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THE BROAD CANYON DAM

by

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The Broad Canyon Dam is a zoned earthfill, floodwater-retarding structure. Sediment storage is a secondary purpose. It is located in sec. 36, T. 20 S., R. 2 W., Dona Ana County, New Mexico. It is owned by the Elephant Butte Irrigation District. Operations were initiated upon completion of construction in March 1970.

The dam is one of seven planned in 1965 for flood protection in the Hatch Valley and Selden Canyon areas under the U.S. Department of Agriculture, Soil Conservation Service Watersheds Program. The U.S. Department of State, International Boundary and Water Commission participated in the plan development. The dam was authorized for construction under Public Law 566, 83d Congress, 68 Stat. 666 as amended. The construction contract cost \$466,493.41. The prime contractor was O. D. Cowart Contracting Company.

During the period 1938-1942, the U.S. section of the International Boundary and Water Commission completed channelization of the Rio Grande from Caballo Dam to El Paso, Texas. This work consisted of construction of a low water pilot channel of about 1,500 cu ft/sec capacity and a levied floodway with a total capacity of 12,000 to 22,000 cu ft/sec (E.B.I.D. 1965). This plan is one step along the route of trapping sediment and retarding floodwater from sources adjacent to this segment of the river in order to protect the channel, croplands, and irrigation systems. The flood of 1957, a 4 percent chance of occurrence event, over the Broad Canyon Arroyo drainage, resulted in \$10,760 damage to the Atchison, Topeka, and Santa Fe Railroad at the mouth of the canyon (E.B.I.D. 1965). The International Boundary and Water Commission also expended large sums in the removal of sediment at the confluence of Broad Canyon and the Rio Grande.

The dam controls a drainage area of 64 square miles. The drainage is fan-shaped and has a topographic relief of 2,500 ft. The drainage extends 14 mi northwest-southeast and 10 mi northeast-southwest. Broad Canyon Arroyo heads in the Sierra de las Uvas, with Magdalena Peak on the western boundary of the drainage. Bell Top Mountain is within the drainage 8 mi southwest of the damsite. Coyote Canyon Arroyo, a tributary to Broad Canyon, heads in the Rough and Ready Hills and Cedar Hills which form the eastern boundary of the drainage.

The dam is 71.5 ft in height and 1,434 ft in length, with

398 ft maximum width at its base. The embankment consists of 781,700 cubic yards of compacted earthfill (Fig. 1). The reservoir has an as-built storage capacity of 6,080 acre-feet. Sediment storage for a design life of 100 years will utilize 2,278 acre-feet of that capacity. The emergency spillway is 520 ft wide and is protected by an 8-inch thick soil cement apron. The spillway has a design capacity to pass the runoff from a 4.5 inch rainfall at 6,630 cu ft/sec. The principal spillway consists of a 4 x 4 ft reinforced concrete box culvert and a 46-ft high, 12 x 4 ft inside diameter inlet with trash rack. A sediment pool drain carries the first stage of the drawdown flow. The principal spillway is designed to carry 580 cu ft/sec and will drain the runoff from a 2 percent chance of occurrence storm (6 hour, 3-inch rainfall) in 87 hours. These features can be seen in Figure 1. The pool drain appears to the right at the front toe of the dam. The top of the principal spillway inlet is seen in mid-embankment, and the smooth flat surface of the emergency spillway contrasts against the rounded low hills of the right abutment in the middle background.

The structure is sited in the poorly consolidated conglomerate facies of the Rincon Valley Formation (Seager and others, 1975). The north abutment consists of about 70 ft of younger unconsolidated silty alluvial sand. Immediately under the Tortugas Surface of this abutment, the alluvium is capped by approximately 25 ft of channel deposits consisting of clean sandy gravel. At elevation 4,075 ft mean sea level, a test hole in this abutment encountered a 1.5-ft thick bentonitic clay bed. However, this bed was not uncovered on the abutment face.

The foundation and abutments were drilled and tested to a depth of 75 ft. The standard split-tube sampler was used in recovering samples and testing for relative density of the materials. The findings indicated high shear strength and low consolidation potential. Gravity flow, continuous head "packer type" water testing disclosed moderately high permeability rates horizontally. Open hole testing indicated slow vertical permeability. The core trench depth was established at 20 ft, well below the less dense channel materials. Silty clay materials found in a large segment of the south end of the dam foundation were removed and replaced with compacted fill. The central core of the embankment consists of compacted clayey and silty sand borrowed from the emergency spillway cut and other outcrops of the Rincon Valley conglomerate facies. Thick deposits of silt found within several hundred feet upstream of the centerline of dam were also used in the relatively impervious core. These sandy silts were also utilized in the manufacture of the soil cement for use in the emergency spillway. The outer shell of the embankment consists of gravelly sands of alluvial channel and fan deposits found capping the north abutment.

REFERENCES

- Elephant Butte Irrigation District, and Others, 1965, Work Plan for Watershed Protection and Flood Prevention.
 Seager, W. R., Clemons, R. E., and Hawley, J. W., 1975, Geology of Sierra Alta quadrangle, Dona Ana County, New Mexico: New Mex. Bur. Mines and Min. Res. Bull. 102.



Photo by Soil Conservation Service
 Figure 1. The Broad Canyon Dam