DEPARTMENT OF MINES
SOUTH AUSTRALIA

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REPORT ON THE ROBINSON FRESH-WATER BASIN WITH SPECIAL REFERENCE TO THE POSSIBILITY OF UTILISING ITS SUPPLY FOR THE TOWNSHIP OF FLINDERS (STREAKY BAY).

Acting under instructions, I have enquired into the question raised by the Officers of theEngineering and Water Supply Department on the possibility of improving the water supply for the Township of Flinder by tapping the underground fresh water basin adjacent to the township

With this end in view, visits to the locality have been unde taken in the compnay of the Resident Engineer, Western District.

INTRODUCTION. The first indication of the existence of an undergrou fresh water area in the county of Robisnon was noted by Dr. R. Lock-hard Jack, and referred to by him as the "Wurkagee-Witera Fresh Wate Area" in Bulletin No.1 of the Geological Survey of South Australia, in connection with the Geology of portions of the Counties of Le Hunte Robinson and Dufferin, with special reference to the undergrou water supplies. In this Bulletin only the extreme south-eastern edge of a fresh water area is suggested namely that occuring in the Hundreds of Wurkagee and Witera.

But the existence of fresh water at very shallow depths furt westward towards the coast in the Hundreds of Campbell, Forrest and Ripton has been known to the residents in those districts for many years, and a considerable number of wells have been sunk in the area, and its water tapped for stock and domestic purposes.

With a view to ascertaining the extent of this fresh water area in the Hundreds referred to, a preliminary investigation was commenced in the neighbourhood of the township of Flinders by Mr. J. I. Miller who located a number of wells and collected certain information in connection with them.

These data have been considerably supplemented by the presne Engineer, Western Districts, and his Engineering Assistant.

The whole of the data collected by these earlier investigato has been made available to this Department.

GEOLOGY OF THE DISTRICT During the inspection of the wells in the locality, notes were made in connection with the general geology.

Both Igneous and Sedimentary rocks occur. The latter beds rest unconformably upon an old granitic terrain, dissected by an ancient drainage system, the details of which are very little known.

Igneous Rocks These appear to consist of a fine and even grained granite, a fine grained granite-porphyry (the phenocrysts being an orthoclase felspar) and a very coarse-grained gelspar porphyry. Outcrops of these porphries may be seen forming an east-west ridge crossing the Hundreds of Rounsefell and Wrenfordsley, with Calca Bluff, Calca Hill and Mount Bell as outstanding outcrops. This ridge extends into the Hund ed of Witeria. Outcrops of thesame rock occur along the southern shore-line of Sceales Bay. A very coarse grained felspar prophyry was struck while sinking wells No. 50, 51, 53 and 56 in the Hundred of Scott, at depths ranging from 50-90 feet. Well No.48, situated in Block 18A, Hundred of Forrest, bottomed on a fine grained granite at 60 feet.

Sedimentary Rocks These consist principally of travertine, limestone sandstones, sands, and possibly clays. These sediments may be referred to an Upper Tertiary and Post Tertiary age. The travertine consists of tabular blocks, which range from a few inches to several feet in thickness, and overlying the greater part of the district.

Recent wind-blown sand overlies portions of the obovementione series in the form of dunes and ridges.

TOPOGRAPHY The central surface of the area under review is somewhat undulateing with sandy ridges on thenorthern part, and extensive swamps in the southern area which occupy the south-eastern corner of the Hundred of Ripon, and the south-western corner of Hundred of Forrest, and the north-centre, and north-eastern corner of Hd. Wrenfordsley.

The timber is principally sheoak, with mallee scrub on the sandy ridges.

The swamps carry samphire and titree.

The presence of these extensive swamps does not appear to have any effect upon the quality of the upper-ground water. The saline surface water of the swamp is held up by swamp-clay. No break

through of the swamp water has been observed in the line of wells at the head of Beard's Bay. The absence of downward percolation indicat the impermeability of a continuous clay bottom to the swamps.

THE WELLS A systematic survey has been carried out of all the known wells in the locality. Levels of the surface, the water, table, and the bottom (reduced to sea level) has been obtained. In addition the temperature and salinity of the water in various wells have been recorded. The first survey was conducted by aneroid, check readings being made with a bench mark on the doorstep of the Post Office at Flinders. A further correction was made by regular hourly barometer readings taken in the field, and at the Post Office. On plotting the readings taken, after they had been reduced, it was found that many discrepancies occured. For instance, the levels of some of the wells located by earlier investigators had been obtained by theodolite, and reduced to sea level, and when the aneroid readings were referred to theys, big differences were found in all cases.

A recommendation was therefore made to the District Engineer to obtain all levels required by theolodite. This accurate work was undertaken by Engineering -Assistant R.T. harvey, in a systematic manner. But for this very careful survey it would have been quite impossibel to have prepared the ground water contours shown on the map, and to have determined the extent of theBasin, owing to the extreme flatness of the water table.

THE FRESH WATER BASIN The extent of part of the fresh water basin is indicated on the attached map, and it is known to extend into the high level area to the east. The basin is somewhat saucer-shaped. The principal intake beds are situated on the high levels to the east in the Hundreds of Forrest and Campbell.

The northern leimit is determined by a concealed east-west ridge of probable granitic rocks, at the western end of which the Township of Flinders is situated. To the west, the ground water contours rise slightly against a barrier, consisting of some impervio material. This barrier includes the whole of Gibsons Peninsular, and the country extending southwards along the shore line, as far as the northern and eastern fringe of Sceales Bay. The impermeability of th sediments underlying thePeninsula is amply illustrated by the number

of holes sunk in an endeavour to locate usable water, even for stock purposes.

The Igneous ridge extending from Calca Bluff towards the east into the Hundred of Witera forms a south and south-easterly barrier t the basin.

The outlet for the waters of the basin is a narrow strip extending from section 85 Hundred Wrenfordsley to Section A1, Hundred Wrensfordsley, which is a little beyond the Council Well on the raod to Yanera, the principal drainage passing into the head of Beard's Bay.

A considerable area of the central and southern portion of th basin is only from one to two feet above normal sea level, and this close proximity to sea level and the nearness of the coast line has an important bearing on the possible usefulness of the basin as a water supply.

From a study of the salinities and depths of the various well sunk into the basin there is ample evidence to show that the fresh water well exists as a thin layer resting upon, and in contact with, a larger body of saline water. The groundwater is generally found in a bed of sand, and in the calcareous sandstones; and in very shallow holes and wells, in the overlying limestone. No evidence was observe of the existence of any beds of clay separateing the two-quality waters. Wells sunk in too deeply into the basin quickly become too saline for general use. This fact was readily observed by the well sinkers years ago, so that most of the wells are only sunk to a depth of from two to four feet below the water table.

Well No.15 in Section 10B, Hd. Forrest is an example of a well which has been sunk too deeply into the basin, and this will account for the high salinity of the water in the well. A test made of the water near the surface indicated a less salinity than that of a sample taken from the bottom.

Samples of the water from a number of wells in various parts of the basin have been collected and analysed. The results are shown in the table attached as Appendix A.

Early in this investigation it became apparent that a series

of groundwater levels and temperature and salinity readings, should be obtained in the vicinity of the township of Flinders, at regular intervals. Certain wells were collected and placed under observation. This work was again undertaken by Mr. R.T. Harvey, the results of which are recorded in the following Tables:

TABLE I

ROBINSON FRESH WATER BASIN

Indicating Variation in Water Levels

Well No. & Name	15/1/30	26/8/32	29/12/32	21/1/33	6/3/33
1 Malangerie	107.71	110.50	-	109.68	109.68
2 Fry's	103.48	104.82	104.11	103.50	103.75
3 Cooeyana	103.42	104.49	-	104.08	103.92
4 W.C.R.	103.33	104.46	-	104.20	104.01
5 Wilkalinsie	102.93	104.57	105.10	104.76	104.46
6 Pankatana	99.67	103.00	102.48	101.97	101.60
8 Pantoulbie	104.57	-	-	104.13	103.88
9 S. of Pantoulbie	104.97	-	104.56	104.11	103.70
1$ Edleba	104.96	-	102.46	101.92	101.33
13 Alcannabie	104.01	-	103.80	103.33	102.83
14 Section 8, N.E. Forrest	105.68	-	-	106.00	106.50
15 Campbell's	113.76	-	112.43	113.03	113.03
93 Sec. 286 Ripon	-	-	103.36	102.56	102.28

These levels have been reduced to normal sea level, datum being 100 ft

TABLE II (next page)

With reference to the first two columns of salinity readings, namely those taken on 15/1/30 and 28/8/32, it must be pointed out that there is a doubt in connection with the accuracy of the salinometer used. A number of these instruments sent from the office of the Resident Engineer have been calibrated and all have shown errors, in some cases vary very marked.. The instrument that was used for the subsequent readings is one that has been corrected so that the later readings check up fairly accurately with the detailed analyses of samples from the same wells whown on Appendix A.

TABLE II

Variations in Salinities

Well No & Name	15/1/30	26/8/32	29/12/32	21.1.33	6.3.33
1. *Malangarie	5/8 at 60	1/8	-	1/8 @ 68	1/8 @ 70
2. Fry's	1⅛ @ 60	3/8 @ 55	5/8 @ 66	1 @ 65	1¼ @ 67
3 Cooeyana	15/16 @ 60	1/2 @ 57	-	1/4 @ 65	1/4 @ 70
4 W.C.R.	5/16 @ 60	5/8 @ 55	-	1/4 @ 65	1/4 @ 70
5 *Wilkalinsie	3/16 @ 60	1/8 @ 55	0 @ 70	0 @ 66	0 @ 75
6 *Ponkatanna	3/4 @ 60	3/8 @ 55	1/4 @ 70	1/2 @ 66	1/2 @ 73
8 *Pantoulbie	3/8 @ 55	-	-	1/4 @ 68	3/8 @ 70
9 *S. of Pantoulbie	1/4 @ 55	-	1/8 @ 70	1/8 @ 68	1/4 @ 72
12 Edleba	3/8 @ 50	-	1/8 @ 70	1/8 @ 68	1/8 @ 72
13 *Alcannabie	1/4 @ 55	-	1/4 @ 68	1/4 @ 66	1/4 @ 72
14 Sec.8, N.E.Forrest	1/4@ 63	-	-	1/8 @ 66	1/8 @ 70
15 Campbell's	1¼ @ 61	-	3/4 @ 70	3/4 @ 68	7/8 @ 72
93 Sec. 286 Ripon	-	-	3/8 @ 70	1/2 @ 66	3/8 @ 72

A detailed analysis has been made of the water in the wells marked *

See Appendix A.

In connection with the observations made, the outstanding feature is the serious falling off of thewater levels. The only wells that appe to hold their levels are No.1 Malangarie and No.2 Fry's Well, but in connection with the latter well - Fry's - the salinity has increased beyond usefulness.

Although the water level of No.5 Wilkalinsie, is falling, the salinity has remained constant, and is the lowest reading in the basin. This may be accounted for by the well being situated on the upper slope of an old drainage channel which may be fed from an underground source situated somewhere to the east and quite independent of the basin itself. It is suggested that No.1 Well Malangarie is situated on the same old drainage channel, but higher up the slope. An alternative suggestion is that there is a shallow zone of more porous rock on the line of these wells, fed by the fresher water from theupper levels.

Owing to the fairly rapid fall of the groundwater levels it is difficult to estimate the probable amount of fresh water available in the basin. It is not expected that at this time of the year the depth of the water available is very large. Another important factor is the rate of movement of the groundwater. The sand and sandstones appear to be fairly porous, with ample bore spaces between the grains for the free movement of the water. The rate of fall of the water table observed since the present investigations commenced seems to confirm this view.

One of the greatest difficulties to be bet with by the Engineer will be the adoption of a method to pick up this thin cream or layer of fresh water without also drawing in the saline water immediately beneath.

A further aspect to be borne in mind is the question of replacement of the water in any one locality after continuous pumping On the removal of a large quantity of the fresh water, will there be a replacement in the body of the basin by saline water from beneath. The groundwater table will tend to re-establish itself if a cone of depression is caused temporarily by the withdrawal of some of the fresh cream. In all probability the contours of thewater table will be restored by the rise of saline water from below. On the other

hand, will the main body of saline water from the higher levels of the basin, in moving down the water table, mix with the thin layer of fresh water, and thus increase the general salinity of the groundwater in the body of the basin? It is quite possible that both these suggested actions may occur.

RECOMMENDATIONS From the information available, there is no definit evidence to support a strong recommendation that the basin is capabl of supplying sufficient water of good quality for the Township of Flinders, that is, within reasonable and economic distance from the township.

It has been suggested that at least 30,000 gallons per day would be required for the Township, with a further 20,000 per day if the reticulation is to include residents on Gibson's Peninsula.

It appears very definite that the basin is not capable of supplying such a large volume of water continuously and still keep within good quality range, ile. below ½ oz. of mineral salts to the gallon. A great deal depends on the "pick-up " method adopted, whether the whole of the water required is pumped up into a storage tank within a period of 8 hours, of an electric automatic "pick-up" system is adopted, whereby the water can be pumped over thefull 24 hour period.

Nor can it be definitely said that no evidence is available to support any scheme. The large number of wells in the district wit a very good quality water, is ample evidence to warrant the expendit ure of a sum of money to carry out a pumping test.

A recommendation is therefore made that a trench 30 feet lon by 3 feet wide, and sunk to a depth of no more than 18 inches below the water table be excavated.

A site on which to excavate such a trench and carry out a pumping test was selected early this month when visiting the localit with the District Engineer. This site is one mile S.W. of No.6 Ponkatana Well, on the edge of a swamp in the extreme S.W. corner of Section 8, S.W. Hd. Forrest.

Since this last visit, however, further information has been obtained form this locality by Mr. Harvey, and additional levels taken, the result of which has been to cast a doubt on selecteing

a site so low down on the water table.

The most favoured site is a little south of No.5 Willkalins well, say abbut ¼ mile whichis situated higher up on the water table and which would intercept all waters passing down the slope from th direction of the well. Although the water level of Wilkaninsie well during the month of March, 1933, was only about 4ft. 6ins. above normal sea level, it appears sufficiently high to recommend this site for a test. The objection that may be raised at this site appears to be mainly a monetary one, for the distance that the water would have to be pumped to the nearest swamp is considerably greate than where the first site was selected . The disposal of the water while carrying out a pumping test is very important. The water table being so extremely flat, it is practically impossible to discharge the water back into the basin at a lower level, without the danger of the water flowing back owing to the wide influence of the cone of depression formed by pumping. The only sure method to prevent this return is to pump the water on to one of the claypans of the swamps.

Should the test near Wilkaninsie well be successful, however the same trench could be utilized for any scheme it is proposed to adopte, as its distance from the township is not too great to consider from an economic point of view.

The former site was selected mainly for its proximity to a swamp, and the cost of a discharge pipeline considerably reduced. But should it have proved successful, a further test (nearer the township) whould have had to be tried as the site is too far dista to be utilized for any scheme desired.

Should the approval be given for the suggested pumping test, it will not be important for any scheme desired.

The rate of pumping from the trench should at first not exceed 30 gallons per minute. (This flow would equal, on an 8-hour period, 14,400 gallons per day, and on a continuous 24 hour period 43,200 gallons per day). This test should be carried out over a continuous 24 hour day period, for at least three weeks. The rate of pumping should then be increased - if possible - for a further

period to ascertain the maximum amount of water available, without increasing the salinity of the water beyond ½ oz. to the gallon.

Salinity readings should be taken with a calibrated salinometer every hour for the first few days, and recorded, and later at regular periods according to the results obtained during the first few days. Samples should be collected at intervals and submitted to this office for detailed analysis as a check.

The actual fluctuation level of the water table should be noted at regular intervals.

A series of shallow 4 inch bore holes put down adjacent to the trench would be advantageous to carry out observations on the rate of flow, and the direction of movement of the groundwater, also to to note the extent of the cone of influence brought about by the pumping.

The water levels and the salinity of the following wells should be checked and recorded, at the end of each week of pumping:

No.1 Malangarie
No.2 Fry's Well
No.3 Cooeyana
No.4 W.C.R.
No.5 Wilkaninsie
No.6 Ponkatana
No.8 Pantoulbie
No.10 S. of Pantoulbie
No.11 S. of 10
No.14 W. of Malangarie
No.15 Dahl's

The writer desires to express his appreciation and thanks to the Western District Engineer, and Engineering Assistant for the very valuable assistance rendered, and the interest shown by these officers during this investigation.

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