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THE IGUANA **"First, Do No Harm"**

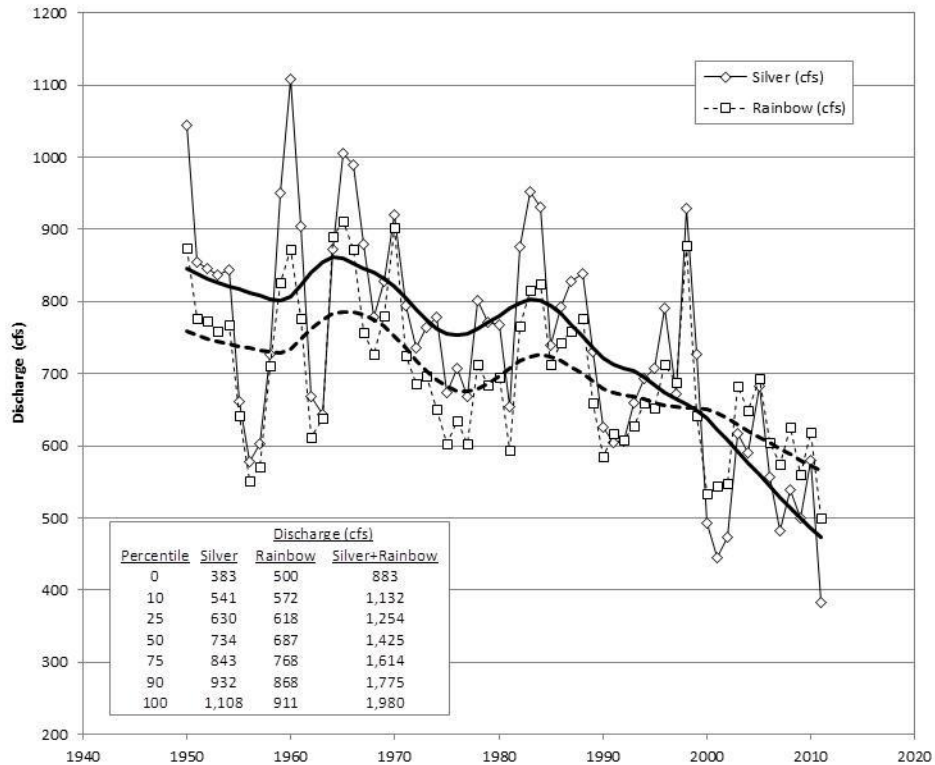
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**BY DR. BOB KNIGHT, DIRECTOR, HOWARD T. ODUM FLORIDA
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"Primum non nocere" (first, do no harm) is commonly referred to as the Hippocratic Oath, the pledge taken by all physicians. Perhaps this oath should also be taken by public servants responsible for the health of Florida's environment.

The absence of normal rainfall in north central Florida earlier this year revealed an inconvenient truth – there is not enough water left in the aquifer during dry spells to maintain the baseflow of our springs. As long as we have average rainfall, the springs keep flowing and it is easier to believe that long-term flow declines in our springs are just a response to a low spot in a multi-decadal weather cycle. But strip away normal rain and what is left? In May of 2012 prior to the onset of the rainy season, Silver and Rainbow springs in Marion County had the lowest flows ever recorded in more than 80 years. Over the past 25 years the average flows from Silver Springs have been declining at a precipitous rate. While last year's drought was one cause for these extreme flow declines, there is convincing evidence that excessive groundwater pumping has made a bad situation worse.

Due to Marion County's limestone geology, the underground basins or springsheds that recharge groundwater to Silver and Rainbow Springs are adjacent and overlap. Flows at both Silver and Rainbow Springs have been declining in magnitude for the past sixty years. Silver and Rainbow flow trends were roughly parallel for the first 35 years of this period. From 1950 to 1985, Silver's flow averaged about 495 million gallons per day or on average about 51 MGD higher than Rainbow's flow.



Annual average flows at Silver and Rainbow Springs and their combined flows for the period from 1950 through 2011. The flows for the two springs tracked each other until about 1985 when they began to diverge. Silver Springs now consistently has lower flows than Rainbow Springs. (data from the U.S. Geological Survey; units are in cubic feet per second [cfs] where 1 cfs is equal to 646,000 gallons per day).

Beginning in 1985, Silver Springs' average annual flow began to decline at a faster rate than the flow at Rainbow Springs. As a consequence of this accelerated flow decline, Silver Springs lost its dominance over Rainbow Springs in 1998. Since that time Rainbow Springs has had higher annual average flows than Silver Springs in all years, averaging about 76 million gallons per day higher in 2011. Since 2000 there has been a long-term average flow reduction of at least 32% at Silver Springs and 18% at Rainbow Springs. Combined, the two springs have lost more than 200 million gallons per day, and have lower flows now than any time in recorded history. This in spite of the fact that annual rainfall totals over the past decade in Marion County are still within the range of rainfall totals recorded over the past 100 years.

These data indicate that there is something very wrong in the springsheds that feed these two first magnitude artesian springs. One plausible explanation was offered by water management district hydrologists in 2010. The groundwater-divide that formerly marked the intersection between the Silver and Rainbow springsheds was not apparent on regional groundwater level maps during dry years as early as 1985. Since Rainbow Springs' water surface is about 12 feet lower than the water surface at Silver Springs, it was suggested by District staff that Rainbow Springs might be "pirating" flow from Silver Springs during dry periods. This hypothesis suggests that the groundwater basin feeding Silver Springs has diminished in size relative to the springshed that feeds Rainbow

Springs. Movement of the groundwater divide between the two springsheds can occur due to a combination of groundwater pumping and reduced recharge of rainfall.

A second plausible explanation for the observed spring flow declines is a regional lowering of the surface of the Floridan aquifer due to a combination of lower rainfall and increased groundwater pumping. The U.S. Geological Survey, the Florida Geological Survey, and the St. Johns and Southwest Florida Water Management Districts have all documented regional aquifer declines in north and central Florida over the past 40+ years. Lower aquifer levels equate to lower spring flows. The key question is: what is the principal cause of these aquifer declines – less rainfall or more pumping?

In May 2012 the Florida Springs Institute brought the accelerating declines in flow at Rainbow and Silver Springs to the attention of the Secretary of the Florida Department of Environmental Protection and to the governing boards of the two responsible water management districts. The response by these state agencies was encouraging since they pledged to work together to develop a thorough understanding of what was happening to the flows at these two first magnitude springs. The agencies began sharing and comparing rainfall, aquifer level, and spring flow data in July 2012 and developed their preliminary findings for public announcement in late August 2012. In summary they concluded that:

- There is a strong decline in both cumulative rainfall and cumulative spring flow at Silver and Rainbow Springs over the past fifty years, illustrating the significance of rainfall to maintain spring flow.
- Water management district models indicate that existing estimated human groundwater withdrawals account for approximately 1% of the long-term average flow reduction observed at Rainbow Springs and about 5% at Silver Springs. The majority of spring flow change at Rainbow is due to changes in rainfall. Increased vegetation growth in the Silver River has resulted in an additional flow reduction at Silver Springs of about 67 million gallons per day (about 13% of the historic average flow).
- The springshed boundaries between Rainbow and Silver Springs naturally move in response to rainfall variations and there is little evidence to suggest permanent shifts in their boundaries.

These findings and explanations are unsatisfactory for at least two reasons. First, they assign responsibility for declining spring flows to natural phenomena that are largely beyond human control, and then do not require reduced groundwater pumping to help offset the effects of naturally low rainfall and recharge. Second, they ignore the fact that groundwater pumping from the same aquifer that feeds these two springs has increased exponentially throughout north and central Florida since the 1930s. Human groundwater withdrawals from the Floridan Aquifer were virtually non-existent in the 1930s and have swelled to over 2.6 billion gallons per day in 2010.

The simple facts are:

- The Upper Floridan Aquifer is a single unit extending for hundreds of miles north and south of these springs.
- Groundwater extractions that occur anywhere in the Floridan Aquifer have an effect on water levels everywhere in the aquifer.
- Before pumping began in the early 20th century, most rainfall and runoff that recharged the aquifer discharged as flows to spring runs and rivers at an estimated rate of about 10 billion gallons per day.
- Current groundwater pumping is more than 25% of the estimated pre-development spring flow.

The inevitable logic of these basic hydrogeologic truths is that all groundwater pumping has a negative effect on spring flows. The evidence is that nearly all of the 1,000+ springs in north Florida that have been monitored have flow reductions, and a number of springs have ceased to flow all together. The challenge for wise groundwater management is to accurately estimate the proportion of this observed flow reduction that can be controlled by a society that wishes to preserve the integrity and the multitude of biological and economic services that springs provide. In the never ending absence of certainty about the spring flow loss attributable to pumping, a thoughtful water manager should err on the side of conserving the resource rather than continuing to increase permitted groundwater withdrawals.

Lowering of aquifer levels and the possible movement of the groundwater divide in Marion County is symptomatic of a regional failure by water management districts to use necessary precaution during allocation of groundwater resources. The age old principal of “*Primum non nocere*” (First, Do No Harm) dictates preserving the life of the patient rather than subjecting him or her to additional unintentional damage. Over-exploitation of the Floridan Aquifer within and outside of Marion County is likely resulting in the unintentional transfer of millions of gallons per day of groundwater flow away from Silver Springs and the St. Johns River and towards the Rainbow River and the Gulf of Mexico. More tangible to the public interest is the fact that the lifeblood of Silver and Rainbow Springs is not being protected during droughts, but rather is being squandered to irrigate lawns in one of the wettest regions in the United States.

Wise management of surface and groundwater in Florida is the state’s responsibility. Water resource decisions by law must be in the public’s best interest, be reasonable and beneficial, and must not impact other legal uses. Florida’s water is the state’s “commons”, a natural resource to be conserved for the lasting benefit of all future generations. Nevertheless, consumptive use permits are issued by the State’s water management districts to many private, for-profit enterprises, including farms, mines, electric generating companies, golf courses, and a beverage companies. Consumptive use permits are also issued to public utilities that supply water for public use. In total there are about 27,000 existing consumptive use permits in north and central Florida that authorize the extraction of up to 4.7 billion gallons per day from the Floridan Aquifer. Another million or more domestic self-supply wells also pump water from the underground aquifer.

Florida's natural environment also needs water to survive. The majority of rainfall is needed to nourish more than 30 million acres of streams, lakes, fields, and forests. Research funded by the water management districts has found that significant harm typically occurs to the ecology of springs, rivers, lakes, and wetlands with as little as a 10 to 15% reduction in average water levels or flows. Under natural droughts these water resources have even lower flows and levels, and more susceptible to reductions caused by human groundwater uses. Thus in equitably dividing up Florida's water pie, it is essential to preserve more than 85 to 90% of the water for the natural systems.

Florida's groundwater is neither unlimited nor inexhaustible. Yet, that is the way the resource is currently managed. There is no defined allocation of groundwater between humans and nature. Responsible management to prevent environmental harm dictates quantification of a sustainable water use that first provides enough water to meet the needs of the natural environment and long-term protection of aquifer levels, with only the remainder allocated to human needs. Any other strategy is doomed to over exploitation, declining aquifer levels, and continuing degradation of water resources.

With continued groundwater pumping at current rates it is unlikely that the historic sustained flows at Silver or Rainbow Springs can be restored, even if future rainfall totals surpass historic values. Rates of groundwater extraction need to be reduced throughout the entire Floridan Aquifer. No new groundwater consumptive use permits should be issued until water managers and the public agree on a level of use that protects our springs and aquifer.

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