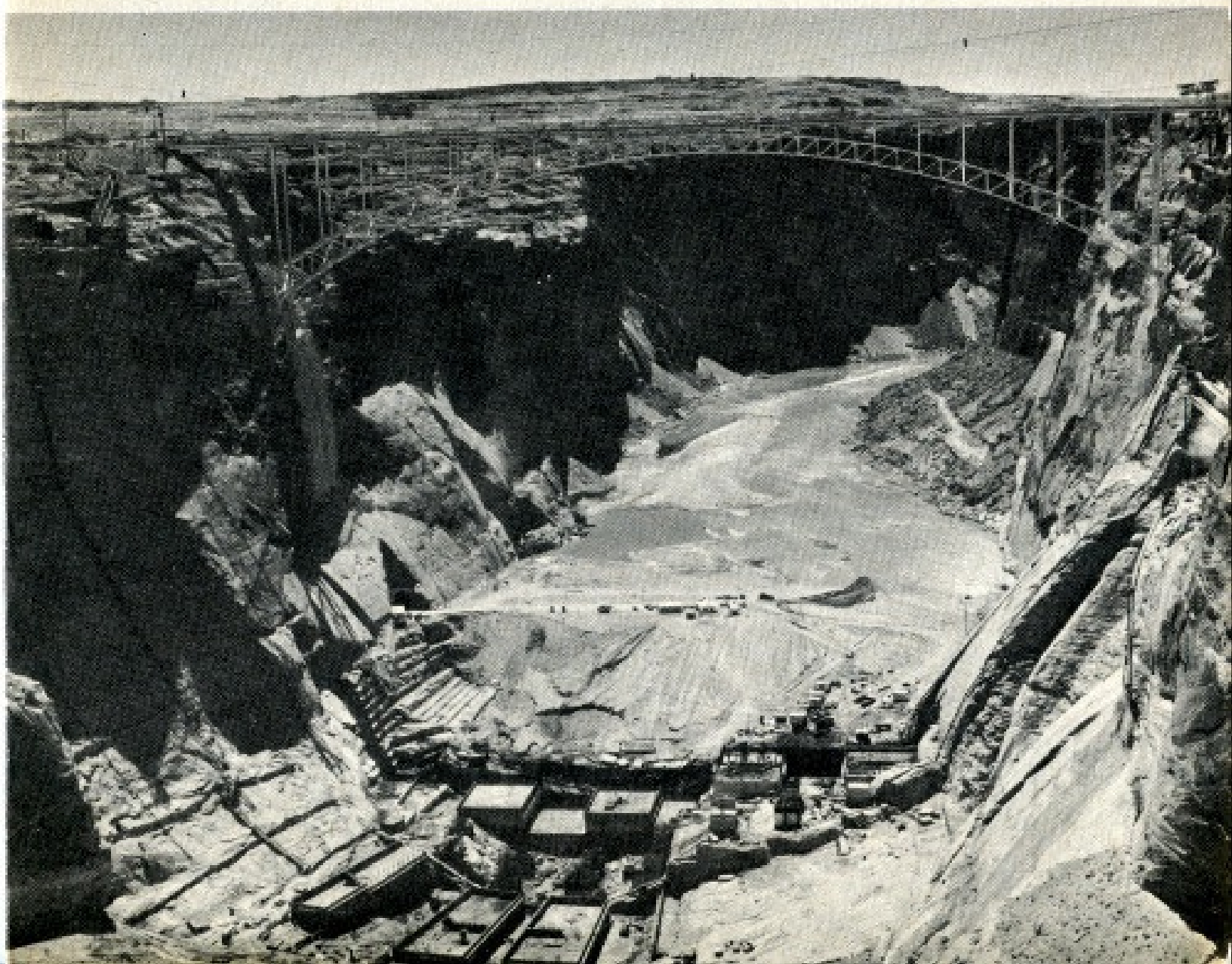


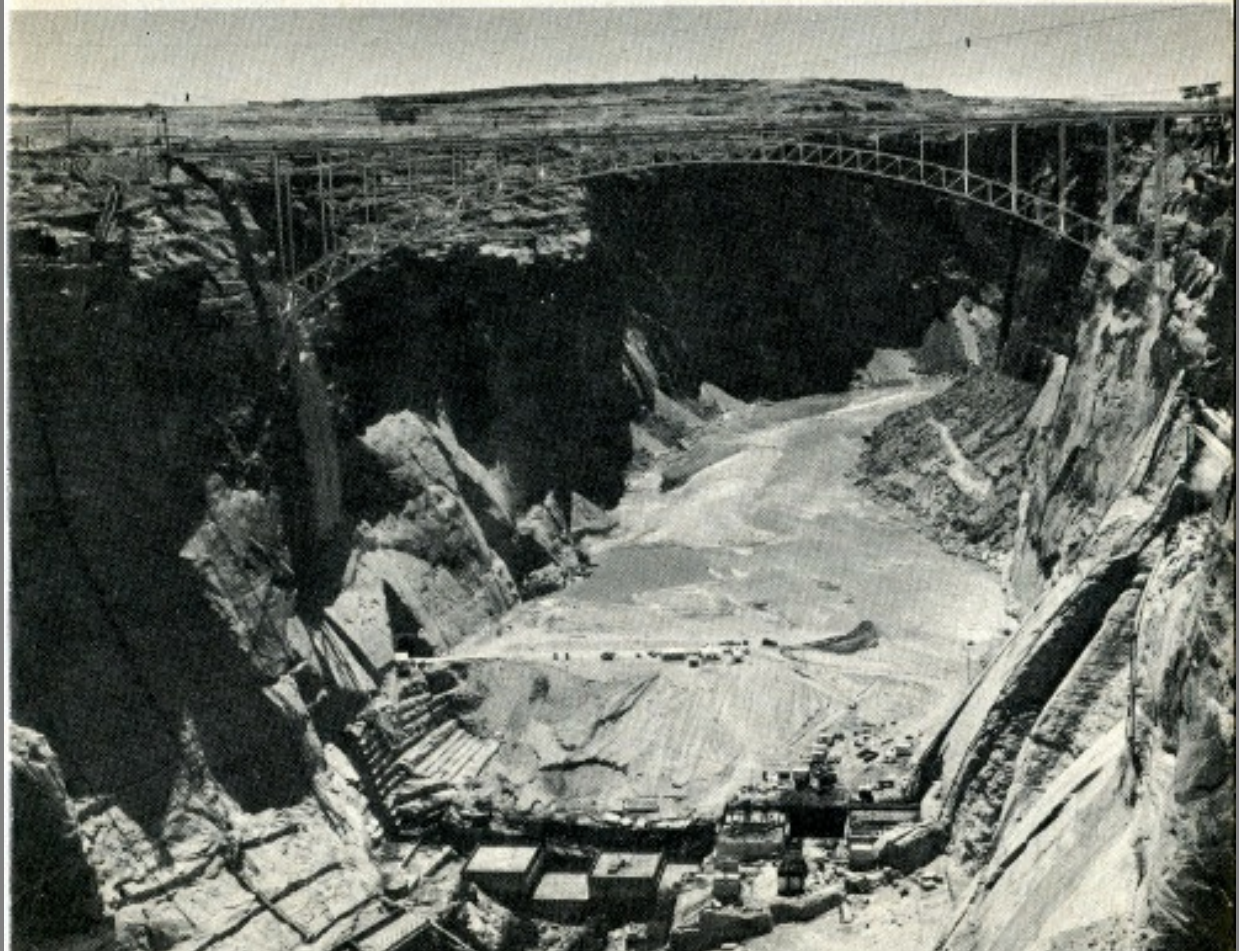
U.S. DEPARTMENT OF THE INTERIOR, STEWART L. UDALL, *Secretary*  
Bureau of Reclamation, Floyd E. Dominy, *Commissioner*

# GLEN CANYON DAM



U.S. DEPARTMENT OF THE INTERIOR, STEWART L. UDALL, *Secretary*  
Bureau of Reclamation, Floyd E. Dominy, *Commissioner*

# GLEN CANYON DAM





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\*\*\* START OF THE PROJECT GUTENBERG EBOOK GLEN CANYON  
DAM \*\*\*

U.S. DEPARTMENT OF THE INTERIOR, STEWART L. UDALL, Secretary  
Bureau of Reclamation, Floyd E. Dominy, Commissioner

# GLEN CANYON DAM

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## PHYSICAL DATA—GLEN CANYON STORAGE UNIT DAM

Type: Concrete arch.

|                        |            |     |
|------------------------|------------|-----|
| Height above river bed | <i>ft.</i> | 580 |
|------------------------|------------|-----|

|                                         |            |     |
|-----------------------------------------|------------|-----|
| Height above lowest point in foundation | <i>ft.</i> | 710 |
|-----------------------------------------|------------|-----|

|              |            |       |
|--------------|------------|-------|
| Crest length | <i>ft.</i> | 1,500 |
|--------------|------------|-------|

|             |            |    |
|-------------|------------|----|
| Crest width | <i>ft.</i> | 25 |
|-------------|------------|----|

|            |            |     |
|------------|------------|-----|
| Base width | <i>ft.</i> | 340 |
|------------|------------|-----|

|          |                       |           |
|----------|-----------------------|-----------|
| Concrete | <i>cu. yds. (dam)</i> | 4,830,000 |
|          | <i>(powerplant)</i>   | 275,000   |

There are  $3\frac{1}{4}$  million cu. yds. in Hoover Dam, and  $10\frac{1}{2}$  million in Grand Coulee.

|                 |            |       |
|-----------------|------------|-------|
| Crest elevation | <i>ft.</i> | 3,715 |
|-----------------|------------|-------|

|                                     |                 |         |
|-------------------------------------|-----------------|---------|
| Maximum discharge through spillways | <i>sec. ft.</i> | 276,000 |
|-------------------------------------|-----------------|---------|

### RESERVOIR

|           |                |            |
|-----------|----------------|------------|
| Capacity. | <i>ac. ft.</i> | 28,040,000 |
|-----------|----------------|------------|

|      |              |         |
|------|--------------|---------|
| Area | <i>acres</i> | 162,700 |
|------|--------------|---------|

|                                   |            |       |
|-----------------------------------|------------|-------|
| Elevation reservoir water surface | <i>ft.</i> | 3,700 |
|-----------------------------------|------------|-------|

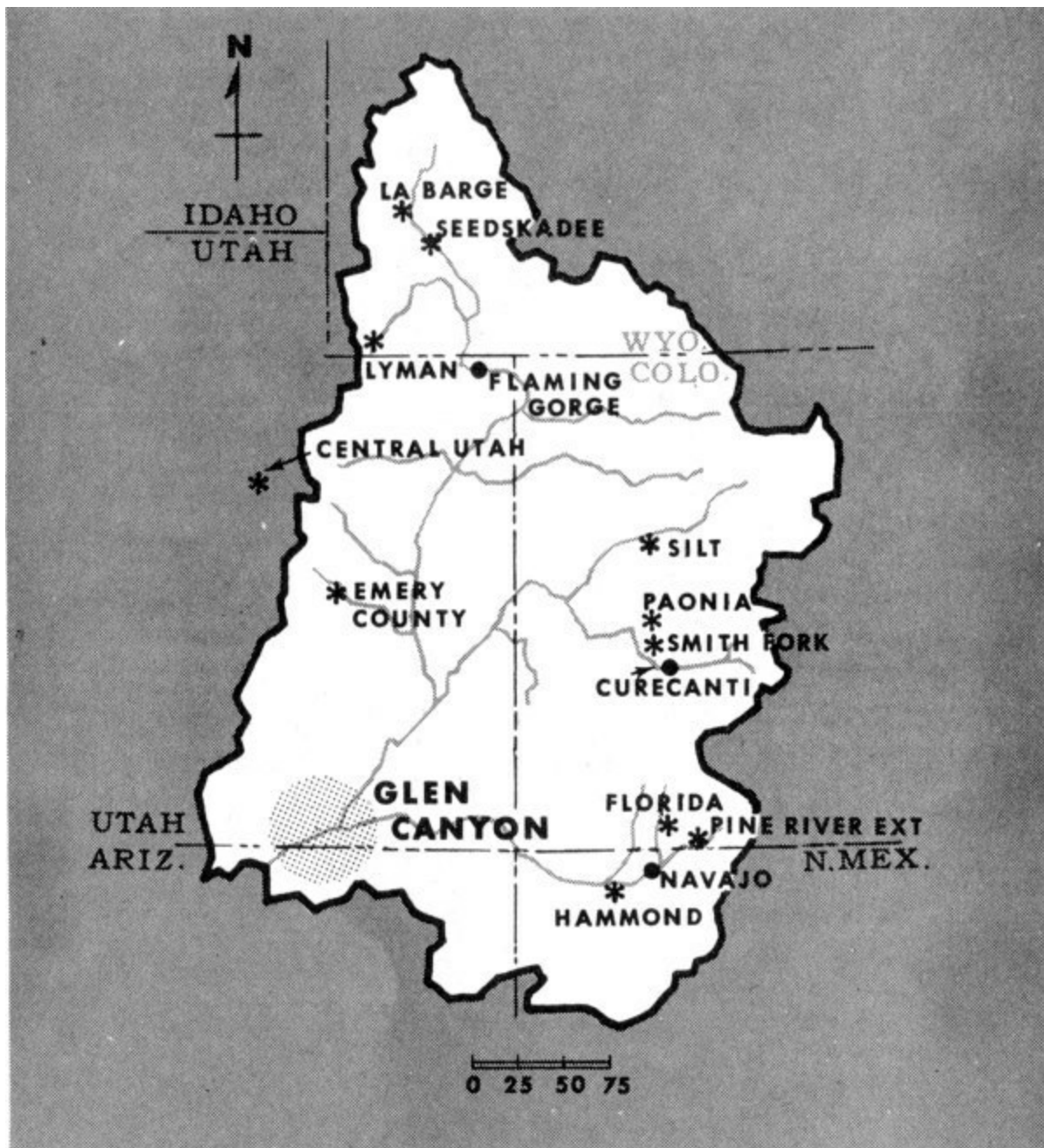
The river elevation at Glen Canyon is 3,142 ft.

|         |              |     |
|---------|--------------|-----|
| Length. | <i>miles</i> | 186 |
|---------|--------------|-----|

### POWERPLANT

|                             |     |         |
|-----------------------------|-----|---------|
| Capacity                    | kw. | 900,000 |
| Number of units             |     | 8       |
| Capacity of each generator. | kw. | 112,500 |
| Capacity of each turbine    | hp. | 155,500 |

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THE PROJECT AND THE DAM

# **GLEN CANYON**

**FLORIDA**

**PINE RIVER EXT**

**NAVAJO**

**HAMMOND**

**LA BARGE**

**SEEDSKADEE**

**LYMAN**

**FLAMING GORGE**

**CENTRAL UTAH**

**EMERY COUNTY**

**SILT**

**PAONIA**

**SMITH FORK**

**CURECANTI**

The Glen Canyon Dam, Powerplant, and Reservoir, which will be known as Lake Powell in honor of the western explorer and geologist, John Wesley Powell, are the principal storage and power features of the Upper Colorado River Storage project. The dam will be on the Colorado River in Arizona, 13 river miles below the Utah border. Lake Powell will store about 28,000,000 acre feet of water—next in size to Lake Mead, downstream, America’s largest man-made lake—to help solve a water resource development problem in the Colorado River Basin.

The crux of the problem is the division of the river’s water between the Upper and Lower Basins of the Colorado River, as provided by an interstate compact. The volume of water flowing down the Colorado fluctuates sharply from year to year. Consequently, there must be long-term holdover storage capacity in order to meet downstream needs and compact requirements—including requirements for Mexico under an international treaty—and still permit the Upper Basin States to deplete the river for upstream use.

This problem will be solved by construction of a system of storage dams and reservoirs in the Upper Basin, of which Glen Canyon, the largest, is one of four initial units authorized. Only 15 miles above the dividing line between the Upper and Lower Basins, it will store no water for use upstream or in the immediate vicinity of the dam, but is the principal unit storing water to regulate the river and thereby fulfill compact commitments to the Lower Basin. The sale of hydroelectric energy generated at the multipurpose dams will return practically all of the cost of the project and a large part of the cost of 11 participating irrigation projects authorized for initial Upper Basin development. That, in general, is how Glen Canyon Dam on the Colorado and three other initial dams on its tributaries will aid in developing the area. The participating projects just referred to, and scattered throughout the Upper Basin (11 of them authorized for construction), will irrigate about 130,000 acres in new farms and improve irrigation on about 230,000 acres in old ones. Some 25 other projects are under various phases of study. Farming, in consequence, will greatly increase. Water from the 4 big storage reservoirs will, as planned, turn generators of about 1,200,000-kilowatt capacity, and industry will use the power. Mineral deposits of inestimable value, uranium among them, will be mined. Flood control and navigation on the Colorado will be improved, and the nation's playgrounds will be greatly enlarged, for some of the world's finest recreation places will lie along the shores of the reservoirs or lakes that will form behind the dams.

Glen Canyon Storage Unit will be the keystone in this whole structure. The dam spans the river near its exit from the Upper Basin, as if in the spout of a great funnel where it can control all of the water in the funnel's cone—the Colorado's own flow and all that its tributaries feed into it upstream from the dam. The powerplant will generate about 75 percent of the project's total power and the reservoir will contribute about 75 percent of the water storage that the Congress authorized in 1956 as initial development for the Upper Basin. This reservoir or lake, extending 186 miles behind the dam, will be flanked by remarkably beautiful scenery. The Nation's gain in new public and private wealth will be tremendous.

The Federal Government will finance the project, but the people who use the water and power will repay about 99 percent of the cost—about two-thirds with interest.



## BRIDGE AT THE DAMSITE



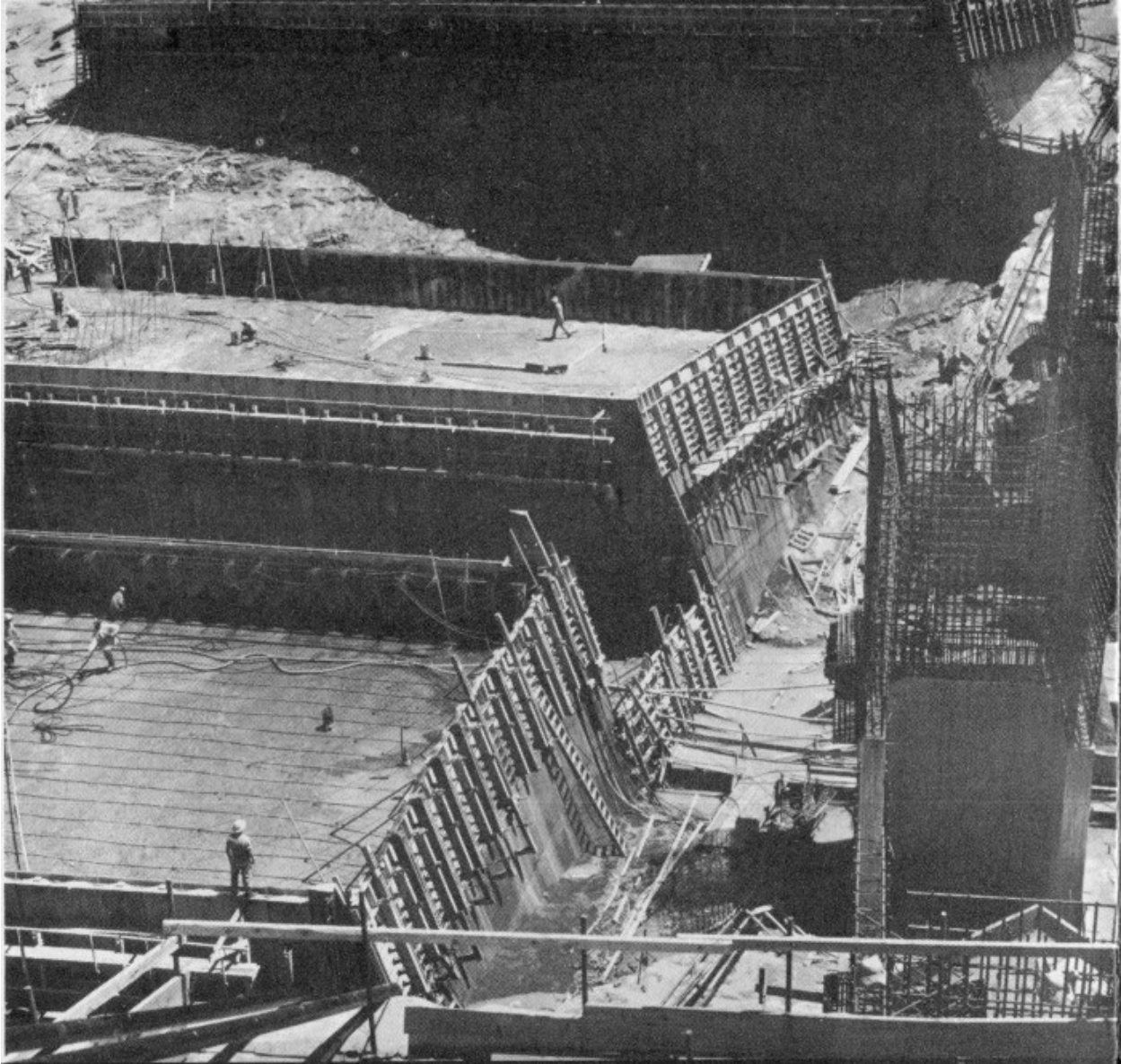
Bridges were among the first essentials at Glen Canyon damsite. The vertical walls of the Canyon rise about 700 feet above the river. The distance from rim to rim is only 1,200 feet in a straight line, but it is about 190 miles by road.

The Glen Canyon Bridge, a spectacular rim-to-rim highway, spans the canyon immediately downstream from the dam. It is the highest and second-longest steel arch bridge in the United States; its 1,028 foot arch stands 700 feet above the river. The deck is 1,271 feet long. The roadway is 30 feet wide and is paralleled by 4-foot sidewalks. The bridge was dedicated and opened to public use on February 20, 1959.

Materials and equipment are transported to the canyon floor by highlines—

heavy cableways stretched between towers, two on each rim. Loads of 50 tons are lowered from them on pendant hooks.

# CONSTRUCTION



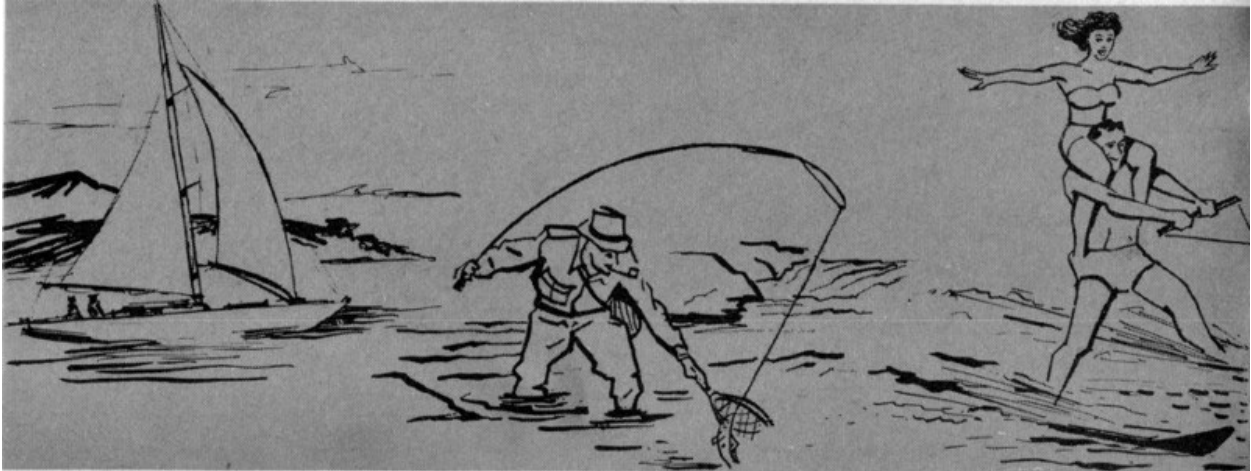
Glen Canyon Dam, like all large Reclamation dams, is being built by private construction companies that are awarded contracts by competitive bidding. The prime contract, totaling \$107,955,122, was awarded to the Merritt-

Chapman and Scott Corporation of New York City, April 29, 1957. It provides for construction of the dam and powerhouse and is the largest single contract the Bureau has ever awarded and probably the largest for any type of construction project.

By June 1960, the contractor had completed the diversion and spillway tunnels, lined them with concrete, built the coffer dams (temporary earth structures diverting the river around the damsite during construction), and excavated the foundation of the dam. First placement of concrete in the foundation of the dam and powerhouse was observed by public ceremonies at the damsite on June 17, 1960. Initial storage of water behind the dam is scheduled for early 1962.

A \$6,392,000 contract for the manufacture of eight 155,500-horsepower, 150-r.p.m., vertical-shaft hydraulic turbines for the powerplant has been awarded to the Baldwin-Lima Hamilton Corp. Additional contracts for generators and other adjuncts will be awarded later to equip the dam and powerplant. Glen Canyon's first hydroelectric generating unit is scheduled to go on line in 1964.

## RECREATION PLANS



The Glen Canyon of the Colorado River is an unusually placid, 162-mile reach from Hite, Utah, to Lees Ferry, Arizona. Major John Wesley Powell, who headed the first expedition down the river in 1869, named it Glen Canyon because of the occasional oak glens along its banks and at its junctions with tributaries.

The 186-mile-long Glen Canyon Reservoir (Lake Powell) will extend upstream into Cataract Canyon. The lake and adjoining lands have been established as the Glen Canyon National Recreation Area under the National Park Service of the Department of the Interior. This is the status of Lake Mead and its environs behind Hoover Dam.

The Park Service will soon undertake construction of recreational facilities for public use as Lake Powell begins to fill in 1962. The Glen Canyon Recreation Area promises to become one of the Nation's outstanding tourist attractions.



*Lake Powell, behind Glen Canyon Dam, will be flanked by varied and beautiful scenery.*



*The first placement of concrete—June 17, 1960.*



**HIGHWAYS TO GLEN CANYON DAM.**—Excellent, new, paved highways have been built to the Glen Canyon dams site. A 76-mile highway through the highly scenic area has been built from Kanab, Utah, to the dams site. A new 25-mile highway extends northward from Bitter Springs to the dams site. Both of these highway links connect with the Glen Canyon Bridge to form a new link in U.S. Highway 89. The Glen Canyon Bridge was completed in February 1959.

**DISTANCES TO GLEN CANYON FROM:**

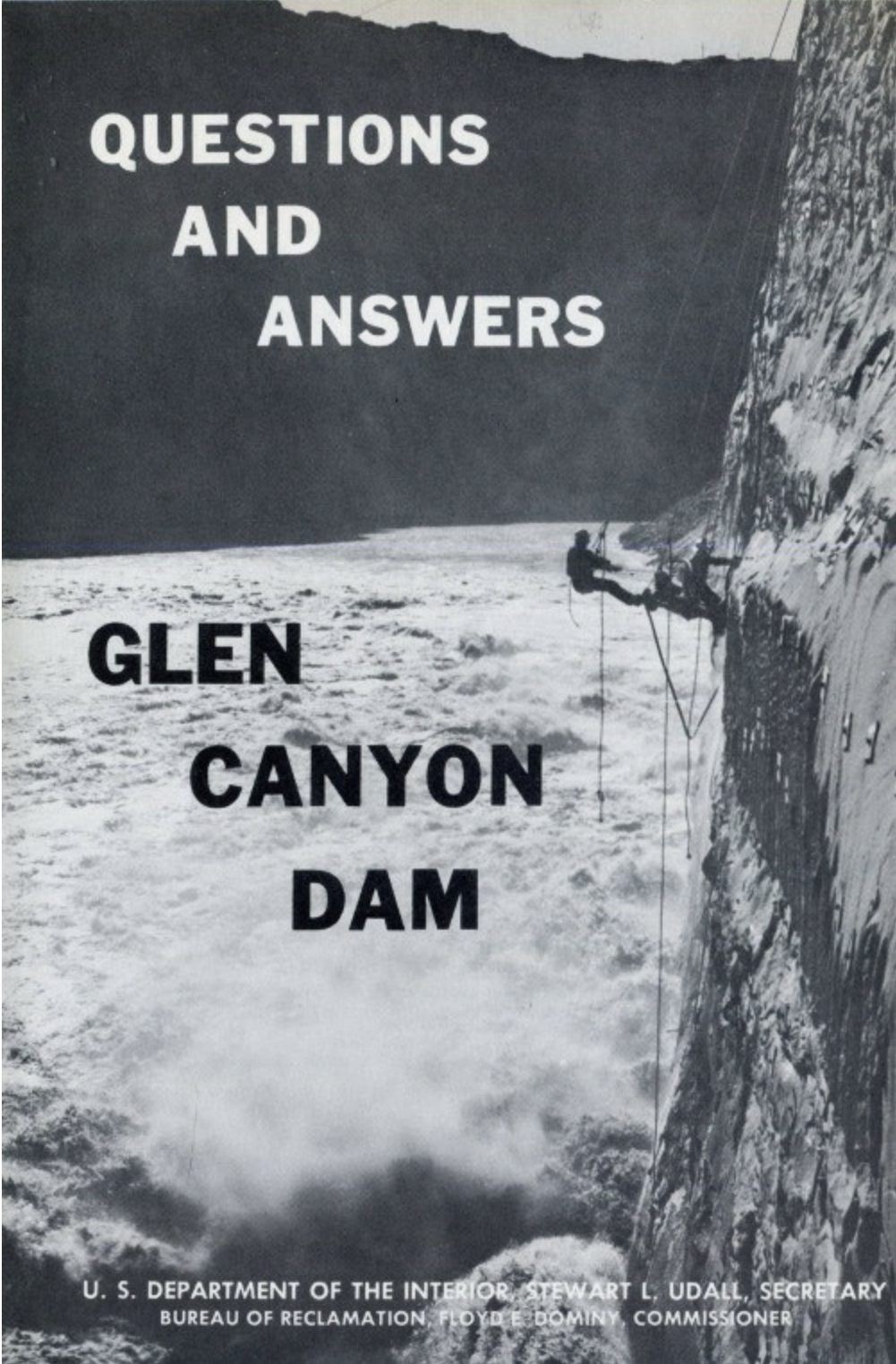
|                    |           |
|--------------------|-----------|
| Kanab, Utah        | 76 miles  |
| Flagstaff, Arizona | 135 miles |

(Flagstaff and Marysvale, Utah, 190 miles from the dams site, are nearest railheads.)

|                         |           |
|-------------------------|-----------|
| Cedar City, Utah        | 161 miles |
| Phoenix, Arizona        | 300 miles |
| Salt Lake City, Utah    | 384 miles |
| National Parks:         |           |
| Zion                    | 100 miles |
| Bryce                   | 138 miles |
| Grand Canyon, North Rim | 124 miles |
| Grand Canyon, South Rim | 142 miles |

*Two 16 mm. color, sound films, CANYON CONQUEST and KEY TO THE FUTURE, are available upon request for showing to school and civic groups, clubs, and other public gatherings. Both films show men and machines at work on this challenging Reclamation project. Send your requests to: U.S. Department of the Interior, Bureau of Reclamation, P.O. Box 360, Salt Lake City 10, Utah. Eastern area residents may write to the U.S. Department of the Interior, Bureau of Reclamation, Washington 25, D.C.*

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# **QUESTIONS AND ANSWERS**

## **GLEN CANYON DAM**

U. S. DEPARTMENT OF THE INTERIOR, STEWART L. UDALL, SECRETARY  
BUREAU OF RECLAMATION, FLOYD E. DOMINY, COMMISSIONER

# QUESTIONS AND ANSWERS GLEN CANYON DAM

U. S. DEPARTMENT OF THE INTERIOR, STUART L. UDALL, SECRETARY  
BUREAU OF RECLAMATION, FLOYD E. DOMINY, COMMISSIONER

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## THE DAM

### HISTORY

**Q. When was Glen Canyon investigated as a potential damsite?**

A. First in 1921, then again in 1946 and in subsequent years.

**Q. When was Glen Canyon Dam authorized for construction?**

A. April 11, 1956, as part of the Colorado River Storage Project.

**Q. When did work actually begin?**

A. The first blast was detonated on October 15, 1956.

### COMPLETION SCHEDULES

**Q. When is the dam scheduled to be finished?**

A. Construction of the dam and powerplant is scheduled for completion in March 1964.

**Q. When is the first power scheduled to be generated?**

A. The first power should go on the line in the spring of 1964.

## EXCAVATION

### COFFER DAMS

**Q. What are the coffer dams?**

A. Large, temporary earth dams across the floor of the canyon and located upstream and downstream from the foundation and keyway areas which mark the axis of the dam.

**Q. Why are coffer dams built?**

A. To divert the Colorado River around the damsite through huge diversion tunnels and to keep water out of the work areas during construction of the dam and powerplant. The deepest excavation to bedrock in the dam foundation is 137 feet below the former river level.

**DIVERSION TUNNELS**

|                                  |            |
|----------------------------------|------------|
| Length (West)                    | 2,749 feet |
| Length (East)                    | 3,011 feet |
| Diameter (lined) of both tunnels | 41 feet    |

**Q. Why does the west diversion tunnel carry the most water?**

A. Because the intake of the west tunnel is 34 feet lower than the intake of the east tunnel.

**SPILLWAYS**

**Q. Where are the spillway intakes located?**

A. They are just upstream from the keyways, one on each rim of the canyon.

**Q. Where will the spillways discharge?**

A. Steep, inclined tunnels will extend from the spillway intakes to intersect with the diversion tunnels far below. Thus, water going through the spillways will emerge from the diversion tunnels as the river water now does.

**Q. What is the maximum combined capacity of the two spillways?**

A. 276,000 cubic feet per second.

**POWERPLANT**

**Q. Where will the powerplant be located?**

A. On the upstream side of the Glen Canyon Bridge just below the dam. The powerhouse will extend across the canyon floor parallel to the bridge.

**Q. How large will the powerplant be?**

A. The powerhouse structure will be about 665 feet long and about 160 feet, or 16 stories high, above the downstream river level. Eight generating units will be installed. The rated capacity will be 900,000 kw for the powerplant.

**Q. What are the square columns between the dam and the powerplant?**

A. These huge concrete piers will support the 15-foot diameter penstock pipes which will carry water from the reservoir through the dam and into the turbines in the powerplant.

## **GENERAL**

**Q. What are the numerous black spots above the tunnel portals and elsewhere?**

A. These are 8-inch square metal plates on the ends of anchor bolts. The anchor bolts extend into the rock to support the relatively thin outer layers of rock.

**Q. What are the white markings on the canyon walls?**

A. Survey control or reference points which have been painted on the rock.

**Q. Why was the small suspension footbridge built?**

A. More than 2 years was required to build the Glen Canyon Bridge—the highest steel-arch bridge in the world. Therefore, the footbridge was built so workers could cross the 1200-foot wide canyon; otherwise, it was 200 miles around by road.

## **CONCRETE PLACEMENT**

### **GENERAL**

**Q. How much concrete will the dam contain?**

A. There will be more than 5,000,000 cubic yards of mass concrete in the dam, and about 400,000 additional cubic yards in the powerhouse, tunnels, and other structures at the damsite.

### **AGGREGATE (Sand and gravel for the concrete)**

**Q. Where does the aggregate used to make concrete come from?**

A. From the streambed of Wahweap Creek, 6 miles from the damsite.

**Q. Is there a conveyor belt from the aggregate plant to the damsite?**

A. No. The aggregate is hauled in large bottom-dump trucks.

### **CEMENT**

**Q. How much cement will be needed?**

A. Approximately 3 million barrels, or 12,000,000 sacks.

**Q. Where does the cement come from?**

A. From a new cement plant constructed by the American Cement Corporation near Clarkdale, Arizona, 188 miles south of the damsite.

## **POZZOLAN**

### **Q. What is pozzolan?**

A. Pozzolan is a cement-like material which occurs in natural deposits.

### **Q. Why is pozzolan used?**

A. Pozzolan is cheaper than cement; it reduces shrinkage in concrete and develops less heat in concrete during the curing period.

### **Q. Where is it obtained?**

A. Near Flagstaff, Arizona, about 115 miles from the damsite. About 220,000 tons will be used along with 564,000 tons (3,000,000 barrels) of cement.

## **CONCRETE MIXING PLANT**

### **Q. What is capacity of the mixing plant?**

A. The maximum capacity is 480 cubic yards per hour, which is mixed in six, 4-cubic yard concrete mixers.

### **Q. How large is the mixing plant?**

A. It is 217 feet, or more than 20 stories, in height.

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## **HIGHLINE CABLEWAYS**

### **Q. What will the highlines do?**

A. Their main function is to carry the buckets of concrete from the batch plant to points of placement in the dam and powerplant.

### **Q. What is the size and weight of the concrete buckets?**

A. 12 cubic yards. When filled, the buckets weigh 31 tons, 24 tons of which is the concrete carried in the buckets.

### **Q. How large are the highlines?**

A. The higher towers are 190 feet tall; the main cable is 4 inches in diameter and about 2,000 feet long.

## **REFRIGERATION PLANT**

### **Q. Why is the refrigeration plant necessary?**

A. A large amount of heat is produced by the chemical action of cement during the setting of the concrete. The heat must be removed to prevent expansion and cracking of the concrete. The refrigeration plant supplies the slush ice and cold water necessary to reduce this heat.

### **Q. How is the heat controlled?**

A. First, the aggregate is sprayed with ice water before going into the mixers. Second, slush ice, along with water, is used in mixing the concrete. Third, cold water is pumped through pipes embedded in the concrete to carry away the heat generated.

**Q. How long will cold water have to be pumped through the cooling tubes in the dam?**

A. Approximately 12 days immediately following placement of the concrete to prevent uncontrolled cracking. Then for about 52 days in the second stage, which may be many months later and which is for the purpose of assuring uniform shrinking of the huge concrete blocks.

## **CONCRETE BLOCKS**

**Q. How large are the blocks of concrete placed in the dam?**

A. They vary in size. The largest are 70 feet by 180 feet in area; all blocks will be 7½ feet thick.

**Q. Why are blocks used rather than building the dam as one solid piece?**

A. Primarily, block placement facilitates cooling of the concrete and controls cracking due to contraction of the concrete. After the blocks have set and cooled, a mixture of cement and water (called grout) is pumped under high pressure into cracks between the blocks to form one solid mass of concrete.

## **PAGE, ARIZONA**

### **GENERAL**

**Q. After whom was the town of Page named?**

A. The late John C. Page, who served as Commissioner, Bureau of Reclamation, from 1937 to 1943.

**Q. Was there a community on the site of Page prior to 1957?**

A. No, nothing but raw desert land like that now surrounding the community.

### **CLIMATE**

**Q. What is the elevation of Page?**

A. 4300 feet, or about 500 feet higher than the rim of the canyon.

**Q. What are the extremes of temperature in Page?**

A. 105 degrees in summer; 10 degrees in winter.

## **ACCOMMODATIONS**

**Q. Does Page have overnight accommodations?**

A. Yes, two modern motels are open year around.

**Q. Are there any restaurants?**

A. Yes, there are now four restaurants in Page. In addition, the contractor's mess hall is open to the public.

**DPS, Utah General Depot, 5-61, 100M**

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DAM \*\*\*

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