March 24, 2008

The Honorable Congressman Raul Grijalva
Chairman of the US House of Representatives
Subcommittee on National Parks, Forests, and Public Lands
1440 Longworth HOB
Washington, DC 20515

Dear Congressman Grijalva,

This letter is in support of the Grand Canyon Watershed Protection Act of 2008 (H.R. 5583). I am a Professor of Hydrogeology at Northern Arizona University (NAU) where I have been studying the aquifers of Northern Arizona and the Grand Canyon region since I arrived in Flagstaff in 1994. I am also the Senior Coordinator of the Arizona Water Institute (AWI) at NAU. The comments in this letter do not represent the opinions of NAU or the AWI, but my own personal observations and interpretations as being a hydrogeologist for 20 years. I have supervised numerous student research projects on the groundwater flow of the aquifers, have developed numerical groundwater flow models to describe flow through the aquifers, and have extensively studied the springs of the Grand Canyon and surrounding regions.

My comments are restricted to my academic specialties in geology and hydrogeology. They are targeted to the issues of 1) recharge to the aquifers, 2) natural discharge from the aquifers through springs, 3) properties of flow within the aquifers, 4) potential impacts from uranium mining on natural recharge and discharge and flow through the aquifers.

<u>Recharge</u>

Although there are multiple and very deep (over 3,000 foot deep) aquifers in the vicinity of the Grand Canyon, recharge to these aquifers tends to be mostly focused and very rapid through faults, fractures, and sinkholes. Recharge to these deep aquifers can be on the order of hours and days, not weeks or years. The faults, fractures, and sinkholes can be pervasive and any enhancement of them can lead to enhanced recharge to the aquifer.

<u>Discharge</u>

Except for a small amount of pumping of water through a few wells, most of the water in the aquifers to the North and South of the Grand Canyon discharge naturally through springs. Recent studies by the USGS and others give us reasonably good estimates of how much water is discharging from these aquifers. These springs in the middle of a very dry landscape support a diverse and rich abundance of plants, insects, birds and animals. They also provide important sources of water for many local tribes and backcountry recreation.

<u>Aquifer flow</u>

Just as recharge tends to be largely focused along faults, fractures, and conduits, so does flow of groundwater within the aquifers. At the same time, the rocks surrounding the faults, fractures, and conduits also contain water which drains more slowly. So the aquifer behaves as a "dual flow" system, with part of the flow system being rapid flow with short residence times (days to 10s years) and part being very slow with long residence times (100s to 1000s years). In the fast flow system, recharge may move from rain/snow on the land surface, through over 2000 feet vertical feet of rock, through 1000s of feet of horizontal flow in the aquifer, to discharge at a spring within a few days to weeks. The springs flow the rest of the year after the rain/snow ends, because of the surrounding unfractured rocks draining water. Most of the Coconino Plateau sub-basin contributes groundwater flow to Havasu Springs, the largest spring discharging from the Coconino Plateau sub-basin (Figure 1). In between Havasu Springs and Blue Springs, the springs of the Grand Canyon discharge from smaller groundwater contribution areas that are located close to the Rim.

Uranium mining impacts on aquifers

Uranium mining in the Grand Canyon region is from breccias pipes which formed due to collapse of paleocaverns in the rocks which now comprise the deep regional aquifer (Huntoon 1996). Uranium is just one of many mineral elements which have been enriched in these deposits (Weinrich and others 1996). If mining or related mining activities were to cause these elements (and uranium) to become mobile and to enter the surface water, or groundwater flow system, they would move toward springs or wells which drain the regional aquifer. Surface water flow is generally focused in the faults and fracture zones as is aquifer recharge and groundwater flow. Some of the watersheds of the region are internally drained, meaning that all surface water flow is focused to a sinkhole that recharges the aquifer, and no surface water flow leaves the watershed as surface flow. Once these elements became mobile through mining activities, they would continue to be mobile through the aquifer and eventually discharge at springs impacting the human uses of water of these springs.

Summary

Although there is a lot of uncertainty in our understanding of flow in the regional aquifers and how it is connected to mineralization in these breccias pipes, what we do know should lead us to exercise the precautionary principle of doing no additional harm. Because there is potential harm to one of the most important natural wonders of the world, and to tribes which count on the water from the aquifers as a sole source of water, it makes good sense to exercise the precautionary principle. There may be the potential for developing mitigation strategies and solutions for potential introduction of contaminants from mining and mining related activities, but it is likely that they would be cost prohibitive for the marginal value of the resource. It seems like it would make much better sense for Congress to encourage investment in developing the abundant renewable wind and solar resources for Arizona which would have positive long-term impacts on the region.

Precautionary principle

Sincerely, Abe Springer

Abe Springer, PhD

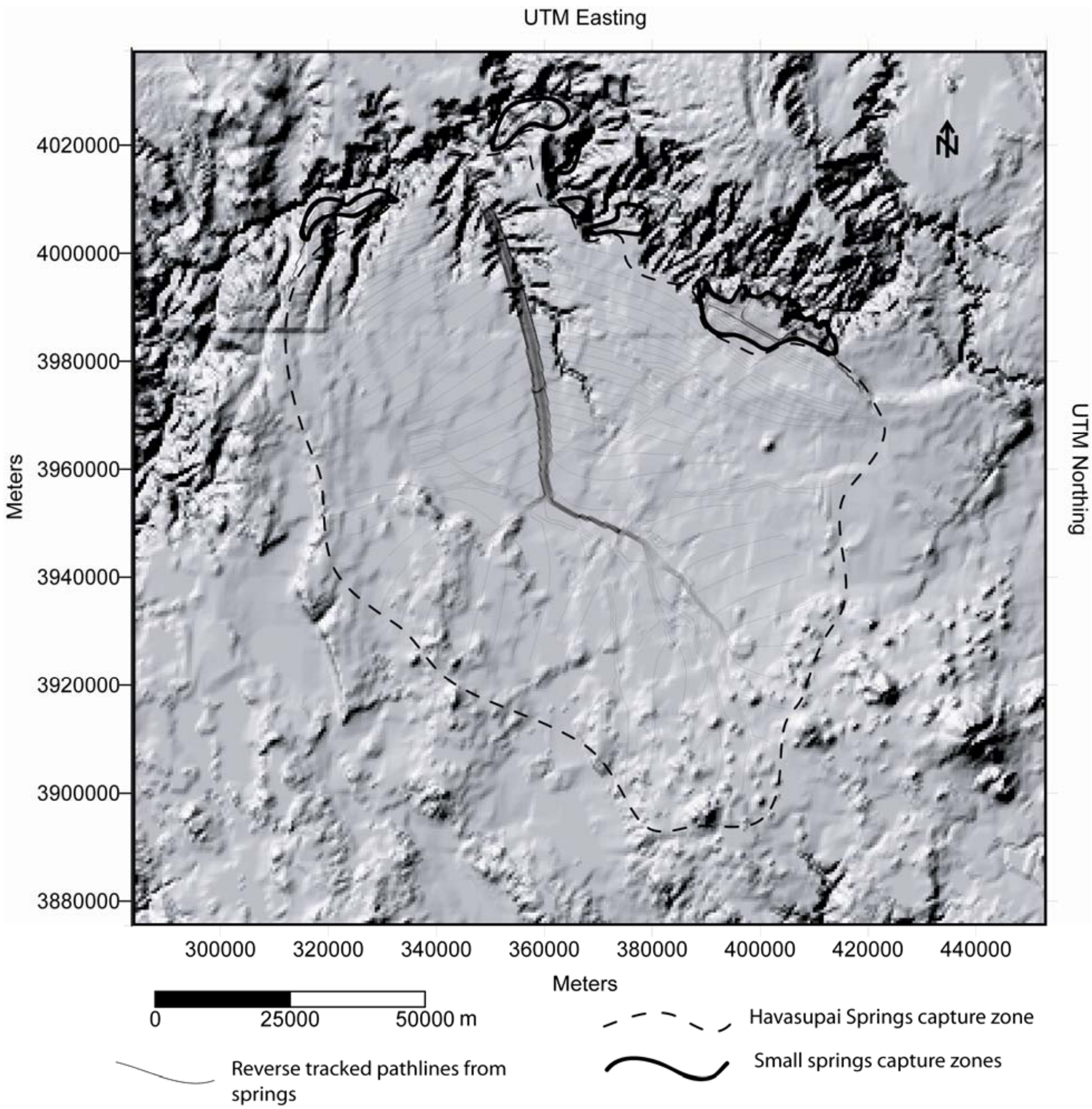

Figure 1. Pathlines and capture zones for Havasupai Springs and small springs of the Coconino Plateau Sub-basin (Kessler 2002).