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Grand Coulee Dam

More Powerful Than a Million Speeding Locomotives

By Renee Heiss

It was the Great Depression. Thousands of people were out of work. As the United States recovered in 1933, President Franklin D. Roosevelt signed the National Industrial Recovery Act. As a result, thousands of people were able to find jobs working on construction projects. One such project was the Grand Coulee Dam on the Columbia River in the state of Washington.

(See picture, "Grand Coulee Dam.")

Grand Coulee Dam

The Columbia River rushes through a Canadian province and seven states before it empties into the Pacific Ocean. On either side of the river lies a trail of fertile land. However, farmers could not count on enough rainfall to support their crops. They looked to the mighty Columbia River for their source of irrigation. Although diverting the river into smaller irrigation channels was a good idea, it proved to be too expensive. The farmers' dream would eventually become a reality when construction of the dam began near the head of the Grand Coulee, a steep-walled canyon where the original river once flowed.

All dams serve three purposes: (1) Some water behind the dam is diverted to provide irrigation to the surrounding farms, (2) The water rushing over the dam generates electricity, and (3) The reservoir formed behind the dam provides a recreational area for boating and fishing. Grand Coulee Dam served all of those purposes, but not all began at the same time. In 1941, the first electricity was generated because selling the power would pay for the cost of irrigation pipes. In 1950, the reservoir was completed. It wasn't until 1952 that the farms would receive water from the Columbia River.

Before work could begin on the mighty dam, workers needed to lay new railroad track, improve roads, and construct new bridges so the necessary materials could be brought into the area. Several towns were constructed to house the workers and their families.

Next, the Columbia River needed to be diverted so work could begin on the dam construction. To do this,

workers constructed coffers, temporary dams that allowed work to progress in three stages. First, water was diverted from the west side of the river while construction of the base began on the east side. Then the process was reversed for the other side. Finally, the center section of the dam was built.

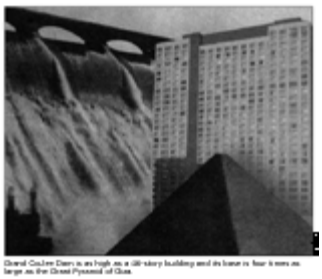
While that process may sound like a logical solution, it was not without some problems. First, the workers needed to progress quickly beginning on New Year's Day of 1935, so the first cofferdam would be done before the spring thaw. The second cofferdam was started in September, but landslides delayed progress. In February of 1936, workers constructed the last cofferdam across the center of the river. They didn't expect to encounter a huge mudslide slipping toward the excavation site.

Engineers developed a unique solution to the mudslide problem. They froze it in place. To do this, they built a refrigeration plant and buried pipelines in the mud. By August, cold water was being pumped into the pipeline, freezing the mud glacier in place. This created a mud dam that was 40 feet high, 25 feet thick, and 100 feet wide. Although the cost of freezing the mudslide in place was $30,000, it saved over three times that much in labor to remove mud from the construction site. The ice dam stayed in place until the foundation for Grand Coulee Dam was completed. Then it was allowed to melt and flow down the bank into the riverbed.

The next problem the workers encountered happened the following March of 1937. They had built a downstream cofferdam to help divert the streambed, but a sudden spring thaw that year caused the Columbia River to break through. Workers took a less scientific approach to solving this problem. They created a temporary dam of everything they could find--mattresses, cable, trees, and cement. Every ten seconds, another dump truck deposited its load at the site to prevent the waters from reaching the primary dam construction site. This temporary fix held back the water until crews could drive steel pilings into the riverbed to strengthen the upstream cofferdam.

While some workers fixed problems outside of the site, others worked to construct Grand Coulee Dam. On December 6, 1935, Washington Governor Clarence Martin poured the first bucket of concrete into the excavated site. For his efforts, Governor Martin received 75 cents, the same amount that a concrete worker would receive for an hour's work.

Grand Coulee was designed as a gravity dam. This means that the weight of the dam had to be strong enough to hold back the water stored behind it. First, the crews filled in the cracks in the granite bedrock so it would be better able to hold the enormous dam. Then, they poured 12 million cubic yards of concrete into 20,000 interlocking columns five feet at a time to form the 500-foot wide foundation.



Grand Coulee Dam: Dimension Comparisons

(See picture, "Grand Coulee Dam: Dimension Comparisons.")

The engineers had anticipated a problem that happens when concrete is poured. Instead of immediately cooling to harden, newly poured concrete produces a chemical reaction that gives off heat. For a structure as big as Grand Coulee Dam, it would take several hundred years for the concrete to set. As concrete cools, it gradually shrinks. If the engineers had not controlled the rate that the dam cooled, it would have cracked. To solve this problem, the workers embedded 1,700 miles of pipeline in the dam, then pumped river water through the pipes. As the workers monitored the temperature of the concrete, they controlled the amount of river water flowing through the pipes. The last concrete for the foundation was poured on January 10, 1938.

With the foundation laid, it was time to construct the working part of the dam. Again, workers poured concrete and monitored its temperature. They built the hydroelectric powerhouse for electricity and the pumping plant for irrigation. Finally, on December 12, 1941, the concrete placement was completed. The total amount of money invested in Grand Coulee Dam was over $300 million. It took 12,000 people working for a total of 150,000 hours to build this dam, the largest concrete structure in the world.

Work was still proceeding on the pumping plant when the first electricity was generated from the powerhouse on March 22, 1941. Since this was during World War II, much of the generated electricity went into the production of warships and airplanes. Ten years later, the two powerhouses were completed as originally planned. The demand for electricity continued to increase, so a third powerhouse was completed in 1975. The three powerhouses have a total of 28 generators and produce around 23 billion kilowatt-hours of electricity each year, which is more energy than a million locomotives could produce. It is the largest producer of hydroelectric power in the United States and the third largest producer of power in the world.

In 1937, work began on the reservoir that would enable the irrigation project. Eighty thousand acres would flood the area behind Grand Coulee Dam. Four hundred and twenty one billion cubic feet of water would eventually cover the towns that had been temporarily built for construction workers. The reservoir was officially named Franklin D. Roosevelt Lake. The first water was delivered to a farm specifically built to commemorate the occasion in 1952. Since then, the water pumps supply 814,000 billion gallons every year to over 670,000 acres of farmland in the Pacific Northwest.

In 1976, the Visitor Center opened to inform tourists about the history and workings of Grand Coulee Dam. Since 1989, a nightly laser light show dances across the 550-foot high structure. Grand Coulee Dam is truly a technological work of art.

Grand Coulee Dam Statistics

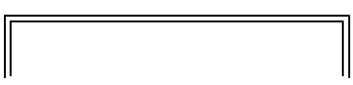
Know your number facts. Draw a line from the numbers on the left to the matching information on the right to find out some amazing statistics about Grand Coulee Dam. All of the answers will be found in this article.

500	Hours of labor that went into building the dam
17,000	Number of people who worked to build the dam
150,000	Height in feet of the dam
20,000	Concrete thickness in feet at the base
550	Cubic yards of concrete used to build the dam
300 million	Number of powerhouses at the dam
12,000	Kilowatt-hours of electricity generated each year
814,000 billion	Dollars spent to build the dam
12 million	Capacity of the reservoir in cubic feet
80,000	Gallons of irrigation water pumped every minute
421 billion	Acres of farmland irrigated by the pumping station
670,000	Number of interlocking concrete columns poured to create the foundation of the dam
23 billion	Miles of pipeline used to cool the setting concrete
3	Size of Franklin D. Roosevelt Lake in acres

Build the Grand Coulee Dam!

Put this puzzle together to witness history as the dam was being built. (See picture, "Grand Coulee Dam Activity.") Above each of the picture squares is labeled with a coordinate. Cut it out and glue it in the proper coordinate.

Answer



(See picture, "Grand Coulee Dam Activity (Answer).")

Grand Coulee Dam Activity (Answer)

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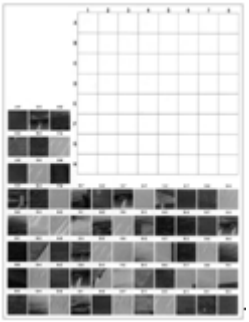
Learn More About the Great Effort of American People to Build This Dam.

Downs, L. Vaughn. *The Mightiest of Them All: Memories of Grand Coulee Dam*. American Society of Civil Engineers, 1993. 195 p. A great reference book for older readers by a man who helped build the dam.

Gresko, Marcia S. *The Grand Coulee Dam*. Blackbirch, 1999. 48 p. An excellent book for younger readers about the building of the dam.



Grand Coulee Dam Activity

Websites About Grand Coulee Dam

Construction Photos of the Grand Coulee Dam
http://www.denniskingphoto.com/original-construction.html

Grand Coulee Dam
http://www.kidscosmos.org/kid-stuff/kids-canyons-gcd.html

Grand Coulee Dam Photo Gallery
http://users.owt.com/chubbard/gcdam/html/photos/construction.html

Grand Coulee PA System
http://www.technomad.com/articles/grand_coulee.html

Lake Roosevelt National Recreation Area
http://www.nps.gov/laro/

Video on Grand Coulee Dam

"Modern Marvels: Grand Coulee Dam." A&E Entertainment, 1994. 50 min.