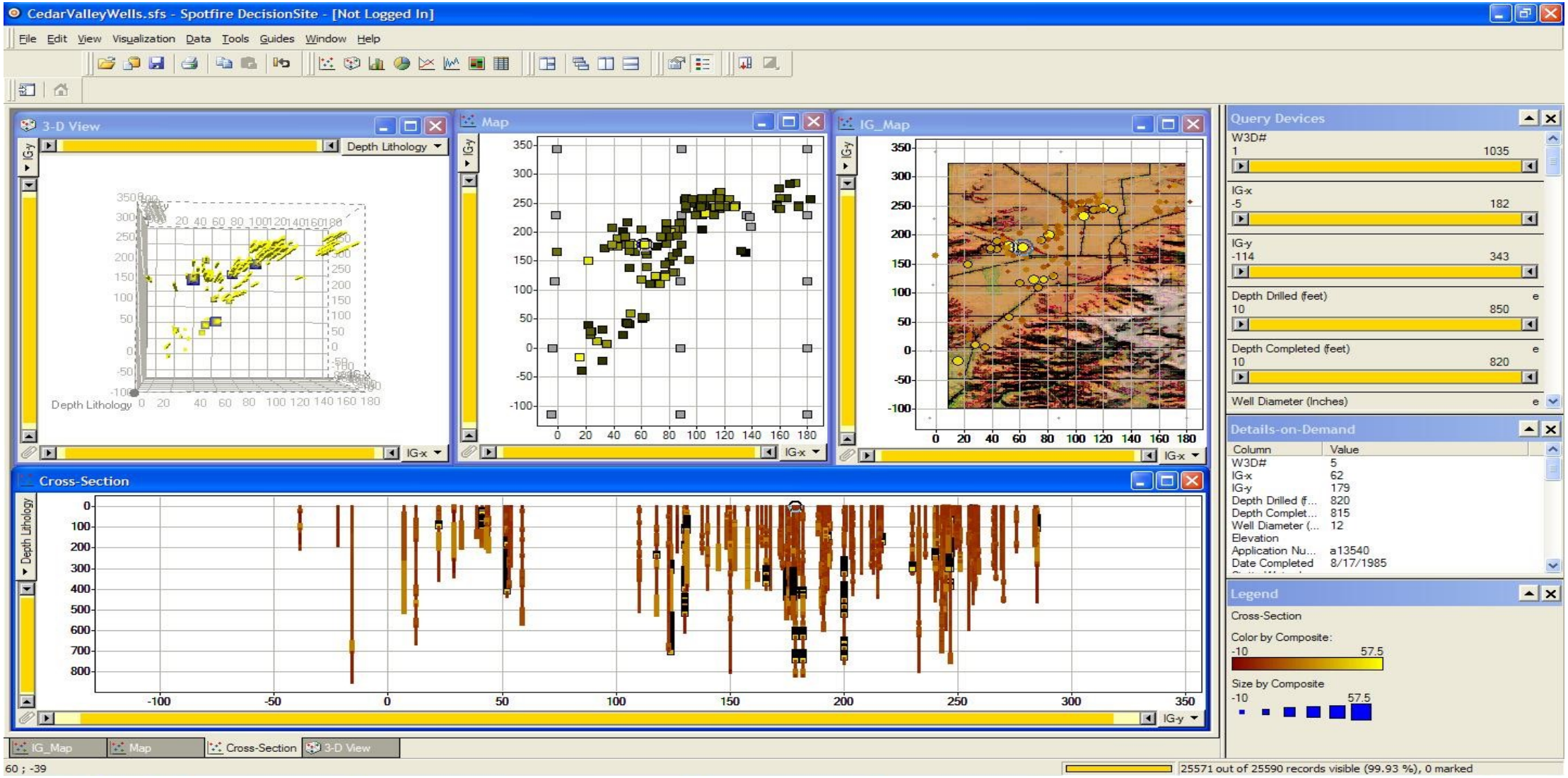


Location of Cedar Valley study area, Iron County, Utah.

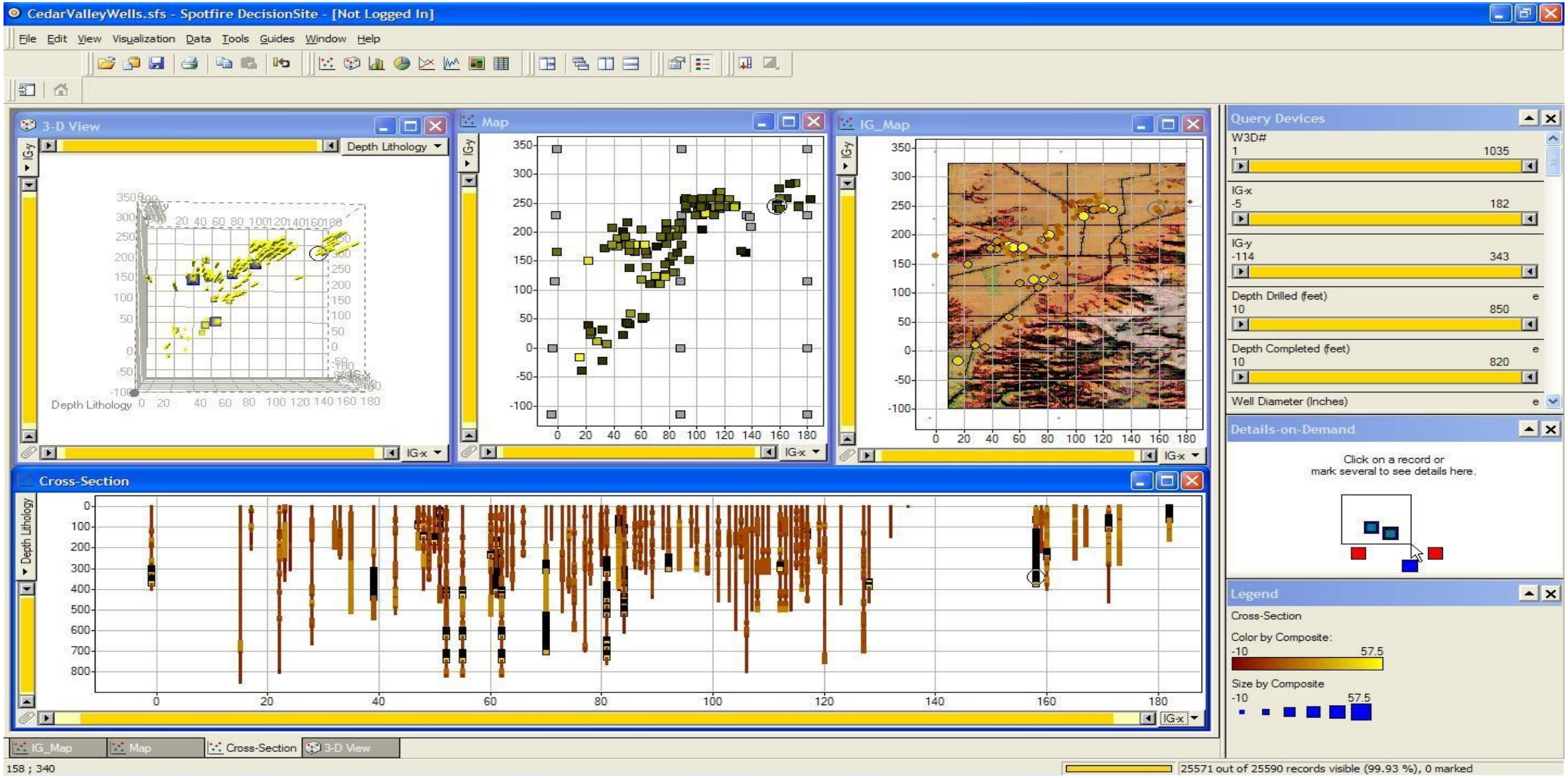
Cedar Valley Aquifer

- The Cedar Valley Aquifer, the aquifer being overproduced, is where sediments have been deposited in the valley (white), which sediments cover consolidated rock (black).
- Other than Coal Creek water, the water in the Cedar Valley Aquifer is isolated from water in the Cedar Valley Drainage Basin by the Hurricane Fault on the east and basal clay sediments at the base of basin fill.
- This is shown by the age of the water being produced dating to Lake Bonneville; i.e. the water has been in the Cedar Valley Aquifer for on the order of 17,500 years.

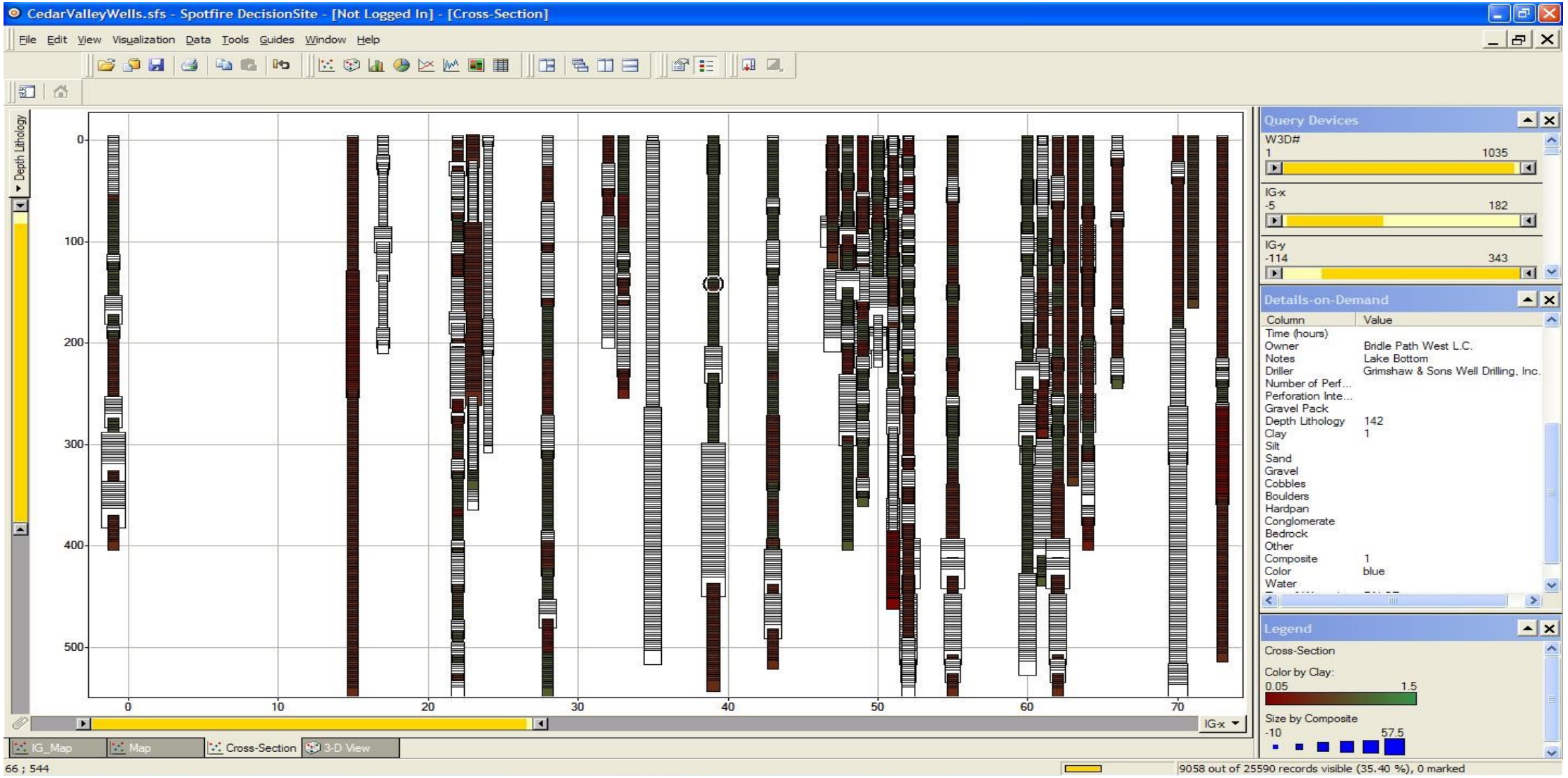
North-to-South cross-section showing wells in the Cedar Valley Aquifer – note deepest wells about 800 feet



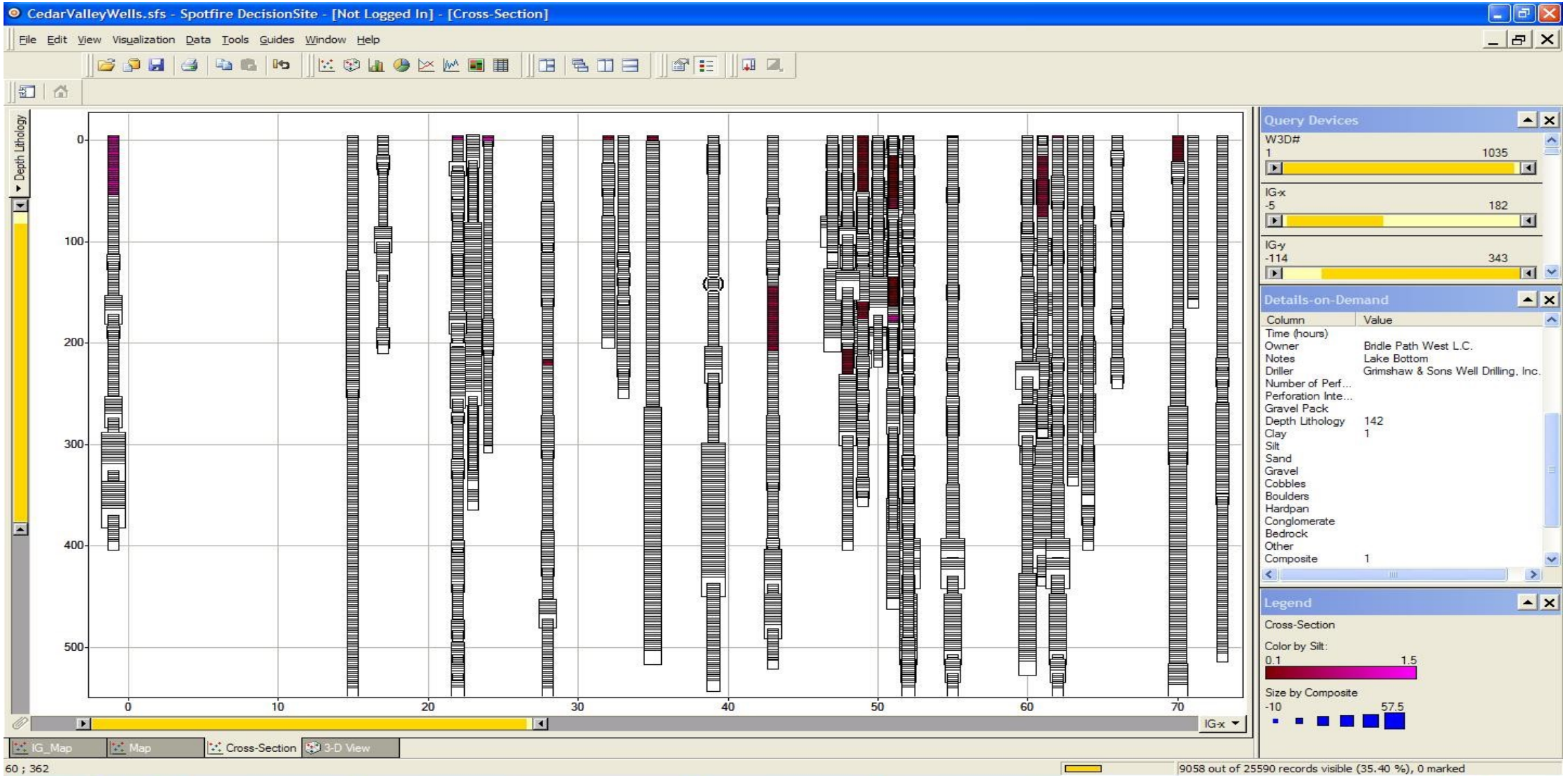
West-to-East cross-section showing wells in the Cedar Valley Aquifer – note only natural recharge = creeks



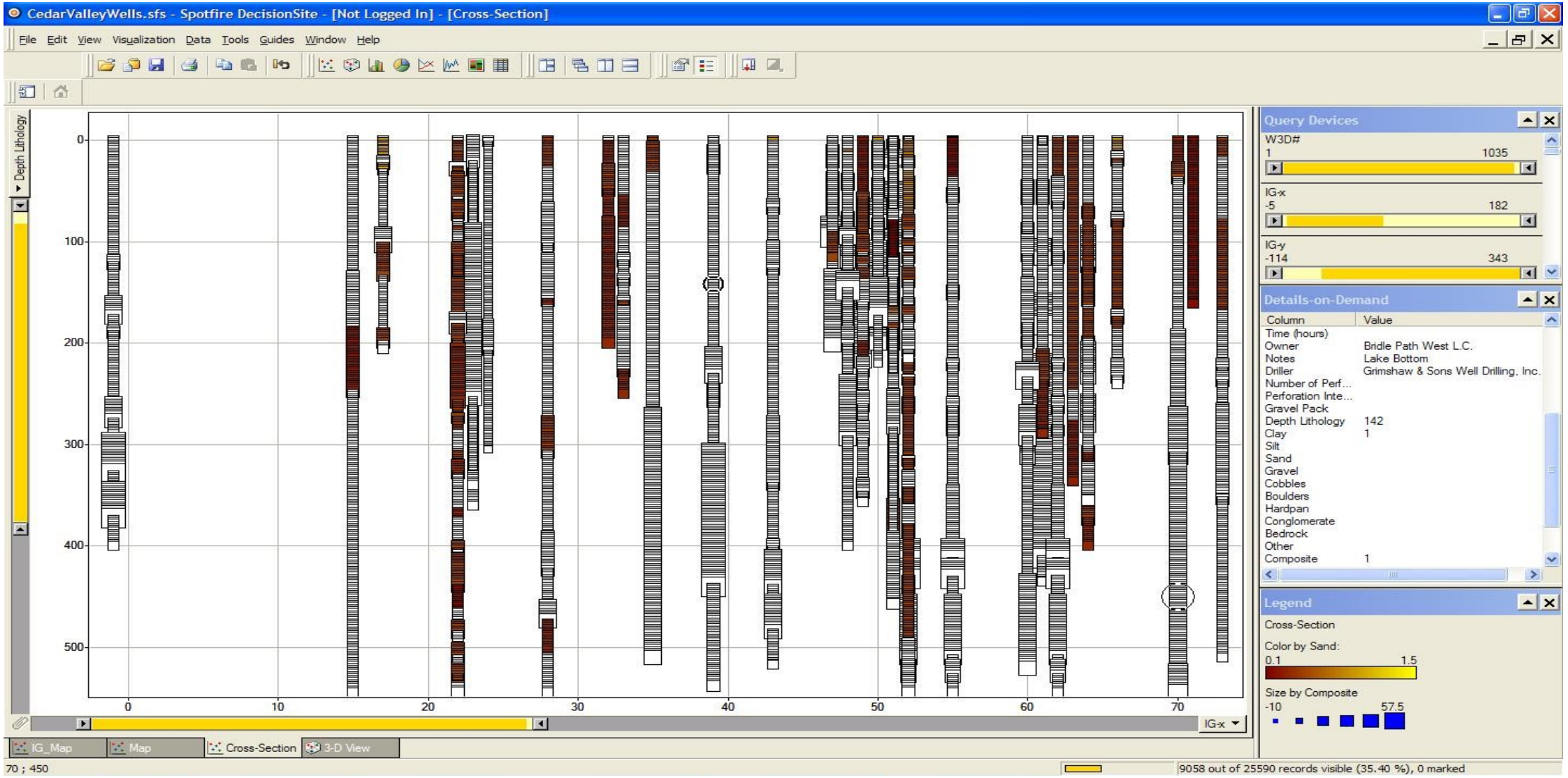
Clay on the west end of the West-to-East cross-section through the Cedar Valley Aquifer – note clay is a drainage barrier



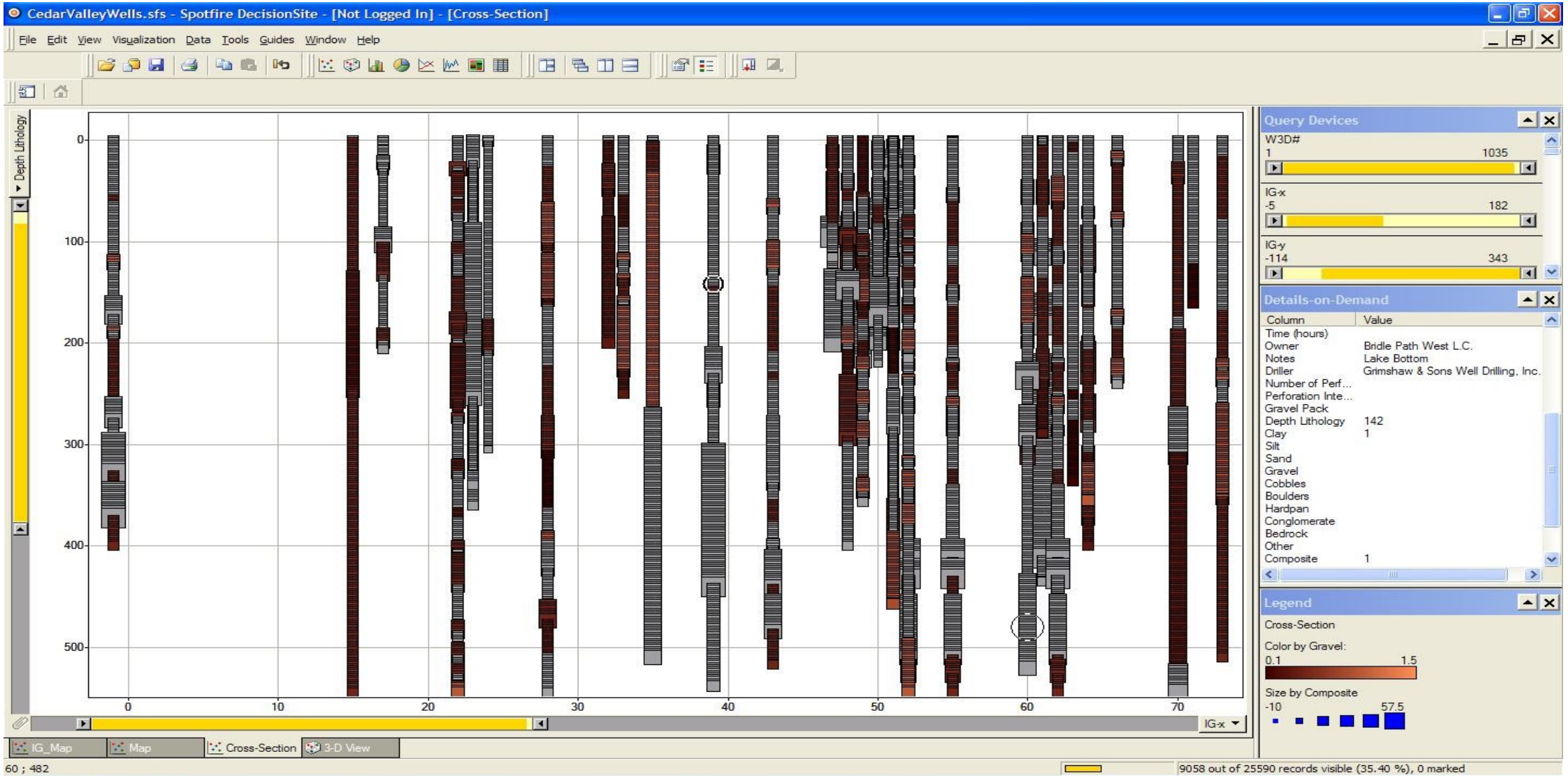
Silt on the west end of the West-to-East cross-section through the Cedar Valley Aquifer



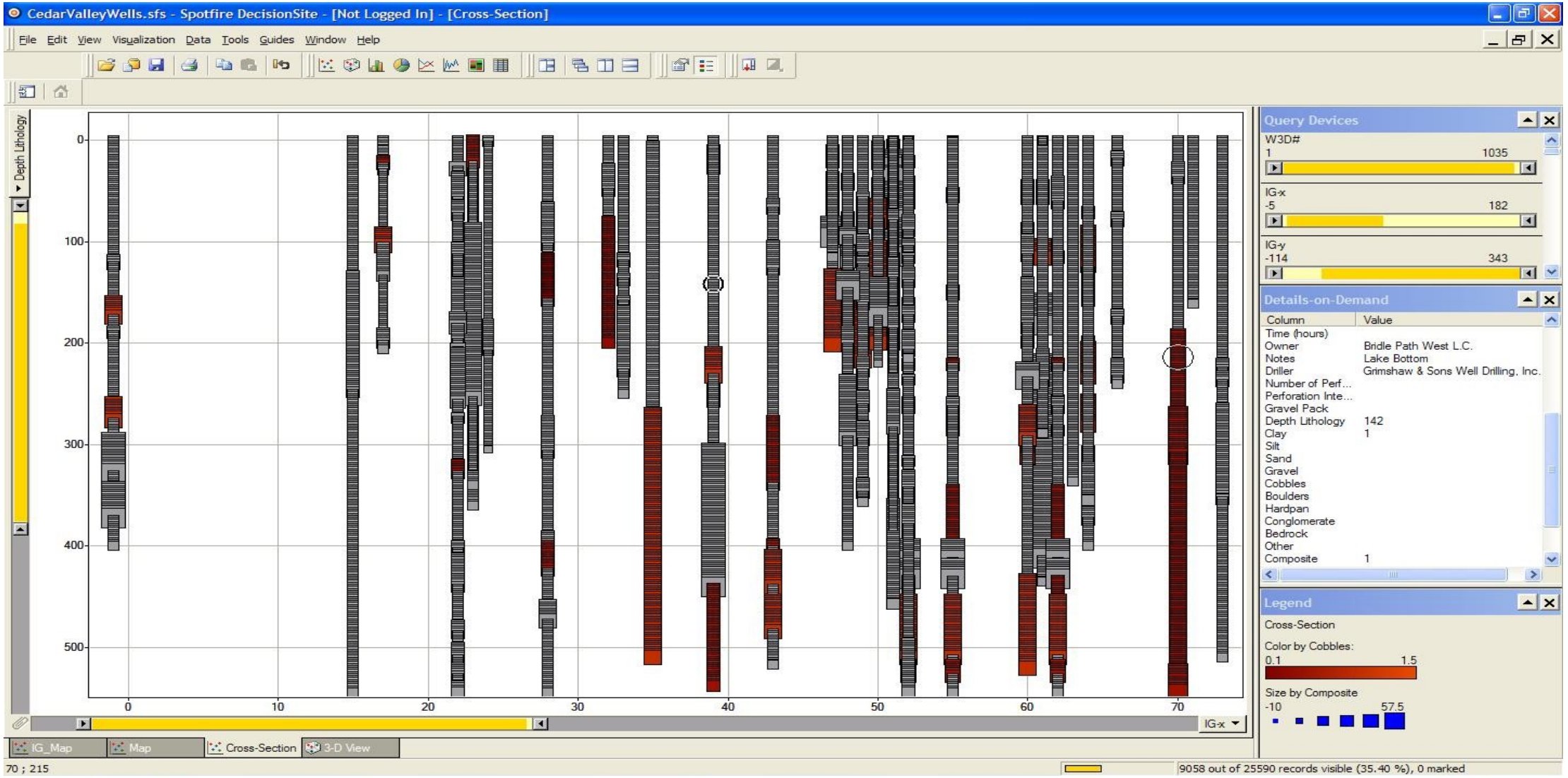
Sand on the west end of the West-to-East cross-section through the Cedar Valley Aquifer



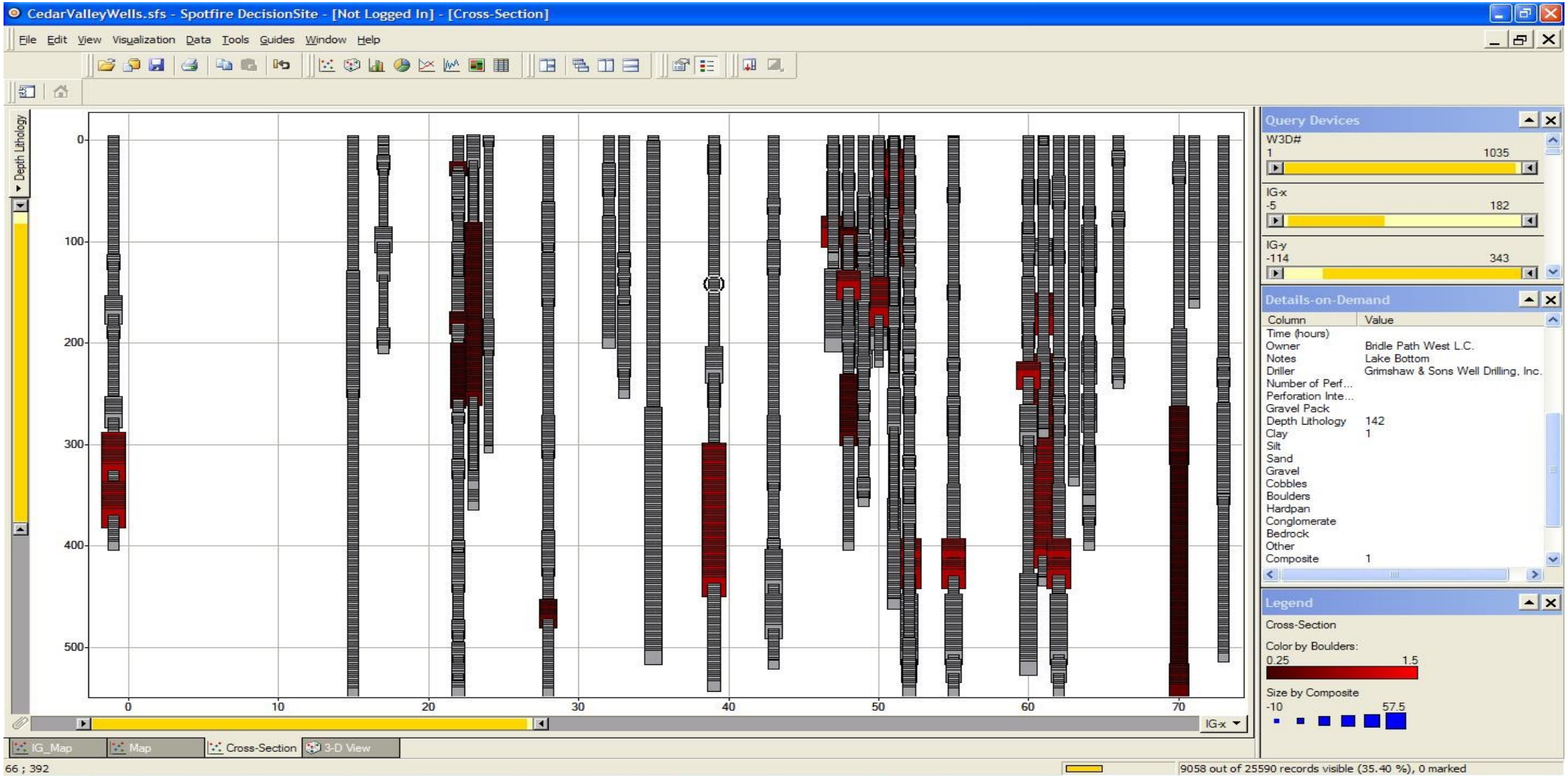
Gravel on the west end of the West-to-East cross-section through the Cedar Valley Aquifer

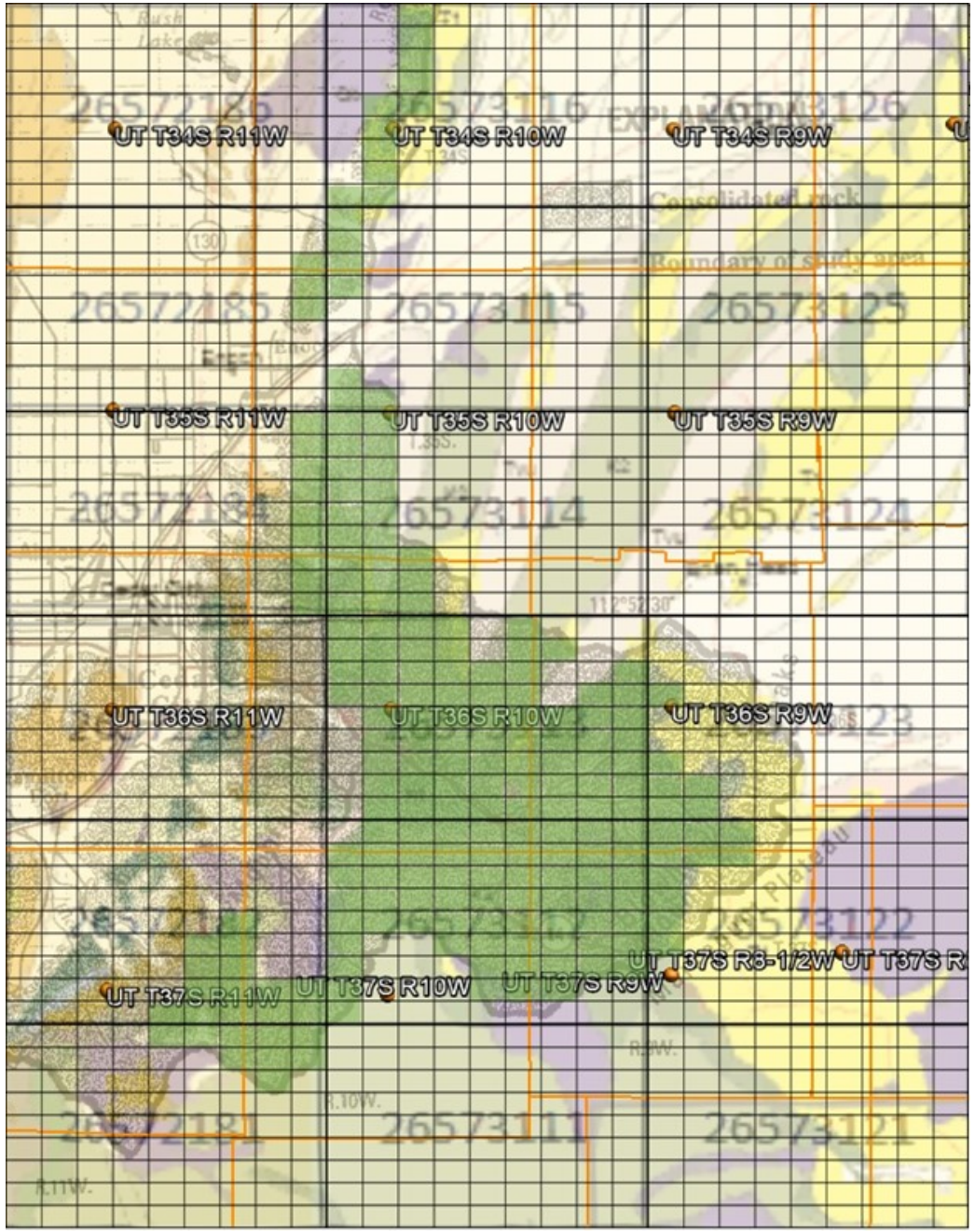


Cobbles on the west end of the West-to-East cross-section through the Cedar Valley Aquifer



Boulders on the west end of the West-to-East cross-section through the Cedar Valley Aquifer – note underground rivers follow geology





4.B. The water in the Cretaceous Aquifer.

- The Cretaceous Aquifer is shown by the green colored squares on this map.
- Each colored square is an IG-5 cell and is about ~0.36 square miles in size. There are 213 IG5 cells covering the Cretaceous Aquifer, or 77 sq. miles.
- This is ~50,000 acres, with an average of 36 inches of precipitation per year, implying an average of 15,000 acre-feet of recharge in the aquifer per year with an infiltration rate of 10%.

Straight Cliffs Formation over Dakota Formation, north of Highway 14 at Mile 8, east of Cedar City.

Photo by Gary F. Player, Utah Professional Geologist 5280804-2250, March 14, 2015

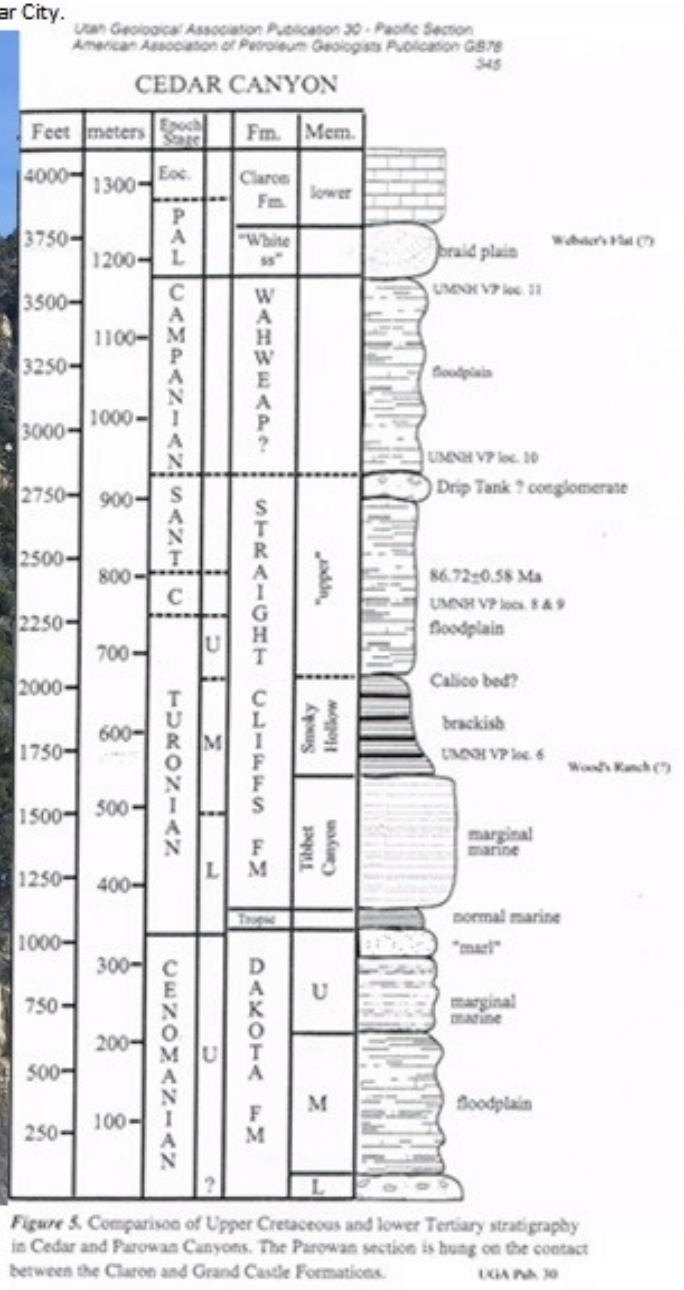


Figure 5. Comparison of Upper Cretaceous and lower Tertiary stratigraphy in Cedar and Parowan Canyons. The Parowan section is hung on the contact between the Claron and Grand Castle Formations. UGA Pub. 30

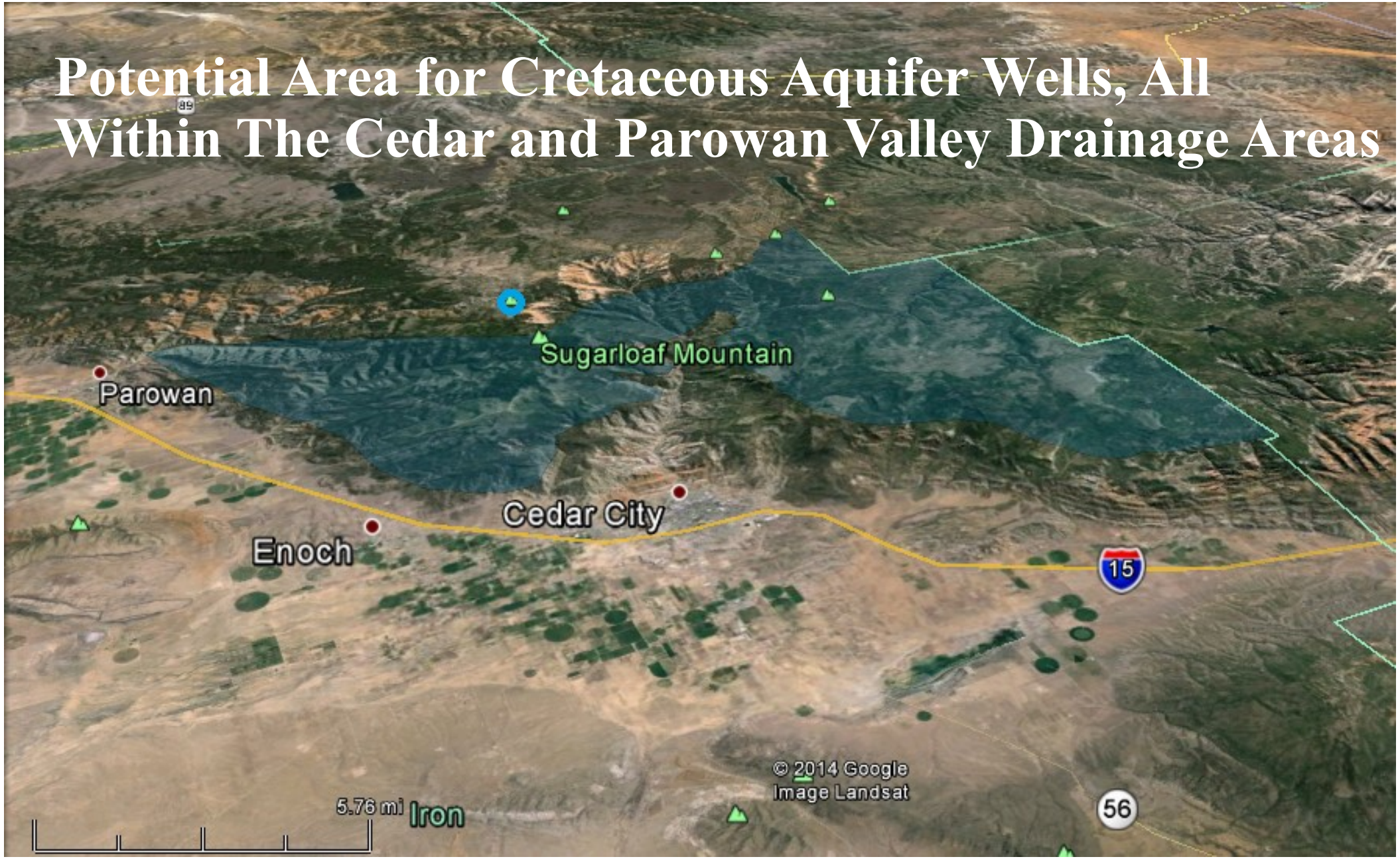
Cretaceous Age Straight Cliffs to Dakota Sandstone up Cedar Canyon

This is where the landslide regularly happens

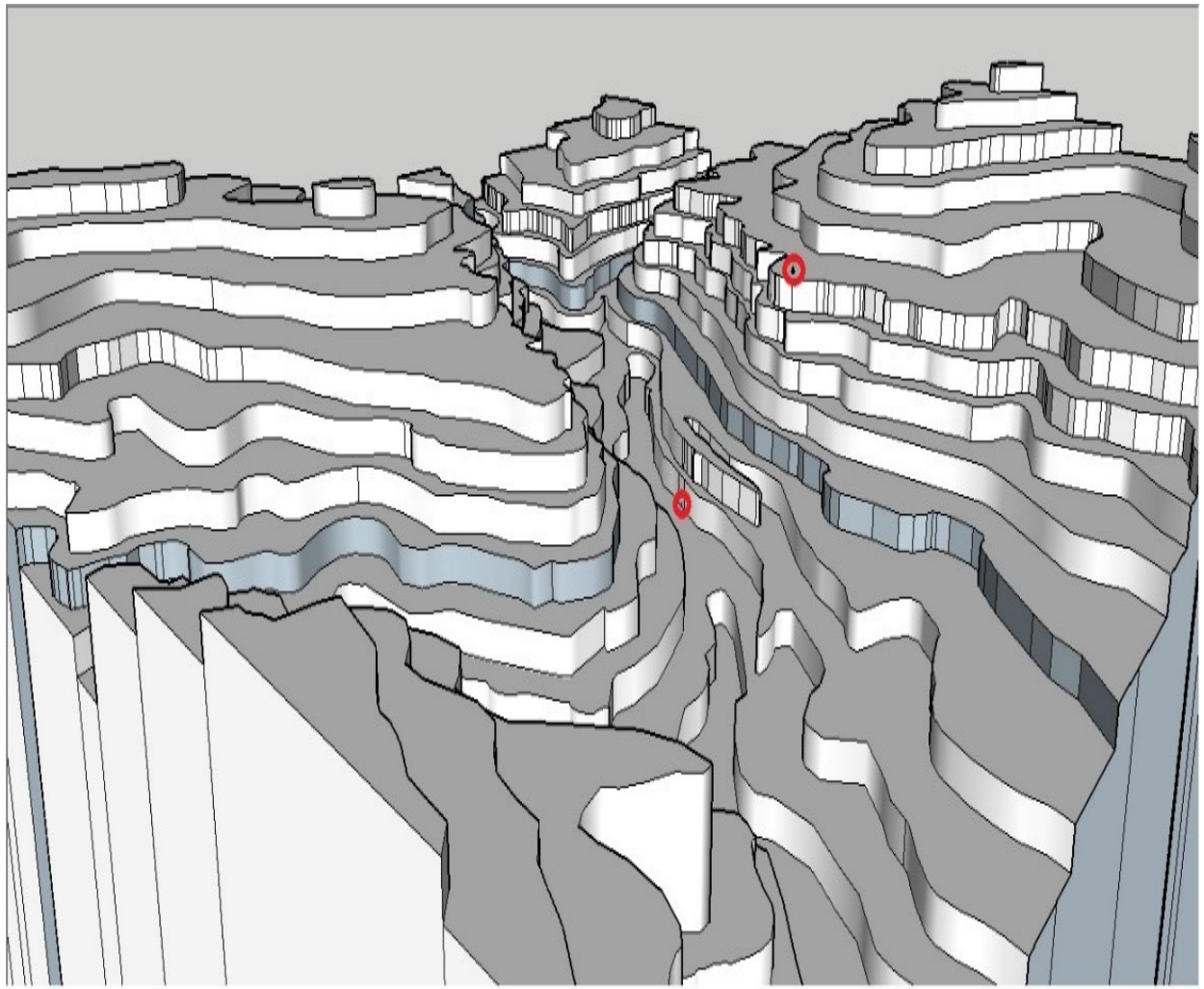
Cretaceous Beds Dip East 10°

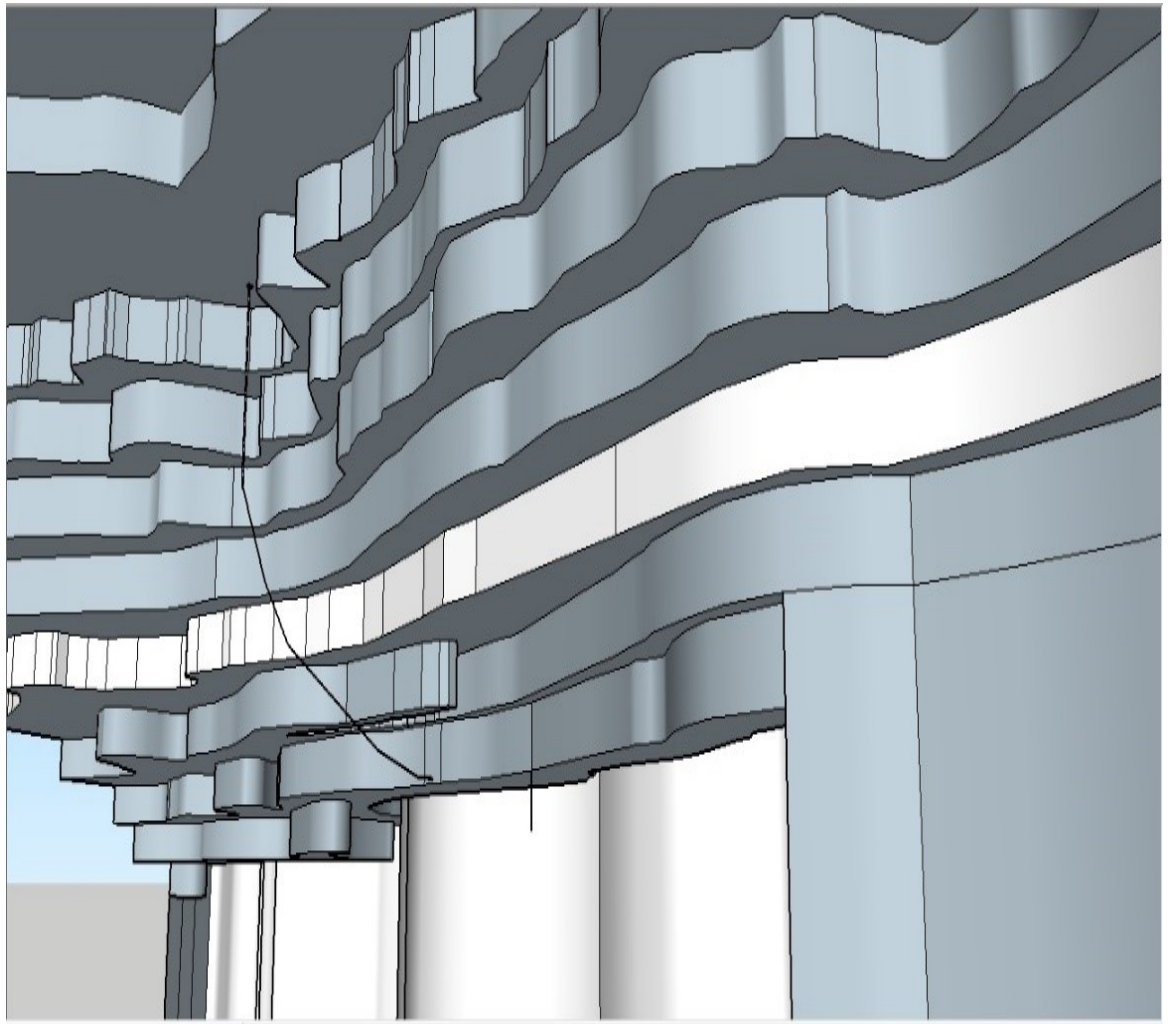
Cretaceous Beds Dip North 12°

Potential Area for Cretaceous Aquifer Wells, All Within The Cedar and Parowan Valley Drainage Areas

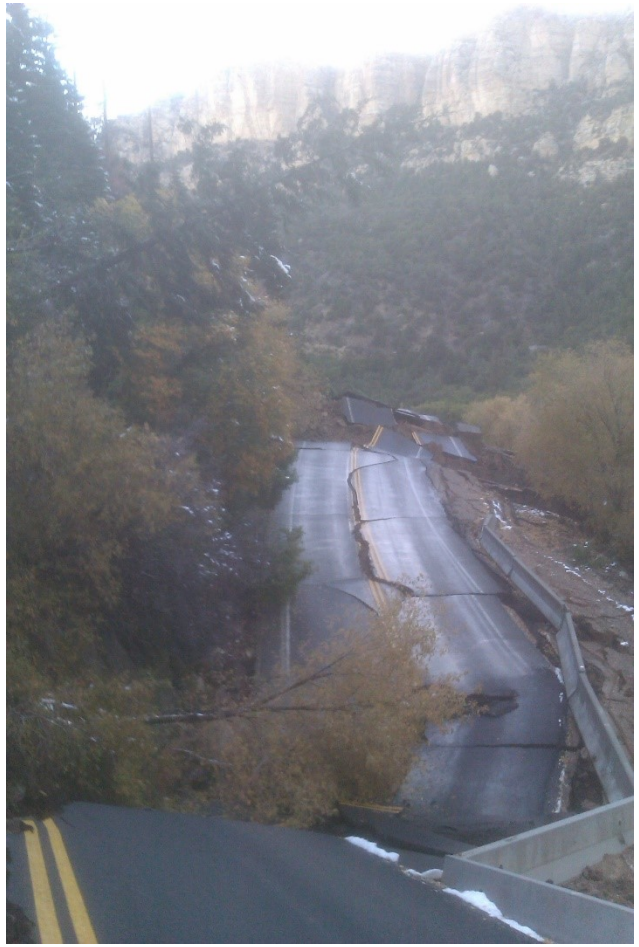


Deviate hole from Straight Cliffs to Dakota Sandstone which, with turbines in the well, could also be a new source of energy

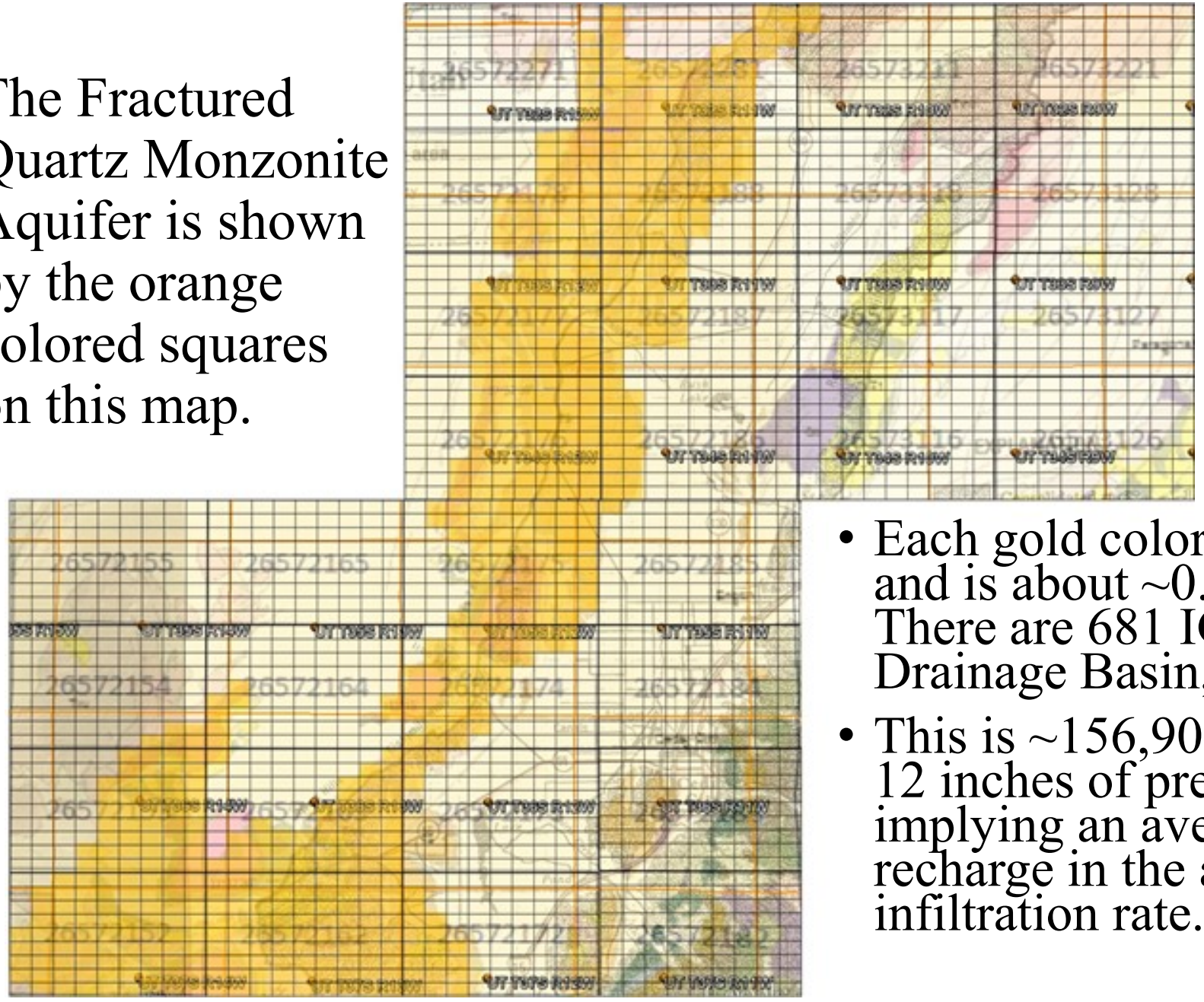




What is the cost to repair the road compared to the cost of drilling a deviated hole and draining the water out of the cliffs?

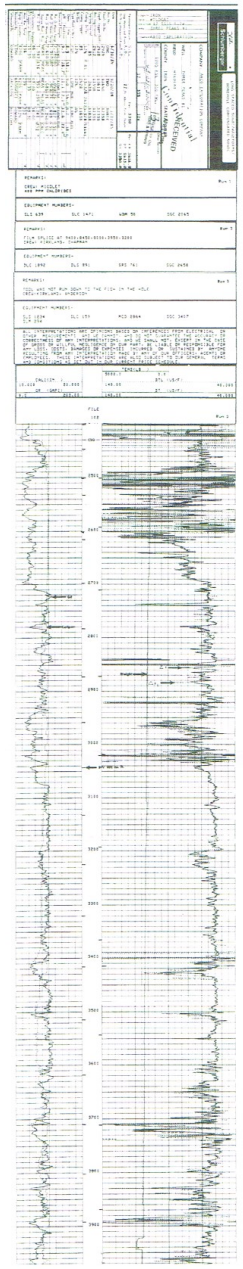


The Fractured Quartz Monzonite Aquifer is shown by the orange colored squares on this map.



4.C. The water in the Fractured Quartz Monzonite Aquifer.

- Each gold colored square is an IG-5 cell and is about ~0.36 square miles in size. There are 681 IG5 cells covering the Cedar Drainage Basin, or 245 sq. miles.
- This is ~156,900 acres, with an average of 12 inches of precipitation per year, implying an average of 15,700 acre-feet of recharge in the aquifer per year at a10% infiltration rate.



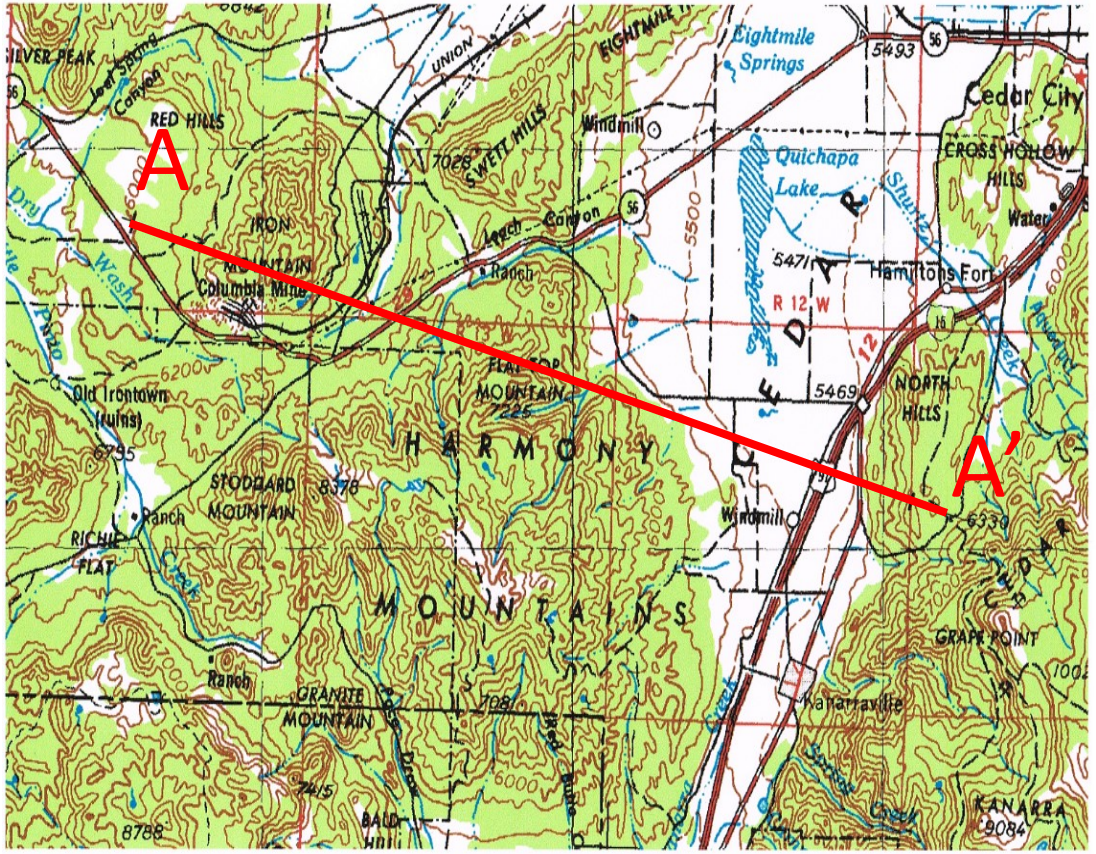
Arco #3 Three Peaks Well

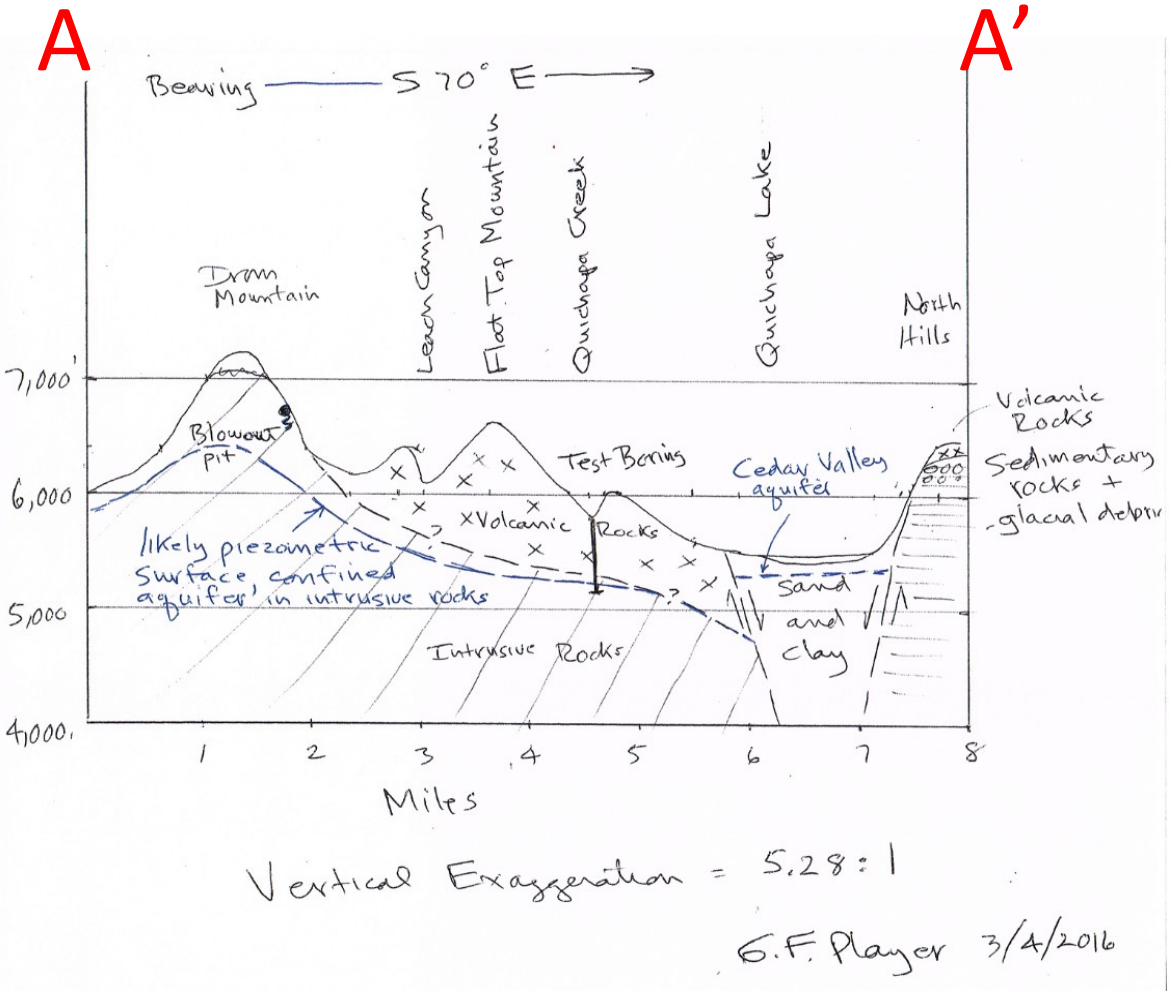
Top Qm = 2,322’
Fractured: 2,500’-2,615’

Fractured: 2,960’-3,050’

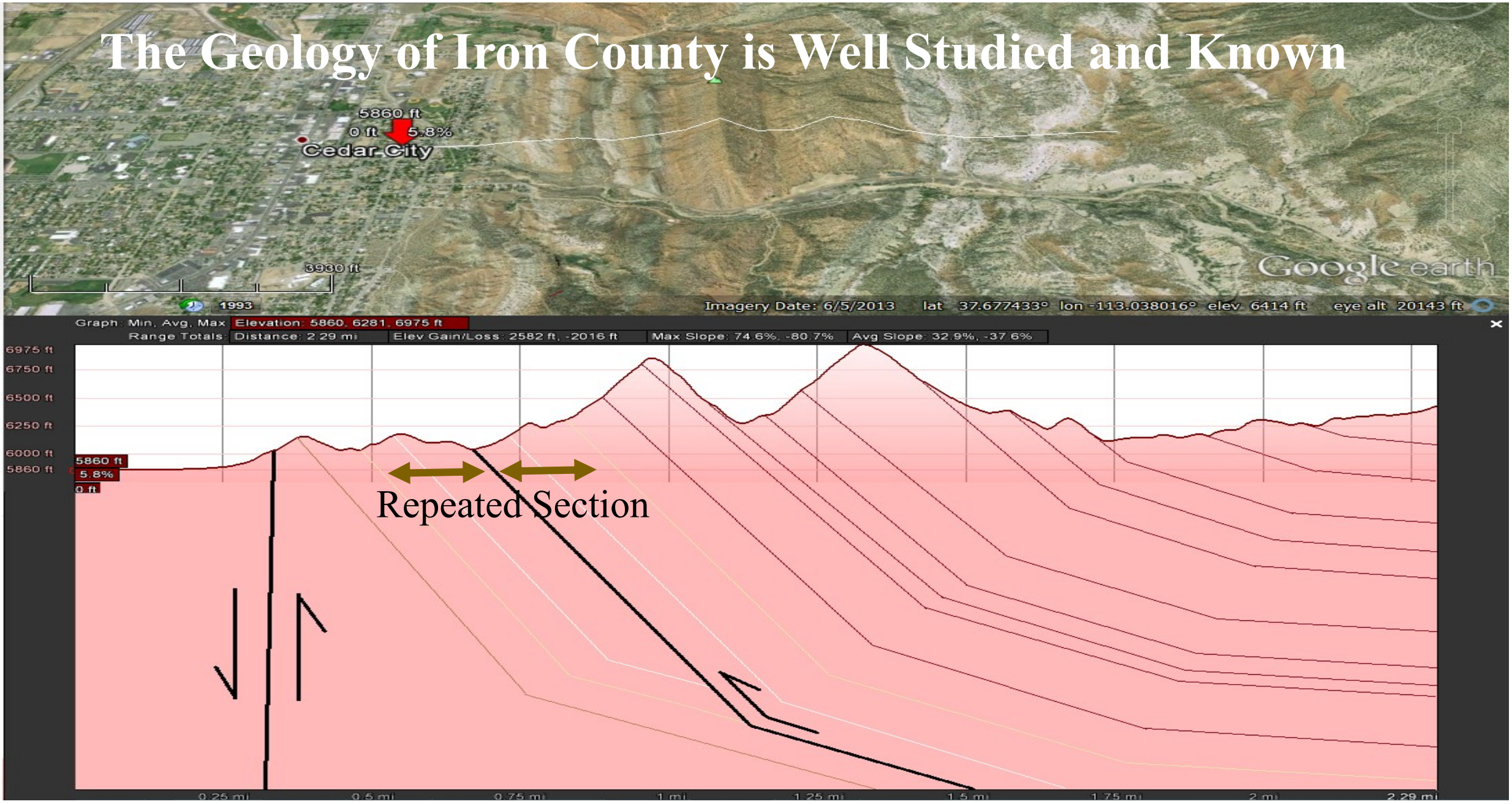
This photo shows the extent of water coming out of the Fractured Quartz Monzonite at Blowout Pit at Iron Mountain

Geologic Cross-Section Showing Southern Isolation of the Cedar Valley Aquifer by large faults and Blowout Pit

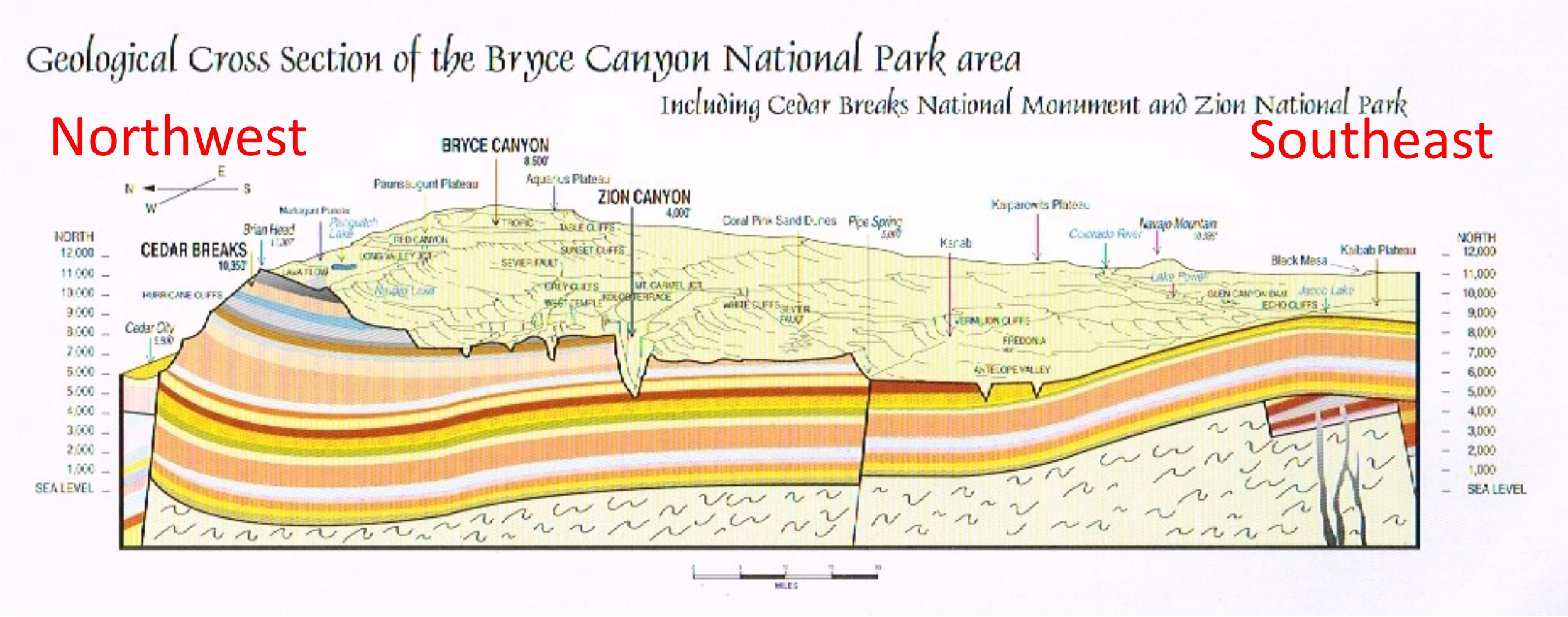




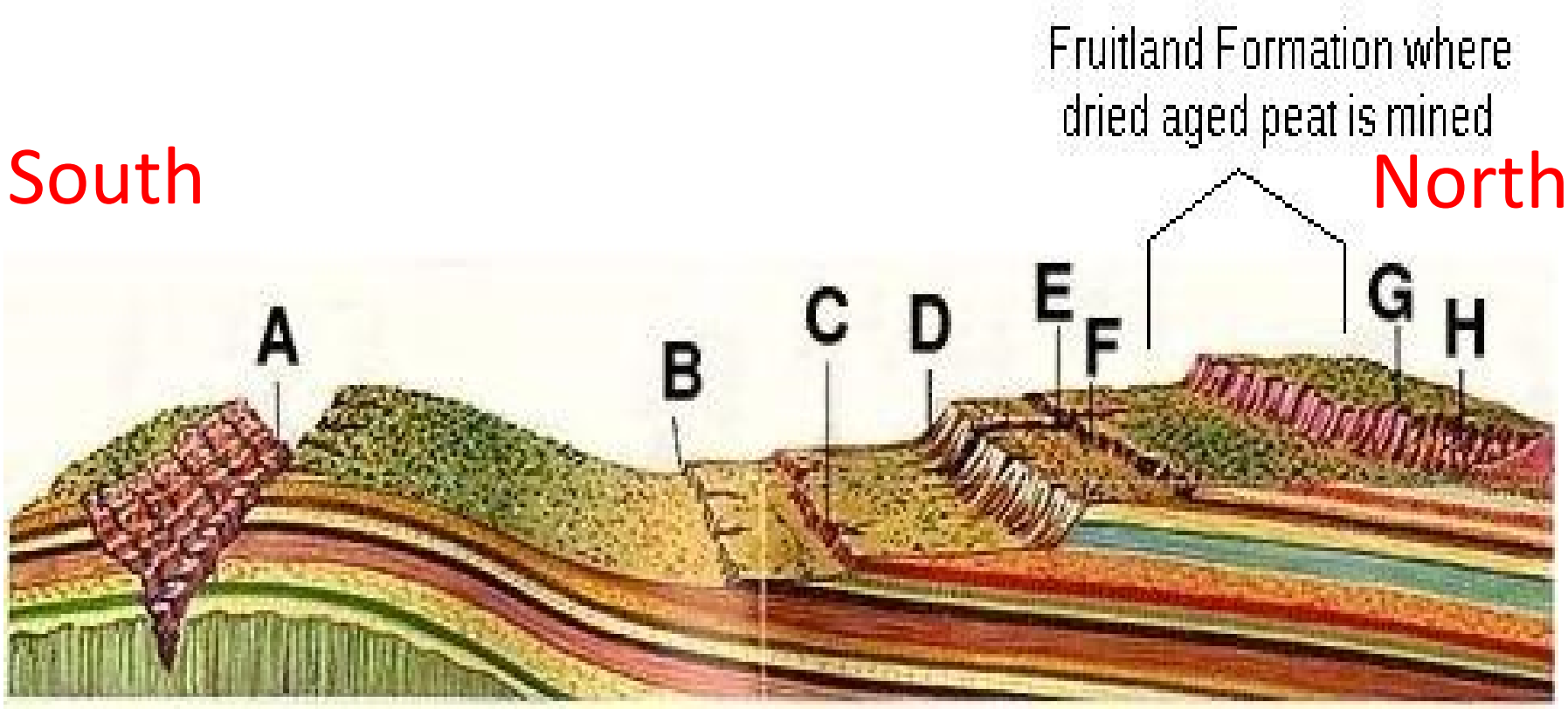
The Geology of Iron County is Well Studied and Known



NW to SE Geologic Cross-Section: Southern Utah

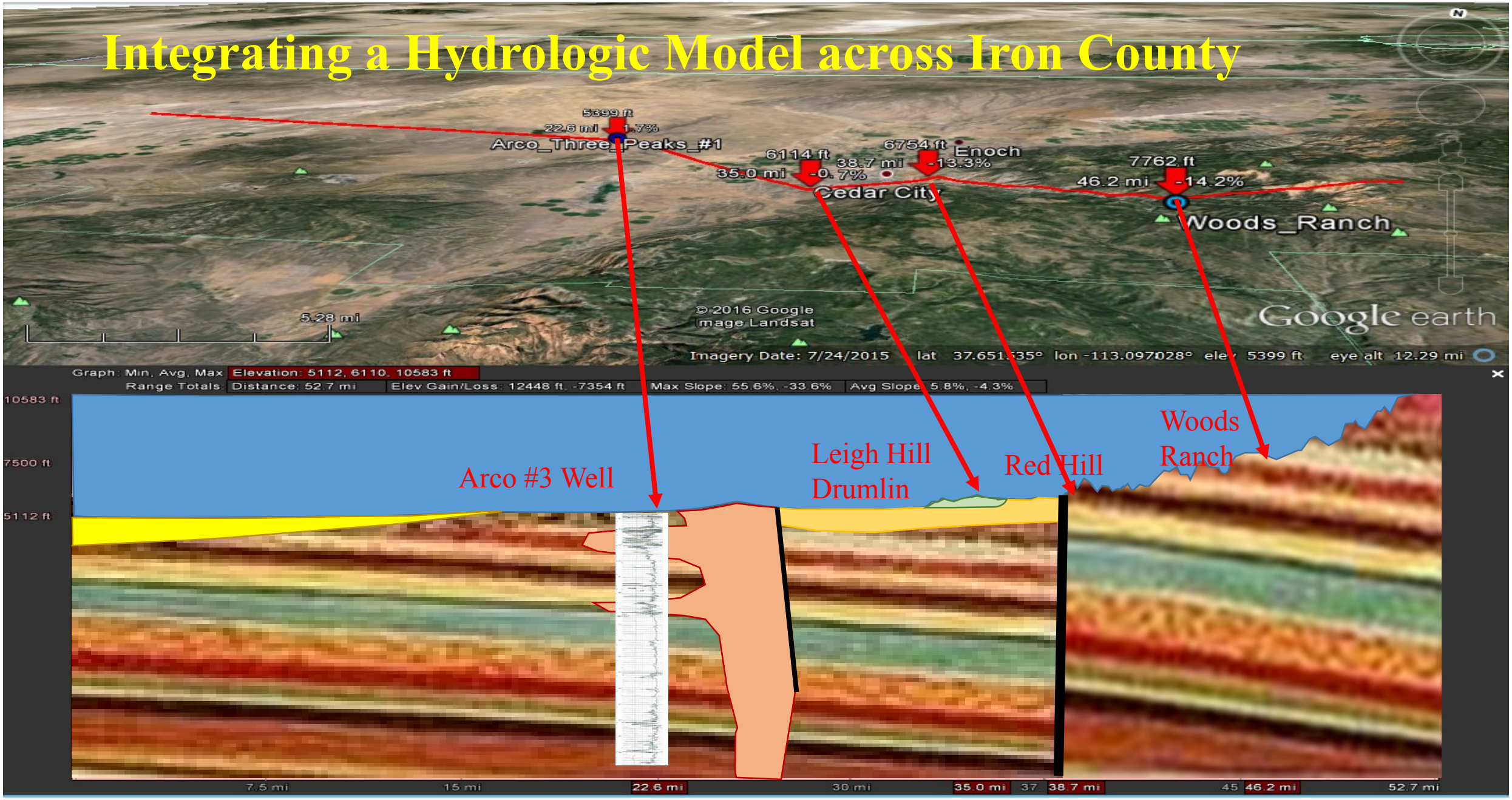


Geologic Cross-Section: Northern Arizona to Southern Utah



Stratigraphic Layers from the Paleocene (Bryce Canyon) to the Pre-Cambrian known as Grand Staircase layer cake geology, specifically: (A) the Grand Canyon, (B) the Chocolate Cliffs, (C) the Vermilion Cliffs, (D) the White Cliffs, (E) Zion Canyon, (F) the Gray Cliffs, (G) the Pink Cliffs, and (H) Bryce Canyon.

Integrating a Hydrologic Model across Iron County



Transferring Water Rights up the mountain or to the west solves over allocation issues!

Potential Development of Bedrock Aquifers in Nearby Mountain Areas

27. *Exploration of bedrock aquifers in the mountains of Iron County could result in the identification of more renewable water than is currently pumped ("over drafted") from the sand and gravel aquifers under Cedar Valley. Average annual precipitation records show that water production from the bedrock aquifers in the mountainous areas of the county can be sustained without damaging existing flows from the springs and creeks now tapped for use. [Gary Player]*
28. *Is there a possibility that the State would consider appropriating new water rights if it was found that water contained in bedrock aquifers does not contribute to the valley aquifer? [Cedar City]*

The State Engineer wants to encourage new groundwater development so long as it does not take away water from existing users. Mr. Player's exploration proposals and his previous reports to Cedar City have been reviewed and compared with findings from other hydrogeologic studies. Two regions have been proposed for exploration: the mountains west of Cedar City and the mountains east of Cedar City. At this time, the State Engineer believes the western mountain bedrock aquifers are hydrologically connected to the valley aquifer and water in the eastern mountain bedrock discharges to Coal Creek or flows southeast and to the Virgin River. Since each of these sources is considered to be fully appropriated, further development would cause impairment to other water rights. To alleviate overdrafts in the basin water rights would need to be purchased and transferred to these locations prior to diverting from these sources.

Good! Help fund a test well!

Wrong! Quartz monzonite aquifers are deeper, 2,200 foot deep at Arco well, than the currently tapped 800 foot deep Cedar Valley Aquifer!

We recommend a $250,000 well at or near Woods Ranch to test the Cretaceous Aquifer. If only 1,000 acre-feet of water are produced, it will have cost $250 per acre foot, and water can be put in Coal Creek.

Infrastructure and the Value of Water

- None of the above "cost of water" includes the cost for infrastructure upgrades.

- Cedar City alone is facing $100 million in required water distribution upgrades.

5. Summary

- We will never run out of water in Cedar Valley,
  just as the world will never run out of oil.
- Iron County has run out of $1,800 per acre-foot water, and will run out of $3,000 per acre-foot water, and needs to run out of anything less than $10,000 per acre-feet of water, just as the world has run out of $5 or $10 or $30 per barrel oil.
- There is a difference between the Cedar Valley Aquifer and the Cedar Valley Drainage Basin, which difference needs to be leveraged.
- The Cedar Valley Aquifer is being damaged by over production.
- There are two significant untapped aquifers adjacent to Cedar Valley which are both included within The Cedar Valley Drainage Basin:
  1. The Cretaceous Aquifer to the east; and
  2. The Quartz Monzonite Aquifer to the west.
- Existing over allocation can be solved by transferring water rights out of the Cedar Valley Aquifer to these two adjacent aquifers.

Thank You!

This presentation is posted at:

- http://www.walden3d.com/IronCounty/CedarValleyWater/160906_Rotary

See Also:

- http://www.walden3d.com/IronCounty
- http://www.walden3d.com/IronCounty/intro
- http://www.walden3d.com/IronCounty/CedarValleyWater/
- http://www.walden3d.com/IronCounty/ig/IronCounty/IC_3_Approaches.html
- http://www.walden3d.com/IronCounty/ig/IronCounty/IC_3_Aquifers.html
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