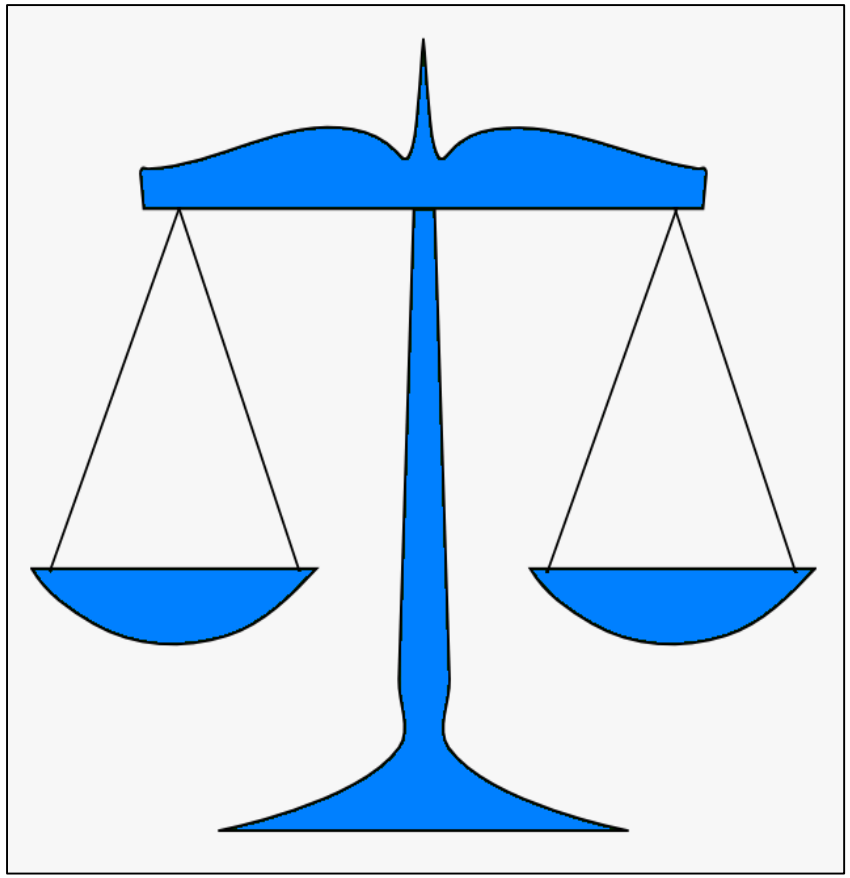
Cedar Valley Water
Issues and Solutions

H. Roice Nelson, Jr. Texas Professional Geoscientist #5120 10 December 2019



Discussing Water Rights, A Western Pastime

This presentation, with links, and a video can be downloaded from: http://www.walden3d.com/water

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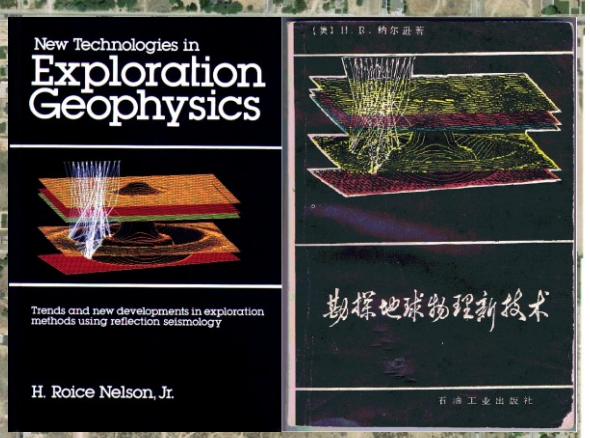
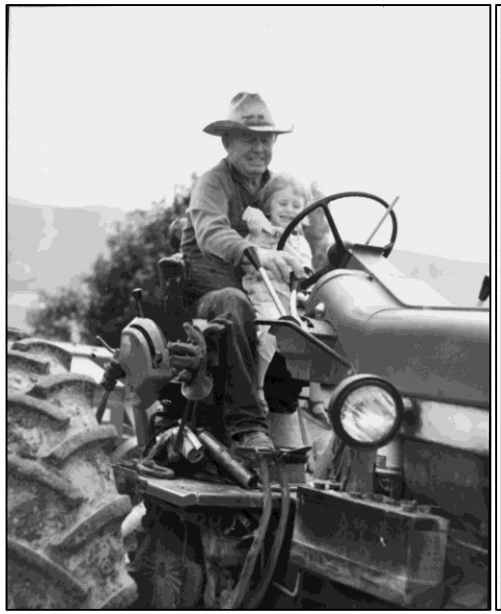


Background & Ties



Howard R. Nelson, Sr.

Sara Penny

Pauline Hafen Nelson

Morris & Maxine Shirts

Russell, Randy, Andrea, Robert, & Steve

WEDNESDAY, OCTOBER 2, 2019

02 Oct 2019 Iron County Today

Life

George W. Middle

by Jay M. JONES
FOR IRON COUNTY TODAY

EARLY SOUTHERN UTAH DOCTOR

One of Southern Utah's outstanding doctors was George W. Middleton, a native of Hamilton Fort, Utah. After receiving his doctorate in 1892 at Louisville, he began medical practice in Cedar City.

In addition to his medical practice, Dr. Middleton had a keen interest in civic affairs. In 1903, liquor prohibition became the major issue in Cedar City politics. As the nominee for mayor on the Citizens Prohibition Party ticket, Dr. George Middleton won 69% of the vote.

Early the next year, Cedar City prohibited the manufacture or sale of alcoholic beverages within the city limits, becoming one of the first localities in the nation to do so.

Dr. Middleton enjoyed the outdoors, and held a lifelong interest in geology. He was also a key promoter of the first culinary water system in Cedar City, which resulted in a significant reduction of local cases of typhoid fever.

In 1904, Dr. George W. Middleton's growing medical and surgical reputation brought an increasing number of people to Cedar City in need of treatment. Up to that time, Dr. Middleton's out-of-town patients were quartered among the townspeople as well as could be arranged.

In order to provide more comfortable care for the patients and allow care providers better efficiencies, Dr. Middleton rented a house on 300 West and equipped it as a hospital. Electrical power was not yet available in Cedar City, so to provide better lighting for an upstairs operating room, skylights were installed in the roof.

The first operation in the new hospital was in June of 1904 for appendicitis, and Miss Emily Banks of Minersville, UT was the patient.

Another case of appendicitis was a sad experience in the early practice of Dr. Middleton, as related by William R. Palmer in the 1942 edition of the Utah Historical Quarterly. He had been called to the local Indian camp too see a sick boy. After diagnosing the problem, Dr. Middleton wanted to take the boy into town for an operation.

The Medicine Man resisted, so Dr. Middleton took out his prescription notepad and sketched the boy's intestines, showing the diseased point. He indicated where an incision needed to be made to remove the appendix. Still, permission was not given for Dr. Middleton to treat the boy.

A few days later, Dr. Middleton met the Medicine Man and inquired about the boy. He was horrified to learn that the Medicine Man had been impressed with the doctor's sketches, and had decided that he could perform the operation himself with a butcher knife. Tragically, the boy did not recover.

Lack of understanding of basic sanitation was widespread. Dr.

see MIDDLETON » 26

DR. MIDDLETON STANDS OUTSIDE THE HOUSE that became Cedar City's first hospital. On the porch are nurses Belle MacDonald, Belle Perry, and Kate Palmer.

PHOTOS COURTESY OF SUU SPECIAL COLLECTIONS

MIDDLETON

« CONTINUED FROM PAGE 19

Middleton took a local sheep rancher to court to keep sheep from grazing at the source of the city water supply. The Justice of the Peace did not see a problem. Dr. Middleton tried to explain about germs and how they carry disease. The Justice was not impressed – he reportedly said, "Show me a germ and I'll eat it. Case dismissed."

Dr. Middleton's reputation as a surgeon continued to grow around Southern Utah. On a return trip from Kanab in 1906, news that he was passing through that area went ahead of him, and several people sought him out along the way. Arriving at Panguitch, he performed five surgeries, leaving the patients in the care of the local physician, Dr. Clark.

Nurses that assisted Dr. Middleton in caring for local patients included Belle MacDonald, Belle Perry, Kate Palmer, and Priscilla Urie.

In 1906, a farewell party was held in Cedar City for Dr. Middleton, who was on his way to major medical facilities in the eastern U. S. and London for additional medical training. Following that, Dr. Middleton established practice in Salt Lake City and became one of the leading surgeons in the Intermountain West.

In addition to his medical practice, Dr. Middleton continued his interest in geology. He became friends with University of Utah geology professor Frederick J. Pack, and together they arranged for horseback expeditions to Cedar Breaks and Zion Canyon with other leaders and residents of Salt Lake City and Cedar City.

George W. Middleton died December 8, 1938 in Salt Lake City from a heart ailment. In an obituary, the Salt Lake Telegram stated, "Dr. George W. Middleton had lived an abundant and intense life. A one-line biography of this widely beloved man would possess a sense of completeness if it but said, 'He went about doing good.'"

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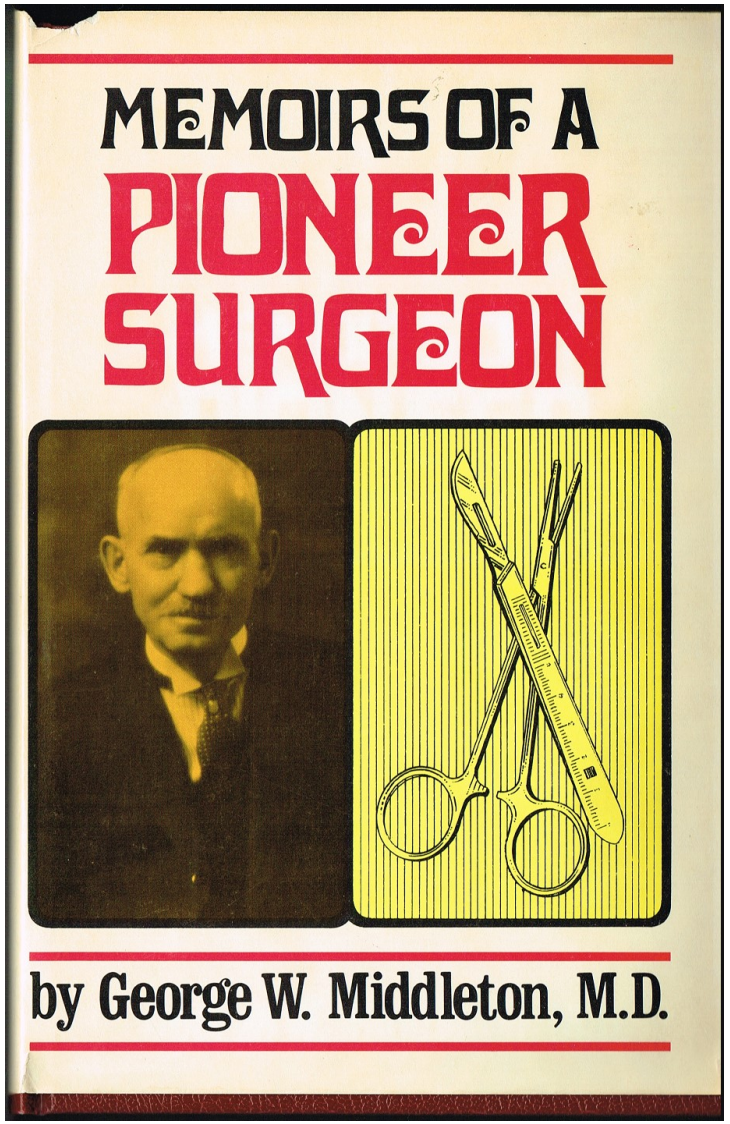
Water has always been an issue here!



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.

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

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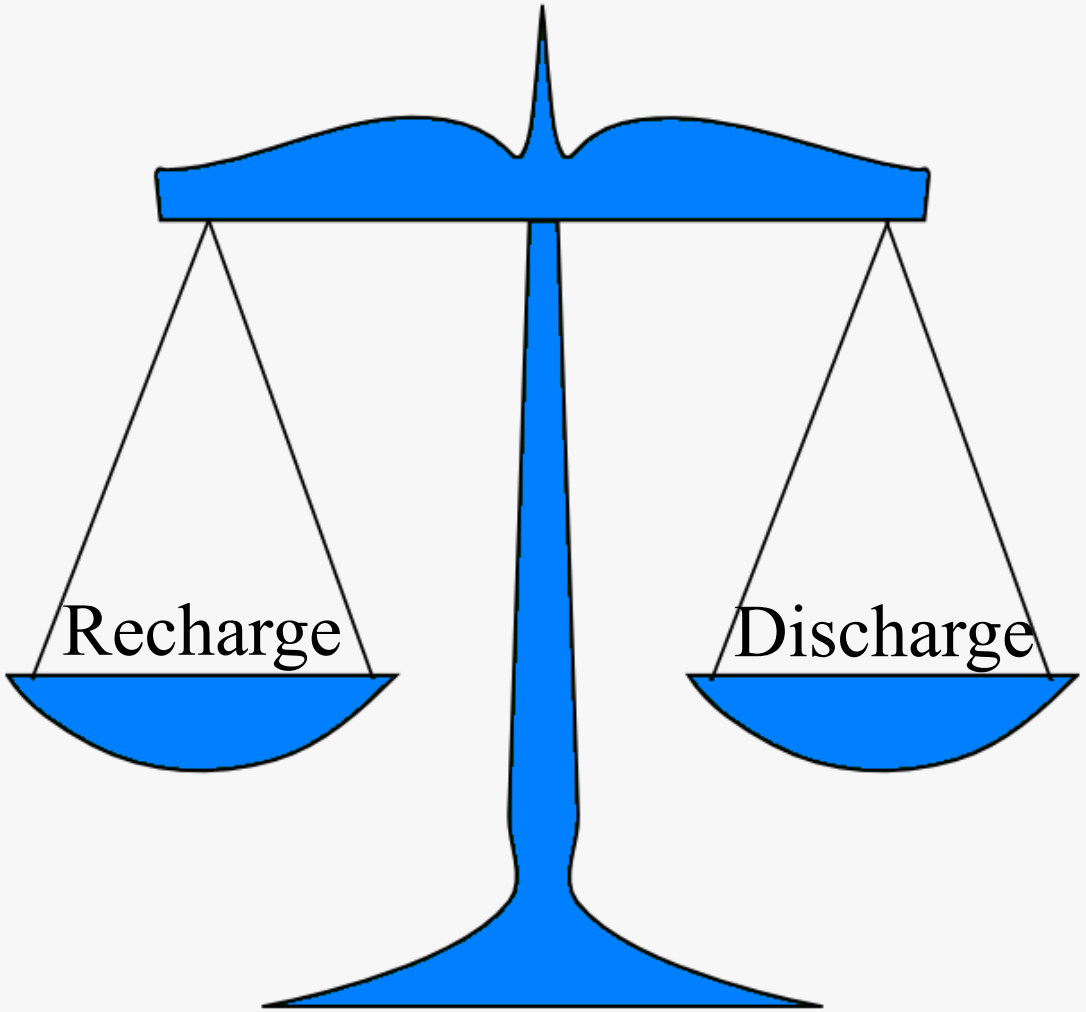
Introduction: Water Issues are Legal not Scientific

Law Requires:

1. Recharge must equal Discharge
2. Depth of Wells not considered
3. Age of Water not considered
4. Enforcement is model based



Science Shows:

1. 28,000 A.F. Out
   21,000 A.F. In

   7,000 A.F. Over in valley aquifers
2. Drainage Basins & Valley Aquifers
3. Using 5K-16K year-old-water
4. Models are, at best, estimates

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Two Legal Concepts used in this presentation

Safe Yield, **t**he basis for State Engineering planning, which is defined as follows:

- Safe yield of a groundwater basin or aquifer system is the amount of water that can be withdrawn from it without producing an undesirable effect (Todd, 1959), including:
  - Reduced discharge of groundwater to surface water features.
  - Reduction in ecological base flows.
  - Overlapping of drawdown cones.
  - Depletion of reserves.
  - Land subsidence due to pore pressure reduction.

Law of Capture:

- The law of capture states that the first person to capture a natural resource owns that resource. The rule of capture helps in determining the ownership of natural resources like groundwater, oil and gas that is captured. The rule encourages an owner to drill as many wells as possible on his/her piece of land so as to extract all the groundwater, oil and gas. The rule of capture was developed by English common law. However, U.S. courts have also applied the rule of capture, and it is the basis of oil & gas law in Texas.

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Ground Water Management Plan

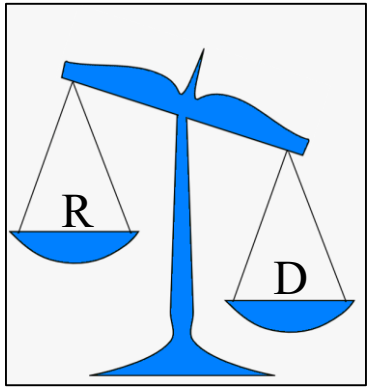
Problems (https://www.waterrights.utah.gov/groundwater/ManagementReports/CedarValley/Recharge%20Estimate%20for%20Cedar%20City%20Valley.pdf):

28,000 acre-feet per year depletion from groundwater pumping,

21,000 acre-feet per year average annual recharge ,

7,000 acre-feet per year over-pumping of The Aquifer +

There is 50,878.36 acre-feet Cumulative Depletion allocated for Cedar Valley.



Plans at Groundwater Plan Web Site for Cedar Valley (https://www.waterrights.utah.gov/meetinfo/m20161208/):

- Recharge aquifers.
- Retract water rights granted after 1934:

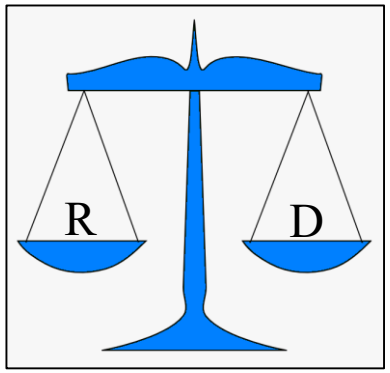


Table 1 Priority Regulation Schedule

Phase	Target Date	Priority Dates Regulated Through	Acre-Feet Reduction in Estimated Depletion	Cumulative Acre-Feet Reduction in Depletion	Remaining Depletion (acre-feet)
1	January 1, 2035	December 31, 1957	5,434	5,434	45,530
2	January 1, 2050	December 31, 1954	7,330	12,764	38,200
3	January 1, 2060	December 31, 1951	8,814	21,578	29,386
4	January 1, 2070	December 31, 1935	6,761	28,339	22,625
5	January 1, 2080	July 25, 1934	1,518	29,857	21,107

- Build a $200-$500 million-dollar pipeline from Wah Wah & Pine Valleys in Beaver County.

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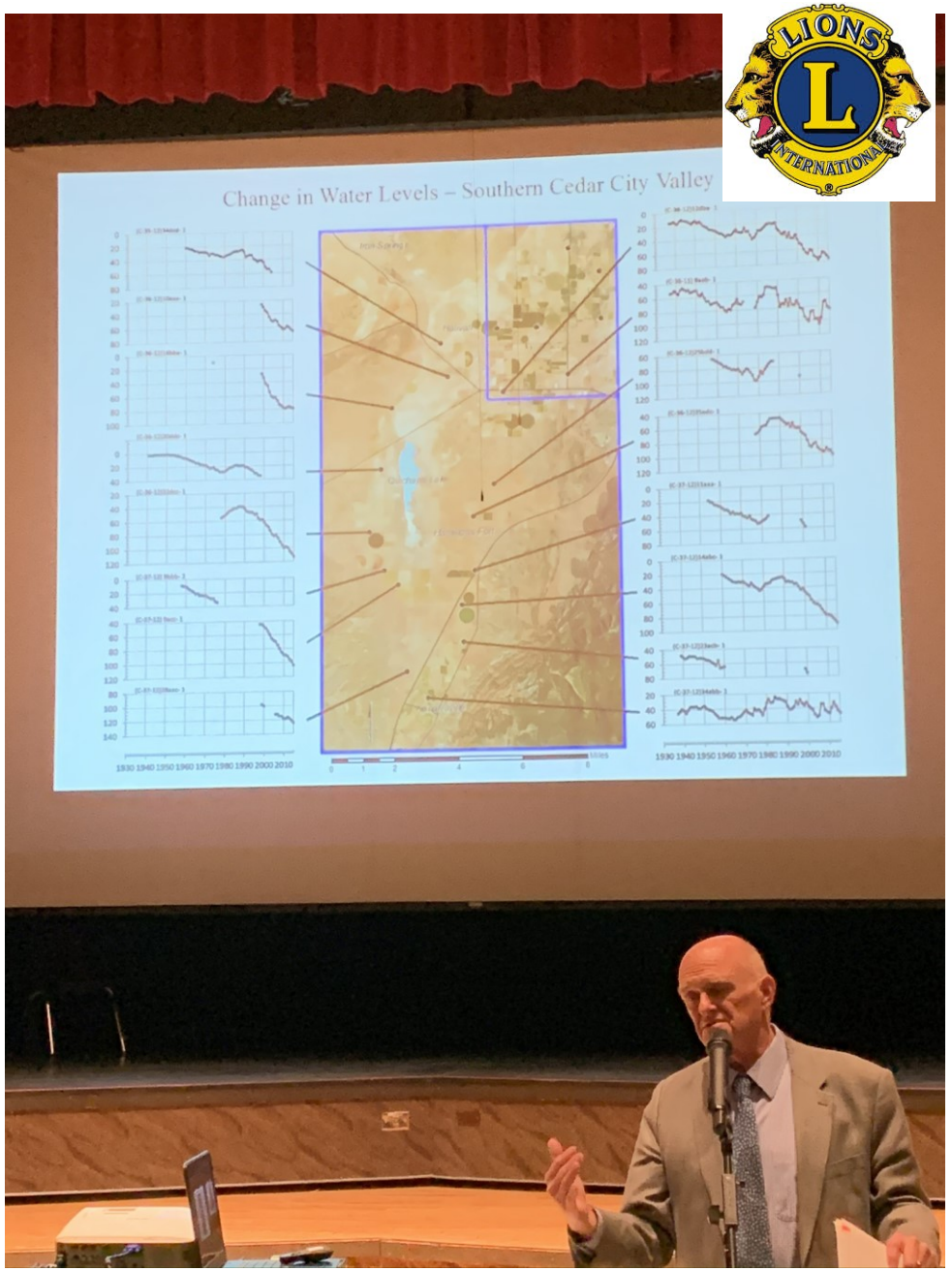
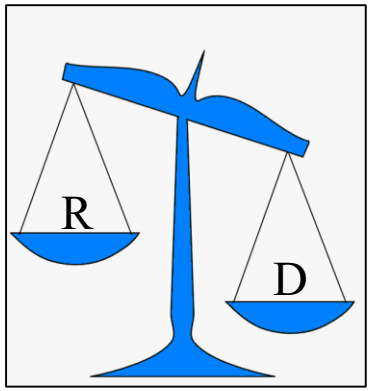
Recharge Must Equal Discharge

- The State Engineer, Kent Jones, presented a ground water management plan for Cedar Valley at Cedar High School on Wednesday, 15 Oct 2019.
- He showed the drop in water levels in wells throughout the Cedar Valley Aquifer.





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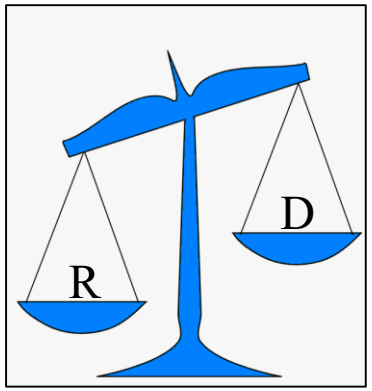
Kent Jones also talked about Recharging "the Aquifer"

Storage Location	(Acre feet)
Schmidt Pit	520
Airport pits	1,719
Horse Alley pits	719
*Western Rock pit	6,000
Enoch Graben	32
Quichipa	100
Total	**9,990**

*Approximate number



- Our deficit in the valley is 7,000 so we exceeded our deficit by nearly 3,000 acre-feet.
- Cedar City, CICWCD, Iron County and Enoch City should be very proud of the accomplishments to capture this precious resource. It was inter-local agencies and the communities working together that made this possible. We will continue to push for future projects to assist in this effort.
- The results of these efforts will protect private and governmental water rights and even though it will be needed at some point it will delay the need for a very expensive pipeline from Pine Valley. Very grateful for the moisture we have been blessed with.

Paul Cozzens
435-590-7618

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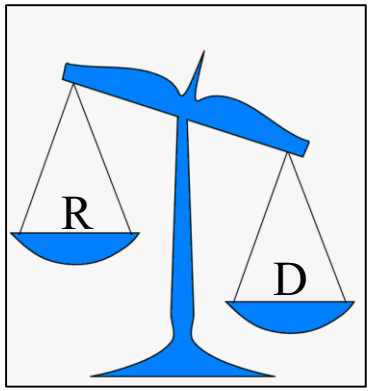
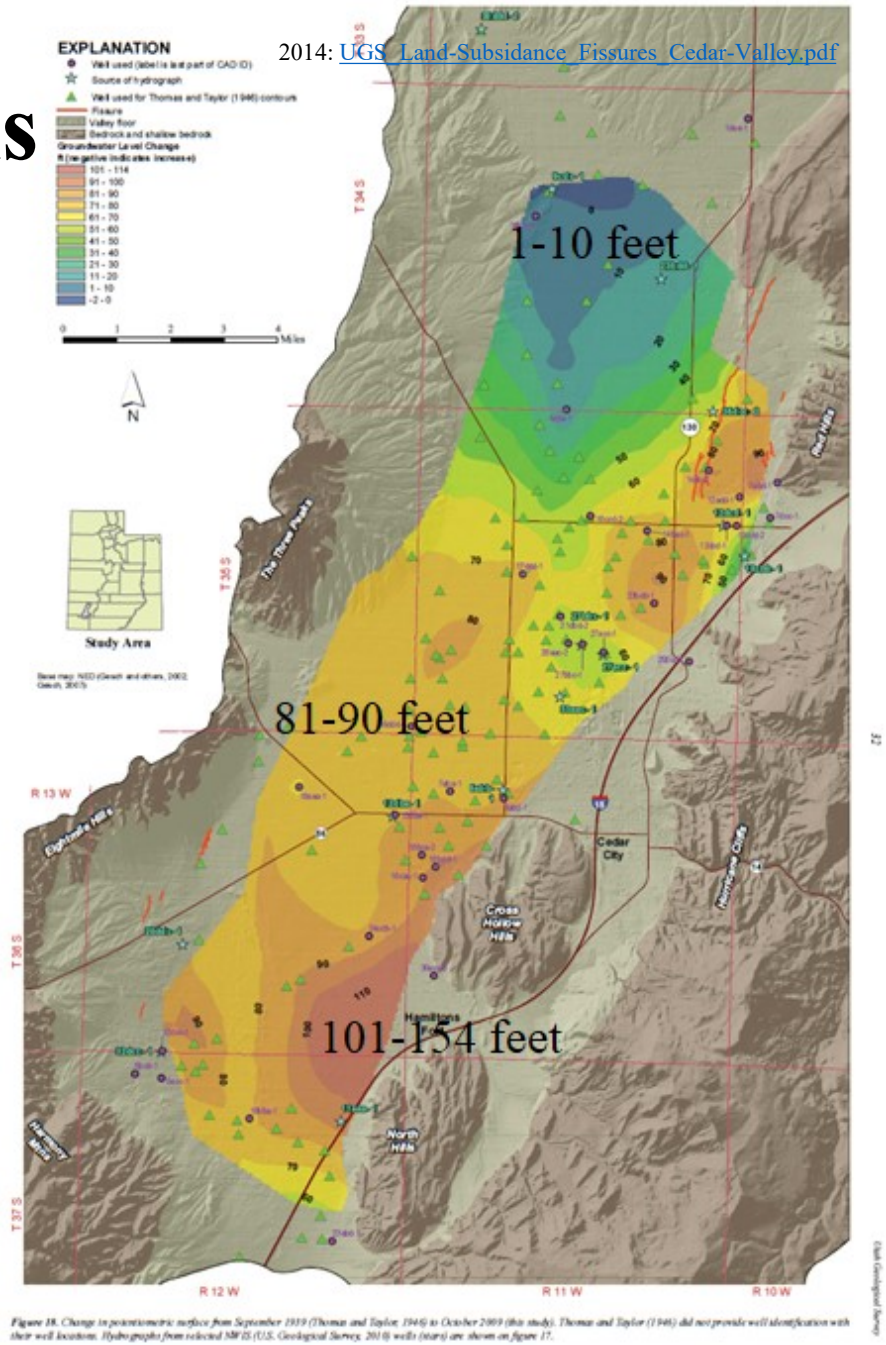
He focused on lowering aquifer levels

- The drop in aquifer levels should be a concern for everyone in Cedar Valley:
  - Empty aquifers collapse, and will not refill.
  - This causes the fissures seen out by Enoch.
- Note the study of aquifers are only in the valley:
  - Bed Rock aquifers, outside of the valley fill, will neither drop nor collapse the same way.
- Next a summary movie:





2014: UGS_Land-Subsidance_Fissures_Cedar-Valley.pdf

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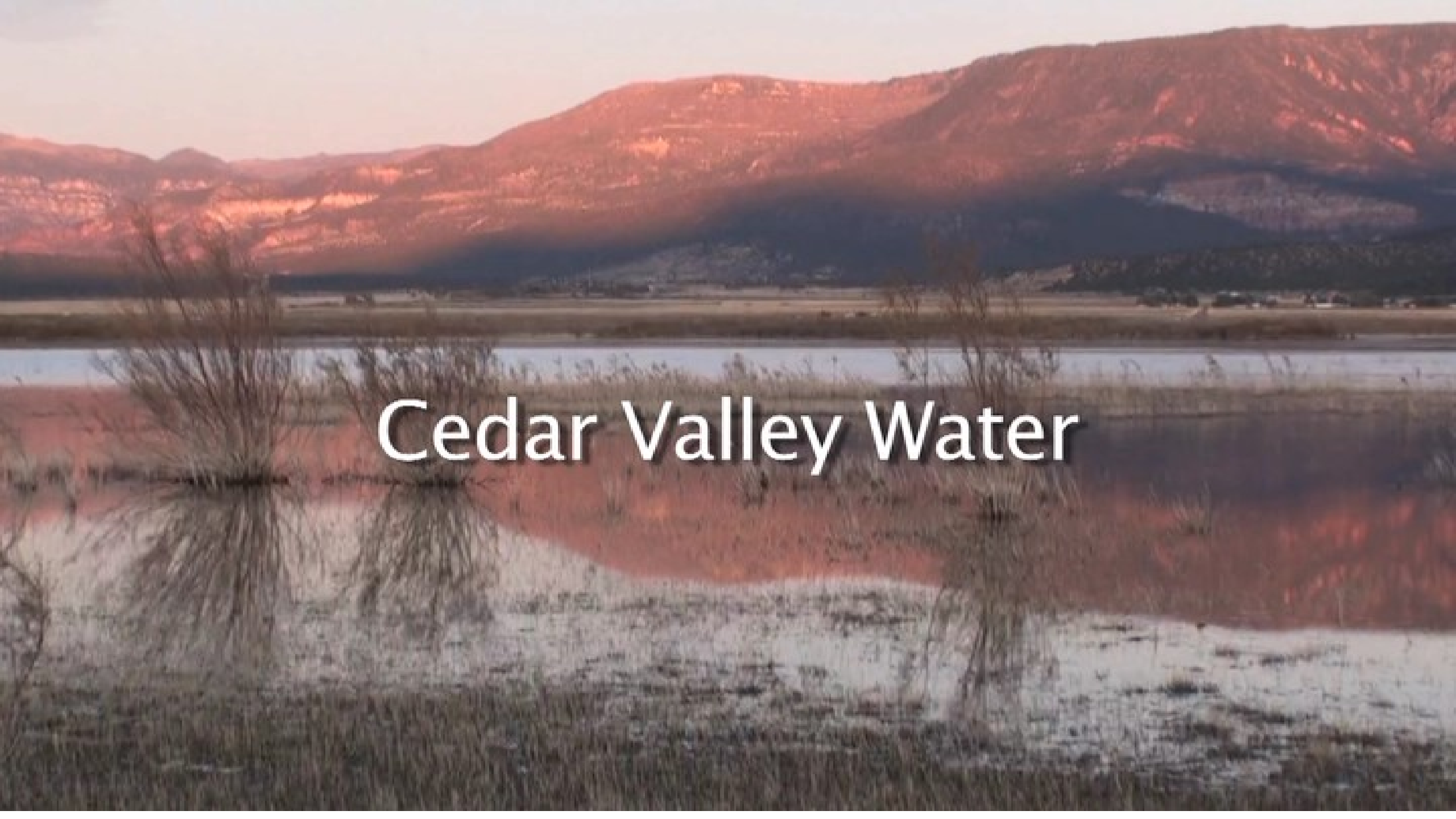

Cedar Valley Water

1. Limit Mandatory Reallocation to the Valley Aquifer

There is an important difference between the "Cedar Valley Aquifer" and the "Cedar Valley Drainage Basin."

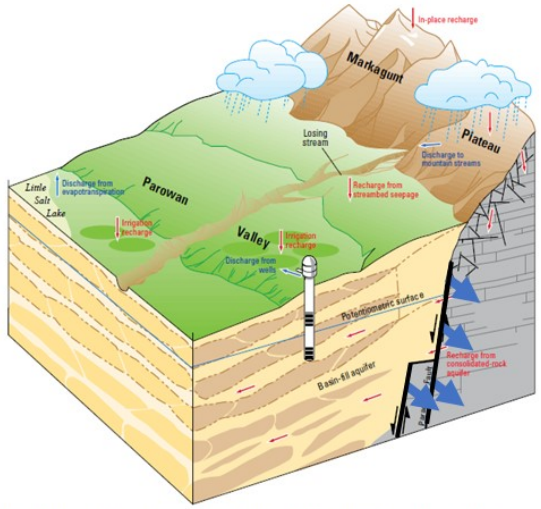
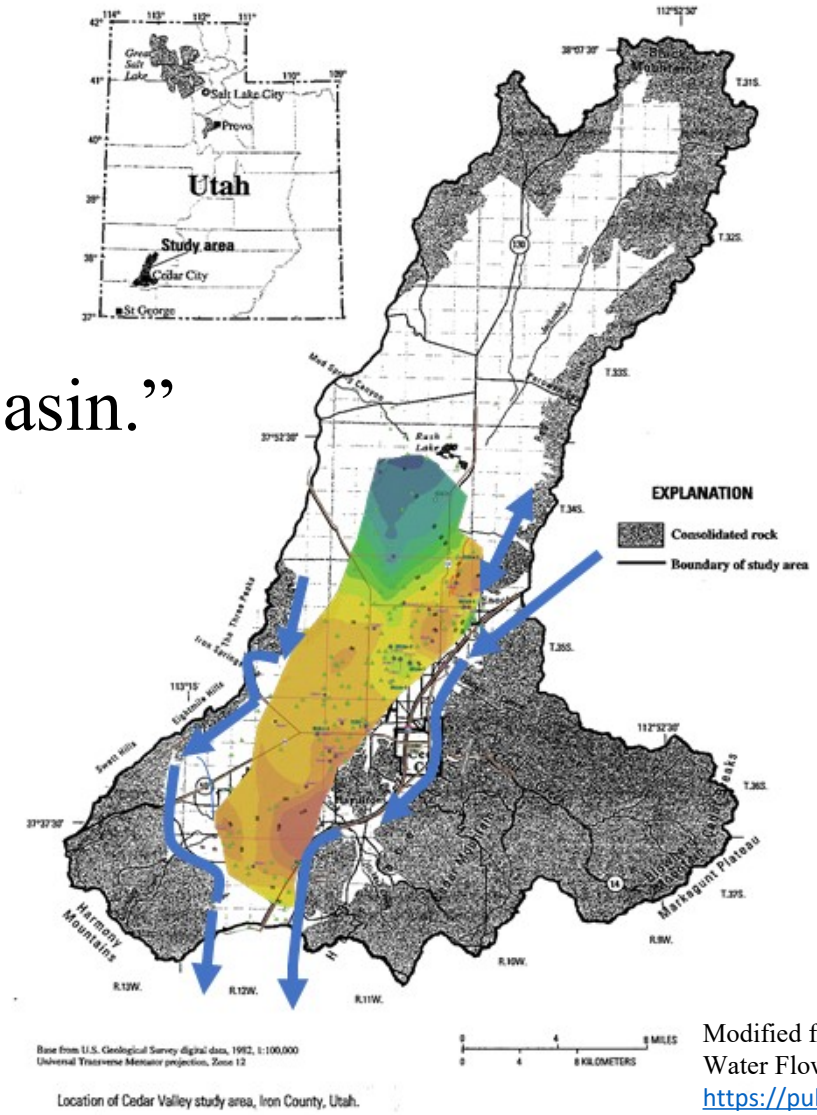


Figure 13. Conceptualized hydrologic setting and groundwater system in the Parowan Valley study area, Iron County, Utah.

USGS Report 2017-5033, Water Resources of Parowan Valley, Iron County, Utah modified with blue south trending, along large faults transport, arrows https://pubs.usgs.gov/sir/2017/5033/sir20175033.pdf.



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

All USGS and UGS Modeling (colored area) was in the Cedar Valley Aquifer (white area).

Black areas are "Bedrock Aquifers."

The State Engineer defined the entire Cedar Valley Drainage Basin as the "Effective Area".

Modified from USGS Report 2005-5170, Hydrology and Simulation of Ground-Water Flow in Cedar Valley, Iron County, Utah, Figure 1 https://pubs.usgs.gov/sir/2005/5170/PDF/SIR2005_5170.pdf.

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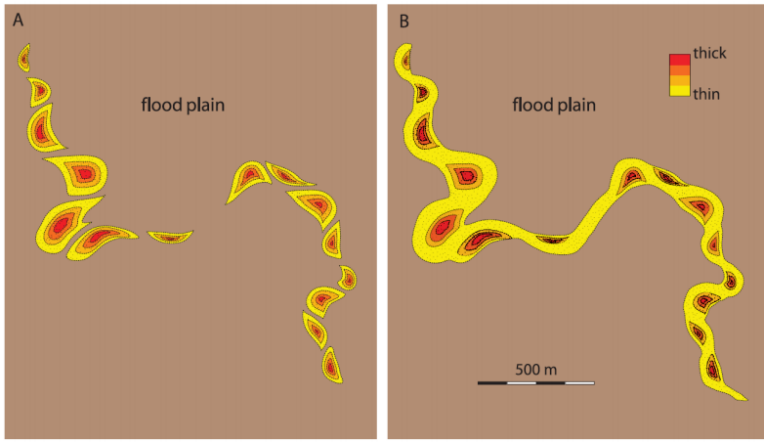
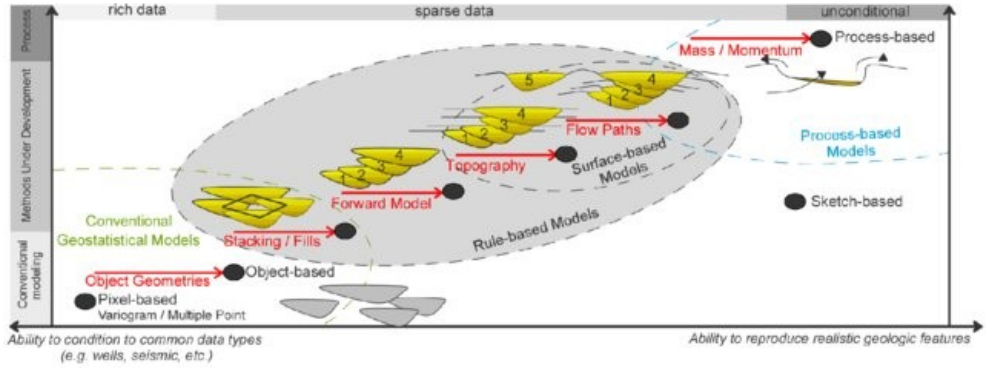
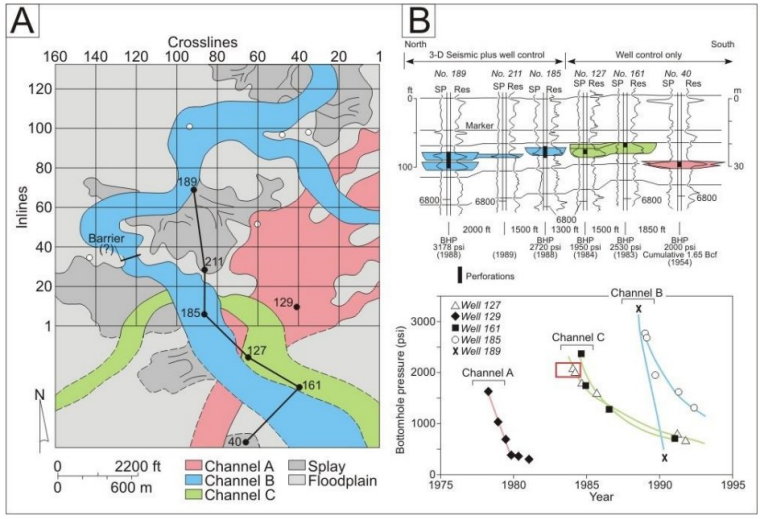
Fluvial Systems and Aquifers,
like the Cedar Valley Aquifer, have complex geometries

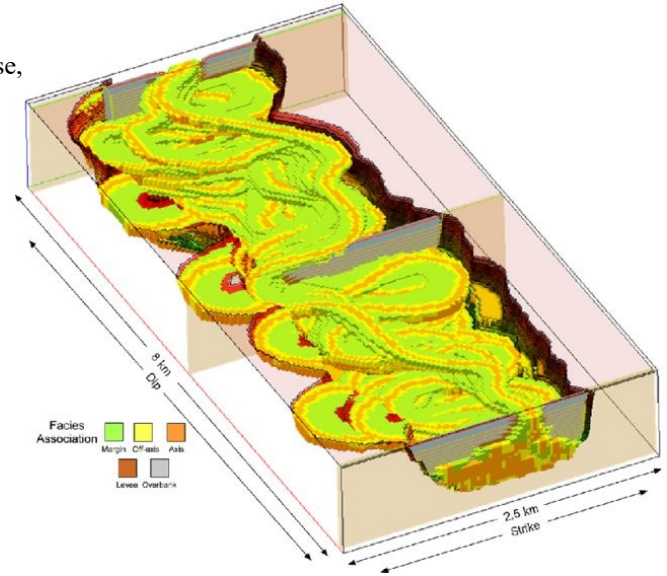




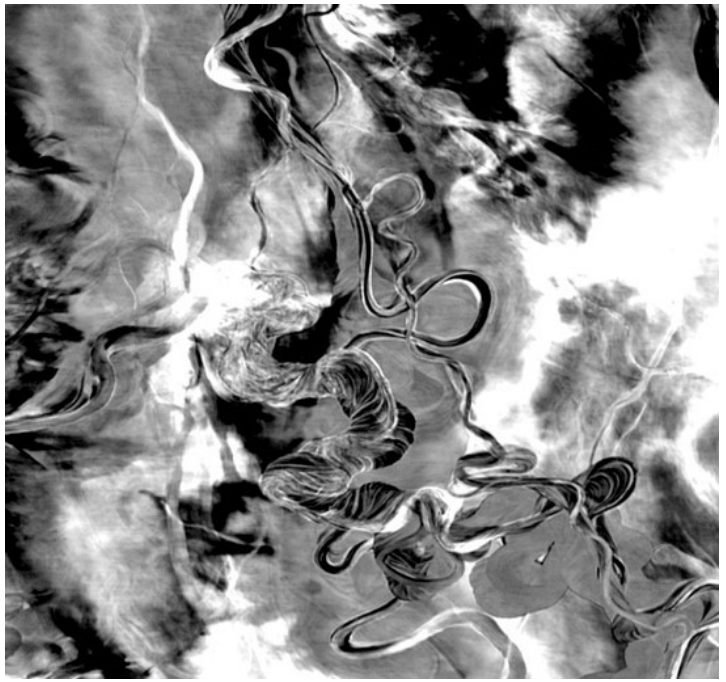
Flow Processes and Sedimentation in a Low-Sinuosity High Net-Sand Content Fluvial Channel Belt: 3D Outcrop Study of the Cedar Mountain Formation, Utah, Bradley Nuse, http://inside.mines.edu/UserFiles/File/CoRE/Thesis_Dissertation/Nuse_Bradley.pdf



A 3-D seismic case history evaluating fluvially deposited thin-bed reservoirs in a gas-producing property, Bob A. Hardage, et. al., Geophysics, Nov. 1994.



https://www.researchgate.net/publication/303960851_Stratigraphic_rule-based_reservoir_modeling/figures?lo=1



3-D seismic horizontal slice showing fluvial channels

https://www.shearwatergeo.com/

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Seismic & Geologic Cross-Sections in Cedar Valley

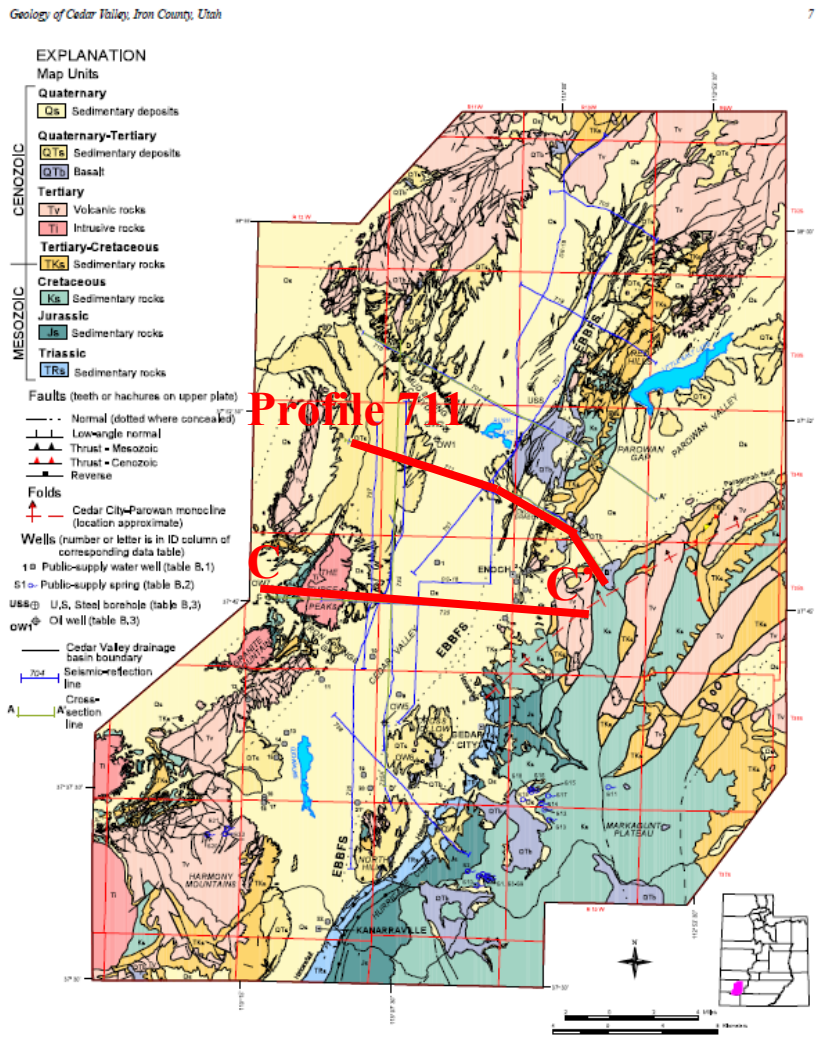
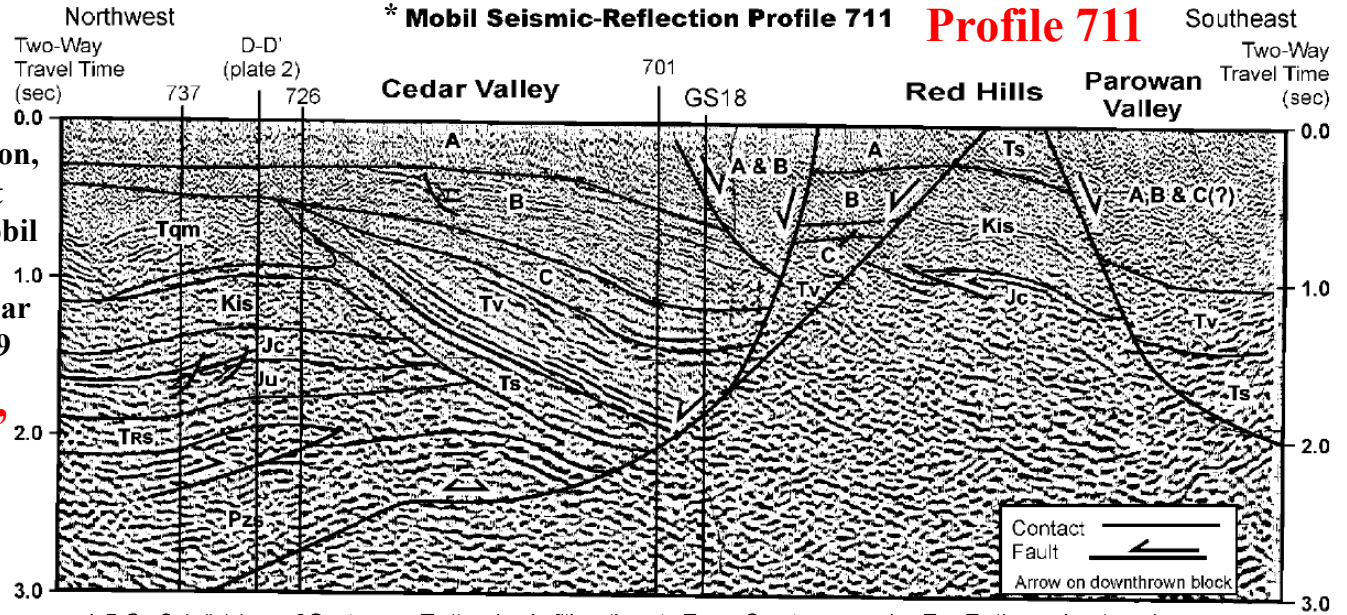


Figure 6. Simplified geologic map of Cedar Valley drainage basin and adjacent areas. EBBFS is eastern basin-bounding fault system. See figure 5 for stratigraphic column, and appendix A for correlation of map units with those on plates 1 and 2.

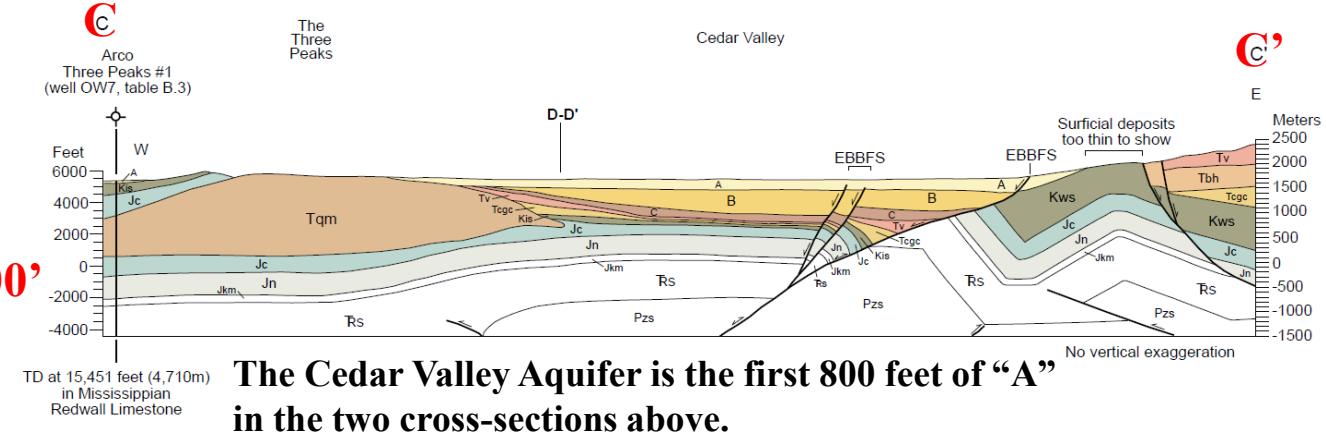
***Roice Nelson, geophysicist running Mobil Oil seismic crew in Cedar in 1978-1979**

~7,000'



A,B,C - Subdivisions of Quaternary-Tertiary basin-fill sediment; Tqm - Quartz monzonite; Tv - Tertiary volcanic rocks; Ts - Tertiary sedimentary rocks; Kis - Iron Springs Formation; Jc - Carmel Formation; Ju - Navajo Sandstone, Kayenta, and Moenave Formations, undifferentiated; TRs - Triassic sedimentary rocks; Pzs - Paleozoic sedimentary rocks.

7,000'



The Cedar Valley Aquifer is the first 800 feet of "A" in the two cross-sections above.

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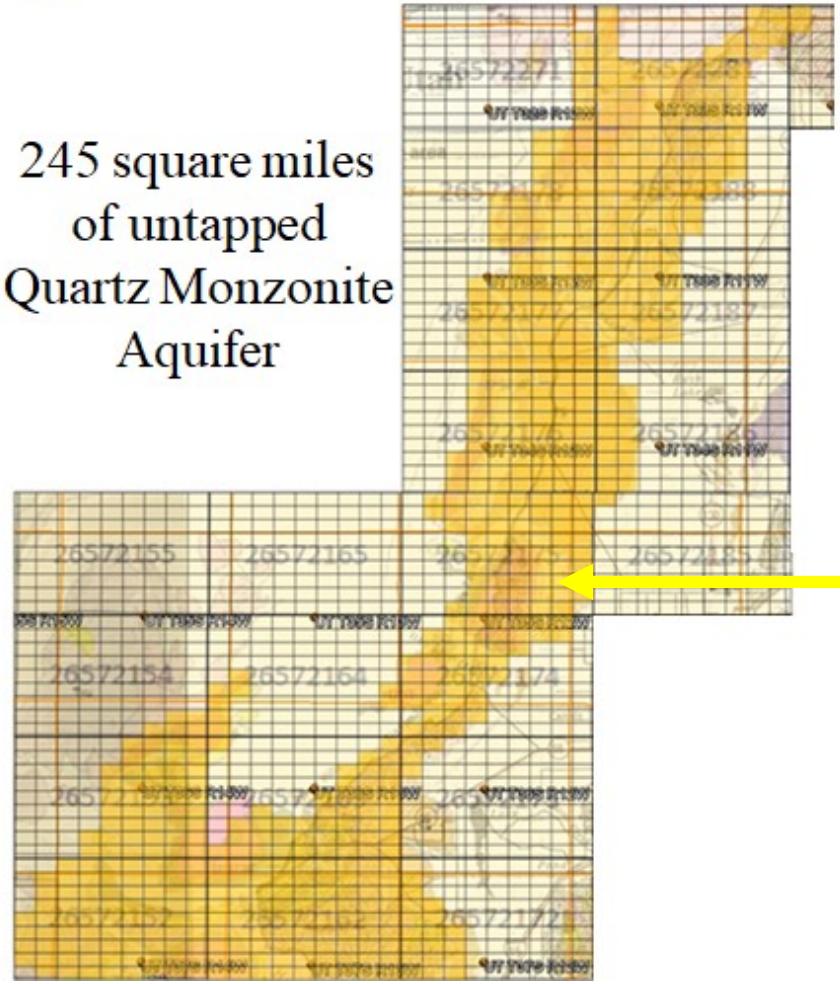
The Geology of Cedar Valley, Iron County, Utah, and its relation to ground-water conditions, https://ugspub.nr.utah.gov/publications/special_studies/ss-103.pdf

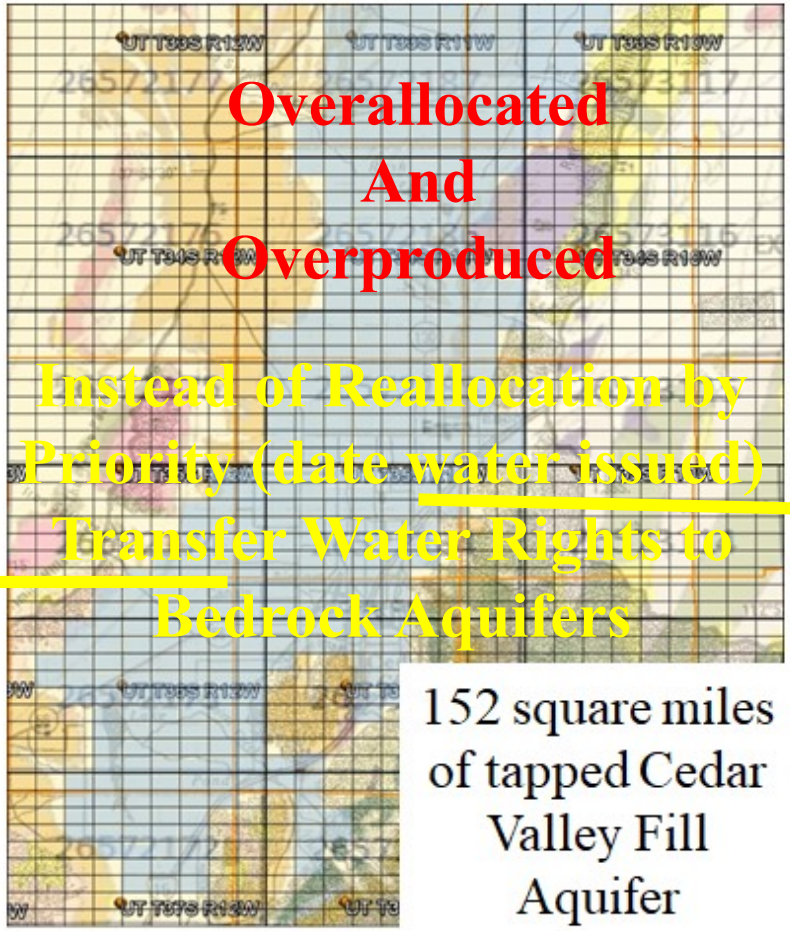
2. Transfer Water Rights to Bedrock Aquifers

Quartz Monzonite Aquifer

245 square miles of untapped Quartz Monzonite Aquifer



Cedar Valley Aquifer



Overallocated

And

Overproduced

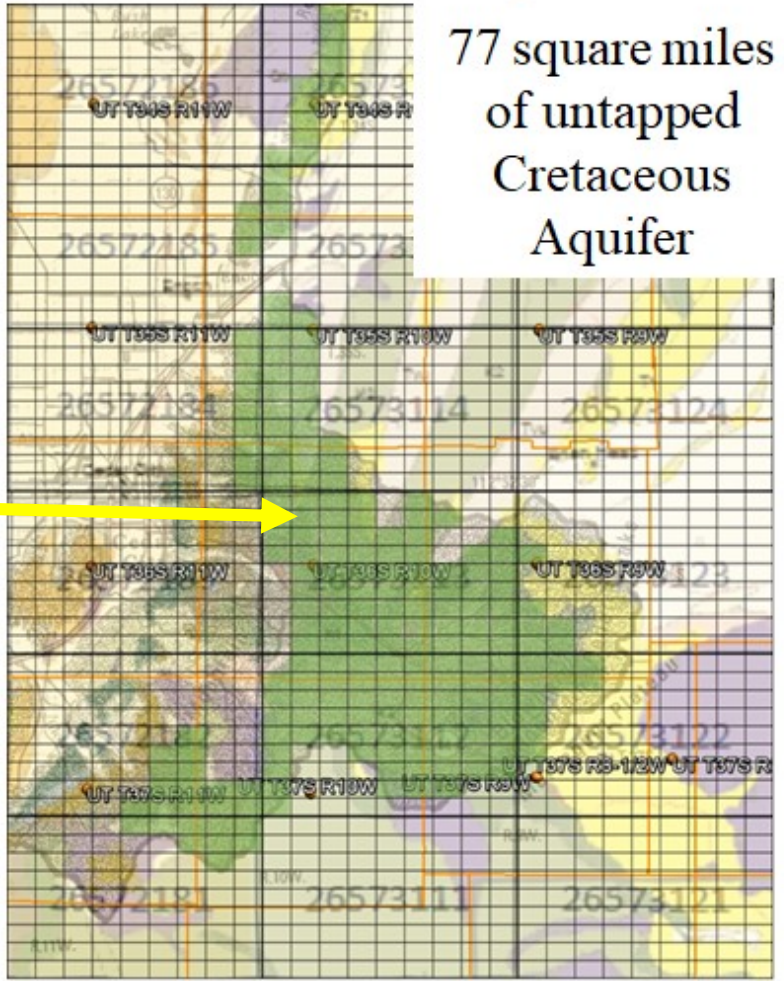
Instead of Reallocation by Priority (date water issued)

Transfer Water Rights to Bedrock Aquifers

152 square miles of tapped Cedar Valley Fill Aquifer

Cretaceous Aquifer

77 square miles of untapped Cretaceous Aquifer



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Water & the Potentiometric Surface

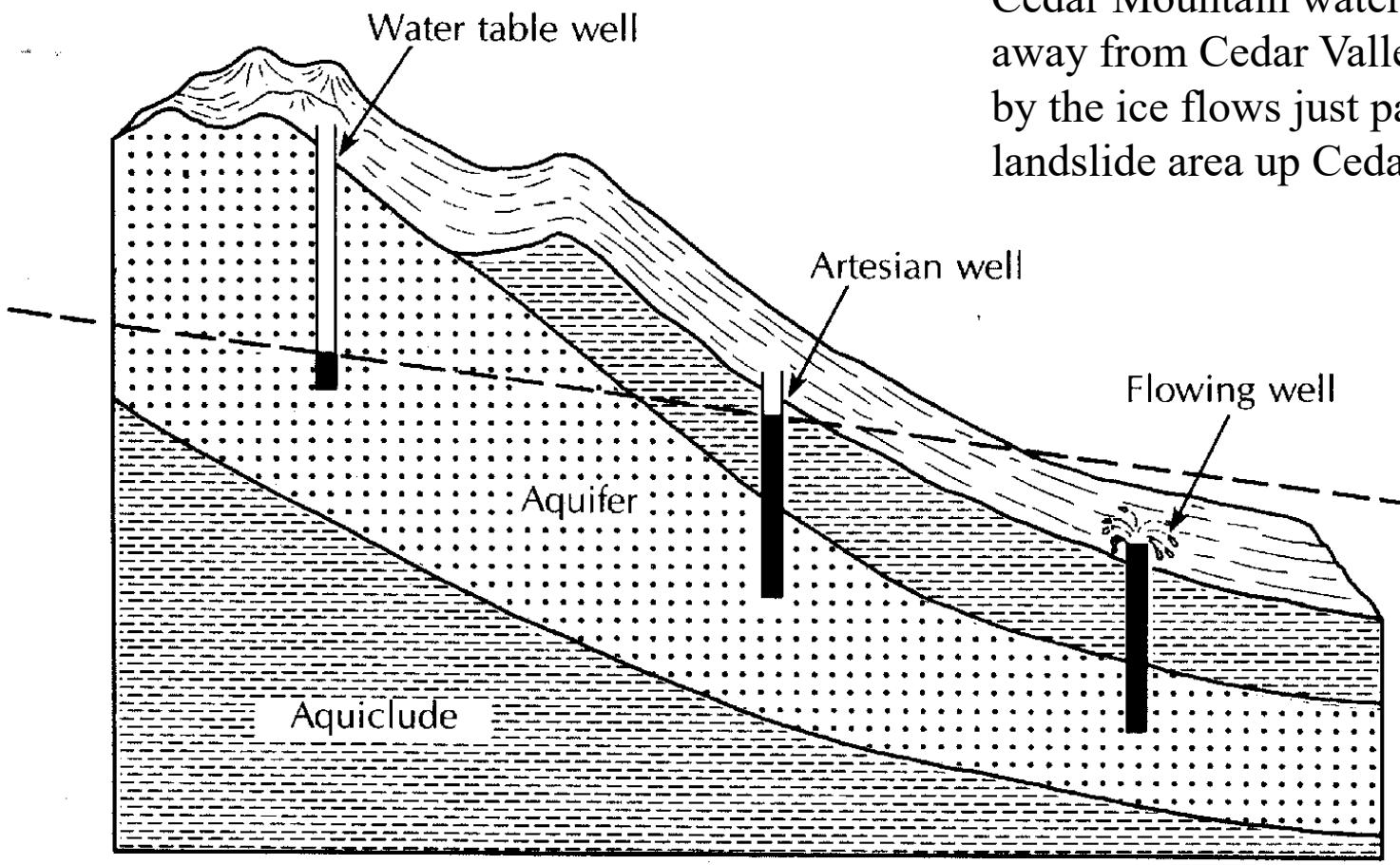

FIGURE 4.21 Artesian and flowing well in confined aquifer.

https://www.slideshare.net/VISHNUBARUPAL/types-of-aquifer-by-bablu-bishnoi-65855846, slide 16 of 24.

Cedar Mountain water flows east, away from Cedar Valley, as shown by the ice flows just past the landslide area up Cedar Canyon

Both photos west side of Highway 14
No ice flows on east, due to east dip.

Photos by Gary F. Player

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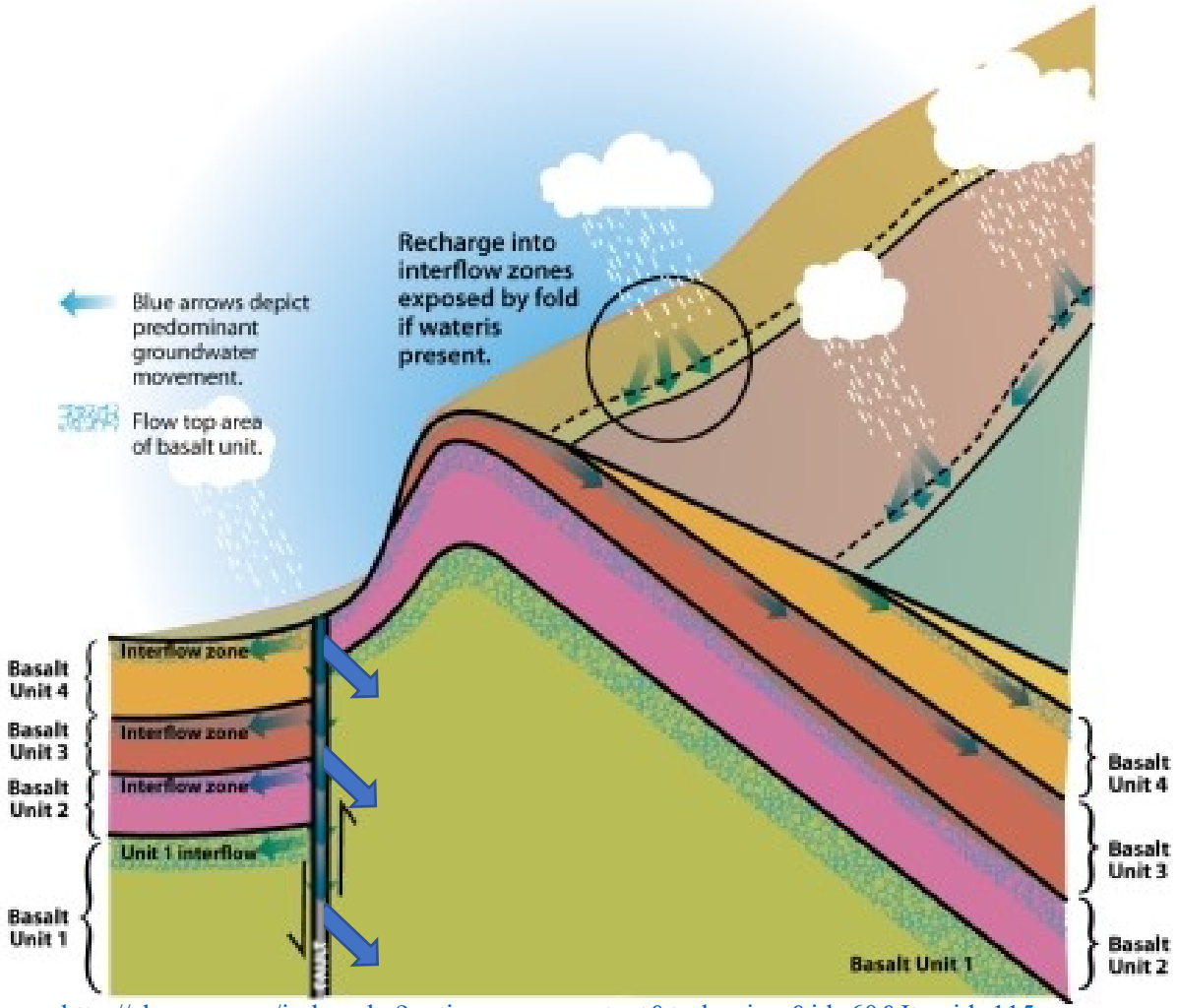
Faults & Dip Force Water Flows from Cedar Mountain East & South



http://cbgwma.org/index.php?option=com_content&task=view&id=60&Itemid=115

- Bedrock dips to the east about 10 degrees;

- Faults bounding the valley disrupt baseflow, especially into the Cedar Valley basin fill aquifer.
- Aquifer overproduction is very shallow (less than 800 feet depth) and except for water flowing down Coal Creek and Fiddler's Canyon these shallow layers are isolated from mountain recharge by layers of clay and the potentiometric surface dip.

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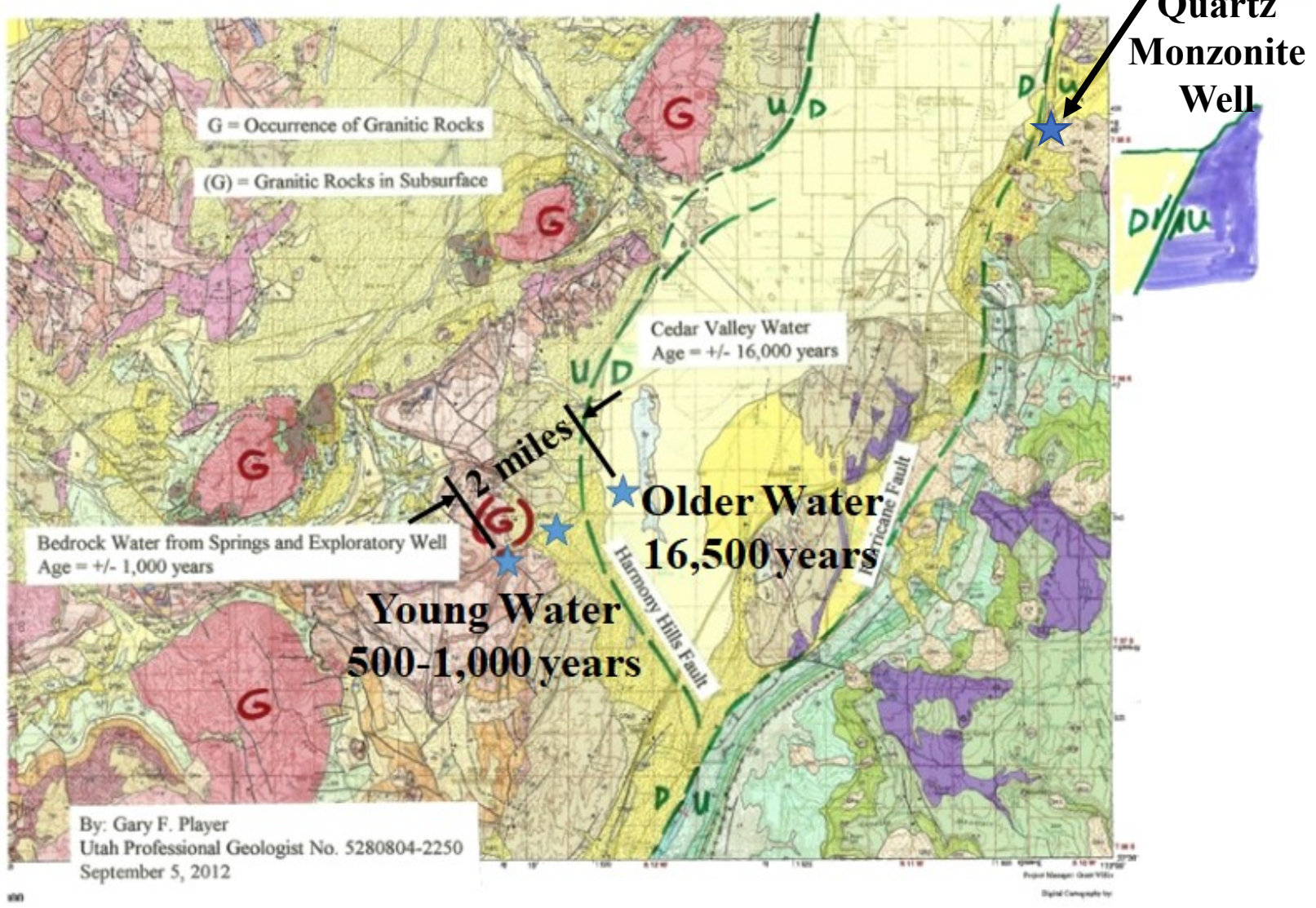
3. Age Date Every Well in Cedar & Parowan Valleys

Understanding Water Age:

- Shows new water is leaking south along the Harmony Hills Fault.
- For $45/sample I can get water ages for ever well in the Drainage Basin at the University of Utah.
- This data can be mapped to show relationships between different producing zones in the unconsolidated Valley Aquifer, as well as tested bedrock aquifer samples.



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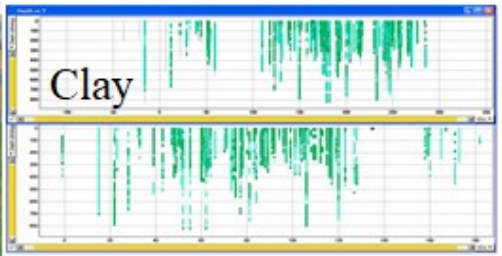
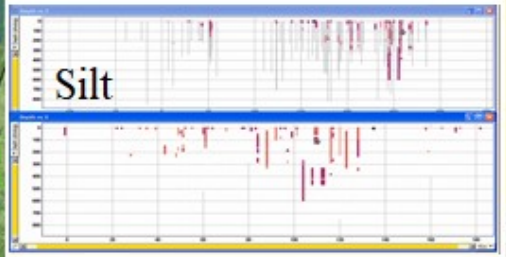
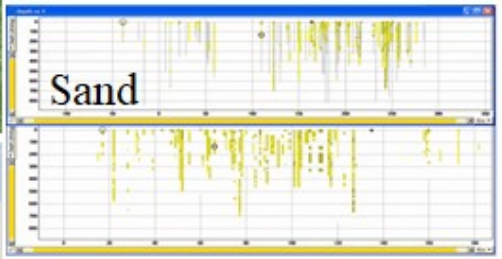
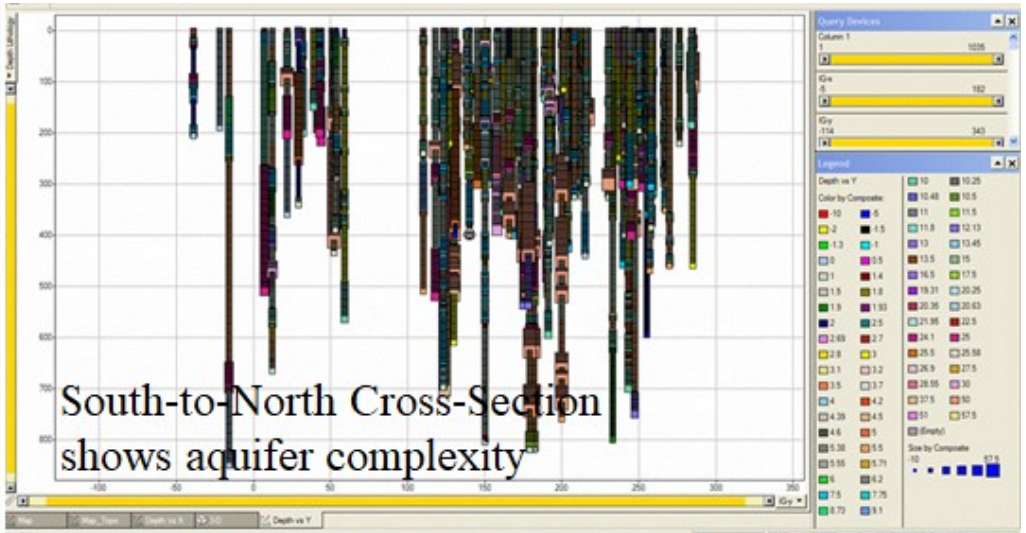
Depth of Wells – Drainage Basins & Valley Aquifers

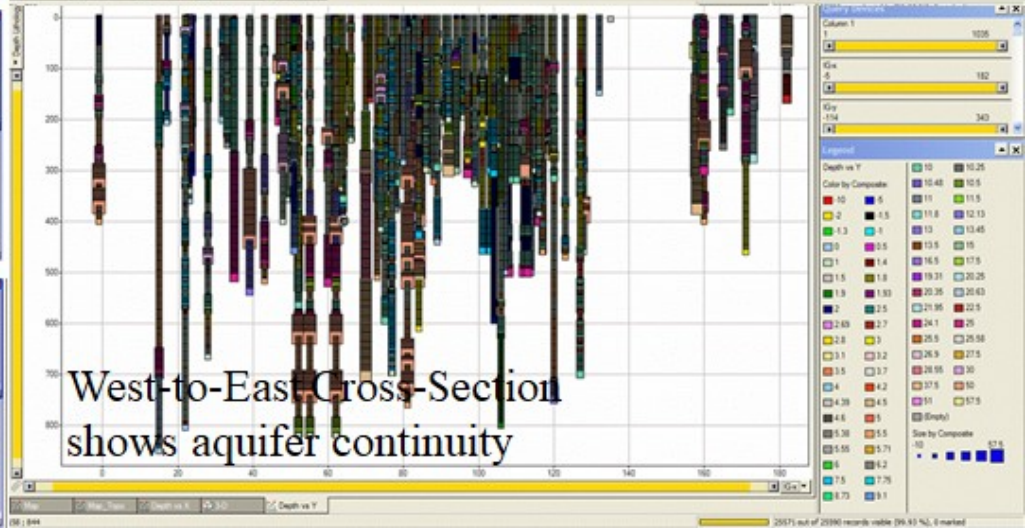
In 2006, I looked at 145 well logs in Cedar Valley, the deepest well was 820 feet deep

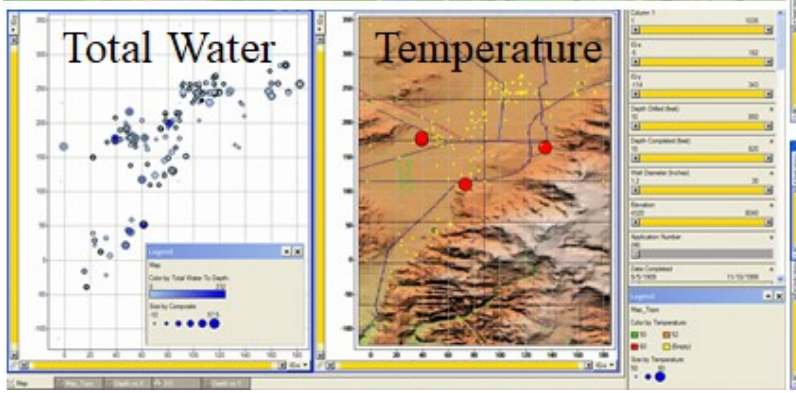












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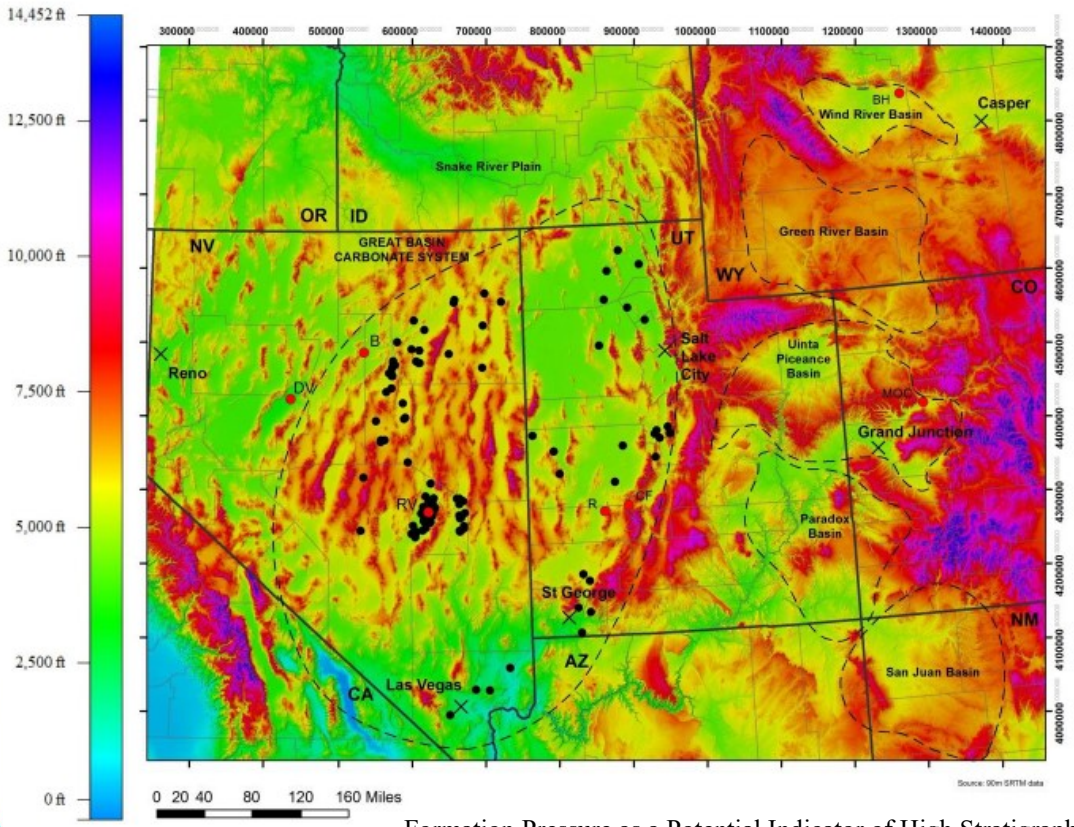
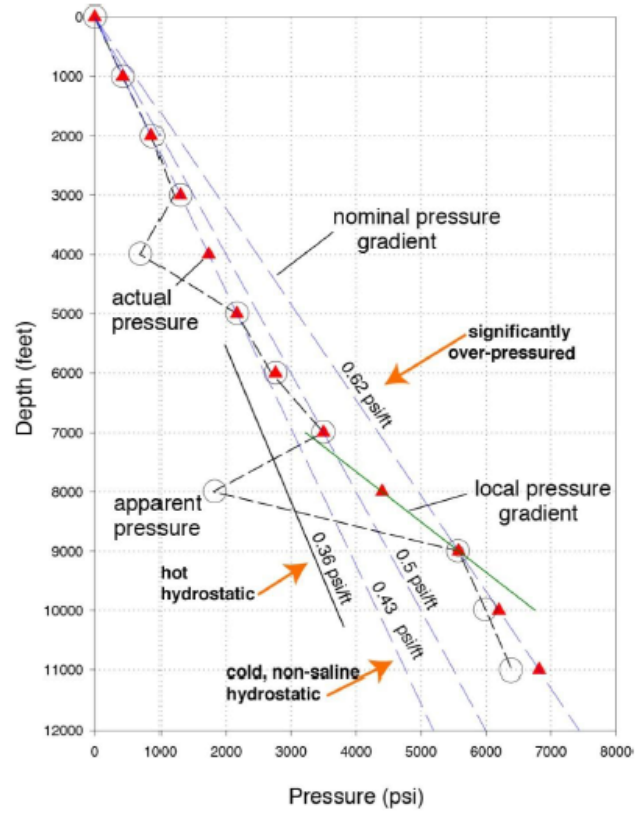
Lower than normal Hydrostatic Pressure, Southern Great Basin

The Southern Great Basin has lower than normal hydrostatic pressure, which the same as when there is low hydrostatic pressure in a city water system, means there is a leak in the system.

The Great Basin leak is Grand Canyon.





Formation Pressure as a Potential Indicator of High Stratigraphic Permeability, Rick Allis, UGS, http://www.walden3d.com/IronCounty/CedarValleyWater/140224_Pressure_Permeability_Great_Basin.pdf

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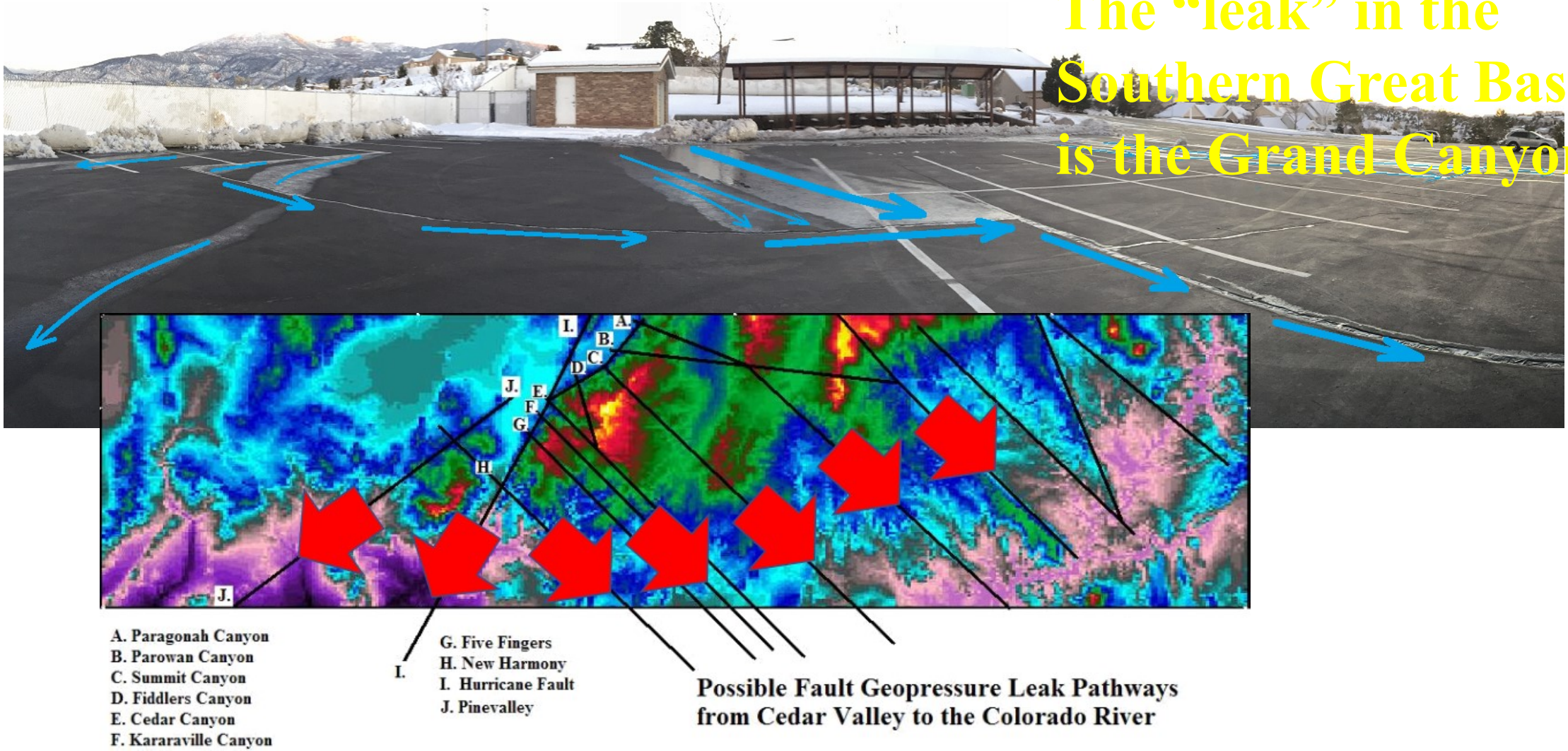
Water Flows by Gravity and along Layers and Cracks



See http://www.walden3d.com/IronCounty/CedarValleyWater/ #8. at bottom of page.

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Loss of Coal Creek Water in Jurassic Sandstone Red Rocks

Water migrates down bedding planes. Bedding planes continue underneath the valley fill soils. Joe Armstrong contends there is 50% water loss from Coal Creek as the creek passes over the high porosity Navajo Sandstone formation.

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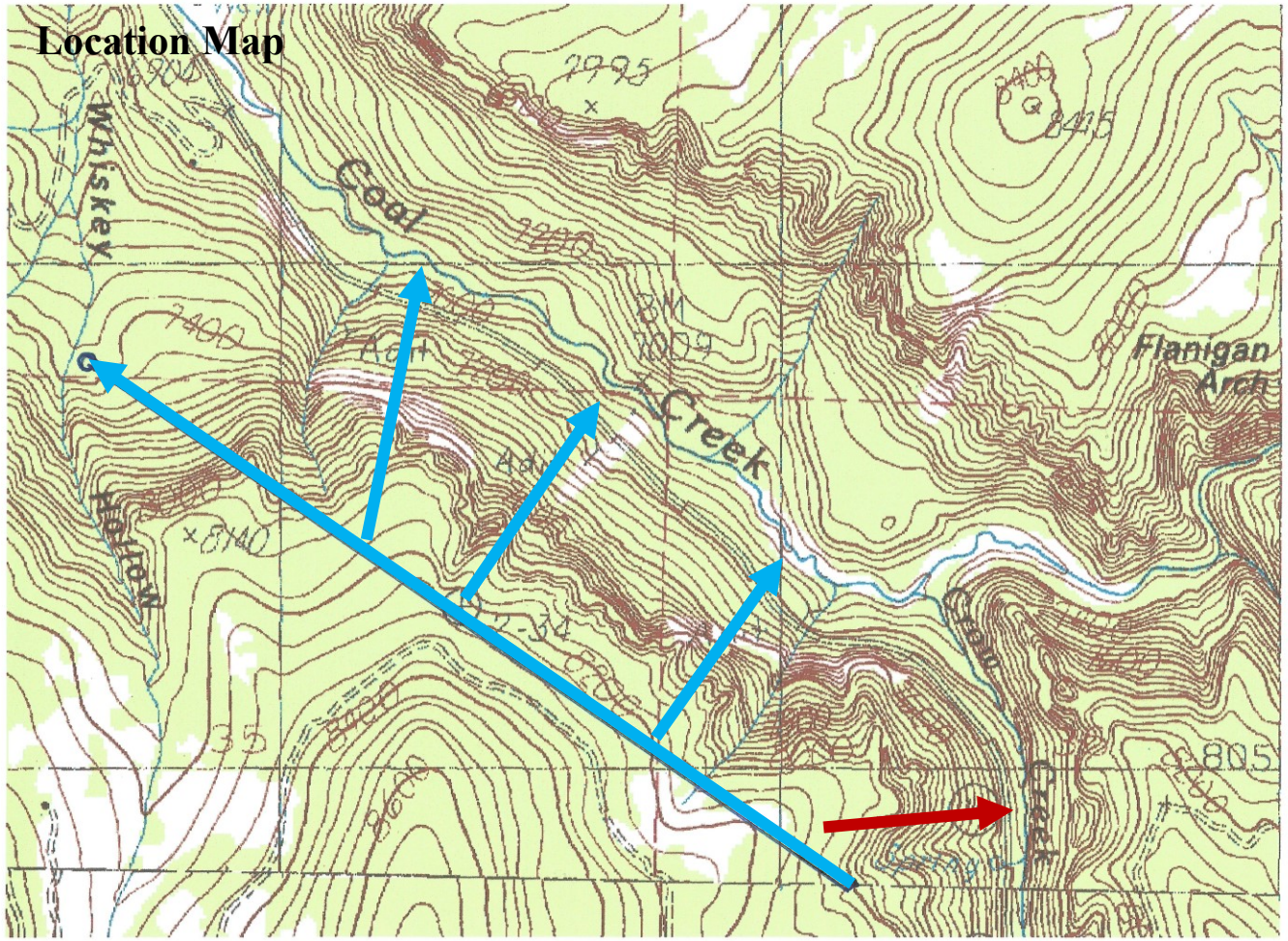
4. Incentivize and Fund Bedrock Aquifer Well Tests



Well to drain Cretaceous sandstones. Surface location to right of Whiskey Hollow.
Horizontal Well Length = 5,665'. Surface Elevation = 7,380'. Well direction = S 60^0 E.

Scale: 5.5" = 1 mile.
G.F. Player 2/8/2018

The landslides are not because the coal mine used to be there, rather they occur because the coal mine is no longer there, and so water is not being drained out of the Straight Cliffs.

Potential Cretaceous Water:
10,000,000 acre-feet
Probable Annual Recharge:
15,000 acre-feet per year

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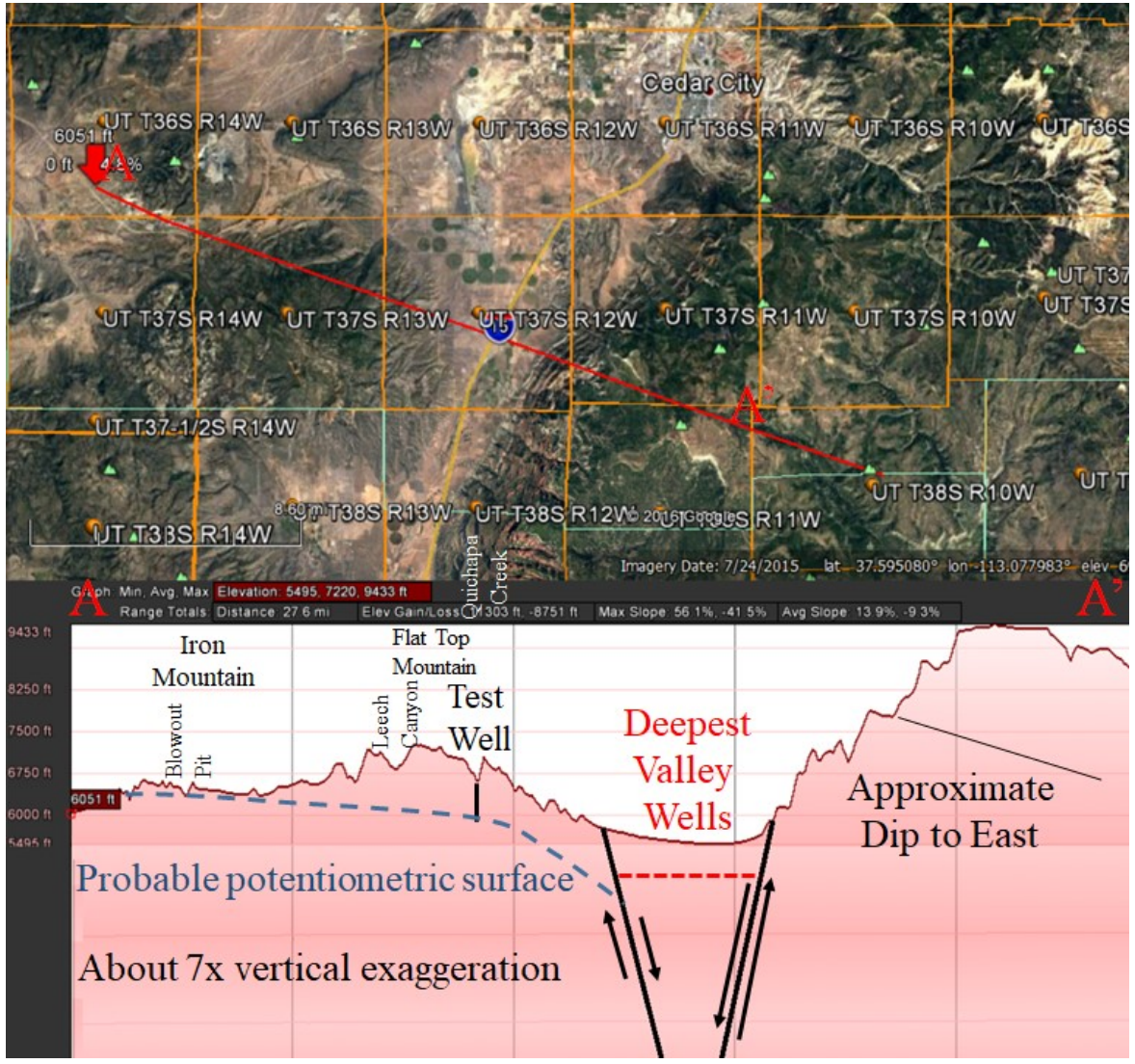
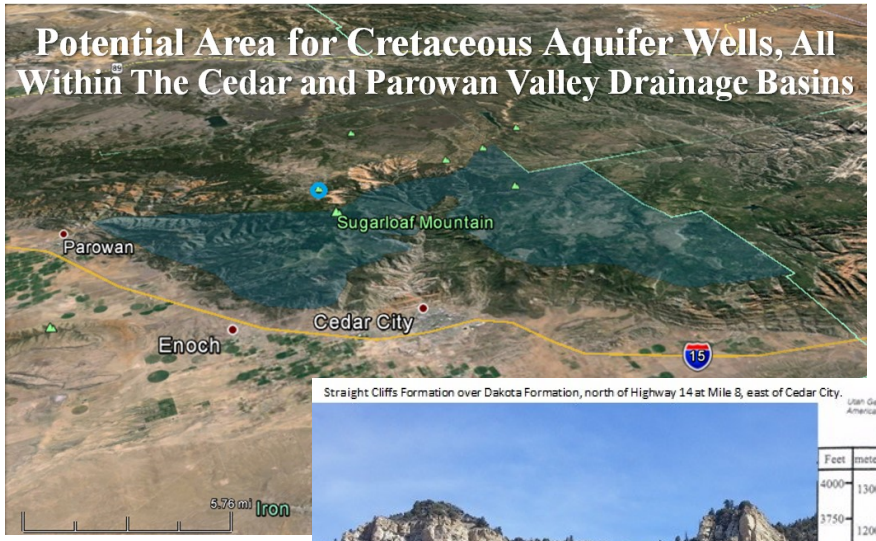
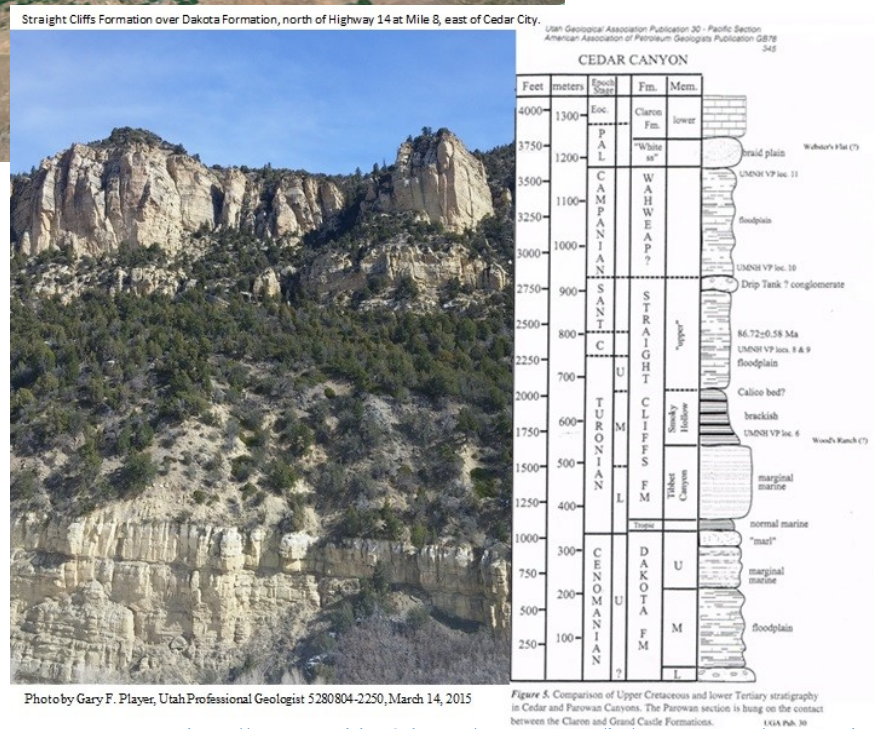
The Cretaceous Aquifer





The Cretaceous Aquifer was successfully tapped at Brian Head in the city well.

There is enough private land to drill test and production wells without having to deal with the U.S. Forest Service



http://www.walden3d.com/IronCounty/ig/IronCounty/IC_KA.html

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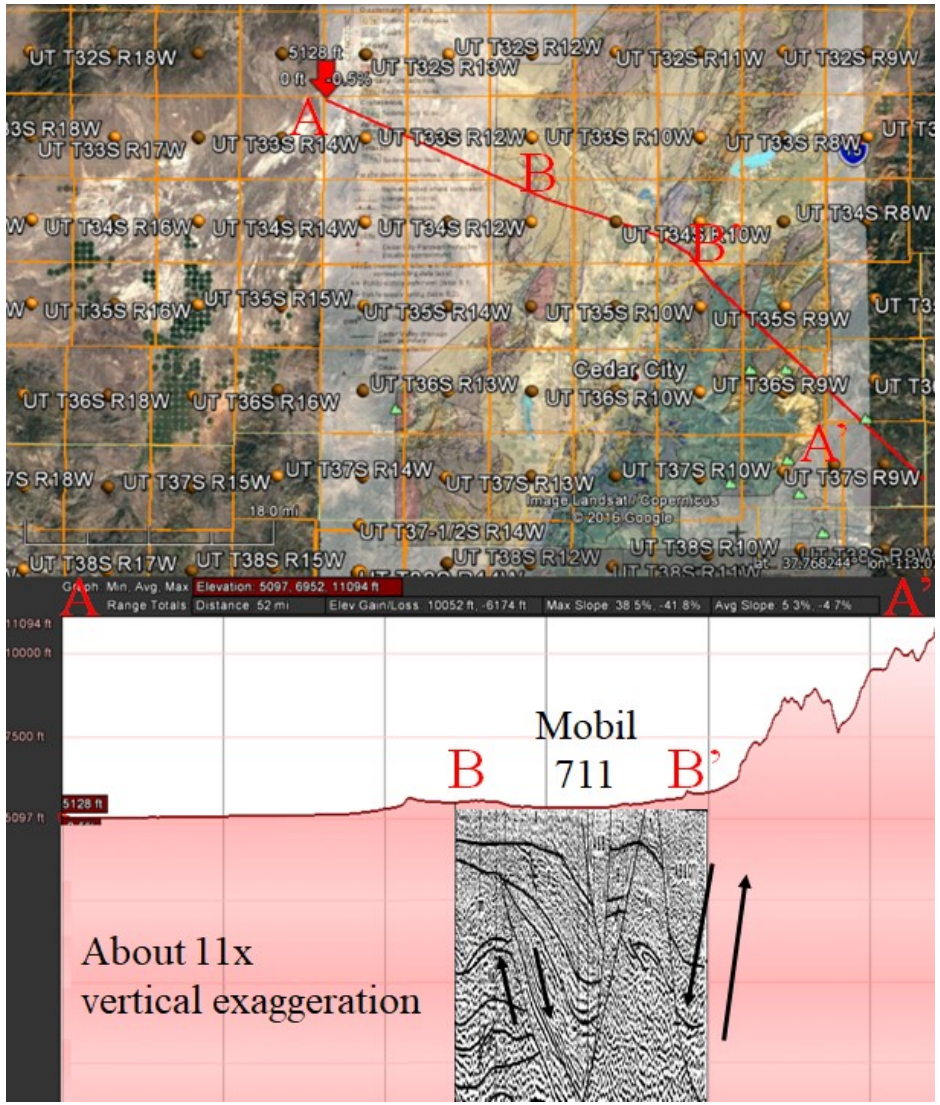
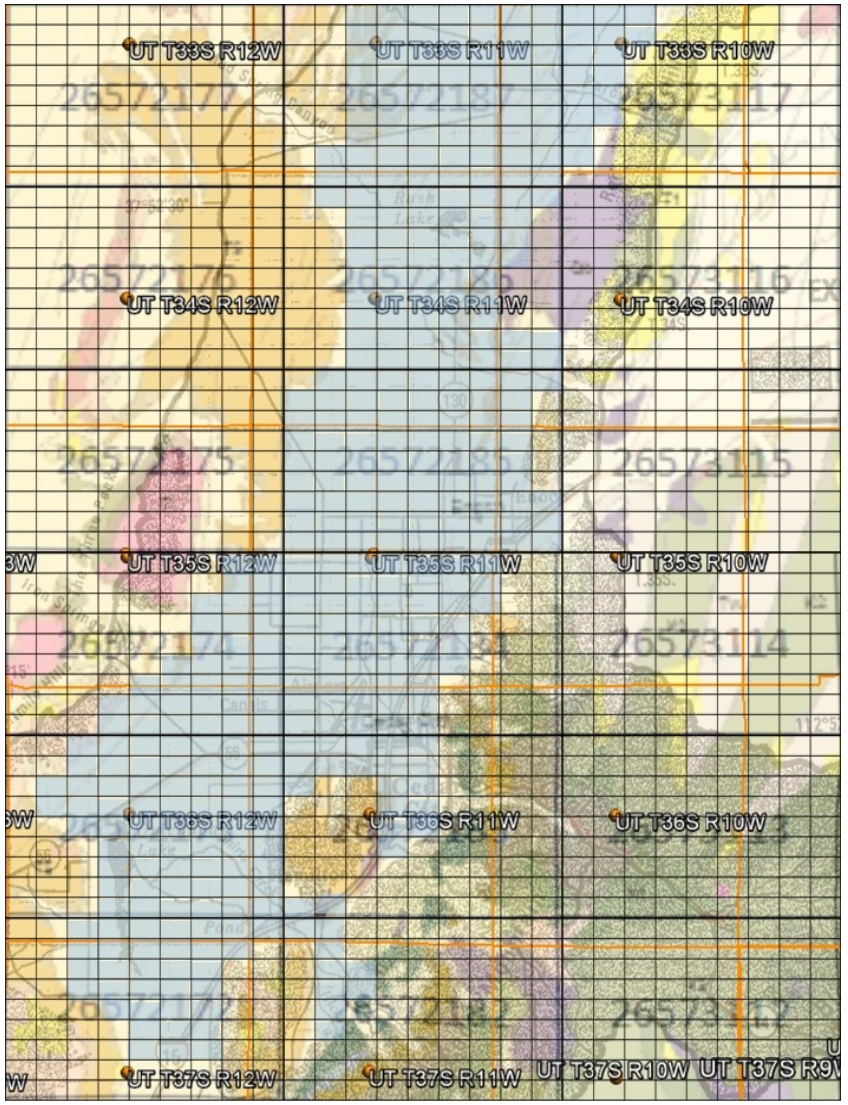
The Overproduced Cedar Valley Aquifer





- Map and cross-section to the far left, show configuration under the Cedar Valley aquifer.
- Almost all water wells are less than 800 feet deep.
- With over a mile of sediment, only the first 800 feet have been tested with water wells and produced.
- The Cedar Valley Aquifer is shown by the blue colored squares on map just to left.
- Each colored square is about ~0.36 square miles in size. There are 421 cells covering the Cedar Valley Aquifer, or 152 sq. miles.

http://www.walden3d.com/IronCounty/ig/IronCounty/IC_CVA.html

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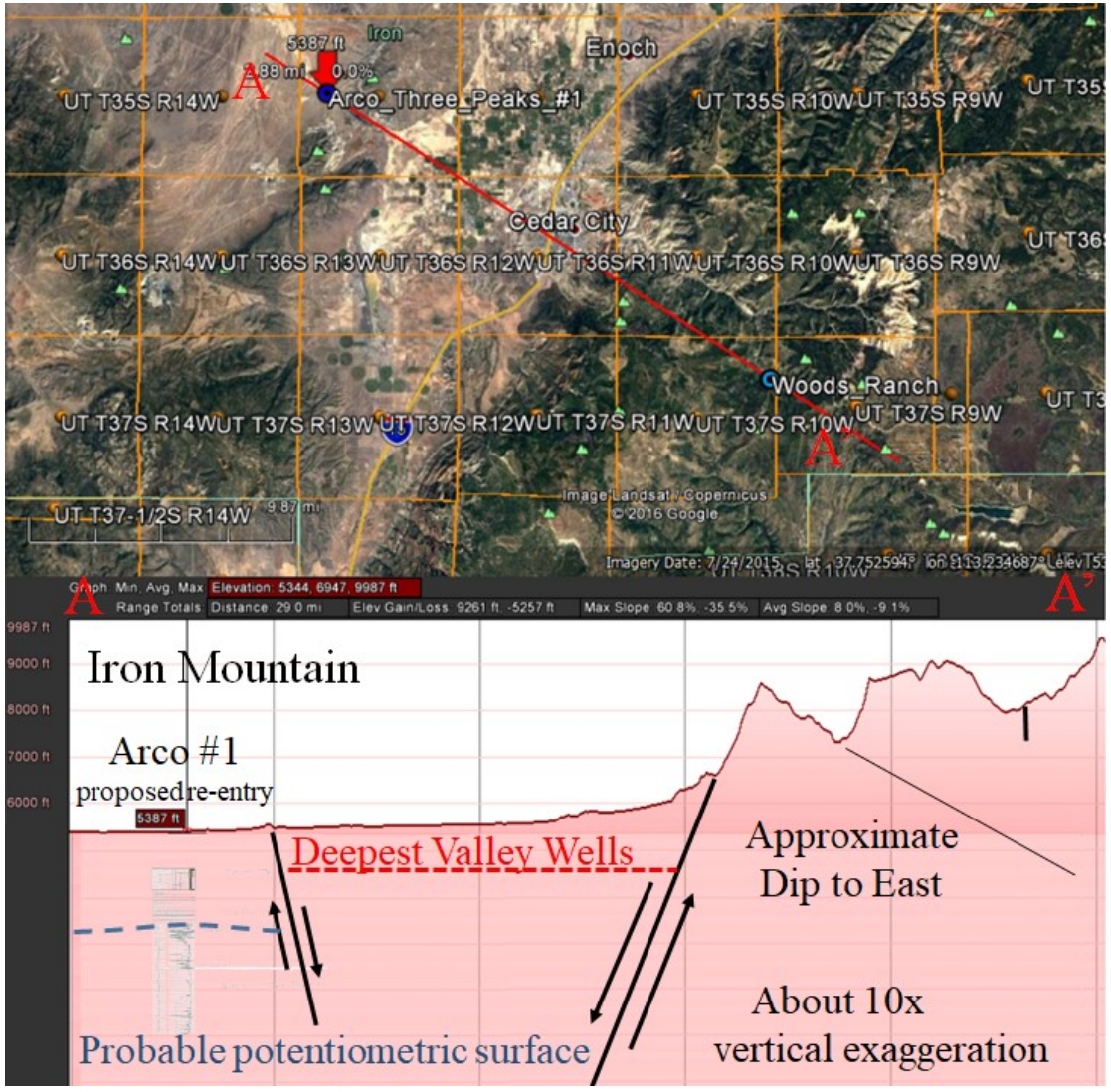
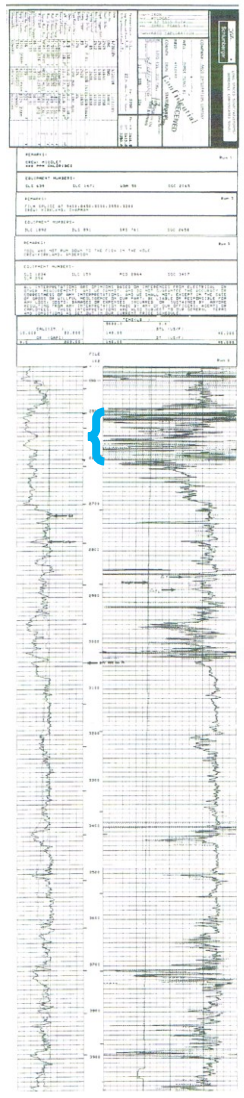
The Quartz Monzonite Aquifer





Water Table on top of untapped quartz monzonite aquifer at Blowout Pit, Iron Mountain.

To the left are Schlumberger well log results dated 30 Jun 1984, 20 Sep 1984, and 17 Jan 1985 from a well Arco drilled at Iron Springs. The high porosity, highlighted with { in blue, is from fresh water in the fractured quartz monzonite. This fractured quartz monzonite is the same geology as the successful well drilled in Enoch against the dipping Cretaceous beds.

http://www.walden3d.com/IronCounty/ig/IronCounty/IC_QMA.html

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5. Evaluate Condensation, Horizontal Wells, Train Transportation, and other related New Technologies

Ever wonder why there are so many springs at the base of volcanic flows?

- Think Condensation.
- Condensation has been used anciently.
- There are new Condensation tools.
- New Condensation materials and procedures are being worked on.

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Condensation Approaches

In 1900, while he was engaged in clearing forests in Crimea (Ukraine), Russian engineer Friedrich Zibold discovered 13 large conical tumuli of stones, each about 10,000 feet square and 30-40 feet tall, on hilltops , near the site of the ancient Byzantine city of Feodosiya. Because there were numerous remains of 3-inch diameter terracotta pipes about the piles, leading to wells and fountians in the city, Zibold concluded (albeit allegedly incorrectly, according to Beysens, et al.) that the stacks of stone were condensers that supplied Feodosiya with water. Zibold calculated that each "air well" produced more than 500 gallons daily, up to 1000 gallons under optimal conditions.

Air Wells - Methods for Recovery of Atmospheric Humidity by Robert A. Nelson

- **Belgian inventor Achille Knapen built an air well on a 600-foot high hill at Trans-en-Provence in France, finished in December 1931.**
- **The tower is 45 feet tall. The walls from 8 to 10 feet thick to prevent the ground heat radiation influencing the inside temperature.**
- **Estimated the aerial well will yield 7,500 gallons of water per 900 square feet of condensation surface.**
- **With 325,851 gallons per acre-foot, this implies a 900 foot long 45 foot tall air well will generate 1 ac-ft/day.**

Air Wells: Methods for Recovery of Atmospheric Humidity by Robert A. Nelson

Figure 39 ~ Dew Pond:

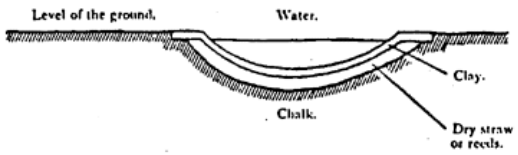

Figure 40 ~ Dew Pond (Oxteddle Bottom, Sussex):

(Photo: Chris Drury)

The water collectors known as "dew ponds" were invented in prehistoric times, but the technology is nearly forgotten today. A few functional dew ponds can still be found on the highest ridges of England's bleak Sussex Downs and on the Marlborough and Wiltshire Hills, and connected to castle walls. They always contain some water that apparently condenses from the air during the night. Gilbert White described a dew pond at Selbourne (south of London), only 3 feet deep and 30 feet in diameter, that contained some 15,000 gallons of water which supplied 300 sheep and cattle every day without fail.

Air Wells - Methods for Recovery of Atmospheric Humidity by Robert A. Nelson

(Photo source: http://www.rexresearch.com/airwells/www.fogquest.org)

A very successful pilot project was established at Chungungo, Chile in 1987. Over a period of 5 years, 94 fog collectors were constructed atop 2,600 ft. El Tofo Mountain, collecting up to 2,000 gallons daily (mean yield: 3 liters/m2/day). The villagers call it "harvesting the clouds". Walter Canto, regional director of Chile's National Forest Corporation, said:

"We're not only giving Chungongo all the water it needs, but we have enough water to start forests around the area that within 5 or 6 years will be totally self-sustaining."

Air Wells - Methods for Recovery of Atmospheric Humidity
by Robert A. Nelson

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Modern Condensation Approaches

WEDEW turns air into drinking water by creating artificial clouds in shipping container

https://www.dezeen.com/2018/11/05/wedew-air-drinking-water-artificial-clouds-shipping-container/?utm_medium=email&utm_campaign=Daily%20Dezeen&utm_content=Daily%20Dezeen+CID_54b9eb332f12236424294a7ff377b048&utm_source=Dezeen%20Mail&utm_term=WEDEW%20turns%20air%20into%20drinking%20water%20by%20creating%20artificial%20clouds%20in%20shipping%20container

http://technology.newscientist.com/channel/tech/dn12923-dewharvesting-web-conjures-water-out-of-thin-air.html?feedId=online-news_rss20

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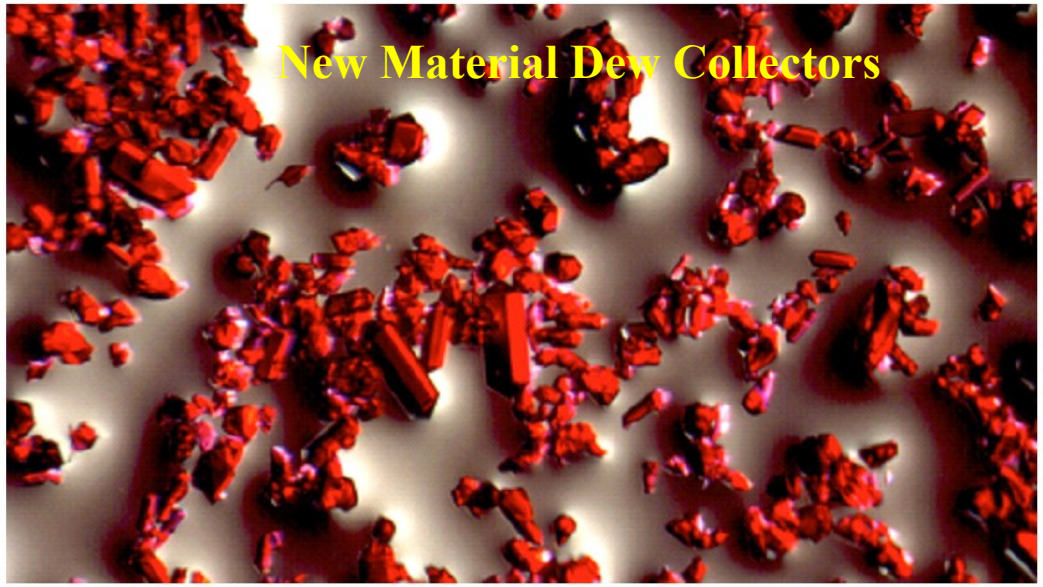
Two New Condensation Tools

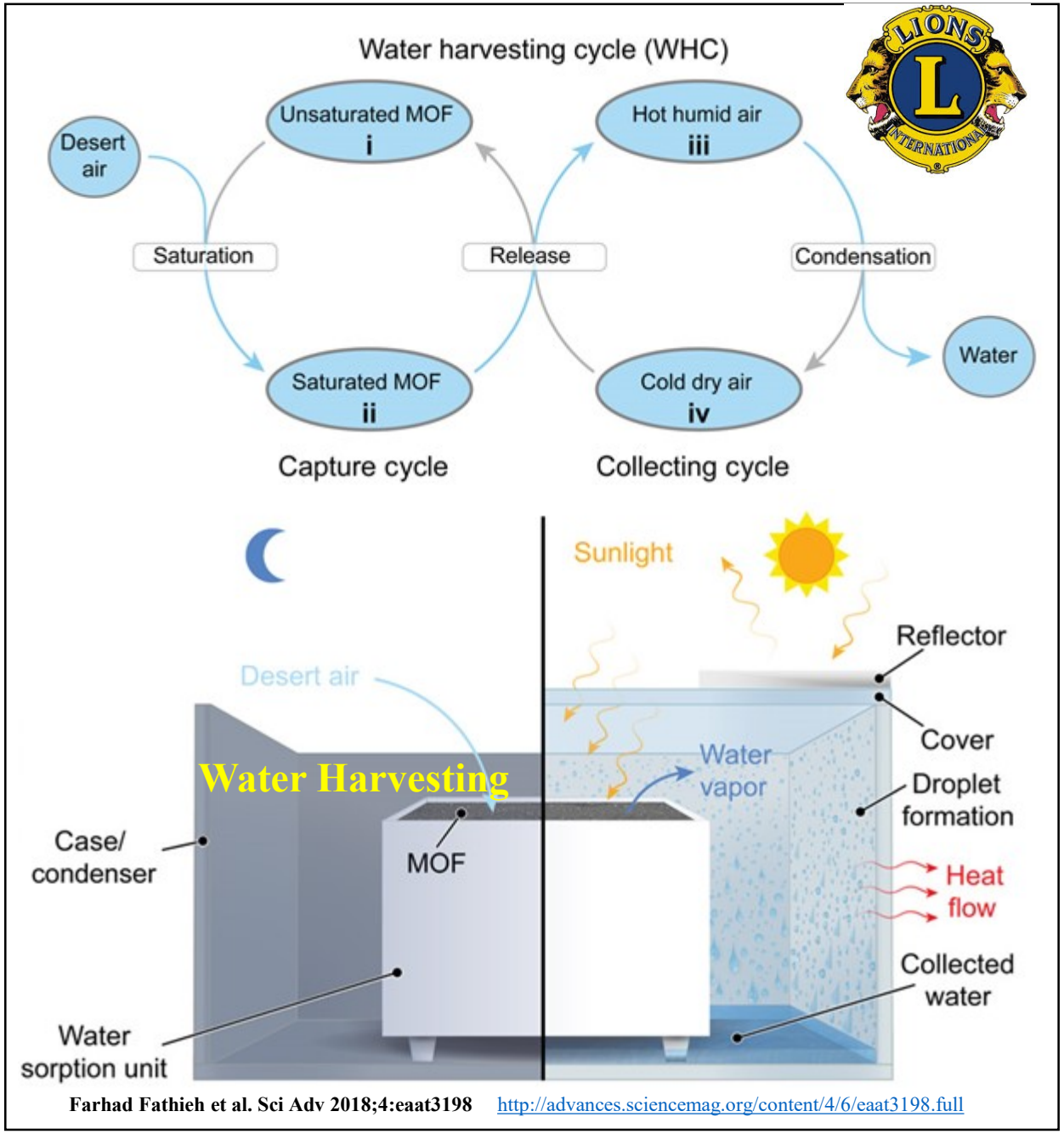


Crystalline materials similar to these can now harvest water vapor from the air.

YAGHI LABORATORY AT UC BERKELEY

This new solar-powered device can pull water straight from the desert air

By Robert F. Service Apr. 13, 2017, 2:00 PM



Farhad Fathieh et al. Sci Adv 2018;4:eaat3198 http://advances.sciencemag.org/content/4/6/eaat3198.full

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Deviated Wells bring water from the Top of the Mountains to the Valley, and turbines, will provide a new energy source.

- USGS and UGS Models do not include consolidated rock.
- There are ways other than priority reallocation to solve water issues in Cedar Valley.

12 Hydrology and Simulation of Ground-Water Flow in Cedar Valley, Iron County, Utah

http://www.walden3d.com/IronCounty/CedarValleyWater/pdf/0508_Hydrogeology-Groundwater_Flow_Iron_County_Utah.pdf

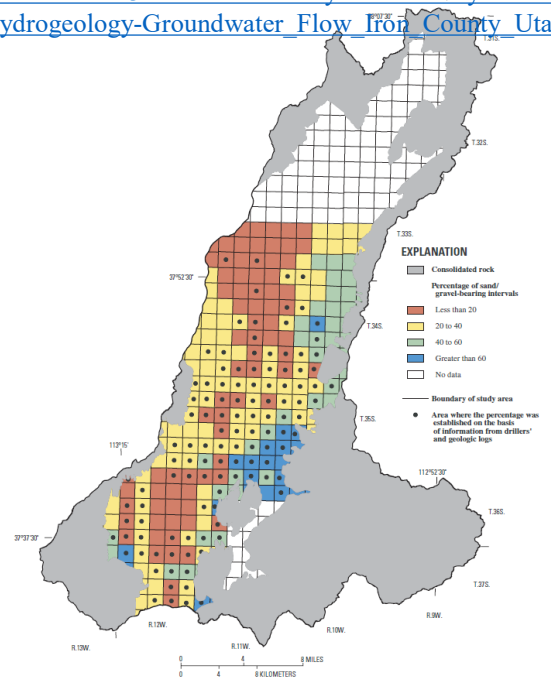
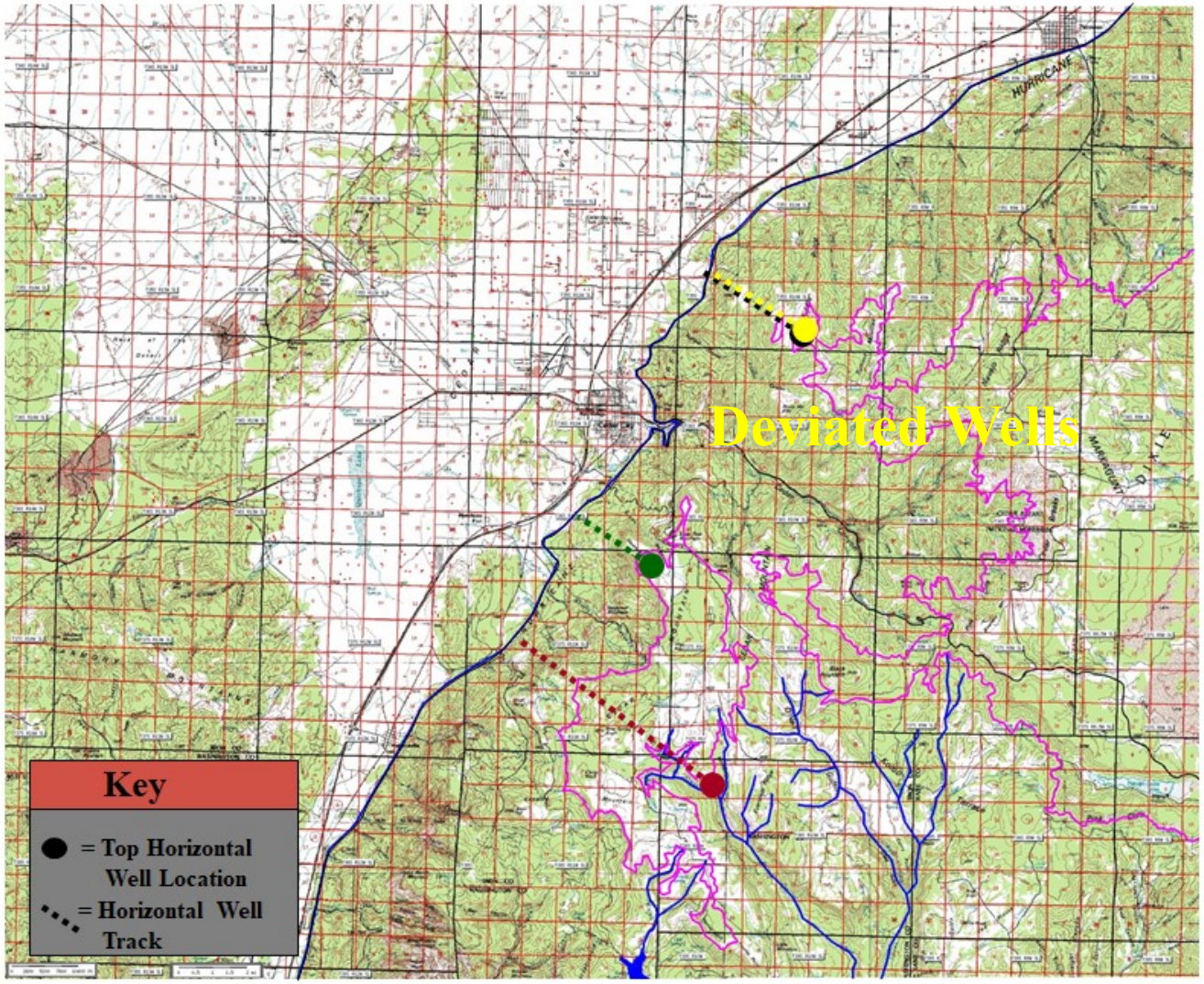


Figure 4. Estimated percentage of sand/gravel-bearing intervals in the unconsolidated basin fill, Cedar Valley, Iron County, Utah.



Source = Condensation Ponds then 4 mile deviation over 3,000 foot drop

Source = Condensation Ponds then 3 mile deviation over 3,000 foot drop

Source = Crystal Creek Confluence 7 ½ mile deviation over a 3,000 foot drop

26 October 2019

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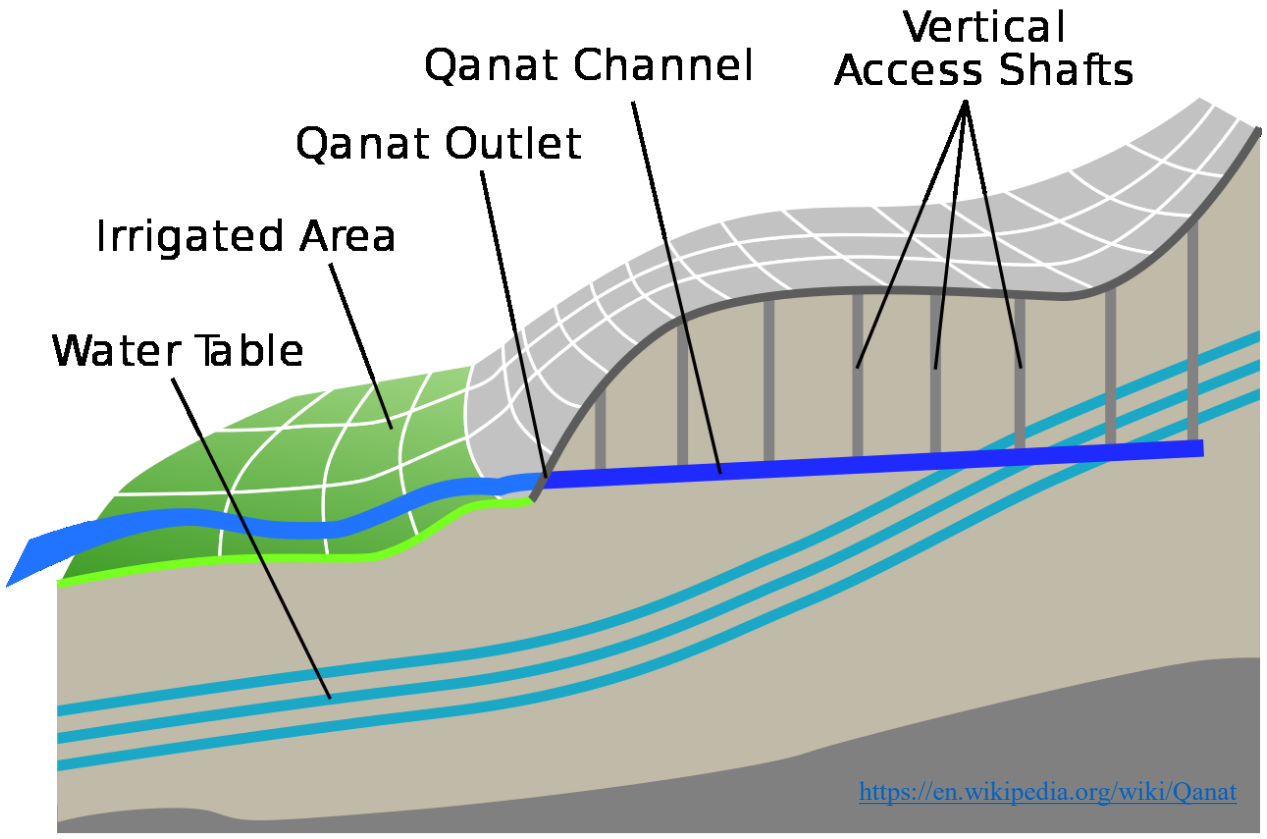
A Qanat is a gently sloping underground channel to transport water from an aquifer to users

- Qanat technology was developed in ancient Iran about 1,000 BC.
- The water in the Granite Vault (think Quartz Monzonite) is a Qanat.



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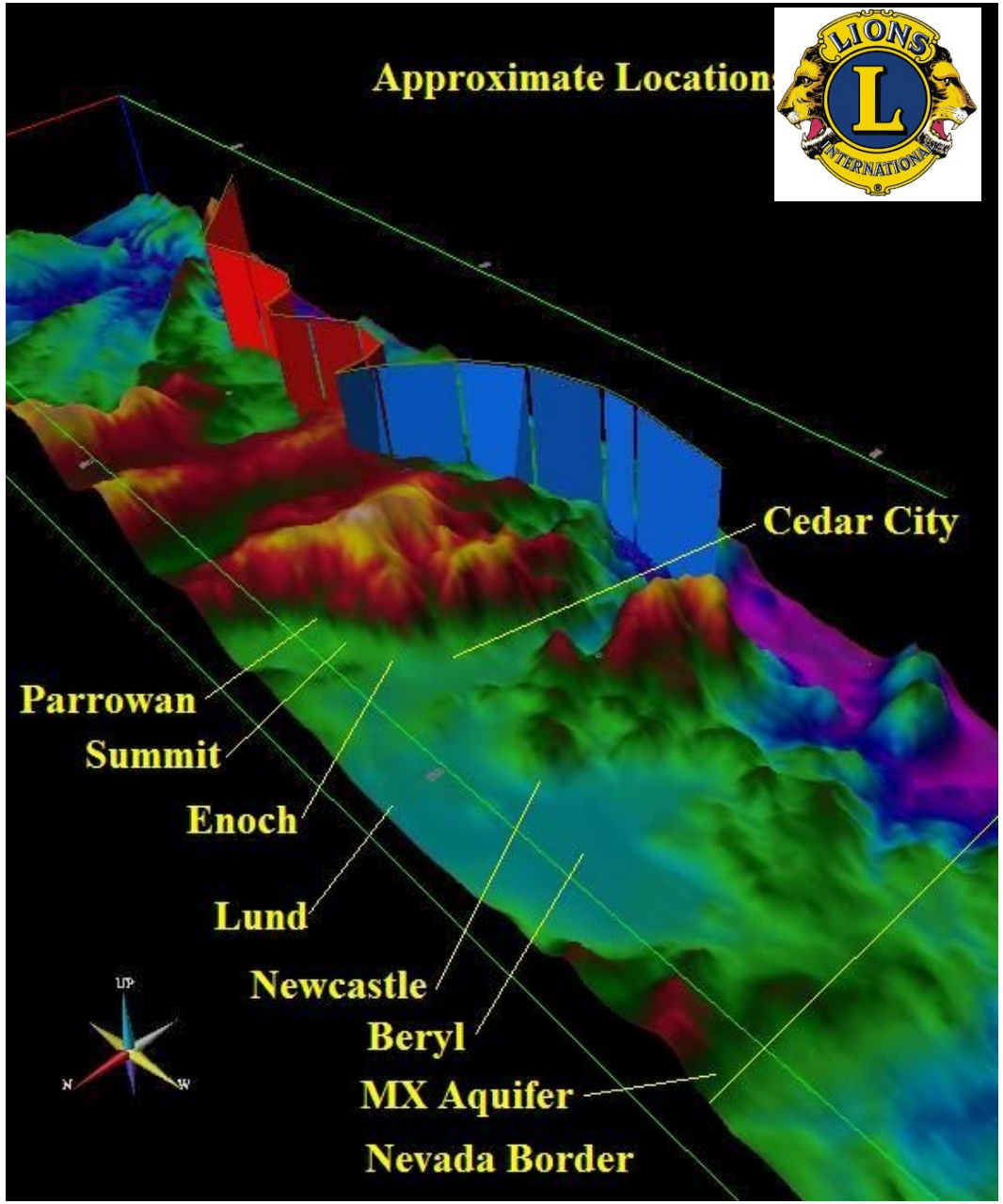
Display for Eldon Schmutz, President of the CICWCD, 2006

Prior to this display, CICWCD was promoting the Lake Powell Pipeline:

- In 2006 CICWCD filed on water in Wah Wah, Pine, and Hamblin Valleys, Beaver County;
- CICWCD has won lawsuits giving them the water rights being sought in Wah Wah and Pine Valleys;
- This is a forward looking, aggressive, and a worthwhile accomplishment.
- However, the current $500 million estimate for a pipeline is unreasonable for the existing tax base.



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Pine and Wah Wah Valley Water ($500 million pipeline):

The only source that will provide new water for Cedar Valley?

- Over 12% Hay and 30% of grassy hays exported overseas (Saudi Arabia, China, etc.).
- This is exporting water from Iron County (Tax this exporting of water to pay for pipelines?).
- A less expensive alternative to building a pipeline is to build a rail line into Pine Valley, and transport water by train.
- This would allow water to be sold and transported to anyplace with an emergency, for example Flint, Michigan.

From Kelly Crane <kcrane@ensignutah.com>
Subject **Summaries from evaluations** 11:00 AM
To Me <rnelson@walden3d.com>, Gary Player
Cc Paul Monroe

Roice and Gary,

Attached you will find copies of your submissions with comments from the experts about their thoughts on the proposals in red off to the right side. The group that evaluated these are people that have been looking at the Cedar Valley for many years dating back to before the establishment of the District in some cases.

As the District moves forward with projects needed for the good of the aquifer and the sustainability of the Cedar Basin they will be required to utilize the USGS and other State Agencies to verify the science of what they are doing. The science from these experts is telling us that the only reliable long term source of water that we have access to is the Pine and Wah Wah valley water. This is the only source that will provide a new source of water for this valley.

Thank you for submitting the proposals and we look forward to a discussion with you once you have had a chance to digest the comments associated with them.

Kelly Crane

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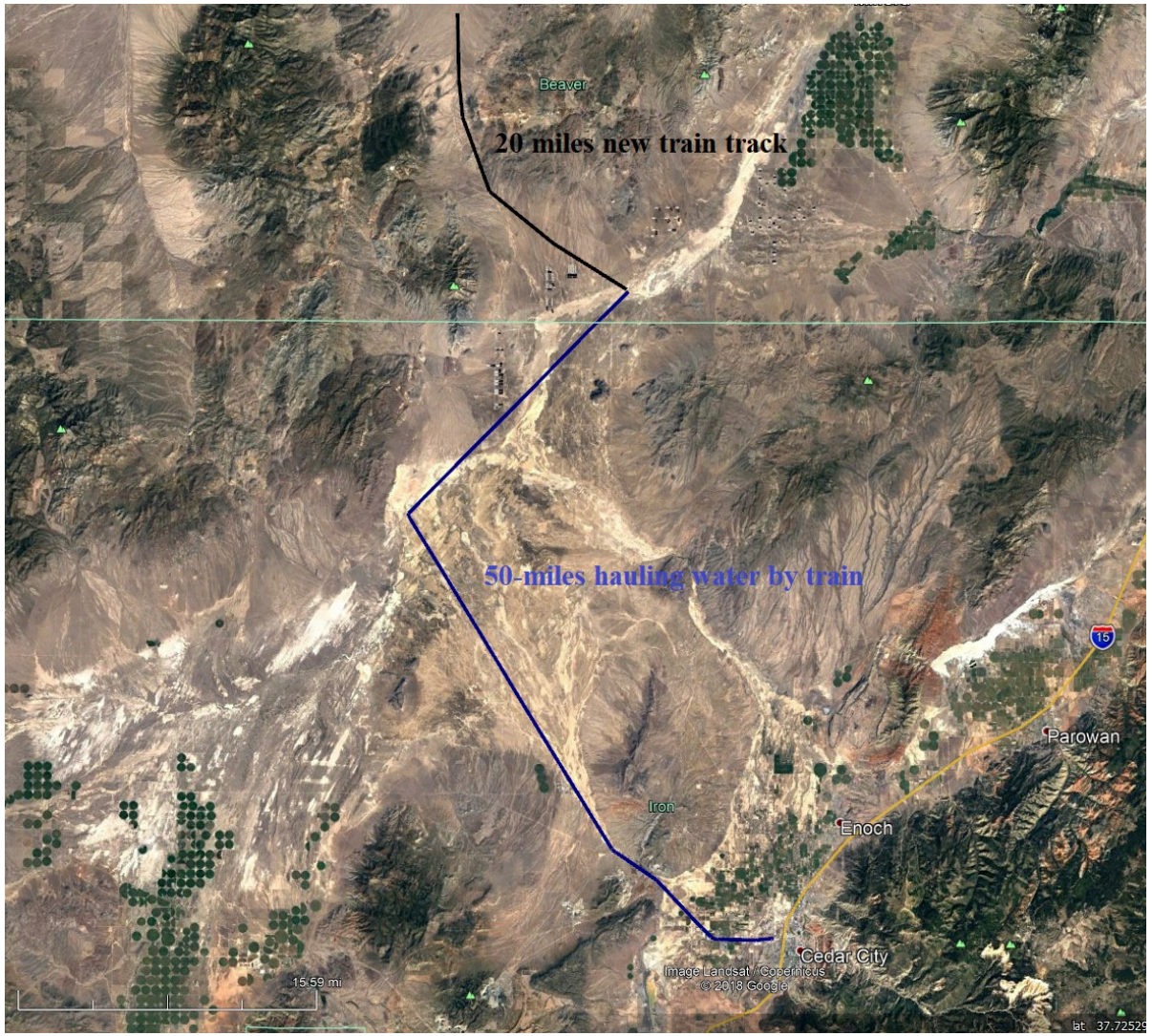
Water Train – A Less Expensive Pipeline Alternative



Assumptions:

- 20 or 30 miles of new track
- 1 or 2 SD70 DC or SD900MAC locomotives
- 40,500-gallon DOT 117 Tank Car
- 100 or 200 Tank Cars
- 1 trip, 300 days per year
- Transporting 2,285 acre-feet or 4,330 acre-feet water
- 5 gallons diesel per mile at $3/gallon

Implies:

- Low Cost $24,725,000 year 1, & $225,000 per year 2-N.
- High Cost $77,500,000 year 1, & $900,000 per year 2-N.
- Water can be transported anyplace a train goes to for humanitarian purposes, or for profit.
- This provides a train for other uses in Cedar Valley, including transporting workers to use water at origin.

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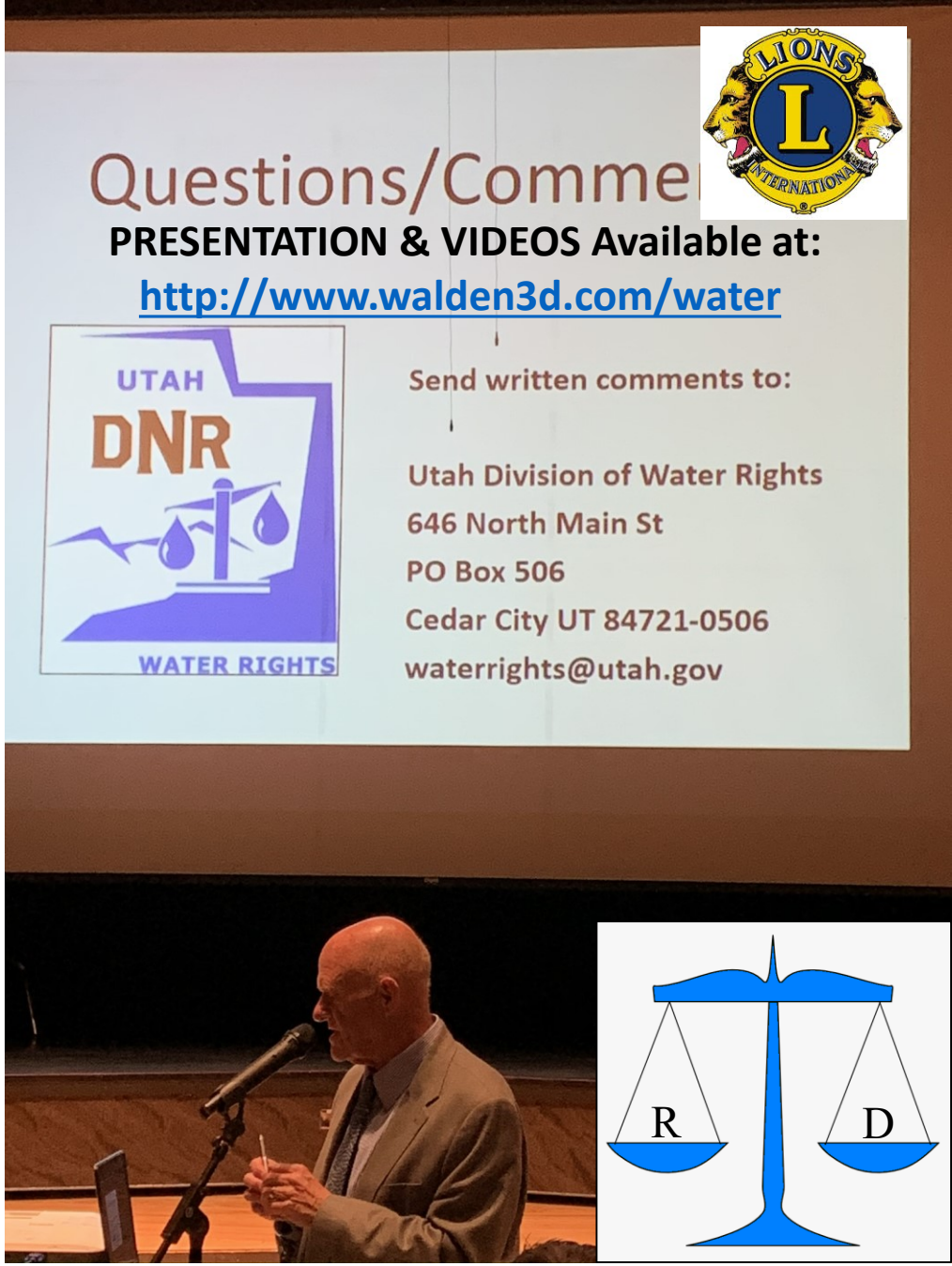
Summary

1. Limit the mandatory reallocation plan to the Cedar Valley Aquifer, where all modeling was done, and not to the entire Cedar Valley Drainage Basin.
2. Transfer Water rights from the Cedar Valley Aquifer to Bedrock Aquifers in the Cedar Valley Drainage Basin - reduce overproduction and the 50,000 acre-feet over-allocation, and any wells to the east can use existing distribution systems to get water to the farms.
3. Age date every well in Cedar and Parowan Valleys, and map the ages to define relationships between the different producing zones within the Valley Fill Aquifers and with any tested Bedrock Aquifers.
4. Fund Bedrock Aquifer test to prove up the bedrock Quartz Monzonite and Cretaceous Aquifers wells (for example, get The Department of Transportation to drain rubble beds at landslide area). Note: by age dating all wells it will show Bedrock Aquifers can be produced under the Law of Capture without impacting Safe Yield to other basins over the next 500-1,000 years.
5. Have the Water Management Committee look into condensation, horizontal drilling, train transportation of water, and other related technologies before creating a $500,000,000 bond.

Notes: 1. Kent Jones, State Engineer, announced his retirement the week he told Iron County residents about the mandatory water reallocation plan.
2. I have a meeting with the acting State Engineer, James Greer, to discuss the comments I provided to their office.



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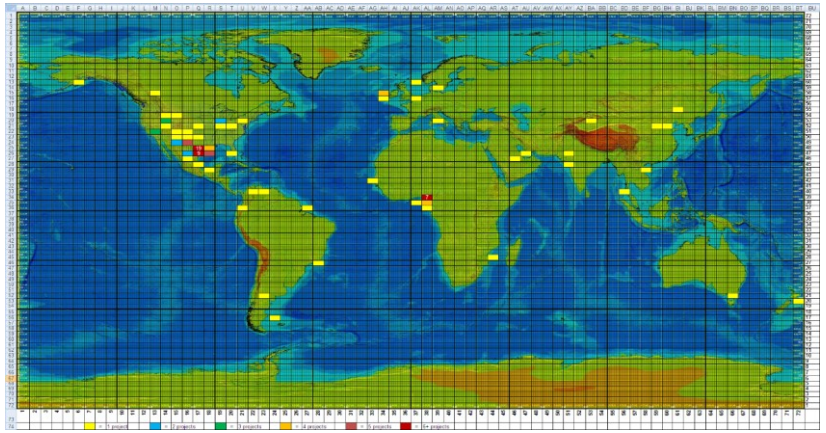
H. Roice Nelson, Jr. Vita

GENERAL STATEMENT

Roice is an experienced interpretation geoscientist who has spent his career working in the international petroleum industry. As a seismic interpreter he has worked over 100 interpretation projects worldwide. Roice has proven success in using, creating, and building new tools and processes for the hydrocarbon exploration industry. In 2008 Roice selected 6 professionals to join with him as co-founders of Dynamic Measurement, LLC (DML), and they have spent the last 10 years laying the groundwork for a new branch in the geophysical service industry: lightning analysis.

As the initial founder of Landmark Graphics, Roice designed the interpretation software, and created a university program which placed advanced interactive interpretation systems in many universities worldwide to support research and teaching. He taught courses on interactive interpretation and new technologies for Landmark and for IHRDC all over the world. He also has a consulting company (W3D) and an exploration company (DRC) to utilize industry and proprietary tools and processes to explore for, develop, and produce natural resources: hydrocarbons, geothermal energy, minerals, etc.

The map below shows locations of many of the exploration projects Roice has worked on since 1970.



W3D Infinite Grid[SM] Spatial Resume showing Roice's interpretation project locations.

ROICE NELSON CHRONOLOGY

Dynamic Measurement LLC, Co-Founder / Manager, Oct 2008-Present
DML established to exploit using lightning data as an on-shore and shelf NSEM (Natural Sourced Electromagnetic Method) exploration tool and to create a new branch in the geophysical services industry.

Dynamic Resources Corporation, Finder / President, Jan 2001-Present
Generate and drill or mine prospects and commercialize new technologies.

Walden 3-D, Inc., Finder / President, May 1990-Present
W3D established as a new company incubator, doing geotechnical consulting and mini-urban design. Primary companies started include DML, DRC, Walden Visualization Systems, vPatch, Advanced Structures Incorporated, HyperMedia Corporation. Completed major seismic interpretation projects on 5 continents, and developed several unique information technologies including The Infinite Grid[SM], The Knowledge Backbone[SM], and the Abbott Atlas.

Geophysical Development Corporation (GDC), Vice-President Interpretation Business Development, April 2004- Sep 2007
Opened GDC China market, and helped build an integrated interpretation business. Interpretation for Ji Dong (3700 B/D, largest find in China in 10 years), Tarim (130 BCM, 3rd largest gas field in Xinjiang), Da Qing, Xing Jiang, and Tuha Chinese Oilfields. Created GDC's Tiles[TM] Studies.

Continuum Resources Intern'l Corp., Co-Founder, Sep 1997-Aug 2000
Demonstrated real-time simultaneous virtual reality collaboration with terabyte databases in London England, Perth Australia, and Houston.

HyperMedia Corporation, Jan 1991-2007, Co-Founder
Designed, built, and produced a UNIX, X-Windows, Motif, Client-Server hypertext engine, sold, and installed site-license to Saudi Aramco.

Landmark Graphics Corporation, Nov 1982-Sep 1992, Co-Founder
Designed user interface of first stand-alone seismic interpretation workstation software, only exploration geophysicist, worked with customers all over the world, established and ran Landmark's University Program.

University of Houston's Allied Geophysical Labs (AGL) & Seismic Acoustics Lab (SAL), Jan 1980-Nov 1982, Founder, General Manager
Managed physical modeling facility at SAL, created 4 new labs.

Mobil Oil Corporation, Jul 1974-Jan 1980, Geophysicist
Seismic interpretation, processing, and acquisition geophysicist.

Amoco Corporation/Pan American Corporation, Summers 1973 & 1970
Summer Intern and Assistant Geophysicist in Denver

EDUCATION

1981, MBA (Master's Business Administration) Southern Methodist Univ.
1974, B.S. Geophysics, University of Utah

OTHER

Published 220+ technical papers since 1973, including the book New Technologies in Exploration Geophysics in English and Chinese. Details available on request, lightning papers can be reviewed at http://www.dynamicmeasurement.com/TAMU.

- Co-Organized 9 SEG Research Workshops, including Remote Sensing Workshop at the Anaheim, California Convention, Friday, 19 Oct 2018.
- Honorary Membership GSH (Geophysical Society of Houston).
- Enterprise Award SEG (Society of Exploration Geophysicists).
- Key Professional Societies: AAPG, EAGE, GSH, HGS, and SEG.

PROFESSIONAL REGISTRATIONS

American Association of Petroleum Geologists Number 476651
Texas Professional Geoscientist #5120
Louisiana Professional Geoscientist #879 (not active).

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