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GEOLOGICAL INVESTIGATION OF PROPOSED MEXICAN DAMSITE NEAR JAY CREEK SETTLEMENT, N.T.

by

N.O. Jones.

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The proposed site was revisited on 7th October, 1955. This report is essentially comment, in the light of the geological investigation, on J.A. Kerr's report on his work in August, 1955. Kerr's investigations included determination of levels of the surface of the proposed reservoir, pitting and sounding to give a cross-section at the damsite and a limited amount of testing of the depth of the sand reservoir.

GEOLOGY

The area consists of schists and gneisses of the Arunta Group, unconformably overlain by the Heavitree Quartzite. The strike of the foliation of the metamorphic rocks is very variable but is dominantly NE-SW. The Heavitree Quartzite strikes east-west across Jay Creek and dips steeply to the south. All the rock units have been highly faulted but all fault planes appear to be tight except the north-trending faults in the quartzite.

The bed of Jay Creek is filled with gravels and sands, only moderately sorted. The banks of the creek are composed of silty and clayey soils. Some of the lower ridges are capped by coarse river gravels, believed to be of Tertiary age.

THE DAMSITE.

The proposed damsite is at the narrowing in the creek bed at the Heavitree quartzite. The quartzite is silicified to such an extent that porosity between the sand grains is negligible. The quartzite would be suitable as a foundation for a concrete dam.

However, there are two directions of marked faulting in the quartzite. One of these directions is thrust faulting striking almost parallel to the quartzite and, like the quartzite, dipping to the south. Where they can be observed these thrust faults although large, are very tight and no serious loss of water should be expected along them.

The second direction of faulting is a normal tension faulting parallel to, and probably controlling, the bed of Jay Creek.

None of the faults show any sign of recent movement and it is believed that a concrete wall could safely be built across these fault planes.

There is a risk that the north-south fault planes are open fractures and that an appreciable water loss could occur along them. Against this is the fact that in the Jay Creek area there are two water tables - one being approximately 150 feet below the creek level and the other perched approximately at the depth of bedrock under the creek. This suggests that the floor of the old channel is sealed by clay and that no great quantity of water would escape into the bedrock faults. The dud bore just off the edge of the creek north of the proposed damsite was completely dry to 90 feet even though water was present in the adjacent creek sands at a depth of less than 10 feet.

POSSIBILITY OF SEEPAGE LOSS.

Most of the rock strata bounding the proposed reservoir have low porosities and tight fractures. Generally the surface of these rocks will be sealed by clayey soil.

The only possibility of major water loss by seepage would be to the south-east past the proposed surface damsite along an old creek channel. This possibility is serious only if the Mexican Dam is raised considerably above the present stream level as the floor of the old channel appears to be higher than the sand level in the present creek.

STORAGE CAPACITY

Kerr has suggested that the dam wall should be raised some 3 feet above the present sand level in the gap. This suggestion is sound and would add appreciably to the storage in the reservoir.

Kerr's estimate is based on the assumption that the average depth of the reservoir below the suggested crest level will be 13 feet. Although very little information is available on the depth to the floor of the channel, Kerr's estimate seems far too high. The greatest known depth below crest level is 17 feet at the damsite. At the damsite the mean level of the floor is 14 feet below crest level. There is no evidence of any scouring upstream from the quartzite bar. In general, the floor of the channel will rise gently to the north. Kerr assumes the cross-section of the reservoir will be almost rectangular, with average depth almost equal to the greatest depth. In the broader part of the reservoir where softer rocks are being eroded the cross-section may be more nearly triangular, (note shallow depths of pits 16 and 18). Further the floor of the reservoir will have furrows and ridges parallel to the foliation of the metamorphic rocks.

Another assumption which Kerr has made is that all material which has penetrated by the sounding rod is both porous and permeable. Evidence for the presence of a clayey layer overlying bedrock has already been given.

Two factors partly affect these reductions in the estimated storage capacity. The rock bar limiting the reservoir to the north is probably not as continuous as Kerr has assumed. A small amount of storage in the upper basin may be available. Secondly the area of alluvium along the east bank south of the settlement may be in part underlain by porous sands (which could be sealed off by clay).

The top foot of material in the reservoir would probably lose most of its contained water by evaporation.

It is difficult to reduce these modifications to a quantitative statement but a revised mean depth for the reservoir might be 9 feet giving a storage capacity of 13,500,000 gals. To this might be added a possible 1,500,000 gals. storage in the upper reservoir and the east bank alluvium. Total storage 15,000,000 gals.

The reservoir would be entirely sand-filled (although several years might be required before the sand reached the raised crest level). Therefore the quantity of water stored is the capacity of the reservoir multiplied by a factor for the porosity of the sand. No porosity tests have been made on Jay Creek sands but this overall porosity is not likely to exceed 25%. Perhaps 20% porosity can be assumed for present estimates of water storage. Probably 90% of the stored water would be available to a well for pumping.

$$\text{Water Storage} = 15{,}000{,}000 \times \frac{20}{100}$$

$$= 3{,}000{,}000 \text{ gals.}$$

CONCLUSIONS

A Mexican Dam could be constructed at the gap at Jay Creek settlement with water storage, on present information, being of the order of 3,000,000 gallons. No definite figures have yet been given for the settlement's water requirements but this quantity is low if it is intended to irrigate several acres of garden as allowance must

be made for periods of one year without appreciable replenishment of the storage. Occasionally there could be periods greater than one year without replenishment of the storage.

Department of Works cost estimates show that an earth dam could be constructed south-east of the settlement at much the same cost as the Mexican dam. This alternative proposal for an earth dam with surface water storage of 60 million gallons is preferred.