1987/41. Spear bore installation at the South Arm School

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Abstract

Three new spears at South Arm Primary School would, with a suitable pump, probably yield quantities of water up to 10-14 litres per minute in the long term. This appears to be sufficient for the requirements of the school. A further two spears could be used as an emergency supply or be connected into the system. The water quality is good and the water should be usable for most purposes.

INTRODUCTION

The South Arm Primary School is being redeveloped, and a greater quantity of water is required than that obtained from the present spear system. Three spears were installed in 1980 to serve as a toilet supply and as a reserve for fire protection. It is not known how many of the three spears are operational at present as the whole system is buried but the output appears to be about 5 litres per minute (about 70 gallons per hour). A request was made from the Department of Construction to install three new spears near the present spears.

NEW SPEARS

The sand in the South Arm area from which the water is extracted has a variable clay content and this influences the supply to a spear. Three holes were drilled near the existing spears, and while the drill was in the area, other parts of the school ground were examined. In all, eight holes have been drilled (fig. 1). Two (Holes 5 and 7) were regarded as being unsuitable for extraction of useful quantities of groundwater, while Hole 3 only produced a small quantity of water when a spear was installed. This was partly due to its slightly elevated position and a new hole (8) was drilled at a nearby lower position and a spear installed.

Approximate logs of materials encountered in each hole are given in Appendix 1. Five new spears have been installed. Each spear consists of a jetting point made up of PVC fittings and a ball valve, two stainless steel screens (each 0.6 m long) joined together, and a length of 50 mm diameter PVC pipe. The opening on the screens for Holes 1, 2 and 8 was 0.25 mm for the bottom screen and 0.38 mm for the upper. Two screens with a 0.25 mm opening were used in Holes 4 and 6. Short term pump tests have been undertaken on each spear and approximate outputs (short term) have been measured using two methods of extraction. The most common method of extraction of water from a spear is to put a suction pipe down the inside of the spear. However, where yields are relatively low, suction from the top of the spear is possible and yields can be increased. Details of yields from tested holes are given in Table 1.

Much higher yields were obtained with suction from the top of the spear in each case. These tests are short term (from 30 to 90 minute periods) and should not be taken as the long term outputs.

Spears 4 and 6 were pumped together using suction off the top for about one hour and produced water at the rate of about 10 litres per minute (140 g.p.h.), and a figure approaching this may approximate the long term output

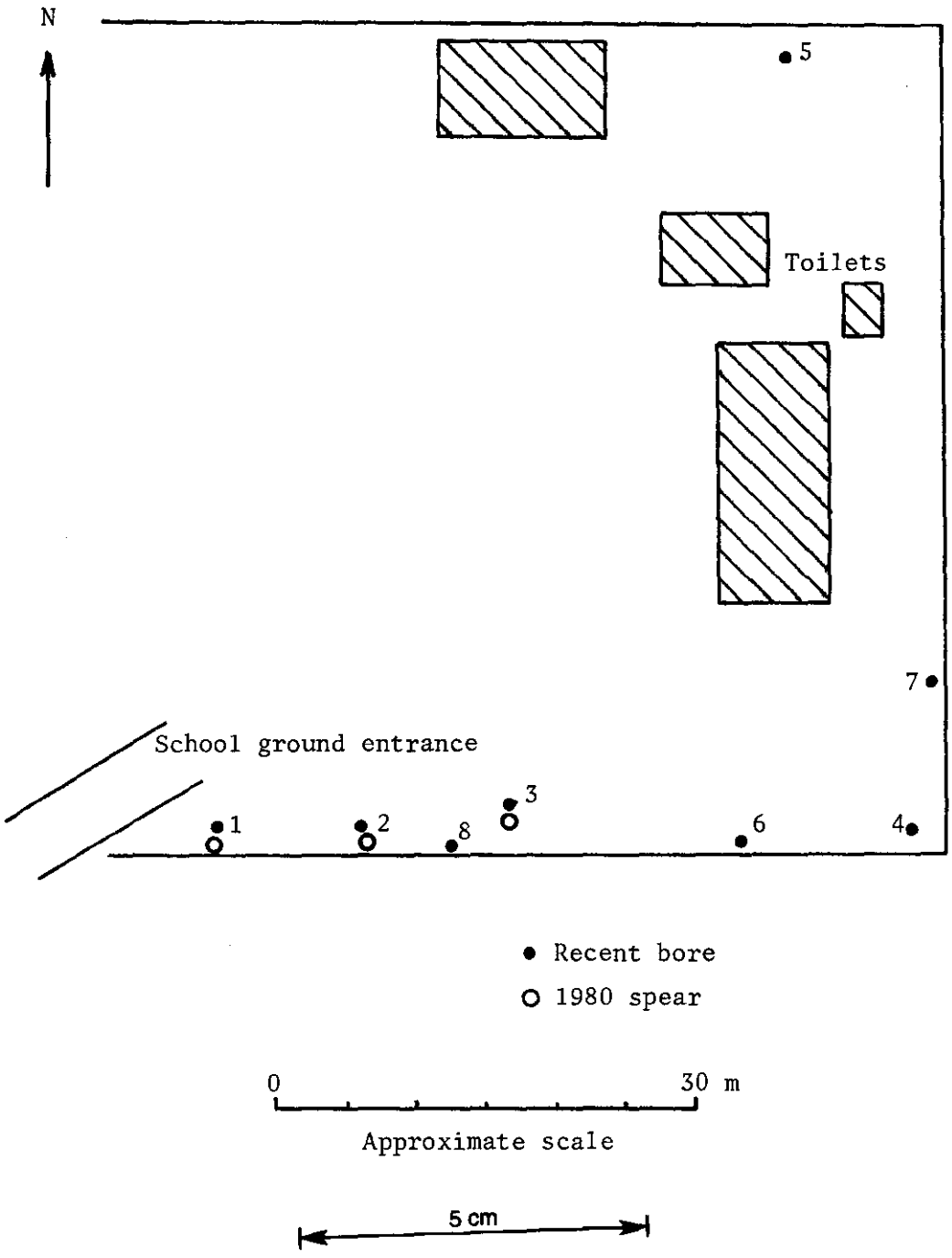

Figure 1. *Location of bore holes and spears*

Table 1. ***Depth of holes and water yields***

Hole no.	Depth of spear (m)	Standing Water Level (m)	Output *l*/m (g.p.h.) Suction pipe	Top suction
1	6.59	5.02	3 (40)	7.6 (100)
2	7.01	5.29	5 (65)	13 (170)
4	7.06	4.87		7 (90)
6	6.81	4.99	4 (50)	8 (110)
8	6.71	5.08	4 (50)	9 (120)

(perhaps about 7 *l*/m may be a safe figure). Attempts were made to pump Spears 1, 2 and 8 together but a pump of suitable size was not available and the full capacity of the system of three spears was not attained (some 7 *l*/m was pumped for about 10 minutes). It is expected that a larger pump than is used on the present system will be required, and that probable long term outputs for the three spears when pumped together would be about 8-10 *l*/m using suction hoses in the spears and 10-14 *l*/m using top suction.

WATER QUALITY

Water samples were collected while Spears 4 and 6 and Spears 1, 2 and 8 were pumped together. Chemical analyses are given in Table 2.

Water of this quality is suitable for the purposes proposed, i.e. toilets and for fire protection. It would be suitable for watering lawns and shrubs. If shown to be satisfactory bacterially, the water would probably be suitable as a drinking supply. However, as the area is dependent on septic tanks, there may be some risk involved with its use for this purpose.

Table 2. ***CHEMICAL ANALYSES OF WATER SAMPLES***

	Spears 4, 6	Spears 1, 2, 8
pH	7.0	6.8
Conductivity µS/cm	490	410
Item (mg/l)		
CO_3	Nil	Nil
HCO_3	85	89
Cl	83	60
SO_4	43	35
Ca	3.3	5.8
Mg	1.8	6.1
Fe	<0.1	<0.1
Al	<0.2	<0.2
K	2.0	1.8
Na	115	86
TDS	350	300
Hardness - Permanent	Nil	Nil
- Temporary	15.5	40
Alkalinity as $CaCO_3$	70	73

CONCLUSIONS AND RECOMMENDATIONS

It appears likely that the required amount of water could be obtained from Spears 1, 2 and 8. This would leave Spears 4 and 6 as an emergency supply. Pumps, whether delivering surface water or groundwater, tend to break down at times and a portable pump could be fitted to the two spears when required. The five spears could be connected into the one system if it was thought necessary. An appropriate pump would need to be selected.

The quality of the water from the spears is good and could be used for most purposes. Bacterial tests would show whether it was suitable for a drinking supply.

When the pumping system for the new spears is being installed, it is suggested that an officer from the Department of Mines is present and perhaps advises on the process (B. Cox is suggested). It is expected that the Department of Mines will have to service the spear installation in the event of failure for any reason. The old spears have been altered from the original installation and it is not known what the situation is at depth.

As part of the establishment of the new system, a storage tank near the toilets, from where water can be gravity fed, should be considered. The present scheme has no storage to cover periods when there is a failure in the system, whether due to spear failure or the pumping system to the toilets. A tank with a capacity of 5000-15 000 litres should be sufficient for a week or so during which any necessary repairs could be made.

[16 September 1987]

APPENDIX 1

Logs of drill holes

Hole 1

0 - 1.8	Fine cream quartz sand
1.8- 2.4	Slightly darker quartz sand
2.4- 3.4	Light brown sand, some clayey sand - consolidated
3.4- 4.3	Brown sand, some clayey sand pellets
4.3- 5.2	Light grey-brown quartz sand (damp)
5.2- 6.4	Light grey sand (damp)
6.4- 7.0	Light brown sand (damp)

Hole 2

0 - 0.9	Cream sand
0.9- 1.5	Lighter cream sand
1.5- 2.1	Grey quartz sand
2.1- 3.4	Brown sand, some clayey pellets
3.4- 4.3	Brown sand
4.3- 5.2	Grey quartz sand (damp)
5.2- 7.0	Darker grey sand (damp)

Hole 3

0 - 0.9	Cream sand with mudstone fragments (Permian)
0.9- 1.5	Cream sand
1.5- 2.4	Creamish grey quartz sand
2.4- 4.9	Brown sand with clay pellets
4.9- 7.9	Grey sand (wet)

Hole 4

0 - 1.5	Cream quartz sand
1.5- 3.4	Light brownish sand with clayey sand pellets
3.4- 4.3	Cream sand
4.3- 6.1	Grey-brown sand becoming dampish
6.1- 7.9	Wet grey sand

Hole 5

0 - 0.9	Cream sand
0.9- 3.4	Darker cream quartz sand
3.4- 3.7	Chocolate-brown clayey sand
3.7- 5.2	Mid-brown clayey sand
5.2- 6.1	Brown sandy clay, a few gravel fragments
6.1- 7.0	Grey sand and clayey sand (wet)

Material suggested a spear would be low yielding.

Three further holes were drilled quickly without closely monitoring the depths of the various materials accurately.

Hole 6 (to 7.6 m)

Cream sand
Brown clayey sand
Cream sand
Grey-brown sand
Grey sand
Clayey sand 7.3-7.6 m

Hole 7 (to 7.9 m)

Cream sand
Light brown sand
Cream sand
Darker grey-brown sand, some clay

Material suggested a spear would be low yielding.

Hole 8

Grey sand
Light grey-brown sand
Light brown clayey sand
Grey-cream sand
Grey sand