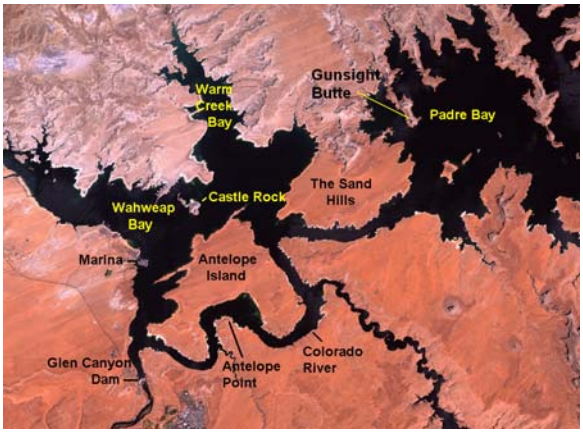
Drought: Lake Powell – Upper Colorado River Basin

Location: Lake Powell, Utah
Date: 1999, 2000, 2002, 2004
Image Source: Landsat 7
Inset Image: Lake Powell, Landsat 7



The Development of Lake Powell

Created in 1963 with the completion of the Glen Canyon Dam, Lake Powell became the second largest reservoir in the United States following Lake Mead. It came into existence as part of a larger project to control flooding on the Colorado River, provide water for the Upper Colorado basin and produce electrical power for the southwest United States. Construction on Glen Canyon Dam was started in 1956 and completed seven years later in 1963, after which the water from the Colorado River proceeded to backup behind the dam to form the lake. In June 1980, after seventeen years, Lake Powell reached full pool size with a volume of 27 million acre-feet (MAF) and a surface area of 266 square miles (689 sq. km.). At full size the reservoir was nearly 186 miles (299 km.) in length with a water depth of 560 feet (170.7 m) at the dam.

Variability in Lake Levels of Lake Powell Since 1980

With Lake Powell being located in an arid region its water level varies considerably and provides a good barometer of water conditions within the Colorado River's 246,000 square mile (637,137 sq. km.) basin. From 1995 through 1999 its water level was above average and as late as September 1999, the reservoir was still 95 percent full. However, precipitation levels in the upper Colorado River basin from October through December 1999 fell to 70 percent below average, signaling a low runoff for 2000 and the beginning of an extreme drought.

The four Landsat true color composite images illustrate the shrinking size of the reservoir between 1999 and 2004. The first image was taken on October 10, 1999 when the reservoir contained 22,876,730 acre-feet of water. The current drought basically started at the time when this image was recorded. The other three images were taken near the beginning of June in the years 2000, 2002, and 2004. By June much of the spring runoff from the snowpacks in the surrounding mountains has made it to the lower portion of Lake Powell. After June the summer and fall inflow to the reservoir generally decreases.

In 1999, Wahweap Bay was at its full extent and Castle Rock Island occupied the center of the bay. Not much change occurred in the bay between 1999 and 2000. On June 6, 2000 Lake Powell's water level had dropped to only 21,385,072 acre-feet, approximately 1.5 MAF below the October 10, 1999 level. By June 12, 2002 the drought had lowered the reservoir to 16,427,414 acre-feet and Castle Rock Island was no longer an island. A land bridge appeared linking the island to the lake edge. Also in 2002, only a narrow inlet connected the upper and lower portions of Wahwaep Bay. By June 1, 2004, the reservoir was at 10,575,179 acre-feet, a 46.2 percent drop from the October 10, 1999 level. A wide land bridge closed the inlet and the two portions of the bay were now separated. Boats maintained in a marina located in the lower section of the bay now must enter the main channel of the Colorado River to reach the upper half of the bay. Antelope Island has merged with the mainland. Warm Creek Bay, just off of Wahweap Bay, shrank considerably within the four-year period.

In 1999 some small islands are located in Padre Bay, which is situated just upriver from Wahweap Bay. By June 2000, only nine months after the October 1999 image, these islands are noticeably larger in area. In the 2002 image some of these islands have coalesced and new islands have appeared as the reservoir's water level continues to drop. By 2004, a large land bridge extends from Gunsight Butte to these islands, making for a continuous land body. By 2002 and especially by 2004, a white line outlines much of the edge of the reservoir. This line identifies exposed land that only a few years before was under water. A rather large section of this newly exposed land appears on the Colorado River directly across from Antelope Point. The water level had to drop 30 feet (9.1 m) to show this area.

Long-term Effects of the Regional Drought

After the construction of the Glen Canyon Dam in 1963, it took seventeen years of normal inflow for the reservoir to reach to full storage capacity. May 1969, when the reservoir was still filling, was the last time that Lake Powell was at the water level seen in 2004. From the 2004 water level, it would take eleven years of normal inflow for the reservoir to return to full storage capacity again. The ground level photographs demonstrate how severe the drought had become; only eighteen months separate the dates of the two photographs. In addition to not being able to provide freshwater to farms and cities, Lake Powell's ability to produce hydroelectricity was in jeopardy. Glen Canyon Power, which operates the dam's power facilities, indicated that if the drought continued, it would not be able to generate electricity. At full capacity, Lake Powell produces enough electricity to power 1.5 million homes, mainly in Arizona and New Mexico.

Interpretive Learning…

1) Locate the states that are in the Colorado River Basin. (Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming).
2) Identify the source(s) of water for the Colorado River within the Upper Colorado River Basin. (An elevation map of the basin might help in answering this question. The water comes mainly from the melt down of large snowpacks in the San Juan Mountains, Central Rocky Mountains, Uinta Mountains, and Wind River Mountains.)
3) Discuss all the ways in which water is used within the home. Conservation of water is essential during a drought. Create a list of all the non-essential water uses in the home that could be stopped or curtailed to conserve water. (The average American uses 150 gallons of home water per day. This figure does not include a home swimming pool.)

Explore More…

Baumann, P.R. 2006. Drought in the Colorado River Basin: Shrinkage of Lake Powell. *Geocarto International*. 21(4) 75-79.

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Sources:

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Carothers, St. W and B. T. Brown. 1991. *The Colorado River Through Grand Canyon*. Tuscon: The University of Arizona Press.

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Topping, G., 1997. *Glen Canyon and the San Juan Country*. Moscow, Idaho: University of Idaho Press.

Acknowledgements:

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