

The coastal plain country north of Gingin Brook and known as the Beermullah plains is apparently sound. This country is watered by numerous swamps and lakes and by the Mungala Brook.

The only section of the area examined which is affected under all circumstances is that country close to Gingin occupied by Cretaceous outcrops.

On the coastal plain the disease appears to be governed by whether the country is watered by Gingin Brook or by the Moore River. The only apparent distinction between these two waters is their source. The Gingin Brook has its source in sediments and is entirely cut off from the granite, while the Moore River has its source in granite country and must receive a very large proportion of its water from granite areas.

*Conclusion.*—The disease is not confined to any particular geological type of country, but there is evidence that waters derived from country of different geological type may have some effect in the distribution of the disease. Analyses of water from various sources to test this conclusion is indicated.

### 3.—ARTESIAN WATER POSSIBILITIES ON KIMBERLEY DOWNS AND NAPIER DOWNS STATIONS, WEST KIMBERLEY.

(F. G. Forman, B.Sc.)

Following your instructions I proceeded to Kimberley Downs Station on the 28th August and was engaged until the 2nd September, investigating the artesian water possibilities on Napier Downs and Kimberley Downs. During this visit I was able, through the courtesy of Mr. A. Thompson, manager of Kimberley Downs Station, to visit many of the outlying bores and wells on the two properties and to view the salient geological features of the district.

The area examined is shown on the Lands Department Litho. 134/300 and is bounded on the north-east by the Napier Range, on the south by the Derby-Hall's Creek Telegraph Line and on the west by the holdings of the Meda Pastoral Company.

The Lennard River, which forms the boundary between the Kimberley Downs and Napier Downs Stations, is flanked by red alluvial flats and black soil plains, carrying Rosewood, Boxwood and Bauhinia, with Bundle-Bundle, Flinders and Ribbon grasses. The remainder of the area is made up mostly of well grassed Pindan country carrying Beefwood, Bauhinia, Peach bush, small patches of dense wattle and small Boxwood flats. The grasses are mostly Ribbon grass and soft spinifex.

The rocks in this area consist of sandstones, grits and shales of Carboniferous age with regional dip of about 2deg.-3deg. S.S.W.

The sandstones with underlying shale beds are well exposed at Kimberley Downs homestead, where they outcrop forming a typical dip slope of which Mt. Marmion is an outlying remnant.

Scattered over the country are a number of small buttes of which Hawkstone Peak, Mt. North and Mt. Perry are typical examples. These hills are all composed of the same current bedded sandstones and

grits that are seen at Mt. Marmion, and are apparently remnants of an old tableland whose surface has since been denuded to the present configuration.

In the Napier Range, the lower Carboniferous limestones, which underlie the sandstone and shale series, outcrop and the strata here steepen and dip from 20deg.-25deg., but still in the same regional direction.

About two miles west of Napier Downs homestead a fossiliferous limestone outcrop was observed, with a dip of about 40deg. to the north-east. This unusual dip is probably caused by drag along a fault plane with a north-west-south-east strike, but may be evidence of normal reversal of dip due to local folding. Fossils, contained in specimens from this limestone, have been identified by Miss L. Hosking of the University of Western Australia, as possibly of Lower Carboniferous age.

The igneous and metamorphic rocks, which outcrop to the north and east of the Napier Range, require no mention here as they are not a potential source of artesian water.

The rocks of Carboniferous age, which occupy all the area under consideration, are lithologically and structurally well adapted for the storage of artesian or sub-artesian water. The sandstones and grits have the requisite porosity for the storage of water and the shale members of the series furnish efficient cover beds. The structure, which is that of a very gently dipping monocline, is an ideal one for an artesian basin, the low dips involved leading one to expect that supplies of water would be available by quite shallow boring.

During the wet season there is no lack of water, the chief difficulty being one of transportation owing to the wide spread flooding caused by the Lennard River and its tributaries. During the dry season, however, the rivers all cease running and there are very few reliable pools left at widely separated intervals in the river bed.

The water supply has been augmented to a certain extent by shallow sub-artesian bores and wells, while at the 67-mile peg of the Derby-Hall's Creek telegraph line there is a Government artesian bore, which is said to yield 142,000 gallons of water per day from a depth of 1,003 feet.

On Napier Downs station there are three sub-artesian bores; one, the Hawkstone bore, just west of Hawkstone Peak; a second, the Halfway bore, about halfway between Hawkstone Peak and Napier Downs homestead; and a third, the Travellers' Creek bore, on the road from Kimberley Downs to Napier Downs and about one and a half miles north of the Lennard River.

The three bores all yield good supplies of fresh water, the Hawkstone bore and the Travellers' Creek bore being fitted with pumps. A fourth bore has recently been put down at Napier Downs homestead. This bore was in shale and dense limestone and yielded no water, being sunk in an unfavourable location too close to the sedimentary outcrop.

Kimberley Downs station uses the water from the 67-mile artesian bore, but apart from this has no other bore waters developed. A number of shallow hand bores have, at different times, been sunk on this property in various places.

A hand bore three miles south of the homestead sunk to a depth of a little over a hundred feet, carried good fresh water but yields too small a supply to be of use for stock. Three wells, shown on the Lands litho. about nine miles south of the homestead, are said to have struck fresh water but seem not to have been developed. One of these is probably identical with the "Sisters Well" shown on the Kimberley Downs Pastoral Company's private map, the other two being apparently unknown to the present manager.

About two and a half miles east of the homestead on the south bank of a small creek, which parallels the sandstone scarp on which the homestead is built, a shallow hand bore has revealed fresh water but an insufficient supply. At a point about two and a half miles north of the 52-mile point on the telegraph line three shallow hand bores revealed the existence of small supplies of salt water.

Two wells, two and a half miles north and eight miles south-east, respectively, of Mt. North have been sunk and carry good supplies of fresh water. These wells have been improved by the erection of crude oil engines and pumping jacks. They are known as the Mungee Wheeler well and the Barnes' well.

Artesian or sub-artesian supplies of water should be available at moderate depth anywhere in the area examined which is, say, ten miles down dip from the outcrop of the sedimentary beds in the Napier Range. Closer to the Range than this there is risk of disappointment, as it is too close to the outcrop of the porous beds for the water to have developed any hydrostatic head.

Within this ten-mile strip close to the Range much perhaps could be done by sinking shallow wells and obtaining the necessary quantity of water to keep a pump running by putting in drives at the bottom. The presence of fresh water at shallow depth in widely separated localities, such as the Halfway Bore and Mungee Wheeler and Barnes' Wells, suggests that good wells could be obtained almost anywhere within this strip of country. Before sinking wells the sites should first be tested by hand boring.

The experience of the Meda Pastoral Company, who have in one bore passed through 1,100 feet of shale carrying intensely saline water, and who have met with shale continuously in other bores put down, indicates that there is a thick shale horizon within this area.

The bore now being put down by the Kimberley Downs Pastoral Company at the Telephone Dam is apparently close to the northern edge of this shale member of the series. A shallow hand bore put down about two miles to the north was almost wholly in sandstone, with only a few thin shale bands. The Telephone Dam bore started in shale and has continued with little change to its present depth of 800 feet. Taking into consideration the low dips observable at Mt. Marmion and the fact that the base of this shale must be somewhere south of the hand bore two miles to the north of the Telephone Dam, this bore should now be very nearly through the shale and should then pass into the sandstones met with in the hand bore further north, from which a good supply of water is to be expected.

Assuming a 4deg. dip for this shale bed and that the outcrop is two miles to the north of the bore site, the bore should have passed into a water-bearing sand at approximately 740 feet.\* The results of boring up to date have not borne out this theory, and the only reason which can be advanced for this failure is that sub-surface dips in the vicinity of the bore are steeper than those observable at Mt. Marmion.

If boring operations in this area are considered in the future it would be well to locate any bore site to the north of the shale horizon and thus avoid the cost of penetrating it; the water in the shale itself being too saline for watering stock.

#### 4.—THE UNDERGROUND WATER SUPPLY AT POINT WALTER RECREATION RESERVE.

(F. G. Forman, B.Sc.)

Following a request from the chairman State Gardens Board, I was instructed to investigate the water supply possibilities at the Point Walter Recreation Reserve.

The Point Walter reserve is situated on the south side of the Swan River facing Freshwater Bay, and distant from Perth and Fremantle about eleven miles and three miles by road respectively.

Like most of the metropolitan area, the rocks in this locality consist of limestones and calcareous sandstones, overlain by drift sand. False bedding of the sandstone is common and at several horizons sub-recent fossil shells occur. The sandstones and limestones are in places cavernous, as evidence the number of small caves situated close to the water level and opening out in the cliffs which face Blackwall Reach on the western side of the reserve.

How far these caves extend is not known, as the openings are usually too small to be accessible, and even where they are accessible the caves soon become too narrow and too low for further travel. That these caves are undoubtedly water channels is evidenced by deposits of brown clay on the floors on which the marks caused by running water are plainly seen. They probably carry streams in wet weather. Along Blackwall Reach there are numerous fresh water springs issuing from the cliffs at or just below high water mark.

Two wells have been sunk on the reserve. One of these is situated near the foreshore on the northern side of the reserve close to the jetty. No reliable information relative to the quality of the water from this source is obtainable, as the well is now inaccessible; the brick lining having been removed and the well filled in. It is said that the water was unusable owing to a high salt content.

The second well is situated on the top of a hill near the centre of the reserve. The water level in this well is 92 feet below the collar of the shaft, and at the time of my inspection there was about three feet of water standing in the bottom. From the irregular shape of the bottom it is suspected that the well was at one time deeper, and that it has been partly filled in.

\* Since writing this report water was actually struck at 868ft. and rose to within 23ft. of surface.