

GEOLOGICAL REPORT ON THE HYDRO-ELECTRIC WATER
CONSERVATION SCHEME ON THE ARTHUR RIVER

Location and Access

The proposed scheme is located along the Arthur River at a distance of approximately 15 miles to the south south-west of Myalla.

The present means of access is from the railway station at Myalla on the North-western railway. From this place, a metalled road runs in a general south-westerly direction for 6 miles to near the gorge of the Hebe River. A formed but unmetalled road then continues to the south for a further 4 miles. At this point a pack track branches off the road and runs for a distance of 6 miles in a general south-south westerly direction and connects with a wire rope and cage over the Arthur River. Localities further upstream can be reached by foot track only.

Another means of access which will be used in the near future is by road from Preolenna or Yolla and then by Quiggan's Track which leads to the old Victory mine on the north or east bank of the Arthur River.

Topography

The bed of the Arthur River has a elevation of approximately 400 feet above the sea, while the adjacent hills rise to heights of 1,100 - 1,300 feet above the sea. The topography is thus of very high relief, and appears to be one which has reached only an early stage in its development. In spite of this, the survey of the streams has shown that it has a remarkable flat grade of less than 20 feet to the mile.

The Arthur River has in the portion which has already been surveyed a general north-north-westerly direction. Its largest tributaries the Keith River and Wedge River - enter it from the south-south-west. The tributaries entering it from the north or east are only short creeks.

The highest point in the immediate vicinity is that of Phantom Peak (charted as High Peak), situated between the Wedge and Arthur Rivers. Several miles to the south-south-west, the Blue Peaked Hill rises to greater altitudes. To the north of Phantom Peak, Mt. Dipwood and other hills rise to prominent height. East of the Victory Mine, the Campbell Range rises abruptly above the surrounding country.

The whole of the area, particularly that to the south and west of the Arthur River has not been previously surveyed and is a comparatively unknown territory. For this reason the Wedge and Keith Rivers and other prominent features are not shown on existing plans.

The recently-retired Surveyor-General, Mr. E. Counsel has for a considerable period recommended the examination of this area and the provision of the necessary vote for this purpose.

Geology

The country is occupied chiefly by Pre-Cambrian rocks. Igneous rocks of probably Devonian age, intrude the above but are of small extent.

In the vicinity of the Victory Mine and the Keith River a considerable area of Permo-Carboniferous rocks occur. A small area of basalt outcrops at the northern end of the district between the cage and the lower dam site. Flats of river alluvium occur along the Arthur River.

Pre-Cambrian

These rocks consist chiefly of mica schists, quartz schists and quartz-mica schists, with lesser amounts of phyllites and limestone. The mica schists are generally very fine-grained, fissile types containing abundant secondary white mica. When the schistose structure is not so strongly developed these schists show all gradations to phyllites.

The quartz schists consist of white quartz with in many cases mica developed along the planes of schistosity. In some cases these schists are very fissile, but in others they are massive and more of the nature of quartzites. All gradations between mica schists and quartz schists are found giving the series of quartz-mica schists.

Limestones have been found at only one point viz. the Monument Rock a small headland which juts into the river about $1\frac{1}{2}$ miles upstream from the upper dam site. The rock is a greyish white, compact type, only occasionally traversed with veins of crystalline calcite. While not showing any schistosity it is very thinly jointed which jointing seems to correspond to the planes of schistosity in the schists.

G.A. Waller (1901) reports a dolomite as existing in the Victory Mine and considers it to be intimately related to the adjacent pyroxenite. The discovery of the limestone at Monument Rock is suggestive that the above dolomite may be similar and of sedimentary origin.

Included among the schists, there occurs at several localities belts of almost completely decomposed basic igneous material. Such localities are near the junction of the Arthur and the Wedge Rivers and near Kay's Gold diggings (as incorrectly charted).

Some of the material appears to have a schistose character and so was present in the schists before they were subjected to the pressure which developed their schistosity. The strike of the material appears to conform to that of the schists and it may therefore represent lava flows or tuffs formed contemporaneously with the enclosing sediments.

The schists have a strike varying from 0° to 40° and a general dip to west or north-west from 50° to nearly 90° . Towards the south boundary of the schists along the Arthur River the dip sometimes seems to be to the east but the evidence is not conclusive. Apart from this possible exception the

schists appear to form one conformable series. The length of exposure along the river is 6 to 7 miles but as the river crosses the strike of the beds at an average angle of 60° the width of beds at the surface at right angles to their strike would be approximately 4 miles. Assuming an average dip of 60° the total thickness of beds would be at least 2 miles. Mica schists form the lower part and the quartz schists the upper part of the series. The limestone occurs approximately at the middle of the series.

Devonian Igneous Rocks

Along Cann Creek at the eastern edge of the large flat to the north of Monument Rock, a comparatively fresh igneous rock occurs. It is dark-greenish, medium grained rock and appears to consist entirely of ferro-magnesian minerals. It is therefore an ultra-basic type and probably a pyroxenite. It may belong to either the Porphyry or Devonian phases of igneous activity, but more probably the latter.

A similar rock type is described by G.A. Waller (1901) from the Victory Mine further up the river.

Permo-Carboniferous

Strata belonging to this System outcrop along the Arthur River from near the junction of the Keith River upstream at least as far as the old Victory Mine huts. They consist of dark-grey, thinly bedded mudstones which readily break into small pieces on exposure. They are horizontally-bedded and apparently unfossiliferous. Well-rounded pebbles are numerous on the areas occupied by these rocks and may be derived either from them or possibly from old terraces of the Arthur River.

The exact horizon of the Permo-Carboniferous which these mudstones represent is not certain, but it would appear that they correspond to the 300 feet or more of similar mudstones which occur between the basal conglomerates and the Lower Marine Series in the adjacent district of Preolenna, as reported by Loftus Hills (Bulletin 13).

Tertiary Basalt

Basalt occurs plentifully on the North-West Coast districts of Tasmania and gives rise to the rich soil of those parts. One small area of it occurs in the valley of the Arthur River between the cage and the lower dam site. It is the typical fine-grained, basic, olivine basalt of Tertiary age which occurs in so many parts of Tasmania.

Its occurrences in the Arthur River is somewhat unusual as it goes below the stream level and appears to occur as an intrusive body 5 to 10 chains wide in the schist. It also occurs to elevations of several hundred feet above the river level and parts of it here may represent surface flows.

River Alluvium and Gravels

Fairly extensive river flats have been formed along the Arthur River at several localities. The largest of these extends on both sides of the river upstream from Cann Creek. Such flats are unusual in a district of such high relief, but their formation is readily understandable when the low grade of the river is considered. The flats are composed of the typical dark river alluvium and occur at elevations of 10 to 20 feet above river level.

Small sandy beaches occur at river level and are due partly to the tailings from the mines around Waratah.

At elevations above the river greater than those at which the alluvial flats occur, well rounded pebbles are found. These indicate river gravels which are probably remnants of terraces formed when the Arthur River was flowing at a higher level than at present.

The Dam Sites

Two possible dam sites have been chosen on the Arthur River. The suitability of these sites is determined in many ways by the rocks forming them and the geological structure of the site and adjacent regions.

Foundations, Leakages Etc.

These are two of the most important considerations in the selection of a dam site and are absolutely determined by the rocks occurring there and their structure.

Upper Dam Site

At this point, both banks of the Arthur River are formed of high cliffs of schists. The schists are mainly mica types but interbedded quartz schists also occur. The rocks have a strike of from 30° to 40° and a dip of 40° to 50° to the north-west.

The quartz schists are strong, hard, resistant types suitable in every way for a dam site. The mica schists are less resistant to weathering, but at depth are hard and suitable for foundations, especially where as in this case they are reinforced by interbedded quartz schists.

The schistose planes of the rocks may appear open at the surface, but at depth they are closed and no leakage is likely to occur along them.

The site may therefore be regarded as a suitable one.

Lower Dam Site

The banks of the Arthur River at this locality are formed by bold and steep cliffs of quartz schists. These rocks are dense, white and massive types composed of white quartz resembling reef quartz. The schistose structure is almost absent and they have more the appearance of quartzites.

These rocks are strong, hard and resistant and are particularly suitable for dam site purpose. In addition no leakage is anticipated throughout these rocks.

Several chains upstream basalt outcrops in the river bank (north side) and also occupies a small area between the Button Grass Creek and Hyena Camp Creek. At river level the basalt appears as a wide dyke intruding the schists. Part of the upper portions of the basalt may be surface flows, but even if they do, their position with regard to the dam site is such that the presence of the basalt does not affect the suitability of the site.

Materials of Construction

The quartz schists at the lower site would provide excellent material for use in any concrete work in connection with the construction of the dam. Good faces could be opened up for quarrying purposes and the quantity of material is practically unlimited.

The mica schists at the upper site would not be so suitable for concrete. Quartz schists also occur and would be suitable, but the conditions for quarrying and the quantity of material available are not so satisfactory as at the lower site, because the quartz schists occurs only as beds intercalated in the mica schists.

If rock and soil are used in the construction of the dam, the supply of such materials could be much more easily and cheaply obtained from the area of basalt near the lower site. This would give the lower site a decided advantage over the upper one..

Bye-Pass During Construction

If it be found necessary to provide by tunnelling a bye-pass for the river water during construction of the dam, the nature of the rocks to be passed through will have an influence on the site selection. At the upper site, mica schists and to a less extent quartz schists would have to be driven through, while at the lower site quartz schists would be passed through. Mica schists are softer and easier to drive through than quartz schists, so that the upper site would have an advantage in the above respect.

Conclusions

From the above discussions it is clear that the lower dam site is the more suitable as regarding the nature of the rocks for foundation purposes, and prevention of leakages and also for the existence of supplies of material for dam construction. If a bye-pass has to be provided by tunnelling during construction of the dam, harder rocks would be encountered at the lower site than the upper one, but this would possibly be counter balanced by the physical features being more advantageous at the lower, so that the total costs would be approximately the same.

The upper dam site is also suitable but the conditions are not generally so favourable as at the lower site.

Storage Basin

In addition to the actual dam sites, the holding capabilities of the storage basin has to be considered geologically. The presence of very porous rocks in a storage basin will permit the escape of water underground from the basin. Limestones are the most dangerous rocks from this viewpoint, though some sands and sandstones also come under this head.

The position of such porous rocks within the basin has also to be considered.

In the portion of the storage basin of the Arthur River scheme that was examined, the only rock likely to affect the basin is the limestone at Monument Rock. As far as can be ascertained from the occurrences, this rock forms only a narrow bed in the schists and little or no leakage could take place from it.

Further any possible leakage from it would be into tributaries of the Arthur River which deliver the water back into the basin. Northwards from Monument Rock, the limestone would if it continues cut across Cann Creek, Bird Creek, Hyena Camp Creek and other small streams. These all deliver into the Arthur River above the lower dam site, but the first two only above the upper site. Southwards from the Monument Rock, the limestone would traverse the Keith River valley and so any leakage would be returned to the Arthur River above the dam sites.

A large part of the storage basin has not yet been surveyed and was not examined during this visit. It would be advisable to have the remainder of the basin examined when its extent has been determined by survey. This applies especially to the vicinity of the Victory Mine where G.A. Waller (1901) refers to a large body of dolomite half a mile north of the Mine - a fact which the writer was unaware of until his return from the Arthur River. This could be best carried out while the camp is situated at the Victory Mine huts.

Conclusions and Recommendations

The geological investigation has shown that the two possible dam sites are both satisfactory but of these the lower one is regarded as being the better from many viewpoints.

The storage basin is also satisfactory as far as it has been surveyed, but it is recommended that the remaining part be geologically examined when its extent has been determined.

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