

To: Teresa Wilhelmsen, State Engineer

From: Citizens' committee regarding Sand Hollow Groundwater Study 04/02/2025

Our Motive: Good faith effort by us to be responsible water users. We want to have the safe water yield estimated as closely as possible so that we can maintain the natural aquifer. We have a number of questions and concerns in regard to the current study being undertaken of groundwater in the Sand Hollow basin.

Summary of issue:

From the letter submitted to the State requesting the study: "The District believes that excessive withdrawals from the Sand Hollow Aquifer are impairing their water rights now and that a groundwater management plan is needed to help prevent impairment going forward." City of Hurricane and City of St. George joined in the request.

It appears that the District assumes the aquifer is being overdrawn by users other than the District based on safe yield estimate of USGS study compared to "paper" water rights.

The Sand Hollow Basin is unique and thus more study is needed to accurately define the basin and its geology, including but not limited to faults, fissures, and caliche shelves. We also suggest that sources of water that recharges the aquifer is not included in the USGS study. The USGS study concludes safe yield is 2100 acre-feet which would mean the aquifer has been overdrawn since 1969. We believe there is evidence that the aquifer has been stable for decades after that. A correct water rights list needs to be compiled that shows water users currently using water, and does not include rights being petitioned to be moved into the basin. Determining a correct safe yield is vital to small water users. Some users have rights as small as 1 acre foot and a reapportionment and reduction in their water right unfairly impacts such users. The District and the City own the vast majority of water right in this basin and we ask the State to consider making any adjustments needed in apportionment on a percentage of water right owned, rather than across the board. We also need to identify any users who are grossly drawing over their water right.

Below we have summarized the meeting held on the above date and added as much information as we could in terms of study references and well log data, as well as an anecdotal historical summary.

HISTORICAL DATA: Historical Summary:

Anecdotal evidence: Some people recall enough water to grow tamarack at the base of the rock that is now the island in the reservoir and possibly water markings on the rock. Dale Wilson, whose father Wayne Wilson was extensively involved early in the Water District and plans for

the eventual reservoir, says he is happy to talk to the State Engineer to provide historical context. Dale is 92 but remembers a lot. His phone number is 435-635-4603.

Tom Marston, USGS, said it was his understanding that the water level under the reservoir pre-construction was approximately 100-150 feet.

Well data, logs, etc.: We request additional time to gather data from smaller users over the period of time prior to building the reservoir to compare to data since reservoir construction. Initial small user well data and data from Hurricane City west well shows static water levels and recharge have remained stable for up to 50 years, including pre and post reservoir. Could we present that data in June at the next meeting?

Here is what we have so far.

Carson's sounding measurements of the center well east of 3400 West at about 2012 South.

12/29/2002	42'
05/31/2003	65'
06/30/2003	49'
01/02/2004	38'
06/30/2004	45'

Thompson well just to the west has been 35-39' with draw down to 70' during irrigation for the last 40 years. This is a 200 foot deep well.

Unable to find minutes from hearing held prior to State granting RC004-001. However, those of us that were there remember being told the reservoir was being designed in a manner that it not interfere with the natural aquifer. We have to assume our water use would not then impact the District's recharge water right.

Also see:

Sand Hollow Reservoir Project Report 1997; Greystone.

Groundwater Resources of the Virgin River Basin in Utah, 1987, Calvin G. Clyde

DISTRICT CONTENTION THAT OTHER WATER USERS ARE IMPAIRING ITS WATER RIGHTS:

Condition 5 of the Memorandum Decision

- Memorandum of Understanding pg 2, Amended Order of the State Engineer application to recover ground water RC004-001, page 2, and Solomon 2005

pg 4: "In order to be efficient, an Aquifer Storage and Recovery System must recover water before it moves laterally beyond the capture zone of recovery wells." Pg 5: "Recharge water stays in the capture zone 10-40 years".

- If district is pumping recharge water as recommended, we do not understand how they are losing recharge water due to other users over-drawing. Dr. Solomon's study concluded that, "on the basis of net input and net withdrawal of 15,000 acre-feet as proposed, all measurable ground water effects would occur within the boundaries of the applicant's project properties and would not likely be evident at the protestants' wells and properties."

- Pg 5: applicant (WCWCD) "proposed that at the end of 25 years the applicant would then accept a 10% reduction of the annual recharge based on the principle that the first water in is then the first water out." That was amended in 2018 to change specific reduction amounts to excluding "losses." How is District documenting "losses" and is the method comprehensive of all possibilities or are some data assumed?

- We ask that more study be done to look at possible sources of loss other than over-pumping by water users.

- We request verification that the District is not over-pumping its water right out of recharge water, not over-pumping its water right in the natural aquifer, and not "trading" recharge water for water in the natural aquifer.

- **CONCERNS ABOUT STUDY DATA:** Static water levels over time can be used to determine safe yield and that the natural aquifer is not being drawn down over time. State said they would be appreciative of any well data we have regarding water levels. We believe the benefit of this data is that small users are more randomly distributed and may give more accurate picture, even though data is collected less consistently.
- Monitored C42-14 and wells in close proximity are interconnected by pipes and these wells currently and for the last 3-4 years have been used by construction companies to fill water trucks. There is no period of rest, as there is with agricultural water use, to allow static levels to return to an accurate state. Wells have also been used over the last 10 years or so to water acres of feed grass, acres of melons, as well as acres of sod which is also virtually year-round use. The melons are gone but there is now stock watering. None of this water use is metered. Using this well for study is probably not an accurate source of aquifer level data.

SAFE YIELD: Estimated to be between 2,100 acre-feet (USGS model) and as much as 8,500 acre-feet (LRE study).

- How do we find and accurate safe yield? What can small users do to help? WCWCD and City can afford to take percentage cuts. We cannot. Safe yield must be accurate; therefore, much more data is needed.
- If safe yield in the basin is actually 2100 acre-feet, does that imply that there is not enough water to support the thousands of homes that are on the verge of being built in the basin? Is need for culinary water driving this possible reapportionment?
- “Model Limitations The numerical model is a simplified representation of the groundwater system and includes limitations regarding the simulation of natural recharge, uncertainty in hydraulic conductivity in areas far from the reservoir, assumptions regarding discharge to the Virgin River, the use of an equivalent porous media model to simulate preferential flow in a fractured dual-permeability aquifer system, the assumption of uniform storage properties, not including the possibility of upwelling higher-salinity groundwater as a form of recharge, and the simulation of withdrawals from shallow drains using the head dependent Drain package. In this model, natural recharge as infiltration of precipitation was set to values obtained from Heilweil and McKinney (2007) rather than adjusting it during parameter estimation. Also, average long-term recharge rates were assigned rather than accounting for seasonal and annual variability.”
- We also wonder if pond scum sealed off bottom of reservoir given the warm water and the algae growth? (Swimmer’s itch) or if clay used to line reservoir has prevented infiltration?

CORRECT BASIN INFORMATION: (State suggested these questions were more appropriate for USGS. Mr. Marston was out on leave the week of April 7-11. We have been unable to speak with him regarding these questions. We request additional time to address these issues.)

- Study area changed from map of previous studies. What was the reason for expanding study area to the east but not to the west or south, and to exclude Sand Hollow Resort where there is known high water table and Turf Sod Road, and to include Bench Lake area and east Hurricane. Geology did not change. Why did study area change? Would that State consider a study using LIDAR? LandSat mapping?
 - Is there loss along faults along east shore?
 - Frog Hollow drains area on the east of the Hurricane fault. Should this water be added to recharge (and thus safe yield) of natural aquifer?

- Jason Campbell asked if the Bench basin is separate from the lower area below the 3000 ft ridge

LRE study states: “However, we believe that some aspects of the natural system are not accounted for in the model.”

- **Geology:** From documents provided in meeting, it appears recharge water has only travelled a small distance from reservoir and may be leakage through the dike. USGS says it estimates it will take up to 650 years for recharge water to move from reservoir to River on the north. Water studies can date water and identify natural aquifer versus recharge water. Will this be done? What did boreholes show about fractures?
- Kayenta and Springdale sandstone not included in study as other sources of water storage capacity. Recharge water could be lost through fissures in the Kayenta on the west and south. Has there been study of the springs along the Virgin in this area?
- How will volcanic flow in the northwest part of the study area affect flow? Do we need to address that, and potentially lava tubes? What about volcanic areas on the east?
- Is caliche impeding recharge? Is gypsum affecting recharge? Core samples available from wells drilled in reservoir bed prefilling?

CORRECT SOURCES OF RECHARGE:

- “Recharge to ground water in the study area occurs through infiltration of streamflow, infiltration of precipitation, infiltration from irrigation, and subsurface flow from adjacent areas.” WCWCD septic study 1997. Not all these sources are included in the current study.
- Natural recharge does not seem to address water that we assume ends up in the aquifer from percolation of water to the north into deep rock. Not everything that falls on Pine Valley Mountain runs off. What happens to the water that soaks into the rock itself? Many of us remember being told by water authorities that water in the natural aquifer primarily originated in mountains to the north (Pine Valley, Kolob) and eventually soaked into the sandstone and flowed south into the Berry Springs/Dixie Springs area. Is there aquifer flow where Silver Reef formations go under the river? Mines closed when drilled deep enough to be filled with groundwater. We do note the Heilweil study pre-reservoir that indicated flow is from south to north. However, if the flow is south to north, it seems overdraft of aquifer

would be first apparent at Berry Springs, not District wells near the reservoir. If flow is north to south, we would see evidence of overdraft before the District would see it in its wells.

- Questionable data/assumptions about recharge: Need/request data on geology between west dike and river. Is water going to the west because of infiltration into the aquifer, leakage through the earthen dike, or water travelling on a shelf of caliche? There was enough water leak at the southeast corner of Dixie Spring subdivision that a substantial stand of cat tails grew and the District drilled wells to recover abundant groundwater west and north west of reservoir. Sand Hollow Resort does not permit basements because of high water table. This area is not included in the study, but because of the high amount of water moving through this area, we believe it should be looked at as potential evidence of loss from the reservoir recharge.

- Is about the 2950 elevation is where Kayenta starts? Past that everything goes to the river? How do we know? Could water escape into the formation under the river? Is flow in Virgin River the best measure of loss or would it be better in conjunction with other data? Assumption of flow data?

- Evaluating recharge to the fractured Navajo sandstone aquifer in SW Utah 1999 to 2002: (Project Number UT-00-254 Heilweil) "Quantification of recharge to the aquifer has been hampered by the lack of understanding regarding the mechanisms controlling surface infiltration and movement through the unsaturated zone. Of particular importance is determining the role of fracturing and fast preferential pathways in the movement of recharge to the water table." What do we know now that we did not know then?

- Are there fissures that are interfering with recharge? Need to study springs along the river and collect water quality data to determine if recharge water is sheeting to the west along a caliche shelf toward and under Sand Hollow Resort, being lost through fissures, or being lost to the south?

- What if aquifer north of reservoir was pretty much full before reservoir was built? Would pressure from recharge mound raise static water levels in wells away from the reservoir or would water saturate less permeable rock such as the Kayenta to the west/south? Direction of water flow in natural aquifer pre-reservoir. Was it to the south or to the north? If we are over-pumping and flow is to from south to north, would it not first show up at Berry Springs? If flow is north to south, it would show up at reservoir but our pumping would not then be impairing recharge water.

- Was sandstone under reservoir dry prior to construction, thus allowing all recharge water from the reservoir to go to storage? If not, what was the static water

level pre-construction under the reservoir? At the meeting in April, Mr. Marston estimated it to be 100 to 150 feet.

CORRECT WATER USERS LIST: Inaccurate user data: Letter says State identified provisionally 20,000 acre-feet of “paper” water right excluding recharge allocation, yet provisional user list states 11,122 acre-feet of cumulative diversion. Cumulative depletion, which I was told was used in conjunction with safe yield, was 7,439-acre feet. Need to know how much is being withdrawn and by whom. Vast majority of water right is owned by District and the City. Most rights moved in since 1970 are District and City. Small water users will be penalized disproportionately if there is a reapportioning of water right. Who was monitoring this and why has it just now become a problem? See notes above about study well C42-14

Is further appropriation closed by the state so no new rights can be moved into the study area?

REQUESTS FOR STATE TO CONSIDER

- Request State to study geology and aquifer west of study area to the river to rule out water loss.
- Request State study geology to the south of the reservoir. Why has that border changed?
- Request pumping data from WCWCD wells (Hurricane City well data already submitted).
- Request accurate water right list in the study basin.
- Request time and guidance to gather well static water level data from 1960 to present to submit to the State for considering in establishing safe yield.
- Request State to include other variables such as golf course watering, canal company recharge, Frog Hollow water, etc.
- How much water is leaking through the dike and being pumped back into the reservoir? How is this water accounted for? Is it metered?

Meeting attendance

-Presenting: Lea Thompson

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