Alberta Research Council
Open File Report 1959-3

Edson Report

53 - 17 - W5

by

R.N. Farvolden

Oct. 1959

Alberta
RESEARCH COUNCIL

Edson Report

In planning the development of the water supply for the Town of Edson it might be advisable to think first of the immediate problem and then of the long-term or possible future problems. The immediate problem is to ensure that, at a reasonable rate of growth, the supply of water is always sufficient to allow for the normal amenities. The long-term problem is to ensure that the Town will not lose an opportunity for development because of an inadequate water supply.

It is fairly obvious that the flow of the McLeod River is large enough so that almost any need for water can be met and the water available for use at any time will depend only on the capacities of plant installations. It is not quite as obvious but the supply of groundwater is also so large that almost any amount can be obtained if the reservoir is developed over a wide enough area. The only problem facing Edson is to determine which source will provide the Town with the cheapest water. Generally speaking, the unit cost of water from a surface source decreases with increased consumption, while the unit cost of water from wells increases with increased consumption, at least where well spacing is a factor.

This report presents the results of a preliminary investigation into the groundwater prospects in the immediate vicinity of the Town. Geology is the factor which determines the availability of groundwater and a short description of the local geology is given below. The mimeographed paper, "Groundwater Supply in Alberta" that is enclosed will explain some of the features that are significant. As mentioned in this paper, deposits of the area may be divided into two types, the bedrock strata and the overlying surficial deposits of glacial drift with a minor amount of Recent alluvium in the river valleys.

The bedrock of the Edson area consists of sandstones and shales of the Paskapoo formation of early Tertiary age. The shales vary from soft, clayey and unctuous, to brittle and silty. The sandstone strata also vary from tight, fine-grained and dirty to permeable, coarse, clear sandstone. The most common rock in the section is likely silty, sandy shale and the end members of the series are much less common. In river outcrops there are massive, crossbedded and fractured beds of fairly clean and coarse-grained sandstone and from the information available it appears that a well will encounter such strata almost anywhere in the vicinity of Edson if it is drilled two or three hundred feet deep. The Paskapoo formation is several thousand feet thick at Edson. The strata strike NW-SE and dip to the southwest at approximately 100 feet per mile.

A mantle of surficial deposits covers the whole area except where it has been removed by Recent erosion. The most common of these deposits is glacial drift, an unsorted and unstratified mixture of clay, silt, sand and boulders. Small deposits of sand and gravel are often associated with the till but only rarely is the till permeable enough to be classed as an aquifer except for seepage wells. The drift cover at the townsite averages around thirty feet in thickness. South of town, in the broad depression now occupied partly by the valley of the McLeod River, the drift is over one hundred feet thick.

The depression likely marks the valley of a preglacial river. There is some evidence that this ancient river valley had deposits of sand and gravel - now buried by a hundred feet of drift. Wells drilled for Mr. Ed Bossert in Sec. 23, Tp. 53,

R. 17, W. 5, and Mr. Elliot Taylor, SW Sec. 14, Tp. 53, R. 17, W. 5, encountered what appears to be the gravel deposits of this river.

Gravels of similar origin are present along the channel of the McLeod River, but these gravels are younger. However, these gravels were also laid down during an earlier time. In this case the gravels are associated with the present-day river and the only factor of importance in the relationship of the gravels to the river is that the river has apparently been down-cutting since the gravels were deposited. Thus, the present-day river level is below the bottom of the gravels, and recharge of these strata by water from the river is impossible.

Possibilities for Groundwater Supply

There are three possible sources of groundwater in the Edson area which are worth considering for a town supply. They are the Paskapoo sandstone strata now partly developed by the Town wells, the buried gravels in the channel between the Town and the McLeod River, and the alluvial gravels in the river valley.

The present wells that supply water for the Town are developed in sandstone strata of the Paskapoo formation. The source of water for these strata is in the highlands to the north and west of the Town. The water enters the strata after seeping through the overlying till and shale layers. Material of this sort is nearly impermeable and movement is slow. However, the shape of the piezometric or pressure surface of these artesian aquifers indicates that this natural recharge condition exists. It is unlikely that recharge under present conditions is as great as the discharge of all the Town's wells, so a large portion of the water now being pumped is likely coming from storage in the aquifer. Under these conditions the water levels in all wells must decline and this has taken place in the case of the Edson town wells. The decline is quite marked at first but becomes less noticeable as time goes on. This is shown in figure two of the mimeographed paper. The cross-sections drawn to show the relationships between the wells indicates that more water could be obtained from these wells. The following procedure is suggested:

1. Shut in well and record recovery of water level.

2. Run a pump test on the well for 48 hours at the normal pumping rate, recording the drawdown at short intervals. It is necessary to be able to plot both drawdown and recovery against time so the time of each measurement must be recorded.

3. Pull the pump and clean the well by jetting and surging with a tight-fitting block. The surging should last until no sand can be recovered.

4. Run in pump and conduct another pump test and record recovery.

5. Set pump depth and rate so that maximum production can be obtained. I suggest that this work will be worthwhile on wells #2, #3, #5, #6, and #7 . It is quite possible that some form of chemical treatment will be beneficial, but I am not prepared at this time to say what this treatment should be.

Most of the sandstone beds are lenticular in nature and are therefore the same beds are not encountered in widely separated wells. Numbers 5 and 6 wells wells apparently encountered the same strata as the logs of the two wells are easily correlated. It seems likely that #4 well and perhaps #1 well could be deepened to intersect the strata that produce water at #5 and #6 wells. It would be necessary to deepen #4 to a total depth of 335 feet and #1 to a total depth of 410 feet. Of course, it is not certain that these same strata occur at the sites of #4 and #1 wells but it is a very good gamble. The water from these greater depths will be higher in dissolved salts than that from the shallower wells but I would be surprised if it is unsuitable because of chemical quality; that is, I think it will fall within acceptable standards.

At the present time there is considerable interference between wells in the Town and any future drilling in the townsite must make allowances for interference. The cross-section (figure one) reveals that in the early test drilling undertaken by the Town the holes were not carried deep enough to intersect the best water-producing strata. From the little that is known about the geology and hydrology, a suitable location for a new well might be that shown on the overlay number one. If the aquifers of wells 5 and 6 extend this far they would be encountered by a well 365 feet deep. A test hole should be drilled first in order that a minimum expenditure be made until success is assured.

According to the figures you gave me, production can now be brought up to about 165 gallons per minute or about 235,000 gallons per day. I think with the steps outlined above a supply can be developed that will be adequate for the immediate future.

For the long-term outlook there are several alternatives that might be examined. There are indications that a preglacial valley runs near the Town, and also that there is a gravel aquifer buried in this valley. If 10 to 20 feet of clean gravel could be encountered at a depth of 100 feet (as suggested by the logs in the Bossert and Taylor wells) one could expect to develop large quantities of water from wells in this valley. However, experience has shown that such gravels are often erratic in occurrence, and therefore expensive to test, and the water they contain is almost always high in iron and hard. All of these problems can be handled but they add to the cost of testing and development.

The bottom of this bedrock channel is certainly higher in elevation than the present river level and therefore no recharge can occur from the river to the gravel. Again, recharge must be from local precipitation and influent seepage. This need not be a discouraging factor for vertical leakage should still be adequate to maintain the water levels in the aquifer. Test drilling and pumping in the surficial material is complicated by the caving nature of the strata. In order to run proper tests it will be necessary to case and screen some of the test holes and this is an additional expense. No expensive work should be done on any hole unless the driller's report and the cuttings are encouraging.

It may be possible to test both the preglacial channel and the bedrock in the direction of the river with the same test-holes. Figure two shows a number of test-hole locations that would serve to outline the buried channel. If any of these holes encounter gravel they could be completed for pumping tests. In each hole the surficial materials could be cased off and the hole continued into the bedrock to test for bedrock aquifers. A line of wells, finished either in the bedrock or buried gravel, from the Town to the river, might supply sufficient water for considerable development. The wells would serve to test a suspected buried valley and also the bedrock over a wide area, and if the pipeline were built it would be available for carrying water from a river treatment plant, if that ever becomes necessary.

The wells drilled by International Water Supply on the river south of town indicate that the alluvial gravels along the present channel do not extend below river level and therefore cannot be recharged by the river. This is substantiated by the occurrence of outcrops of bedrock along most of the river channel, even near the old meander scar in Sec. 12, Tp. 53, R. 17, W. 5. The pumping tests of International Water Supply indicate that very good wells might be sited near the river to take advantage of induced recharge through the fractured bedrock, rather than gravel. This possibility should be kept in mind if a pipeline is ever built to the river, for it could save considerable expenditure on a river intake and treatment plant.

There is a good chance that gravel beds can be found at shallow depths within and near the meander scars in Section 12, Tp. 53, R. 17. Although these gravels will not be recharged from the river, large quantities of water might be developed from them. Testing in this location might be relatively easy, at least the preliminary work, for if the test is only for gravel, there is no point in carrying the hole deeper after bedrock has been encountered. It might be feasible to do the initial testing with a backhoe and then follow up with drilling if the results are promising. In this case any hole that encounters clean gravel below the water table will be an indication that success is possible. If as much as five feet of gravel underlies the area marked "B" on figure two, and this gravel is saturated with water (below the water table), then a large potential is indicated.

I think it would be advisable for the Town to keep close watch on the water levels in the town wells. The Research Council of Alberta has a network of observation wells throughout the Province and, in conjunction with this observation well program, an automatic water level recorder could be installed on #1 well. If the record proved good after a year the recorder might be left there as a permanent installation. If the record is poor the recorder can be removed and regular tape measurements taken instead.

The Town of Edson is quite favorably situated as far as water supply is concerned. I believe the immediate problem can be overcome with a minor amount of reworking as mentioned above. For the future supply, two suitable sources are worth investigating, the river and the groundwater. My suggestion is that the groundwater possibilities be tested by a line of test holes between Edson and the McLeod River.

R. N. Farvolden,
Groundwater Division,
Research Council of Alberta,
October, 1959.

To ACCOMPANY LETTER FROM ROD GREGG TO
R.N. FARVOLDEN, SEPT. 30, 1959.

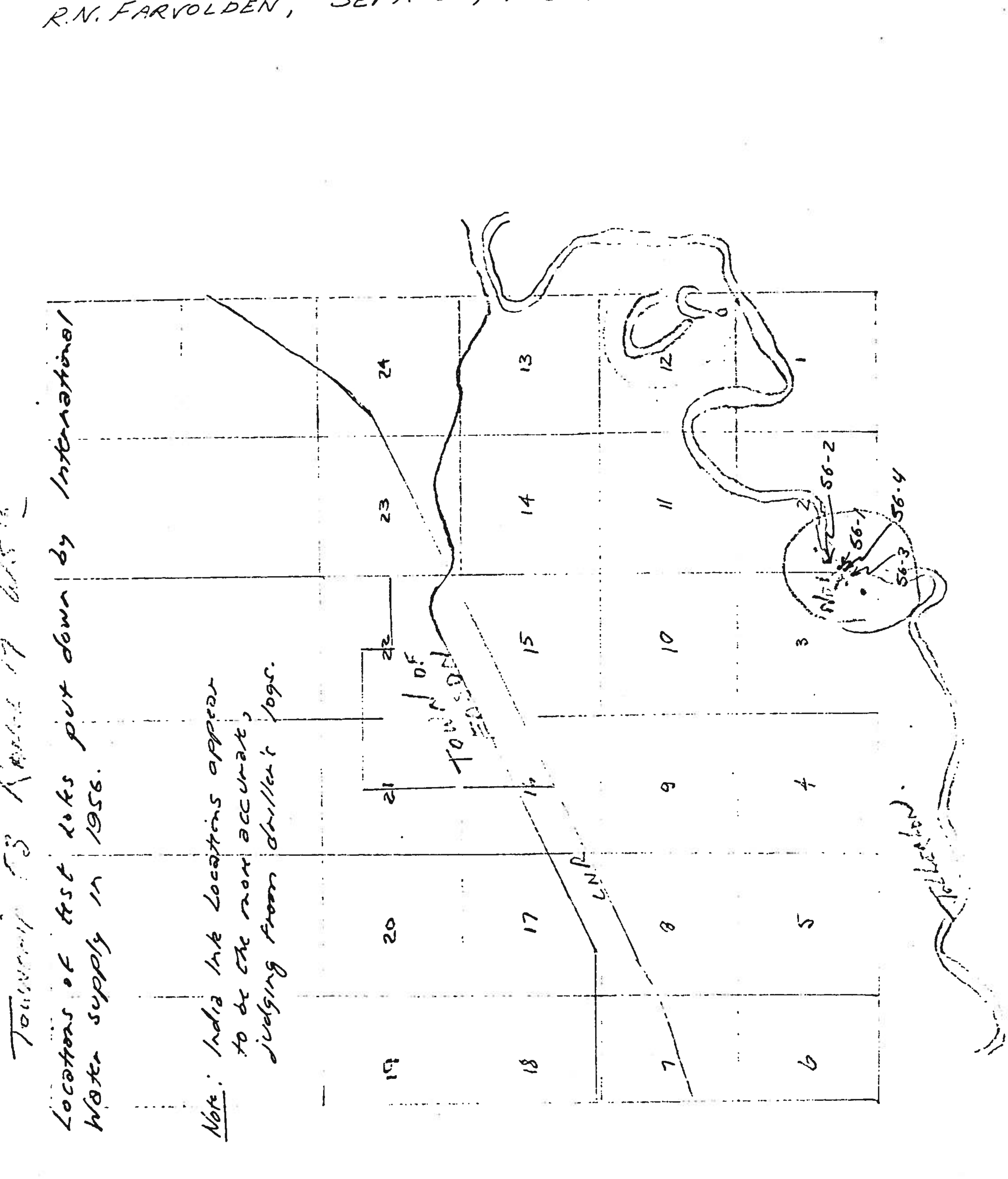

Figure Two

Sketch of Edson Area

Line of proposed test holes and river terrace.