

## LOWER SUNSHINE DAMSITE, PARK COUNTY

Location:- W. 1/2 Sec. 27 and E. 1/2 Sec. 28, T. 48 N., R. 101 W.,  
on Sunshine Creek.

Dates Examined:- August 9, and October 24, 1956.

Storage:- A dam 162 feet high will impound 42,635 acre-feet of water.

### Introduction

The geology of both the upper and lower Sunshine reservoir sites was examined and reported on by Lovering. In his study, neither damsite was found highly satisfactory, but he believed that the upper site was more preferable than the lower site. The geological conditions at both sites are similar, but the west abutment of the lower site adjoins a narrow hill between Sunshine Creek and the Greybull River. This hill is about 150 to 200 feet high and about 400 to 450 feet wide at the base. It was believed by Lovering that excessive seepage would occur here. A later report by the Bureau of Reclamation arrived at the same conclusion.

After Lovering examined the upper site, however, a large earth-filled dam was constructed which impounded the waters of what is now called Sunshine Reservoir. Investigations of this writer have revealed that no reported excess seepage has occurred around the damsite.

### Geology

The rock cropping out in the damsite area includes the upper part of the Cody shale and the lower part of the Mesaverde formation. Both formations are Upper Cretaceous in age. The reservoir basin is eroded entirely in the Cody shale. Here, the drainage of Sunshine Creek trends north-northeast,

transverse across the north-northwesterly plunging axis of Sunshine anticline.

Both abutments of the damsite adjoin the uppermost units of the Cody shale which strike approximately northwest with dips varying between  $13^{\circ}$  to  $16^{\circ}$  northeast (downstream). The most satisfactory exposures occur on the narrow hill which will form the west abutment. Approximately 140 feet of Cody shale crops out here which can be subdivided into three units according to lithology and topographic expression.

The lower unit consists of a buff-weathering thin bedded calcareous sandstone containing ironstone concretions oriented along bedding planes, and this is overlain by a very thin bedded grey to brown shale which is intercalated with sandstone beds of varying thickness. The lower part breaks up into rudely rectangular slabs because of two major joint sets with the following attitudes: N.  $60^{\circ}$  W.,  $85^{\circ}$  SW.; N.  $30^{\circ}$  E.,  $83^{\circ}$  SE.; strike and dip respectively. The entire unit weathers readily and is a slope-former. Approximate thickness is 100 feet.

The middle unit is a tan massive calcareous sandstone that is a cliff-former. Many cavities occur localized along bedding planes or intersections of joints and bedding planes. The cavities average one foot in diameter, but some are as long as 12 feet (along the bedding planes). Because of the two major joint systems; N.  $60^{\circ}$  E., vertical; N.  $40^{\circ}$  W.  $82^{\circ}$  NE. (strike and dip respectively); the unit weathers into large chunky blocks 6 to 12 feet in diameter. Approximate thickness of unit is 15 feet.

The upper unit consists of approximately 15 feet of buff-weathering thin-bedded interlaminated shale and sandstone, containing a few ironstone concretions and small cavities. This is overlain by a tan massive sandstone. The lower part is a slope former. Approximate thickness of the unit is 25 feet.

Overlying the upper unit is another massive sandstone that is similar to the middle unit described above. Since this bed is located down dip from the abutment of the dam, it will not be concerned with any seepage effects.

A thin veneer of terrace gravels of varying size and lithology caps the hill.

With the exception of the middle massive sandstone, the rocks are poorly exposed on the hill forming the east abutment. The remainder of the other units described above are covered with slope wash and terrace gravels.

### Conclusion

The limiting factor in the construction of a dam is the possible effect of excessive seepage through the narrow hill at the west abutment. Factors, such as the downstream dip of beds, joints, cavities, and the poor resistance to erosion, facilitate seepage. Since most of the rocks are cemented by calcium carbonate, it is possible for percolating water to dissolve some of the cement thus enlarging existing cavities and creating new ones. The existing cavities, however, may only be results of surficial weathering and may not extend into unexposed rock. A favorable factor does exist in that the west abutment adjoins the widest part of the hill. The problem is not as severe at the east abutment since the hill is much wider.

In view of the importance of this reservoir site, it is desirable to carry out further exploration to determine its feasibility. The writer recommends at least two or three diamond drill holes at the west abutment and one at the east abutment drilled to a minimum depth of 150 feet. Core recovery should be as complete as possible, and these cores should be studied with respect to unfavorable aspects. All holes should be pressure tested for seepage. This may be done by constructing a pressure device consisting of a length of perforated pipe equipped with a rubber packer at each end. The pipe is secured in the hole by pumping water into the packers. Water is then forced, under a

pressure of about 50 pounds per square inch, into the interval between the packers by means of a pump. The hole may be tested in 5- or 10-foot intervals, or the whole length by removing the plug from the bottom of the pipe. The amount of water pumped into the foundation is measured by reading a water meter placed in the system. These readings should be taken every thirty seconds and recorded carefully.

If the above investigation reveals no excessive seepage, then, in consideration of the stability of the Sunshine reservoir damsite and the absence of any excess seepage there, the writer would recommend that construction of the project proceed. One additional recommendation should be considered if the dam is built. Riprap should be installed near the west abutment to minimize wave action and possible rock decomposition, since much of this rock is readily susceptible to weathering.

William H. Wilson  
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February 21, 1957

#### Reference

Lovering, T. S., "Report on the Upper Sunshine and Lower Sunshine Reservoir Sites, Park County", Unpub. Rep't., 7 pp.