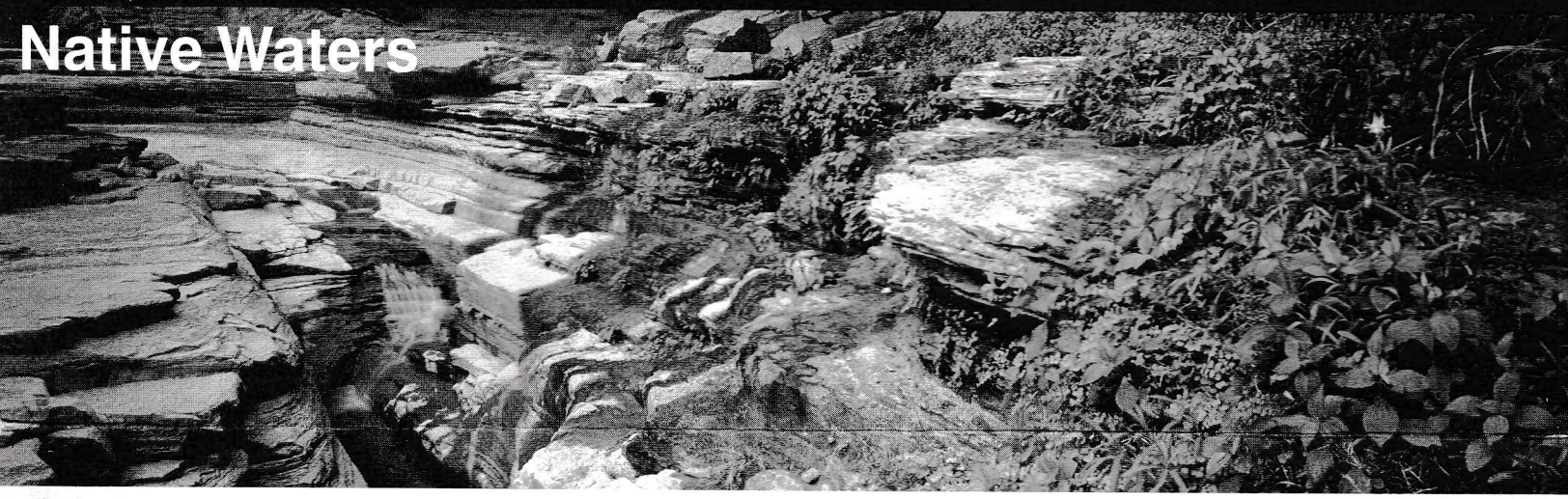
Grand Canyon

National Park
Arizona

Native Waters



"...the Grand Canyon...is the land of music. Mountains of music swell in the rivers, hills of music billow in the creeks, and meadows of music murmur in the rills that ripple over the rocks. Altogether it is a symphony of multitudinous melodies. All this is the music of waters."

John Wesley Powell, 1895

A Study of Grand Canyon's Seeps and Springs

Grand Canyon National Park, the U.S. Geological Survey and the Grand Canyon Wildlands Council are conducting, through funding from the Arizona Water Protection Fund, a three-year study to determine if development outside the park, and subsequent groundwater withdrawals, will effect park seeps and springs—Grand Canyon's native waters.

Currently, all water used on the Coconino Plateau, from Flagstaff to Tusayan, including the water you drink at Grand Canyon, comes from one source: groundwater, either flowing from springs and seeps or pumped from wells.

Grand Canyon's Seeps and Springs Study is part of a larger regional examination of the Coconino Plateau's ability to sustain a water supply for its growing towns.

The goal of the South Rim study, which examines springs between the Little Colorado River and Havasu Creek, is to assess whether the aquifers that supply Grand Canyon's springs and the Coconino Plateau's growing number of town wells are connected. If they are, scientists speculate that water pumped from these wells may affect Grand Canyon springs, but it is unknown when, how, and to what extent. To answer such questions, researchers must gather data to estimate how much water is stored in the Coconino Plateau's aquifers, the age of water currently dripping from springs and how fast the aquifers are replenished.

Predictions indicate that northern Arizona's population and water use will double in the next 50 years, making water in this high desert one of the most important issues facing the region. But the value of springs surpasses the utilitarian to include Grand Canyon's very nature.

In a cool side canyon the sound of dripping waters mixes with the cascading notes of canyon wren. Columbine nod and bob in the slight down-canyon breeze. Tiny rivulets run between delicate shooting stars, maidenhead fern, and scarlet monkeyflower then gather and continue, joining the roiling Colorado where a California condor stoops to drink.

Whether replenishing desert willows or hot, thirsty hikers, the value of the canyon's native waters is immense, the need to protect them strong. Grand Canyon's Seeps and Springs Study aims to provide good science as the foundation for sound management strategies to protect the canyon's native waters.

Plateau Plumbing

Although the Colorado River flows through Grand Canyon's very heart, it is not of this place. It's waters are *exotic*, their source far off in the Never Summer Mountains of Colorado.

Precipitation falling on the Coconino and Kaibab Plateaus creates Grand Canyon's only native waters—waters derived in place—as they percolate through slanting and broken rock layers to spurt later as springs and seeps under the canyon's rim.

Interestingly, no lakes, streams, or ponds form naturally on the plateaus; water is quickly absorbed by the surface—the porous and fractured Kaibab Formation. Below, ancient faults and displacements created by the earth's movement over millions of years form conduits and pockets that collect, and barriers that impede, the movement of water.

On the Coconino Plateau two major regional aquifers (permeable rock layers that hold water) exist. One, the Coconino or "C" Aquifer, forms 1,000 feet below the plateau in the Coconino Sandstone and Toroweap Formation. The second, the Redwall or "R" Aquifer, lies in the Redwall and Muav Limestones 3,000 feet beneath the Coconino Plateau. Most plateau wells drill into these two aquifers.

Aquifers are created when porous rock strata are bottomed by less permeable rock layers—aquitards—that deter further seepage. When water reaches these denser layers, in this case, the Hermit and Bright Angel Shales respectively, it moves laterally along their surfaces until it dribbles and bursts from canyon walls as seeps and springs. (Follow the arrows in the illustration below).

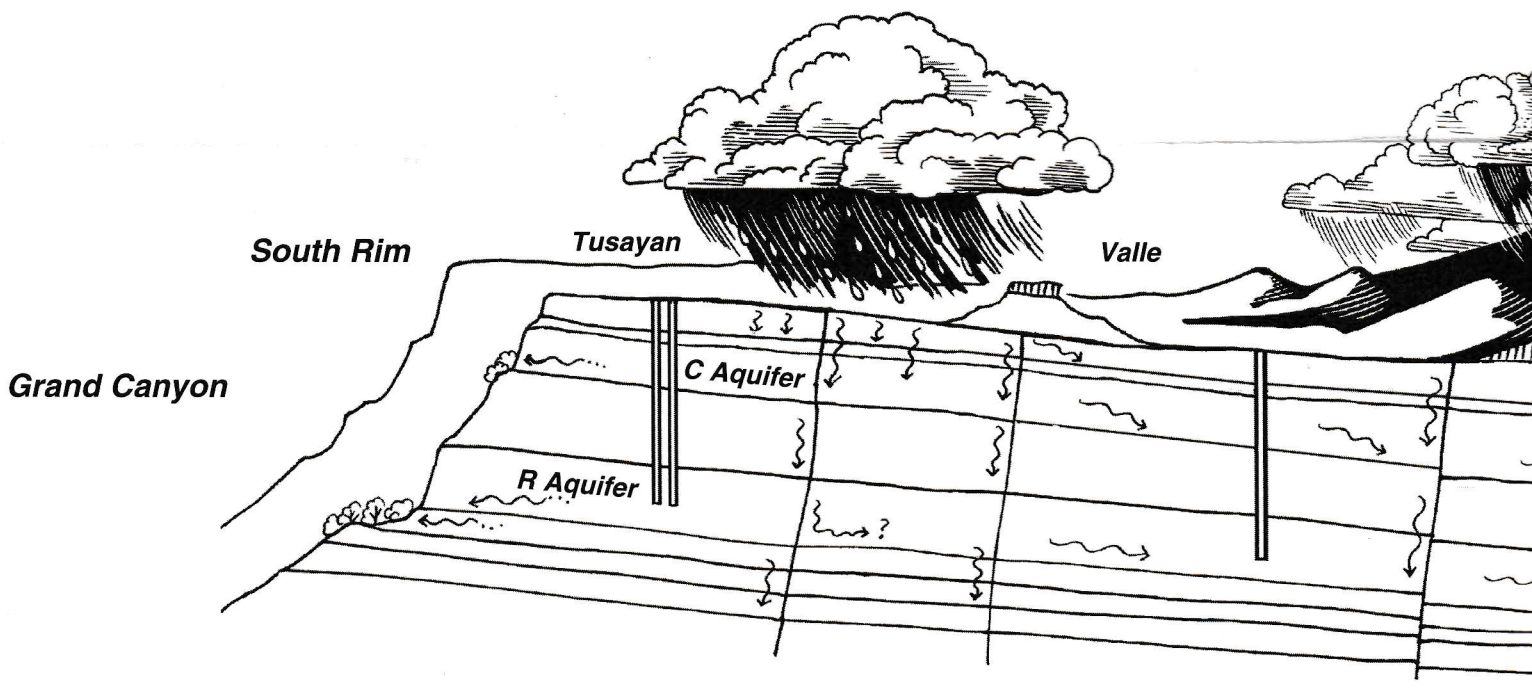
Scientists will also measure water quality and spring flow to establish a long-term baseline. To determine how and when impacts might occur in Grand Canyon springs, researchers must estimate how much water Coconino Plateau aquifers hold, how old the water is that currently drips from springs, and how fast the aquifers are being replenished.

Interestingly, 50-70 years ago, a distinctive chemical inadvertently rained on the Coconino Plateau and percolated into the water system. Tests at springs have yet to show this element—tritium—left behind as fallout generated in the 1950s during nearby atomic bomb testing. Thus, researchers know water flowing from canyon springs is at least 50-70 years old. What researchers don't know is when that water first fell.

Some experts think precipitation recharges aquifers in equilibrium with spring flow. Others wonder if the aquifers store water that fell 10,000 to 20,000 years ago during the much wetter Pleistocene Epoch. If the latter is true, Coconino Plateau wells may pump fossil waters unlikely to be replenished.

The Geology of Native Waters

This illustration reveals what is known about water movement on the Coconino Plateau.



The Biology of Native Waters

You smell it long before you arrive, feel it on the canyon breeze, hear it in the song of yellow warbler, the dizzy seesaw of a tree-frog chorus. You see it far off—the bright lime of cottonwood clutched under the rim; the sudden green of sedges and cattail around a canyon turn. Where springs rush from dry rock, life bubbles.

Although springs make up less than 0.01% of Grand Canyon's landscape, they are its lifeblood. Without water not much would survive the rotisserie of Grand Canyon.

At springs, species concentrate 500 times greater than in surrounding desert lands. Even though springs are the proverbial oasis in the desert for both human and other-than-human, their ecology has not been fully studied at Grand Canyon. The impact of regional pumping on the water quantity and quality of these delicate and rare ecosystems is unknown. Scientists do know that when springs dry up, so do the species that depend on them.

To date, researchers have discovered that each spring is unique and supports a distinctive array of flora and fauna, many of which are endemic (found nowhere else). For example, two South Rim springs are home to the only known white-flowering redbud trees; other springs host myriads of butterflies previously unknown in Grand Canyon.

Grand Canyon seeps and springs emerge from canyon walls usually at the contact between an aquifer and an aquitard. If in a canyon bottom, spring water often disappears into streambed gravel, then reappears downstream in what's known as a canyon floor spring. If the spring emerges on a cliff face, it can form hanging gardens; or if its source has been buried by falling rock, the spring emerges from rock debris on the talus slope below.

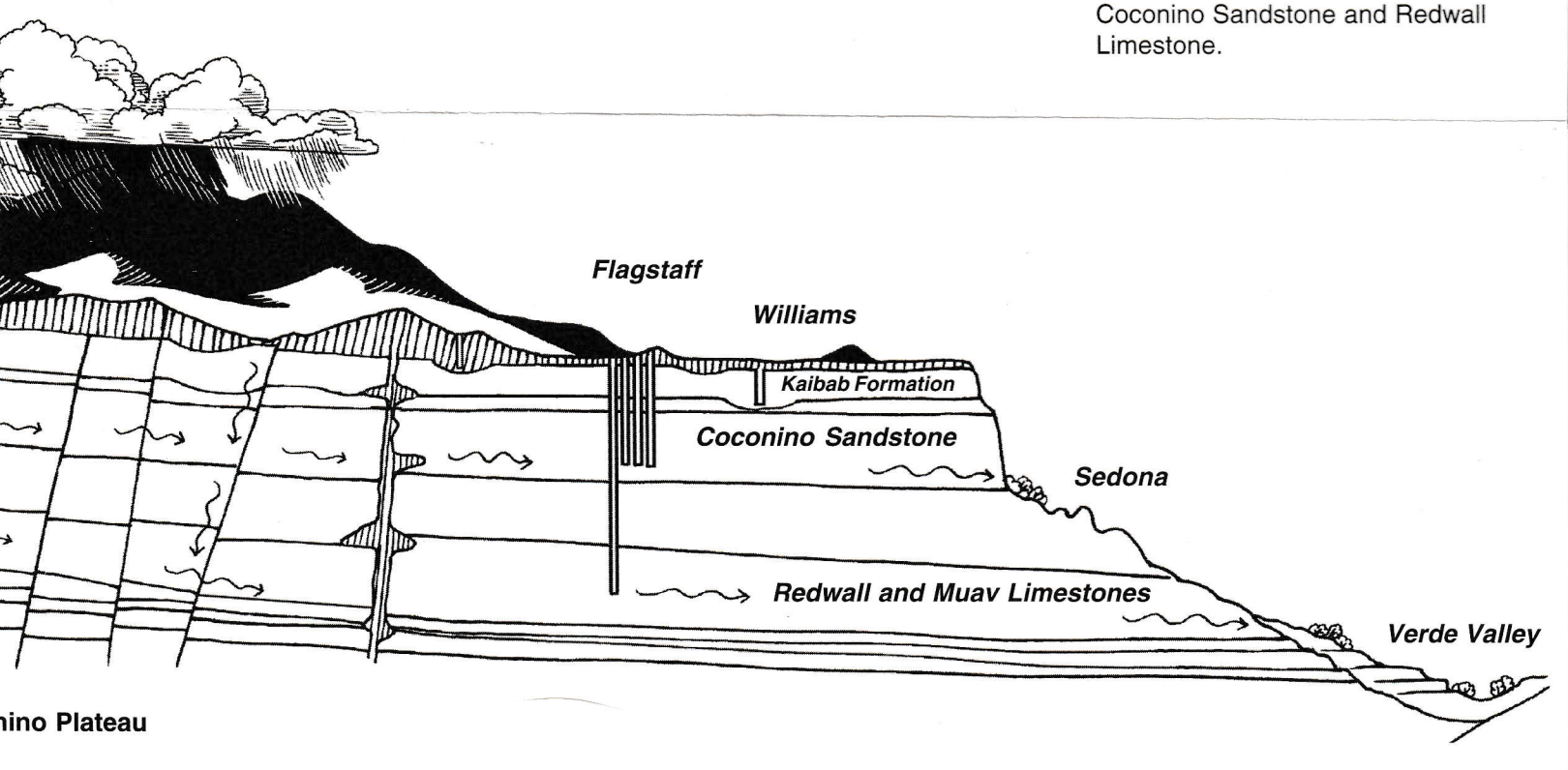
Researchers have discovered that canyon floor springs, vulnerable to repeated flash floods, support an ephemeral biology, one that regenerates after each gullywasher. A hillside spring, protected from such violence, provides the time and stability needed for new species to evolve, and thus creates a biology unique unto itself.

The Seeps and Springs Study will inventory the biotic characteristics of South Rim springs to establish a biologic baseline against which changes can be measured. From this data scientists hope to gain an increased understanding of riparian (streamside) habitats and thus protect Grand Canyon's seeps and springs from possible future impacts.

Redbud

Key

- Arrows indicate water movement
- Single vertical lines show faults
- Double vertical lines represent wells
- Major regional aquifers occur in the Coconino Sandstone and Redwall Limestone.

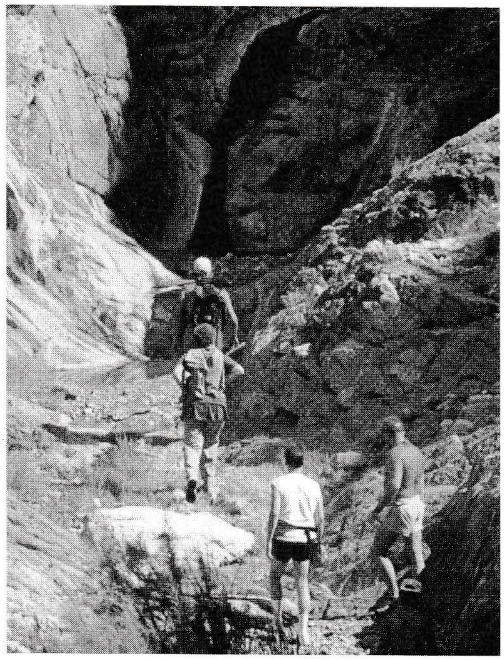


hino Plateau

The Future of Grand Canyon's Native Waters

The coming age of water will have legal, social, and environmental implications for Grand Canyon National Park and northern Arizona. The Seeps and Springs Study will develop management strategies to help minimize possible future impacts on Grand Canyon Springs.

The National Park Service mission...*to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same by such means as will leave them unimpaired for the enjoyment of future generations* enjoins us to protect Grand Canyon's seeps and springs to refresh hikers, nourish the canyon's plants and animals and continue the erosive processes that created this magnificent canyon.



Hikers visit the ephemeral waters of Travertine Canyon.

For Further Information

For ongoing information and study results, contact:
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or visit our website at:
www.nps.gov/grca/water.

The Arizona Water Protection Fund Commission funded this site bulletin. The views or findings represented in this bulletin are those of Grand Canyon National Park and do not necessarily represent those of the Commission or the Arizona Department of Water Resources.

Public Involvement

The National Park Service is interested in your thoughts about issues facing Grand Canyon's native waters. Please complete the form below or use a sheet of paper to send us your ideas.

For example, in what way are seeps and springs important to your park experience? What recommendations or mitigations would you suggest to protect seeps and springs?

Your ideas, opinions, and comments will aid in completion of the final report due out in February 2003.

Mail your comments to:
Grand Canyon National Park
Springs and Seeps Study
P.O. Box 129
Grand Canyon, Arizona 86023

Grand Canyon's seeps and springs are important to me because

I would recommend the following to protect Grand Canyon's seeps and springs

Other Comments

Please use additional paper as needed.

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