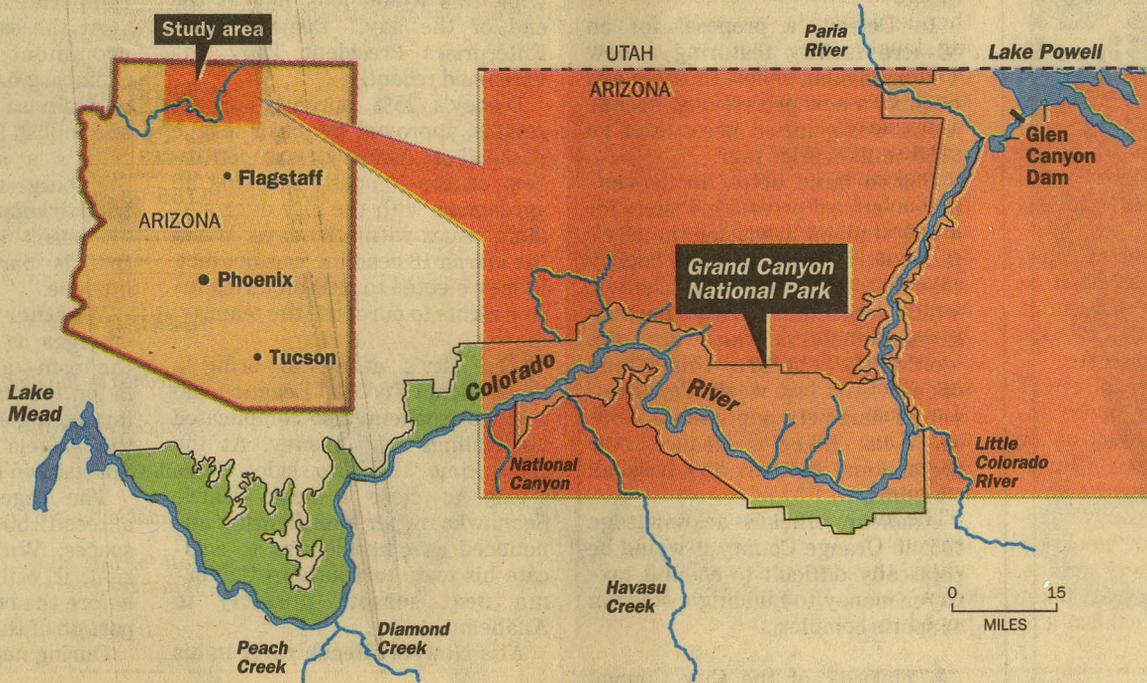


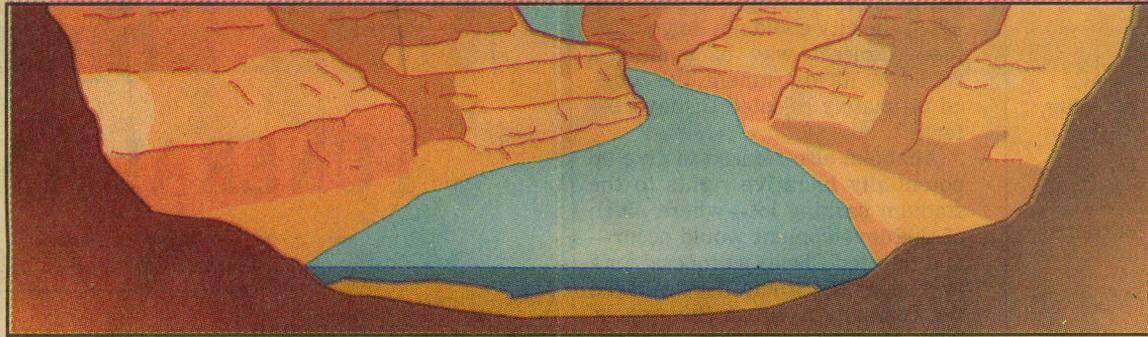
Flooding the Grand Canyon

Glen Canyon Dam interrupts seasonal flooding of the Colorado River and the natural depositing of silt in the Grand Canyon. A weeklong artificial flood that will begin Tuesday aims to restore vital sandbars and beaches by churning up sediment from the riverbed. Officials expect flood waters to deposit the bottom sand on banks in the canyon before reaching Lake Mead, 292 miles downstream.



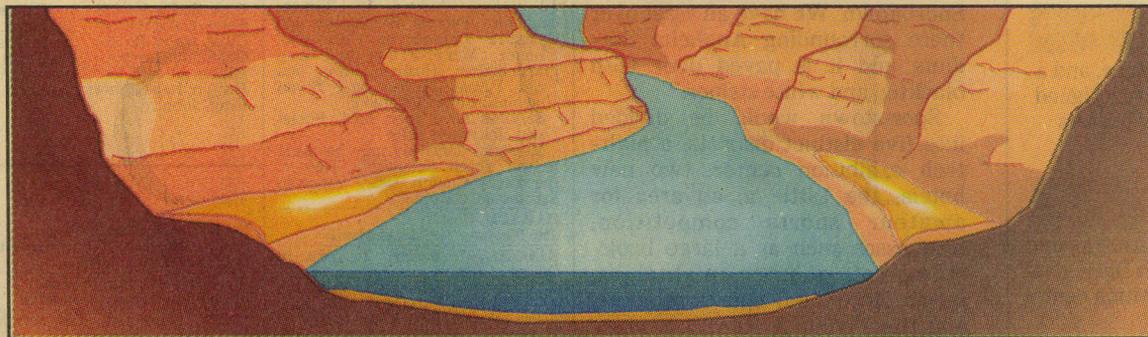
BEFORE THE FLOOD

Sand builds up on the river bottom, instead of on the banks.



AFTER THE FLOOD

Rushing water churns up the sand and leaves it on the banks as the flood recedes.



Continued from A1

There are no homes o
water. Just below the dam lies the r
Grand Canyon National Park. The flo
itself 292 miles downstream in Lake Mead, behind
another, bigger dam.

Still, the discharge of nearly 120 billion gallons of
water over seven days—enough to supply the city of
Los Angeles for nearly seven months—amounts to a
bold experiment. In dramatic fashion, it will test the
notion that by imitating nature humans can begin to
repair the environmental damage done by their big
dams.

Since it was completed in 1963, Glen Canyon Dam
has existed primarily to serve the electrical power
requirements of millions of people in six western
states. The daily manipulation of river flows to serve
fluctuating power demands has taken a harsh toll on
the Grand Canyon.

**'For the first time
at any dam, we are
going to re-create
seasonal flood
conditions to
rebuild beaches
and protect natural
habitat.'**

PAUL BLEDSOE
Bureau of Reclamation

Two species of fish—
the Colorado River
squawfish and the bony-
tail chub—have disap-
peared and two others
are endangered. New
species of introduced fish
have taken to the colder
river. The murky, rust-
colored water that gave
the Colorado (which
means "reddish brown"
in Spanish) its name
runs clearer now, its life-
giving nutrients trapped
in the sediment piled up
behind Glen Canyon
Dam.

Without the natural
floods that used to wash
down the canyon most years, pools that once sheltered
a variety of aquatic life have filled in with debris and
vegetation.

"The canyon and its native creatures evolved in a
highly silted, warm water river that saw annual flood
events," said Pamela Hyde, director of Southwest
programs for the environmental group American
Rivers.

Representatives of the power industry have ex-
pressed concern that the experimental flood will mark
the onset of a new, more costly era in water
management. They say it wastes money to release
more water than the power turbines can handle, or to
send too much water through during the hours when
electrical demand is low.

For others, the torrent of water roaring out of the
dam Tuesday will signal the beginning of a long
overdue healing process. Just as fire can cleanse and
regenerate a forest, a flood can scour and stimulate a
river canyon.

"River systems need to be disturbed," said Bureau
of Reclamation scientist Gordon Lind. "When
you put a dam on a river, you cut down on the flooding
and other dynamic changes that keep things healthy."

Of greatest concern to people who explore the
canyon are the eroding beaches and sandbars. They
have been washing away as the sediment trapped in
Lake Powell no longer replaces sand that is carried
away by the river's flow.

The beaches are a human foothold at the bottom of
this mighty rift in the Colorado Plateau. They are vital
to a \$22-million-a-year river rafting industry that has
taken half a million visitors through the gorges and
rapids of the Grand Canyon.

Grooved into the base of dripping sandstone and
granite walls, sheltered by feathery tamarisk trees,
the fraying ribbons of sand are the only flat land along
much of the river. For rafters, the beaches are the only
places to comfortably camp.

"Over the long term, the canyon could be rendered

inaccessible," said Rob Smith of the Sierra Club's Flagstaff, Ariz., office.

As the beaches peel away from canyon walls, exposing them to the action of the water, other treasures become vulnerable.

Surveys have found 3,500 archeological sites in the Grand Canyon, including Native American dwellings, ceremonial gathering places, fragments of pots and

tools and other artifacts. As the canyon walls lose their footings and banks collapse into the river, experts fear, many of the 475 ruins near the Colorado may disappear with them.

For more than a decade, scientists have been trying to figure out the best way to stabilize the beaches. Since 1991, the daily rates of flow from the dam have been modified in an effort to cut down on erosion.

But those steps did not begin to rebuild the beaches, and that is what government experts hope to start doing.

If the experiment works, the flood will stir up what is left of the sediment on the river bottom—an estimated 12 million tons of sand—and deposit much of it on beaches in the canyon.

But just any old flood won't do.

Too much water moving too fast will simply wash the sand down to Lake Mead. Too little water won't stir up the bottom enough.

Bureau of Reclamation officials who control the water coming through the dam began slowly increasing the flow Friday. According to the plan, by Tuesday morning the dam's power-producing turbines will be handling all the water they can—about 30,000 cubic feet per second. After Babbitt opens the huge overflow tubes, the outflow will reach 45,000 cubic feet per second—enough to fill the Rose Bowl in 7.2 minutes.

That rate will be maintained for seven days and then gradually reduced.

Glen Canyon Dam has let out more water in the past. In 1983, after a heavy runoff, Lake Powell threatened to crest the dam, and water was released at a rate of more than 90,000 cubic feet per second.

The slowly rising water level this week is not expected to pose a danger to hikers or rafters, say National Park Service officials, who do not plan to restrict travel in the Grand Canyon during the flood.

Bureau of Reclamation officials are expecting more than 100 scientists in the canyon to observe. "They'll be in boats and helicopters and hanging off the walls," said David Wegner, the bureau's head of environmental studies at Glen Canyon Dam.

If the experts conclude that the experimental flood has been a success, government officials say they will seek to stage similar events every few years.

Among the onlookers will be scientists working for the Colorado River Energy Distributors Assn., a group of 100 utilities that buy much of their electrical power from Glen Canyon Dam.

Joe Hunter, the association's executive director, said the bureau's efforts to adjust flows to protect the downstream environment will reduce the dam's electrical output 25% and incur \$100 million in extra costs over 10 years.

He said the flood will contribute to those extra costs.

Water for hydropower is not used efficiently if it is expended during hours when it is not needed to meet consumer demands. Even when it is running at peak capacity, generating 1,300 megawatts of power, Glen Canyon Dam won't be able to use all the water that will be coming through when Babbitt throws the switch.

But Hunter said his association won't necessarily come out against future floods.

"We have taken the position that we will live by the science," he said. "If science supports the idea of periodic flood flows, we will accept the verdict."

"But we want to make sure it's the right decision, and that's why our scientists will be there monitoring the effects of this particular flood."