

REPORT ON THE PROSPECTS OF UNDERGROUND WATER SUPPLY
IN THE BELLERIVE-RISDON DISTRICT

In accordance with a memorandum from the Director of Mines to the Government Geologist, dated 6th August, 1945, we have examined the area from 2 miles north-west of Risdon to two miles south-east of Bellerive, in order to determine the possibilities of obtaining underground supplies of potable water from bores in that area. The specified requirement is for one million gallons a day of water with less than 100 parts per million NaCl and less than 200 parts per million of total solids.

In general the water supply prospects in this district are distinctly unfavourable. The largest portion of the area is occupied by Upper Permian siliceous mudstone which offer little prospect of even limited water supply. The next most common rock type is dolerite which is also too impervious to be a general aquifer, although limited supplies of water are sometimes yielded from its weathered or fractured zones.

There is, however, a small area stretching from Geilston to the beaches east of Bellerive which reasonably may be expected to be water-bearing and the water would probably be under sufficient head to be classified as a sub-artesian basin. We have little doubt that appreciable supplies of water are obtainable from this area, but the evidence is rather against obtaining water in the quantity and quality demanded.

Stratigraphy of the Basin

The oldest rocks in the area are the Lindisfarne mudstones of Permian age, white siliceous mudstones containing occasional pebble bands which are probably of glacial origin. This member is well exposed on the Cambridge road near the head of Kangaroo Bay Rivulet, and outcrops round the rock platform of Bellerive headland, and on the north side of Lindisfarne Bay. This is regarded by Voisey as the equivalent of the Woodbridge glacial zone. Its thickness here is not less than 300 feet. It is followed by a coarse sandstone bed about 30 feet thick, which tends to be pebbly towards the base. This sandstone which outcrops boldly and tends to form bluffs will be referred to as the Risdon sandstone. It occurs a little above the level of the old Sorell railway where it crosses the Cambridge Road. It forms the highest part of the headland at Bellerive and Natone and outcrops strongly near the junction of the Risdon, Lindisfarne and Richmond roads. The uppermost beds of the Lindisfarne mudstones immediately beneath the Risdon sandstone are fossiliferous. Fossils have been found on the rock platform on the south-west side of Bellerive headland, along the old Sorell railway half a mile west of the Cambridge road crossing, and about 2 chains from the Richmond-Risdon road on the branch road which leads up Risdon Creek at Bowen's Monument.

Above the Risdon sandstone are more barren white siliceous mudstones like the Lindisfarne mudstones but lacking the pebbles common in the latter. Dr. Lewis has referred to them as the Ferntree mudstones. They are at least 400 feet thick. The Ferntree mudstones are overlain by the lowest sandstone of the Triassic called by Dr. Lewis the Springs sandstone. This is a quartz feldspathic sandstone with much current bedding. It overlies the Ferntree mudstones at the Sugarloaf, a mile north-east of Geilston. It occurs on the Cambridge road about 3 miles from Bellerive, where it is faulted against Lindisfarne mudstones, and small inlier bounded by faults outcrops where the Lindisfarne-Risdon road crosses Geilston Creek. This sandstone is important because it is the most promising aquifer in the district.

The Springs sandstones are followed by about 100 feet of thinly-bedded micaceous and graphitic sandstones, mudstones and chocolate shales some of which are impervious. These outcrop at the head of Lindisfarne Bay, along the Lindisfarne-Geilston road, and on the Lindisfarne golf links. They also occur on the Cambridge road above the Springs sandstone and extend into the hills to the south. These are followed by a thick massive quartzite sandstone which forms the face of the hill behind Lindisfarne, and the hills above the Bellerive rifle range. This sandstone is also a possible aquifer.

Structure

The strata of the district are not folded but tend to have a general low dip to the south-west. However, they are strongly disrupted by a series of faults which have a general north-west strike, and which dominate the structure of the region, and determine the position and boundaries of the water-bearing areas. The Bellerive fault crosses the isthmus at Bellerive where it throws Lindisfarne mudstone against the Springs sandstone. Its throw here is not less than 400 feet with downthrow to the north-east. This fault crosses Kangaroo Bay bringing dolerite against Springs sandstone and thereafter its course has not been definitely fixed but it probably follows the shore by Natone Hill and Risdon.

The Lindisfarne fault outcrops in a quarry at the top of Ormonde Street, Bellerive. Here it throws the contact of the dolerite with the upper sandstone against the Springs sandstone. The fault dips steeply to the north-east and downthrows to the north-east with a throw of the order of 100-300 feet. The downthrown rocks show a strong drag dip of about 45° to the north-east. Crossing Kangaroo Rivulet the fault throws dolerite against dolerite but at the top side of the Royal Hobart Golf Links, the upper sandstone appears on the downthrown side of the fault, thrown against dolerite. The latter is noticeably coarse in grain near the junction and is clearly not a marginal phase. This relationship continues almost to Lindisfarne Bay. Here the shaley and thinly-bedded group comes in beneath the sandstone against the fault, with strong drag dips to the north-east. The fault passes beneath the dressing shed a few yards east of the Lindisfarne Rowing Club Boathouse on the north side of Lindisfarne Bay. Lindisfarne mudstones which have come in again below the dolerite on the upthrow side of the fault show marked jointing parallel to the fault west of the boathouse and become increasingly fractured as the fault is approached. Within a yard of the fault the mudstones are brecciated and the fault itself is marked by mudstone pug. At Geilston Creek the fault is about 5 chains west of the Risdon Road, and throws Springs sandstones against Lindisfarne mudstones. The throw here can scarcely be less than 600 feet.

image

The Howrah fault is roughly parallel to the Bellerive and Lindisfarne faults but throws down in the opposite direction, and on the Cambridge road throws Lindisfarne mudstone against Springs sandstone with a throw of not less than 500 feet. The Flagstaff fault is an oblique fault trending in a west-north-westerly direction between the Lindisfarne and Howrah faults. It throws Fern-tree mudstones and dolerite against the upper sandstones. Its throw is about 400 feet with a downthrow to the south-west.

Relation of Underground Water to Geology

The combined effect of these faults is that the area between the Lindisfarne fault, the Howrah fault and the Flagstaff fault is a senkungsfeld with a general depression of 400-600 feet below its surroundings. The bounding rocks of the senkungsfeld are all impervious, either mudstone or dolerite. The rocks within the

senkungsfeld are mostly pervious with one impervious zone. The rocks of the senkungsfeld are dished with a gentle south-west dip on the north-east and a strong drag dip to the north-east on the south-west. It is, therefore, a natural water trap with a storage capacity of at least 150 million gallons.

Evidence that the Springs sandstone in the basin has been an active aquifer is afforded by an unusual travertine deposit at the head of Geilston Bay. This travertine was first described by Charles Darwin and has been discussed by many observers since. No one, however, has so far given the explanation of the origin of the deposit. The structural analysis carried out by us has now disclosed the story behind this travertine.

The Geilston travertine occurs near the north western end of the senkungsfeld where the Springs sandstone comes to the surface and is nipped off by the intersection of the Lindisfarne and Flagstaff faults. When the reservoir formed by the Springs sandstone trapped in the senkungsfeld becomes filled with water and overflows, the overflow would take the form of a spring at Geilston exactly where the travertine is now found. Now during part of the Miocene period Australia generally endured an epoch of aridity. It was during this epoch that the numerous deposits of bauxite in Tasmania and elsewhere were formed, also the widespread veneers of "duricrust" and "grey billy" and laterite, so characteristic of many parts of Australia. During this arid epoch the seepage from the Geilston spring evaporated round the spring, and in this way built up the extensive travertine deposit. The banding in the travertine reflects the cyclic variations of climate during the long epoch of desiccation. The leaves and snails preserved in the travertine were fossilised in the same way as leaves and shells are rapidly fossilised round travertinous deposits forming today.

The Geilston travertine which is overlain by Pliocene basalt is therefore a fossil spring and testifies to the long history of senkungsfeld as an underground water storage basin.

The basin has the following disadvantages:-

- (1) It is limited in area. (about 2 square miles). However, a deep fault block of pervious strata let down into impervious strata may be expected to have considerable storage capacity. We estimate its capacity at not less than 150 million gallons.
- (2) The intake beds do not make a clear outcrop, but round the greater part of the basin make concealed underground outcrop against the bounding faults. This limits the opportunity for intake to replenish the basin.

With an intake area of less than 300 acres the annual amount of water that may enter the basin by means of the lower aquifer is about 18 million gallons. There will be some intake along the faults but the amount is not likely to be considerable. The upper aquifer has an intake area of approximately 500 acres, with an annual intake of at least 30 million gallons.

- (3) The basin contains an intrusive sill of dolerite above the lower aquifer. Study of the behaviour of these sills on the surface has demonstrated that they are very erratic and subject to rapid thickenings and thinning and often transgress sharply across the stratification. Their course is therefore unpredictable underground. Surface evidence suggests that this sill may thin rapidly from Kangaroo Creek towards Lindisfarne, but this is by no means certain. At the selected bore site it would be necessary to drill through the horizon of the sill which at this point may have cut out altogether but could be 100 feet or more thick.

97

(4) The expected aquifer is the lowest of the Triassic sandstones, which in neighbouring districts has been reported to contain halite, epsomite and other salts. There is, therefore, a danger that the water may be too saline.

(5) The Lindisfarne fault which forms the south-east boundary of the basin cuts across the head of Lindisfarne Bay and for about 10 chains a narrow strip of the edge of the basin is exposed to the waters of the bay. The expected aquifer is not exposed but it is possible that waters from the bay may percolate into them down the fault fissure, and associated cracks, for the rocks are rather jointed. At the present time we do not think such entry actually occurs for the direction of flow at present is probably up these fissures into the bay. A freshwater spring is reported at the head of the bay but at the time of the examination it was little more than a seepage. But if heavy pumping were applied to the basin the water table would be lowered and there is some danger of contamination of the underground water by waters from the bay which would increase the salinity.

Recommendation

In view of the foregoing disadvantages we are of the opinion that it would be inadvisable to go further with the scheme for an underground water supply except as a last resort. If however, the cost of bringing water to the district by other means proves to be prohibitive or impracticable, then we consider that this sub-artesian basin should be tested with a drill. A test site has therefore been selected at Lindisfarne. The test site is accessible to motor transport and the actual position may be moved up to five chains in any direction if required for practical reasons without impairing the geological suitability. The expected drilling depth is between 300 and 500 feet. The drilling would be sandstone then shale, but a sill of dolerite possibly as much as 150 feet thick might be found between the two. The expected aquifer is sandstone. The water is expected to be sub-artesian and should rise to within 50 feet of the surface, but pumping would be necessary.

(sgd.) *S.W. Carey*

GOVERNMENT GEOLOGIST

(sgd.) *G.J. Henderson*

FIELD GEOLOGIST

Department of Mines,
HOBART.

21st December, 1955

BORE FOR UNDERGROUND WATER FOR ROSNY GOLF LINKS

SITUATION: East side of old Risdon Road between Bellerive and Lindisfarne.

HEIGHT: 170'± - above river level.

DEPTH: 208')

WATER: 190' (. 6 gallons)
per minute).)

CHLORINE: 2,600 parts per)
million of NaCl.)
(NaCl content said)
to be lessening)
with time).)

) Information supplied
) by Mr. Davies via
) Mr. W. Howard of
) Lindisfarne.
)