

UNDERGROUND WATER

TR17-144-156

34. Investigation of water supply, Currie, King Island.

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The King Island Council is planning to extend the Currie water supply which is obtained from an underground supply in dune sands. The population of the town is about 500 and the maximum amount of water used in any one day in the 1971 summer was 1180 kL. An average of over 2270 l/person/day is high by most standards, but Currie being situated on sand dunes has very porous soil and large amounts of water are required for gardens to keep them established during dry periods.

The Council requested that an area near the present water scheme be examined as it would be desirable to use existing facilities to pump the water to the reservoir. The area suggested by the Council is just south of the present scheme. There are also plans to develop an independent supply for the new hospital which will have extensive lawns to water.

GEOLOGY

The general geology of the Currie area (fig. 37) has been described in a previous report on the water supply area (Matthews, 1966) and little extra geological information was collected during the present investigation of the area. Briefly, the 'New Dunes' with a high carbonate content overlie the siliceous 'Old Dunes'. The dunes are of variable thickness and in some areas at least, overlie clay, which was met when drilling in the water supply area. It is unknown whether this clay is of clastic origin or whether it is derived from *in situ* weathering of basement rocks. Basement rocks in the Currie area consist of Precambrian mudstone intruded by Precambrian granite.

Only limited information concerning the subsurface geology can be gained from surface inspection in the Currie area. Factors such as depth of sand accumulation, depth to the water table, thickness of saturated sand and depth to basement could only be surmised in most areas. For this reason, geophysical methods were used to aid the interpretation of the subsurface geology.

HYDROLOGY

The groundwater is derived from rain falling on the dunes, which percolates down until it reaches the water table or basement rocks. Depending on whether the point that it reaches is higher or lower than the surrounding points on the water table or basement, it will either move laterally or remain stationary. Water table measurements taken from wells and water holes in the previous survey of the water scheme (Matthews, 1966) show that the water table rises from the shore line to inland positions. The groundwater, under the influence of gravity will tend to move from the higher points to the lower points, that is towards sea level. It will do so by seepage through the sand on a front, the direction in which it moves being controlled by the shape of the water table and also by the slope of the basement rocks.

An attempt was made to define the catchment and storage area in 1965 and this was determined at about 1.7 km². As well as serving the water supply area there are a number of seepages along the shore line that must be supplied by the same catchment area. Surveys carried out in areas in New

South Wales have estimated safe yields from similar sands. Curriane (1944) estimated that the safe yield for an area near Newcastle from the Dampas Sandstone is 425 MGD for average annual rainfall is about 1000 mm. Curriane (1944) regarded this safe yield as a little high but thought such a figure was reasonable for the four Dampas area where the rainfall is about 1000 mm.

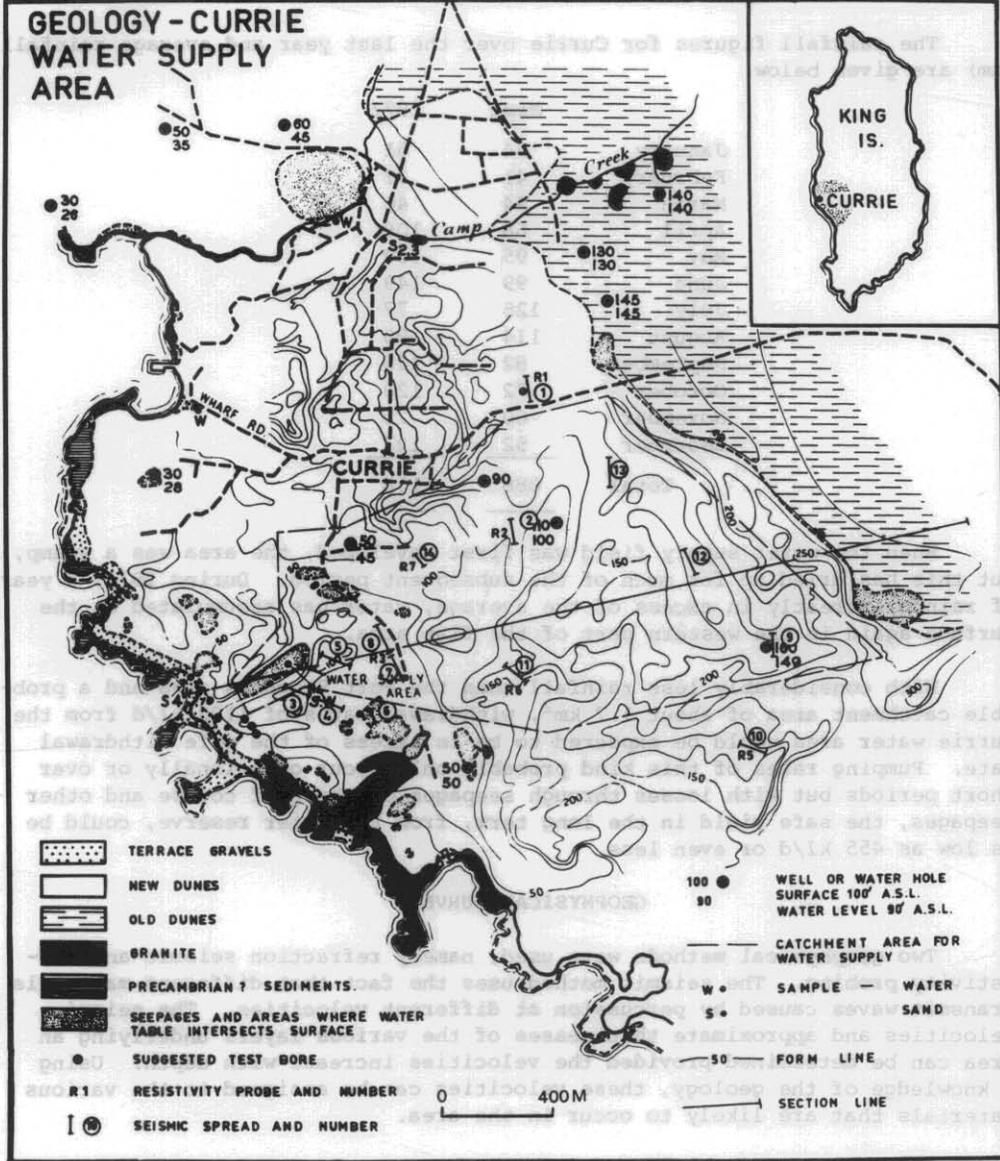
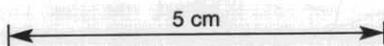


Figure 37.



South Wales have estimated safe yields from similar sands. Corlette (1944) estimated that the safe yield for an area near Newcastle from the Tomago Sandbeds as 878 k1/day/km² where average annual rainfall is about 1060 mm/year. Griffin (1961) regarded this safe yield as a little high but thought such a figure was reasonable for the Port Stephens area where the rainfall is higher at an average of about 1320 mm/year.

The rainfall figures for Currie over the last year and average rainfall (mm) are given below.

| | Mean | 1971 |
|-----------|------|------|
| January | 34 | 61 |
| February | 41 | 32 |
| March | 44 | 46 |
| April | 68 | 108 |
| May | 95 | 139 |
| June | 99 | 149 |
| July | 125 | 77 |
| August | 114 | 95 |
| September | 82 | 125 |
| October | 72 | 128 |
| November | 60 | 71 |
| December | 52 | 127 |
| Total | 888 | 1158 |

When the water supply field was first developed, the area was a swamp, but this has dried up for much of the subsequent period. During 1971, a year of rainfall greatly in excess of the average, water has accumulated on the surface again in the western part of the flat area.

With considerably less rainfall than the Port Stephens area and a probable catchment area of about 1.7 km², withdrawal rates of 1182 k1/d from the Currie water area would be expected to be in excess of the safe withdrawal rate. Pumping rates of this kind probably only occur occasionally or over short periods but with losses through seepages on the golf course and other seepages, the safe yield in the long term, from the water reserve, could be as low as 455 k1/d or even less.

GEOPHYSICAL SURVEY

Two geophysical methods were used, namely refraction seismic and resistivity probing. The seismic method uses the fact that different materials transmit waves caused by percussion at different velocities. The seismic velocities and approximate thicknesses of the various layers underlying an area can be determined provided the velocities increase with depth. Using a knowledge of the geology, these velocities can be assigned to the various materials that are likely to occur in the area.

As with seismic properties, different materials have differing resistance with respect to the passage of an electric current, and a resistivity probe measures the apparent resistivity of various layers. Sand saturated with water, for instance, particularly if the water has moderate quantities of dissolved solids, has much lower resistivity than dry sand.

Apart from surveys in the hospital area and in the water reserve, seismic spreads and resistivity probes were undertaken in the area regarded as the storage and catchment area for the water supply. Altogether, nineteen seismic spreads of twelve geophones with 7.6 and 3 m geophone spacing were

fired from each end. The spreads with 7.6 m geophone spacing were designed to indicate the position of the basement while from the spreads with the 3 m geophone spacing, it was hoped that the position of the water table would be indicated. Where spreads with 3 m geophone spacing were fired, they were always set out along the line of a spread with a 7.6 m spacing with the northern shot point common to both spreads. Where two such spreads are located, the long spread has been given a number and the short spread the same number followed by A (e.g. 11 is the long spread and 11A is the short spread in the same area). Seven resistivity probes using the Schlumberger configuration were performed along different seismic spread lines. The positions of the seismic spreads and the ones along which resistivity probing was undertaken are shown in Figure 37.

RESULTS

Although the results of the seismic and resistivity surveys are shown in the sections in Figures 38 and 39, a brief summary of each is given below, with interpretations of the likely materials making up the layers.

Seismic Spread 1. (Hospital area)

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 380 | 2.4-5.2 | Soil and loose sand. |
| 2 | 640 | | Damp, compact or cemented sand. |
| 3 | 1700 | 3.0-4.5 | Water saturated sand or weathered basement rock or clay. |
| 4 | 2740 | | Siltstone basement or weathered or jointed granite. |

The third layer was not definitely indicated by the 7.6 geophone spacing, but if present would be about 12 m from the surface. The fourth layer occurs at 15-18 m from the surface but if the 1700 m/s velocity layer is present then this refractor could be slightly deeper.

A plot of the resistivity probe along this spread shows a lowering of the resistivity from about 2.1 m to about 14 m (fig. 39). The resistivities of the various layers were calculated as 250, 700, 75, 15 000 Ω -m and the depths to the interfaces between these layers are 0.6, 3 and 14 m.

Spread 2

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 380 | 3.6-6.0 | Sand and loose sand. |
| 2 | 1700 | 4.2-7.6 | Water saturated sand, may be partly clay or weathered bedrock. |
| 3 | 3350 | | Granite or siltstone basement 9-12 m below the surface. |

Spread 2A

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 300 | 3.0-4.0 | Soil and loose sand. |
| 2 | 1700 | 6.0-6.7 | Saturated sand and weathered basement. |

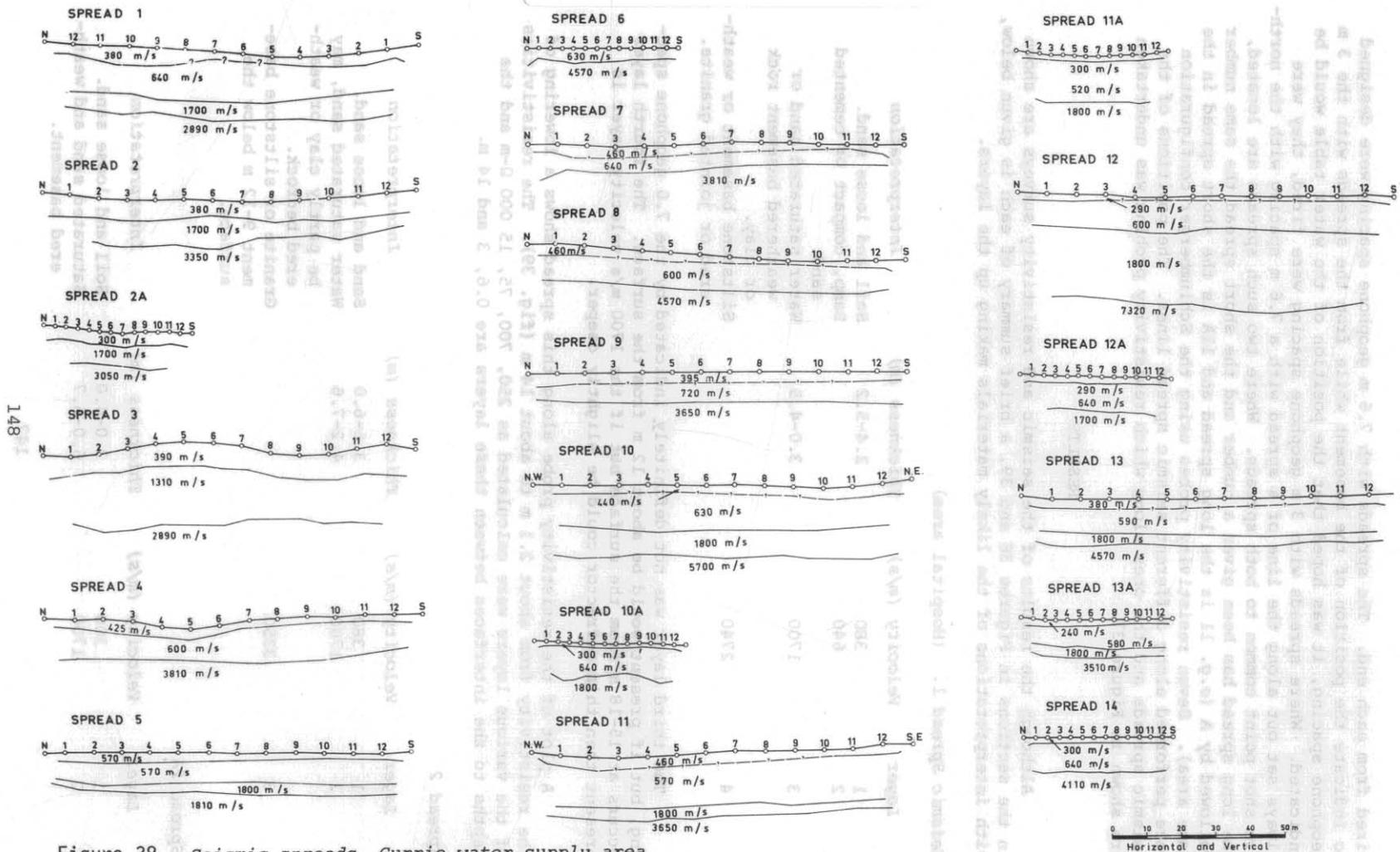


Figure 38. Seismic spreads, Currie water supply area.

Spread 2A (continued)

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|-------------------------------------|
| 3 | 3050 | | Basement 9-10.5 m from the surface. |

A resistivity probe near the well indicated decreasing apparent resistivity from 1.5 m to about 23 m. Resistivities of about 350, 600, 20 and 1000 Ω -m have been assigned to the layers and the depths to the interfaces between these layers are about 0.6, 1.5 and 23 m.

Spread 3

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 390 | 4.5-8.0 | Soil and loose sand. |
| 2 | 1310 | 10.5-15.0 | Interpretation given below. |
| 3 | 2890 | | Basement rock, 15-19.5 m from the surface. |

The 1310 m/s velocity layer only occurred in this spread. This velocity layer might represent water saturated sand as it is approximately an extension of the water level from the water supply area. It could also represent a zone where the sand is more compacted by carbonate precipitate than in other areas or it might be weathered bedrock. A further possibility is that the velocity is only apparent as the surface is undulating in this area and no corrections have been applied for the resultant reduced geophone spacing. However the results from Spread 4, which is also in undulating country, gave no indication of this velocity layer.

Spread 4

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 425 | 2.0-3.5 | Soil and sand. |
| 2 | 600 | 5.0-12.0 | Moist or slightly cemented sand. |
| 3 | 3810 | | Basement rock, 8.5-12 m from the surface. |

A resistivity probe between Spreads 3 and 4 shows gradually increasing apparent resistivity from the surface to 45 m, apart from two small zones where there is a decrease. Either of the small zones could indicate a thin water bearing lens or a clay lens.

Spread 5

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 365 | 1.5-3.0 | Soil and loose sand. |
| 2 | 570 | 4.5-6.0 | Moist or slightly cemented sand. |
| 3 | 1800 | 3.0 | Water saturated sand, weathered basement or clay. |
| 4 | 3810 | | Basement rock, 9-12 m from the surface. |

Spread 6

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|----------------|
| 1 | 630 | 3.0-4.0 | Damp sand. |
| 2 | 4570 | | Basement rock. |

Spread 7

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 460 | 2.0-3.0 | Soil and sand. |
| 2 | 640 | 3.5-6.0 | Moist or slightly cemented sand. |
| 3 | 3810 | | Basement rock, 5-9 m from the surface. |

Spread 8

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 460 | 2.0-3.5 | Soil and sand. |
| 2 | 600 | 6.0-6.6 | Moist or compacted sand. |
| 3 | 4570 | | Basement rock, 7.5-10.5 m from the surface. |

A resistivity probe between Spreads 7 and 8 shows a decreasing apparent resistivity from 4.5-18 m in depth. As the indicated position of basement rocks from the seismic spreads is about 6-10.5 m from the surface any useful water bearing zone would occur above these levels. Calculated resistivities are 350, 600, 100 and 600 Ω -m and depths to the interfaces between these layers are about 0.4, 4.5 and 18 m.

Spread 9 (continued)

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 395 | 2.0-3.0 | Soil and sand. |
| 2 | 720 | 3.5-6.0 | Damp and clayey sand. |
| 3 | 3650 | | Basement rock, 7.5-8.5 m from the surface. |

No interpretation of the resistivity results gives a depth for saturated sand of 3 m so that the material supplying the water must be very thin.

Spread 10A

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 300 | 1.5-1.8 | Soil and loose sand. |
| 2 | 640 | 6.5-9.0 | Moist or slightly cemented sand. |
| 3 | 1800 | | Water saturated sand or weathered basement rock, 8.5-10.5 m from the surface. |

Spread 10

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|----------------------------------|
| 1 | 440 | 2.0-3.0 | Soil and loose sand. |
| 2 | 630 | 7.5-10.0 | Moist or slightly cemented sand. |

Spread 10 (continued)

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 3 | 1800 | 6.0-7.0 | Water saturated sand or weathered basement. |
| 4 | 5700 | | Basement, probably granite, 18 m from the surface. |

A resistivity probe along the line of Spread 10A shows increasing apparent resistivity from the surface to 10 m followed by decreasing resistivity to 45 m. Resistivities of 350, 600, 2000 and 15 Ω -m with depths to the interfaces between the layers at 0.6, 1.8 and 12 m respectively, have been calculated. The low resistivity at 12 m is probably due to the water table.

Spread 11A

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 300 | 1.2-1.5 | Soil and loose sand. |
| 2 | 520 | 10.5-11.5 | Moist or slightly cemented sand. |
| 3 | 1800 | | Water saturated sand or weathered rock, 12 m from the surface. |

Spread 11

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 460 | 1.8-3.0 | Soil and sand. |
| 2 | 570 | 10.0-12.0 | Moist or slightly cemented sand. |
| 3 | 1800 | 2.0-3.5 | Water saturated sand or weathered bedrock. |
| 4 | 3650 | | Basement rocks, 16 m from the surface. |

A resistivity probe in this area shows a general increase in apparent resistivity to 6 m, a slight decrease to 12 m, an increase to 18 m and then a strong decrease to 45 m. Resistivities calculated for the various layers are 350, 600, 2000 and 15 Ω -m with depths to the interfaces between the layers at about 0.6, 4.5 and 15 m.

Spread 12A

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 1 | 290 | 1.5 | Soil and loose sand. |
| 2 | 640 | 6.7-8.0 | Moist or slightly cemented sand. |
| 3 | 1700 | | Water saturated sand or weathered bedrock, 8.5-9.5 m from the surface. |

Spread 12

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|----------------------------------|
| 1 | 290 | 1.2-1.8 | Soil and loose sand. |
| 2 | 600 | 6.5-8.5 | Moist or slightly cemented sand. |

Spread 12 (continued)

(continued) of spread 12

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|--|
| 3 | 1800 | 18.0-30.0 | Water saturated sand or weathered basement rock. |
| 4 | 7320 | | Basement rock, probably granite, 27.5-31 m from the surface. |

Spread 13A

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 240 | 1.2-1.8 | Soil and loose sand. |
| 2 | 580 | 4.5-6.0 | Moist or slightly cemented sand. |
| 3 | 1800 | 2.5-6.0 | Water saturated sand or weathered rock. |
| 4 | 3510 | | Basement rock, 9-10 m from the surface. |

Spread 13

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---|
| 1 | 380 | 2.5-3.0 | Soil and loose sand. |
| 2 | 590 | 6.0-7.5 | Moist or cemented sand. |
| 3 | 1800 | 2.5-3.5 | Water saturated sand or weathered basement rocks. |
| 4 | 4570 | | Basement rocks, probably granite, 12-13 m from the surface. |

Spread 14

| Layer | Velocity (m/s) | Thickness (m) | Interpretation |
|-------|----------------|---------------|---------------------------------------|
| 1 | 300 | 1.5 | Soil and loose sand. |
| 2 | 640 | 7.5 | Moist or cemented sand. |
| 3 | 4110 | | Basement rocks, 9 m from the surface. |

A resistivity probe indicated four layers with resistivities of about 300, 850, 110 and 150 Ω -m with depths to the interfaces between the layers at about 0.6, 6 and 30 m.

DISCUSSION

The above interpretations have been made in the absence of any complete drill hole sections from the surface to basement rocks and are subject to some uncertainty until drilling is undertaken. A little shallow drilling has been undertaken in the water reserve area and some wells have been dug inland from these. The bore holes and wells indicate the position of the water table and thus offer some control to the interpretations.

The resistivity probes show a moderately low resistivity near the surface which is probably due to soil and perhaps some salt accumulation from sea spray. Higher resistivities below this are probably due to dry sand and the lower resistivities at lower levels could be caused by water saturated sand, clay or weathered bedrock. Very high resistivities probably indicate

the presence of unweathered granite.

Although water saturated sand is not indicated in all spreads, it does not mean that it is necessarily absent because if only thin layers occur, they would not always be discernible from a seismic spread with geophone spacing of 7.5 m. On the other hand irregularities of the basement rock surface could preclude the occurrence of water saturated sand where the basement is high and there could be large thicknesses of saturated sand where the basement is topographically low. The spreads were not levelled with respect to sea level but from their positions on the plan with respect to the form lines, some variable relief in the basement is apparent. In general it appears to rise from the shore line to inland areas in much the same way as the dunes increase in height towards the east. At Spread 13 the basement is about 36.5 m above sea level, at Spread 9 about 39.5 m, at Spread 10 about 32 m, at Spreads 11 and 2 at about 30 m, and at Spread 12 at about 18 m above sea level. This depends on the large thickness of the 1800 m/s velocity material, under Spread 12, being water saturated sand. However it could at least in part be weathered basement rock. The other spreads nearer the water reserve area indicate the basement to be at various levels up to about 15 m above sea level.

Hospital area

The seismic and resistivity work undertaken near the hospital suggests that the occurrence of water saturated sand at about 12 m from the surface, is a definite possibility. The material at this level could also be weathered basement or clay. If the area is drilled, the hole should be continued until basement rocks are reached and the largely unweathered basement is expected to be encountered at about 15-18 m from the surface. If the depths indicated are correct, then it is unlikely that any water that does occur could be developed with spear bores. A screened and possibly gravel-packed bore would be the most efficient system that could be used.

Water reserve area

Seepages occur along the coastline about 40-60 m south-west of the water reserve area and it is in this area that the King Island Council hopes to extend the supply. The catchment area for the seepages is almost certainly the same as that for the water reserve area.

The seismic spreads near the water reserve gave no indication of a ridge in the basement separating the seepages from the water supplying the water scheme but rather a general rise in basement to the south where it outcrops. Development of these areas should aim only at collecting the water that passes the water supply area. Over-development could affect the quantity of water that can be pumped by the presently established system. It is not expected that large increases of water could be obtained from this source although it could supply valuable short-term additions to the supply. It is suggested that 3 or 4 test bores be drilled 40-60 m inland from the seepages in an approximately N-S line as shown on the plan in Figure 37 to establish the presence of sufficient depths of saturated sands to allow development. If suitable low areas are established it is likely that spear bores could be used.

Method of water extraction

The water supply area was first developed as a town supply in the early 1950s when it was a low lying swamp several metres from the coastline. Various systems have been used to extract the water from the shallow sands. These have included 8-inch screened bores that have had their screens replaced

at times because of encrustation. Replacement of the screens in some of these bores has not always resulted in a return to the original yields, suggesting that the aquifer is clogged around the bore. It seems likely that this clogging would be due to precipitation of calcium carbonate from the water.

About 1965 a collection chamber was installed. This consisted of a perforated pipe placed in a trench within the sand and surrounded by a graded filter. This system has not been entirely successful, as the rate at which water can be extracted has slowly decreased.

In later years, a number of patterns of spear bores have been installed and these are the main suppliers of water at the present time. It seems likely that these will tend to give decreasing supplies in the future, as occurred in most cases with the 8-inch screened bores. If surging does not improve the yield after such a fall off, then treatments with acid could be experimented with, as calcium carbonate is soluble in acid. This might also be a means of improving some of the 8-inch bore yields so that they would be a useful alternative source of water if the other schemes fail for any reason.

The scheme depends largely on the water arriving at the water reserve area with little inducement to do so by drawdown in pumped bores. The depth of saturated sand is only about 1.8-2.5 m. The slope of the water table and basement surface must largely control the flow of the water at this point.

Future supplies of water

Several alternatives are available if large additions to the present supply are required in the future. As mentioned, it is considered that only small additions can be safely obtained from the area of the present scheme.

Shallow water from new dunes. If an area similar to the area now being used for a water supply is located, that is with a few metres of saturated sand and the water table close to the surface, then it could be developed in a similar manner with spear bores or a collection chamber. In the 1966 report on the Currie area, seepages near Wharf Road and a swamp north of Camp Creek were suggested sites for investigation. However, measurements of bacterial content indicated that the water in these areas was unsuitable for domestic use (H. Burley, pers. comm.). As Currie is now sewered, it would be expected that the bacteria will diminish with time, although farmlands upstream along Camp Creek could remain a permanent source of bacteria. The possibility of chlorination should not be excluded as either of these areas, if it is proved that sufficient water is available, could provide the cheapest source of water.

Deep water from new dunes. If a drilling machine is available, testing could be undertaken on groundwater occurring at greater depths. If an area was found where 9-12 m of water saturated sand occurs, and permeability of the sand is similar to that in the water reserve area, quantities as high as 760-1530 l/min could quite possibly be pumped from a properly installed bore. Such a bore would need to be screened and gravel packed, the size of the grains in the gravel packing and screen openings being determined by the sand grain size. Servicing to prevent encrustation on the screen and build-up of precipitated calcium carbonate around the outside of the bore, would be required at intervals.

Considerable thicknesses of water saturated sand have been indicated in areas where some of the seismic spreads were located, for example Spread 2, 3.5-7.5 m thick, Spread 10, 6-8.5 m thick and Spread 12, 18-21 m thick.

These thicknesses are determined from seismic velocities and need not be due entirely to saturated sand as weathered basement or clay could have a comparable seismic velocity. In each case these spreads were located in the storage area of the present scheme and if bores were developed in these localities and pumped at capacity, the supply to the water reserve area would almost certainly be seriously affected.

Conditions in the water supply area are not unique in the Currie area. The new dunes extend about 1.6 km inland from the shore line in this area, but 3.2 km south of Currie they extend nearly 3.2 km inland. Another area that could be investigated is about 0.8-1.6 km north of Currie where the new dunes are about 1.6 km wide and a number of seepages occur around the coastline.

Investigation of the above areas would probably require seismic surveys to determine which areas have the thickest sand cover over basement rocks and this to be followed by test drilling and pump testing to determine bore capacities.

Water from old dunes. The new dunes being predominantly of carbonate composition contribute largely to the high total hardness of the water. Part of the salinity and hardness of the water is due to sea spray drifting inland and later being carried by rain water down to the water table. The old dunes on the other hand are made up predominantly of quartz sand, the composition of which would cause very little hardness in any water contained in them. In addition they occur further inland than the new dunes and would not be as subject to sea spray contamination.

The thickness of the old dunes is unknown but investigation could produce useful information on thickness as well as on any water contained in them. As well as occurring further inland than the new dunes, they underlie the new dunes. Near Spread 1, an excavation in a low lying area encountered quartz sand at about 1.8 m from the surface and as the unweathered basement is expected to be some 15-18 m from the surface the quartz sand of the old dunes could be up to 13.5-16.5 m in thickness. At Spread 2, a recent well struck quartz sand at 5 m from the surface and the unweathered basement is probably 9-12 m from the surface, suggesting some 4.5-7.5 m of quartz sand.

If depths of 9-15 m of quartz sand occur inland from the new dunes it could be expected that a reasonable proportion of the sand would be saturated with water because of the generally low relief of the country.

Surface water. Another alternative source of water is surface water. A stream, Badger Box Creek, 4 km south of Currie was examined and at the time, an estimated 1530-1900 l/min was flowing. Water quality, with respect to total dissolved solids, is about the same as the Currie water supply. A conductivity meter reading suggested about 600 ppm of dissolved solids but the water has a slight brown colour which might be difficult to remove. The strong flow in this stream was no doubt due in part to the recent, above average rains. Another stream, the Etrich River is 8 km south of Currie and has a much larger catchment area than Badger Box Creek. If either of these streams are regarded as a possible water source, then stream gauging should be undertaken over a period of some years to determine flow variations.

CONCLUSIONS AND RECOMMENDATIONS

Only small additional quantities of water are expected to be obtained by the development of seepages near the present water reserve, although they would be valuable short-term additions to the supply. Drilling is recommended to locate a suitable area.

It is possible that the rate of withdrawal of water by the present scheme is exceeding the long-term safe withdrawal rate and some investigations to supply long-term additions are suggested. The following possibilities are suggested:

- (1) Development of shallow water table areas, for example the swamp north of Camp Creek and the seepage near Wharf Road. Chlorination may be required.
- (2) A deep water table water probably occurs in the new dunes north and south of Currie. Seismic surveys and test drilling to locate supplies would be necessary and water from these areas would most efficiently be withdrawn with a screened and gravel packed bore.
- (3) Investigations could be undertaken in areas underlain by the old dunes where it is expected that any water occurring would have much better quality than the new dunes.
- (4) Surface streams south of Currie might be a possible water source. Stream gauging over a considerable period would be required.

The seismic and resistivity survey near the hospital indicated possible saturated sands at a depth of about 12 m. If a water supply is developed from this area, it is unlikely that it would affect the supply to the town water reserve area to any great extent. However, wells in the storage area, such as the one recently dug, could greatly affect the supply if they are pumped to capacity and therefore wells in the storage area should be restricted.

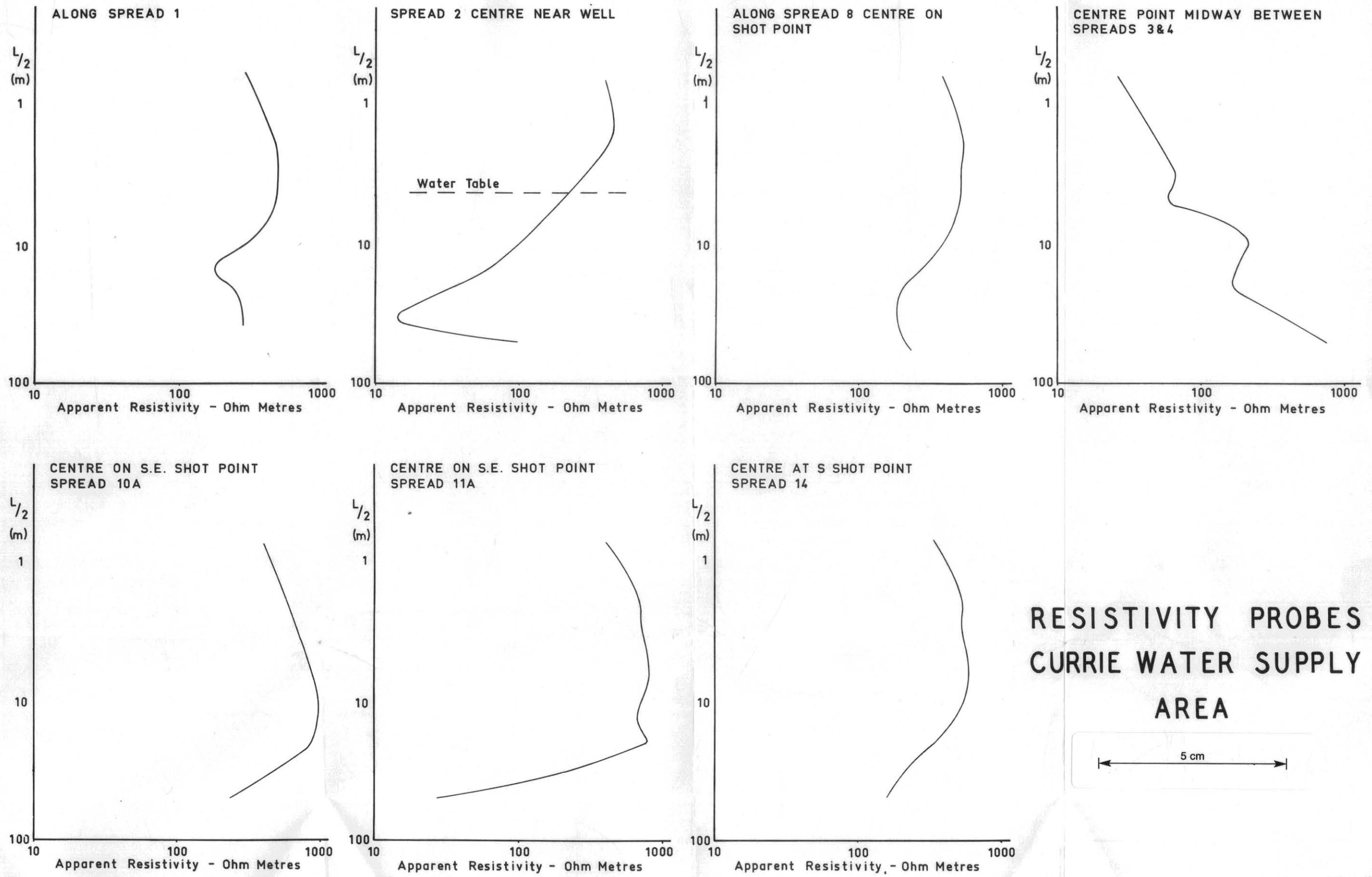
Where the flow to bores decreases and surging does not improve the flow, trials could be undertaken with acid treatments because the decrease is probably due to calcium carbonate precipitates which acid treatment would remove.

REFERENCES

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**RESISTIVITY PROBES
CURRIE WATER SUPPLY
AREA**

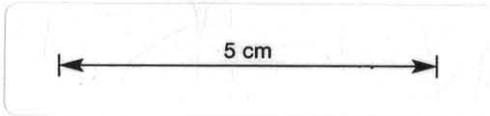


Figure 39.