STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Water Resources Branch

A Report on the Geology and Ground-Water Resources of Land Parcel No. 1-2680 owned by Charles Puckett, Snohomish County, Washington

By
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Purpose and Scope of the Investigation

This study is the result of a request by the Property Management, Department of Highways, seeking information about present and future ground-water availability and the possible adverse effects incurred by the construction of the SR 405 freeway.

The scope of the study was set to include several determinations, which are:

1. Ascertain the availability of ground-water at the present site.

2. Determine direction of ground-water flow.

3. Determine if possible damage to the well by nearby highway construction.

The study consisted of a general geologic reconnaissance of the area and the collection of a water sample for a bacteriological examination. Additional information was obtained from the well owner, the Department of Highways, and from the files of the Department of Ecology.

Location and Topography of the Area

The well in question lies geographically near the southern edge of Snohomish County and is within Section 30, Township 27 North, Range 5 East of the Willamette Meridian, (fig. 1). The altitude of the well is approximately 190 feet above sea level and lies on a relatively flat area with hills raising to the west to an altitude of about 500 feet. The well is located 34 feet west of the northwest corner of the house (fig. 6).

The base map was taken from the Bothell Quadrangle, 7.5 minute series, U.S. Geological Survey, Topographic Branch. The contour interval is 20 feet.

Acknowledgements and Previous Investigations

A report on the Ground-Water Resources of Snohomish County, Washington was published in 1952 was a cooperative study by the Snohomish County Public Utility District No. 1, the U.S. Geological Survey, and the Washington State Department of Conservation and Development (now Department of Ecology), and was authored by R. C. Newcomb.

"Geology and Ground-Water Resources of Northwestern King County, Washington" was published by the Department of Conservation (now Department of Ecology) in 1963 and was prepared in cooperation with the U.S. Geological Survey. The publication was authored by B. A. Liesch, C. E. Price and K. L. Walters.

Additional information was obtained through well records and miscellaneous well data available from water right applications made to the Water Resources Branch of the Department of Ecology. The remaining well information used was obtained from the well owner and information on record with the Department of Highways.

GEOLOGY AND GEOLOGIC HISTORY OF AREA

Physiographic features and rock units of this area represent the end product of a complex geologic process. For this report the rock units need only be divided into 5 units. The major and most important units are the ones which include the glacially derived sand and gravels of Pleistocene age. These are the most recent rock material deposited in the area, and the various units serve as important aquifers (Figure 3).

The Admiralty Clay which is the oldest unit exposed in the area is a firm, finely bedded, gray, green, and blue silt and clay with carbonized wood and a few dirty sand and gravel beds. Poor yields of inferior quality water are generally obtained from coarse beds within this unit.

The Esperance sand member is largely an outwash material which exhibits foreset and master-bedding which generally dip south-southeast. The coarse material yields moderate to large amounts of ground water.

Till, a gray concrete like mixture, principally a ground moraine, is 20 to 150 feet thick. It is essentially impervious, but includes sand and gravel streaks, as well as the disintegrated surface zone, which yields small quantities of ground water.

The older alluvium consists of silt, clay, sand, and gravel in rather tabular deposits, mostly forming terraces just above the present river flood plains, as distinguished from the alluvial deposits that still are accumulating.

The younger alluvium consists of sand, silt, clay, and peat which occurs beneath the flood plains of aggrading streams in the area. The ground-water body in both the older and younger alluvial materials are commonly tributary to and in balance with nearby surface water. Large yields are obtained from wells tapping clean gravel of these recent deposits.

Since the well in question is not over 15 feet deep, we are primarily interested in the Esperance Sand member and the underlying till.

GROUND WATER

Occurrence and Present Availability of Ground-Water

The principal aquifer with which we are concerned is made up of glacially derived sand and gravel of Pleistocene age. The lateral extent of this aquifer appears to be large in the area and can be delineated as Qvae within Sections 19, 24, 25, 30, 31, 32, and 36 on Figure 3.

Little information on this shallow aquifer is available for this area but it can be assumed that the depth is not excessive, less than 40 feet in thickness.

The specific yield of the well in question was not determined; however since the well was reported to have pumped dry in 1967 and very low in 1970 this unit of measurement is not necessary for this problem.

The well under present (March 12, 1971) conditions has a water level which is within three (3) feet of land surface and had a coliform count of less than 2 coliforms per 100 milliliter of water. This count based upon the Department of Health standards is satisfactory. At this level of contamination by non-pathogenic coliforms, the risk of contracting disease by drinking the water is virtually zero.

On July 29, 1970 a sample of water was collected and tested by the Department of Health. This test indicated the coliform count to be 5 coliforms per 100 milliliter of water This count based upon the Department of Health standards is unsatisfactory. The water level was reported to be low as indicated by R. D. Aye of the Department of Highways.

The direction of ground-water flow before construction is shown on figure 4 and if compacting because of highway construction occurred within the aquifer the present flow lines are shown on figure 5. Only where large amounts of fill material was required could we expect compaction within an aquifer to occur. Apparent ground-water flow on the property is shown on figure 6.

Pollution of Ground Water

A safe distance between a water source and the origins of contaminations is dependent upon many local factors and its determination involves, among other things, an evaluation of:

1. Character and location of contaminate.

2. Permeability and structure of water bearing formation.

3. Type well and nature of construction.

4. Natural ground water gradient; and

5. The influence of well pumping on the depression of the water table at the well.

We have three possible sources of contamination of water from this well and they are:

1. Interstate Highway 405

2. Dogs and horses in near proximity to the well; and

3. Contamination from septic tank affluent.

Interstate Highway 405 is on a fill whose toe is approximately 50 feet from the well and said fill slopes toward the well. However the drains on the fill transport the water down the fill and along the toe of the fill in an southeasterly direction away from the well. Infiltration of surface water into the ground could occur along this drainage. It would appear that if contamination occurred from the highway, the type of contamination would not be of the coliform variety, but should be sand or salt used when deicing the road surface occurs.

The changing of the ground-water gradient because of filling and packing is a possibility, however the well presently has a sufficient quantity of water indicating adequate recharge to the well and it was indicated by the owner's wife that the well had in the past (1967) pumped "dry" but recovered in 8-12 hours.

The second possible source of contamination is livestock in close proximity to the well. It is not uncommon for contamination due to local livestock to pollute a well. When water levels are shallow and no concrete slab or sealing off of the aquifer has been done the foreign material can migrate down the outside of the casing and enter the well along with the ground-water. If surface sources are the cause of the well contamination then the high rates of infiltration during winter months would carry larger amounts of foreign material into the well. Since the well test at this time (March 12, 1971) proved to be satisfactory it does not appear that this source of contamination is presently causing pollution of the well.

The last possible source of contamination is the owner's septic tank. The septic tank and drainfield are about 50 feet away from the well and are on the down slope side of the well. At the present time the septic tank is not functioning correctly and the owner is planning to replace it. It is not known when the septic tank first started to malfunction. If

the water level in the well was lowered last summer, which the R. D. Aye report indicated, it is entirely possible that the ground-water gradient in proximity to the well was reversed. This reversal of the ground-water gradient could and probably would occur whenever the water level dropped during the summer months (Figure 7A).

While the septic tank was functioning properly little or no contamination reached the well, however when the malfunction occurred it then allowed pollution to enter the recharge area of the well. When additional water was added to the ground-water system during the winter months the water level would rise to near land surface allowing the ground-water gradient to return to its original coarse. (figure 7B)

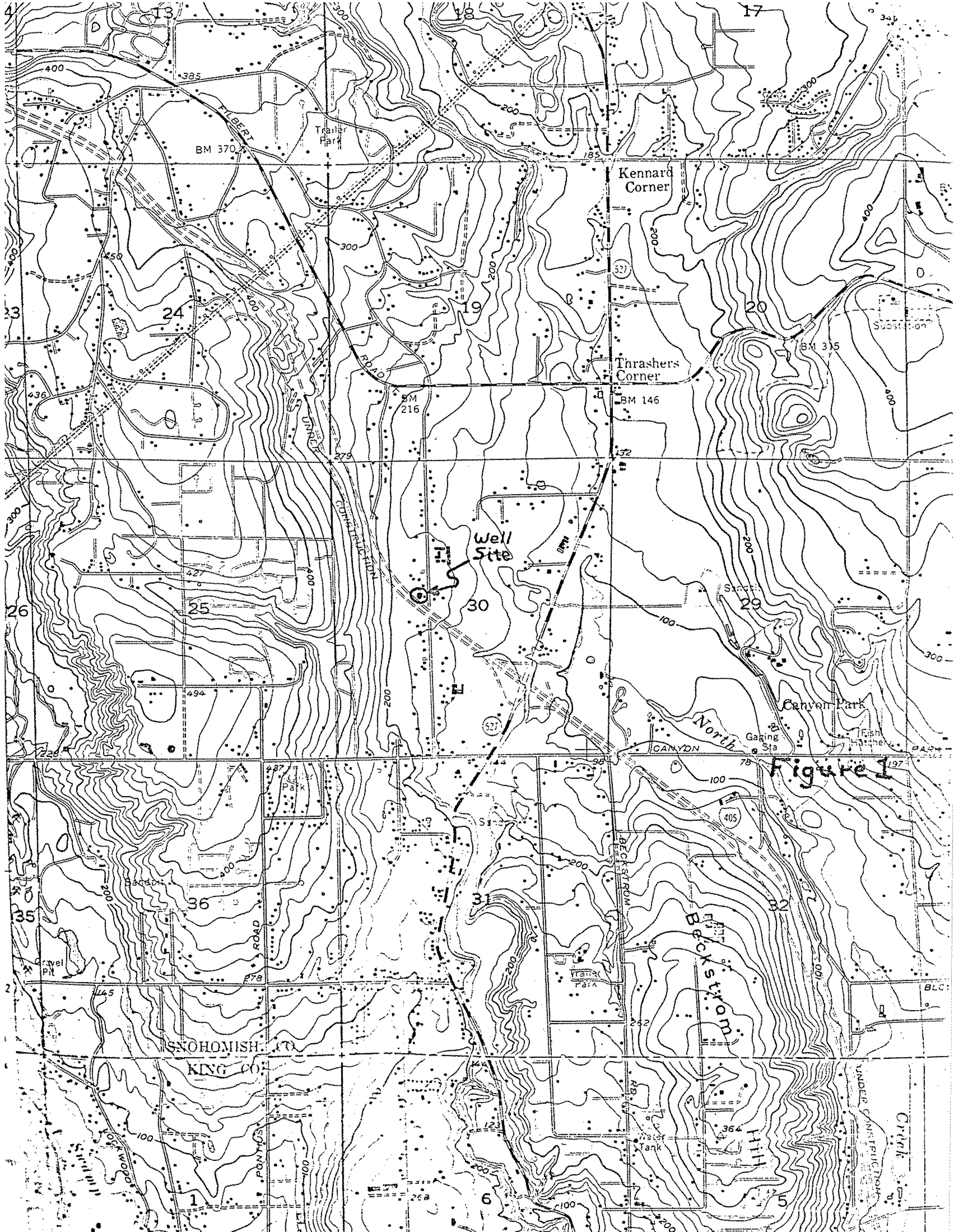
Conclusions

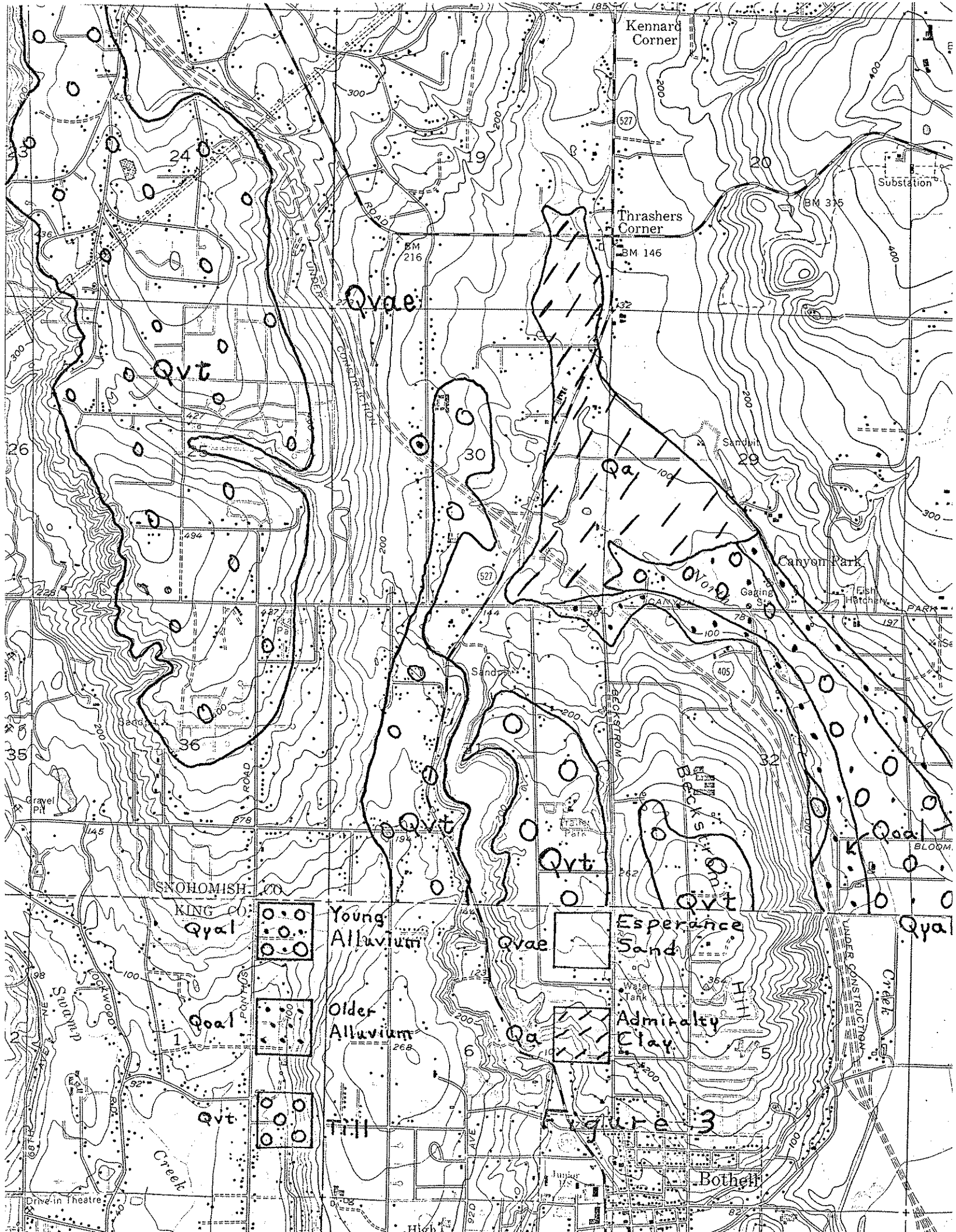
Filling during construction of Interstate Highway 405 may have locally changed the direction of the ground-water gradient. However the well has reported to have gone dry in the past (1967) therefore low summer water levels are not a new problem with the well. The type of contamination in the well during the July 29, 1970 test are not the common "type" of pollution obtained from Highways.

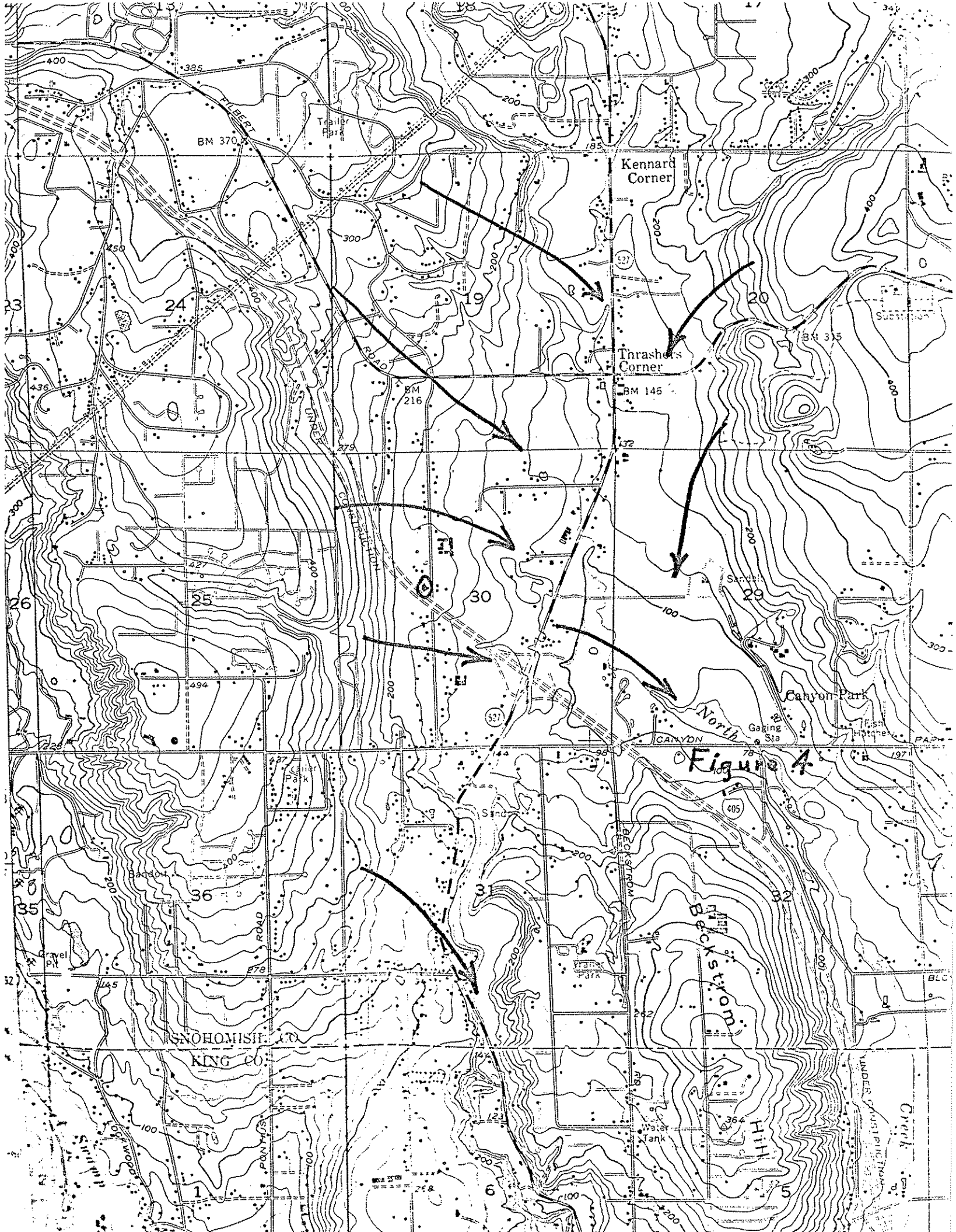
The construction and location of the well are not completely adequate to insure that surface drainage will not infiltrate into the well (letter dated March 26, 1971 from Gary Fraser, Sanitarian, Environmental Health Specialist, Snohomish Health District). However, the quantity of foreign material in the well during the present (March, 1971) test showed less contamination which indicates that the source of foreign material is not presently available to well.

It does appear that pollution due to the septic tank malfunction is the primary source of contamination. When the water level is low in the well the ground-water gradient is locally reversed allowing contamination or recycling of household water to occur.

For the above reasons it is felt that the construction of the highway was not the primary cause of the poor water quality of this well.


Well Site
Figure 1
Kennard Corner
Thrashers Corner
Canyon Park
Trailer Park
FILBERT ROAD
UNDER CONSTRUCTION
North Creek
Beckstrom Hill
BECKSTROM RD
SNOHOMISH CO
KING CO
Gravel Pit
Water Tank
Gaging Sta
Substation
BM 370
BM 216
BM 146
BM 335


Kennard Corner
Thrashers Corner
BM 216
BM 146
BM 325
Substation
Sandpit
Canyon Park
Gaging Sta.
Fish Hatchery
Gravel Pit
Drive-in Theatre
Swamp Creek
Qvae
Qvt
Qa
Qoal
Qyal
SNOHOMISH CO.
KING CO.
Young Alluvium
Older Alluvium
Till
Esperance Sand
Admiralty Clay
Bothell
Figure 3


Kennard Corner
Thrashers Corner
BM 370
BM 335
BM 145
BM 216
FILBERT ROAD
UNDER CONSTRUCTION
Trailer Park
Substation
Canyon Park
North CANYON
Gaging Sta
Fish Hatchery
Gravel Pit
Frankel Park
Beckstrom
Water Tank
SNOHOMISH CO
KING CO
Figure 4

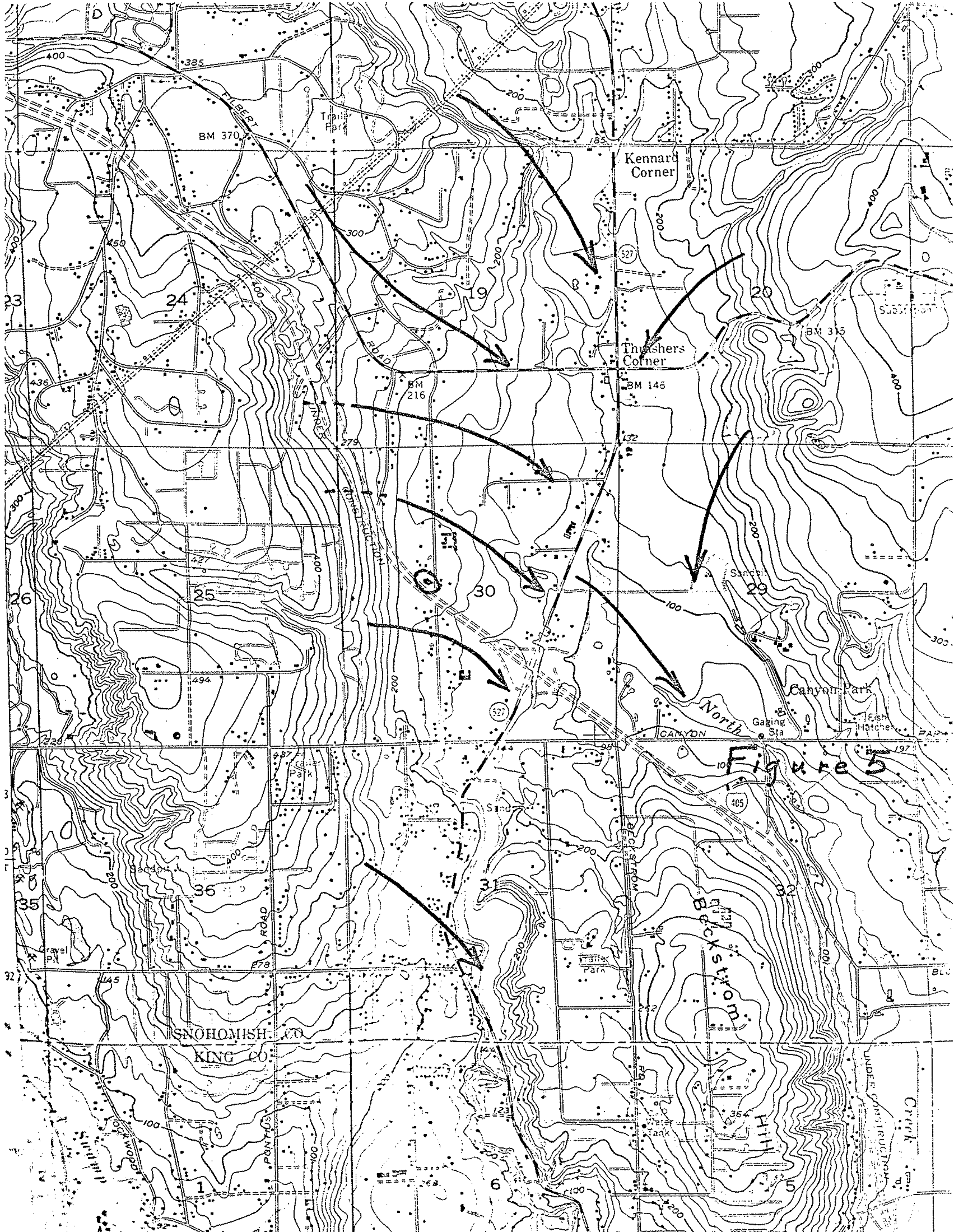


Figure 5
Kennard Corner
Thrashers Corner
Trailer Park
BM 370
FILBERT
ROAD
BM 216
BM 146
BM 315
Substation
INNER
CONSTRUCTION
527
405
Sand
Canyon Park
Gaging Sta
Fish Hatchery
CANYON
PARK
North
Creek
Beckstrom
Hill
BECKSTROM
Gravel Pit
Water Tank
SNOHOMISH CO
KING CO
LOCKWOOD
PONTIUS
UNDER CONSTRUCTION
23
24
19
20
25
26
29
30
35
36
31
32
1
6
5

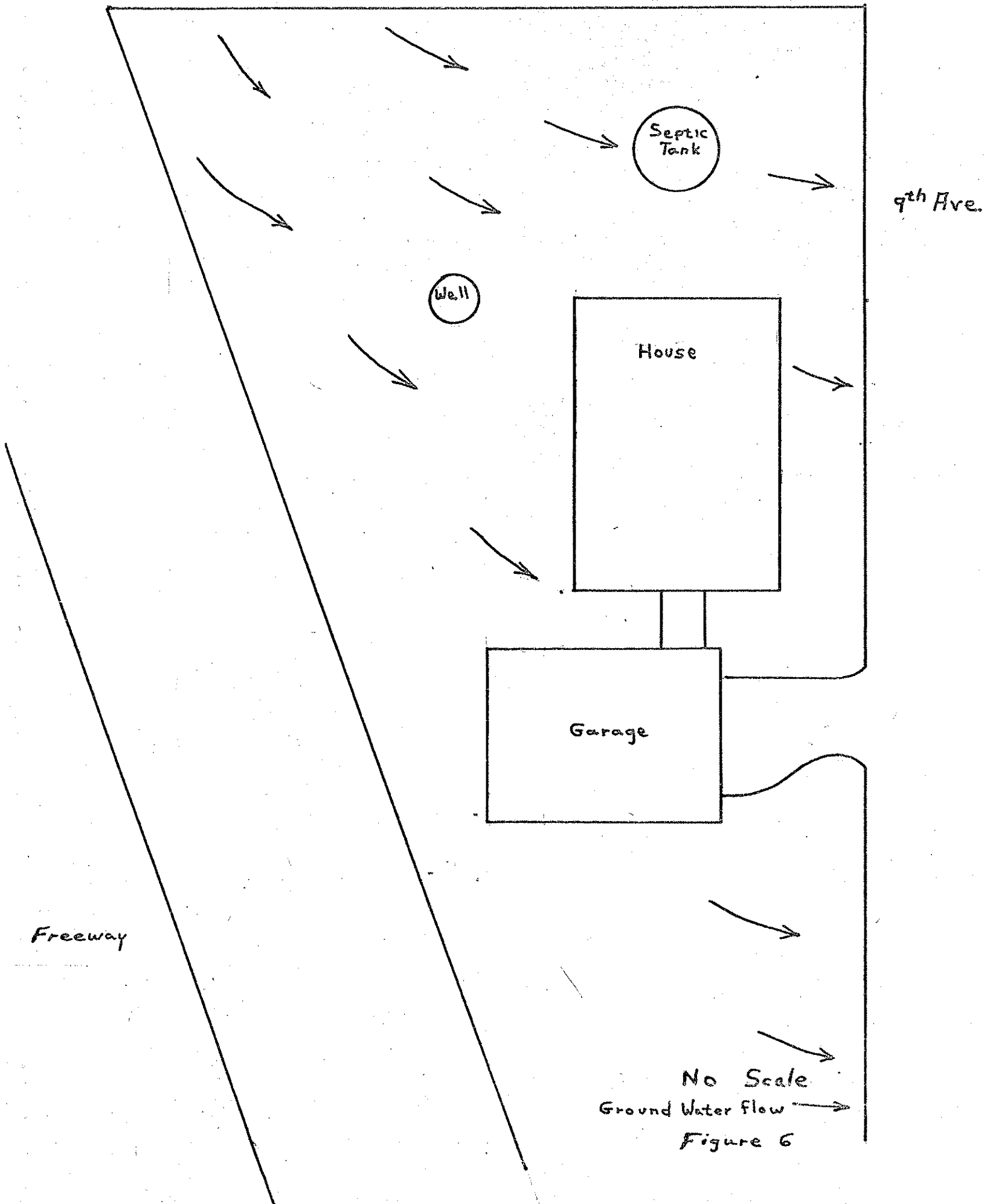
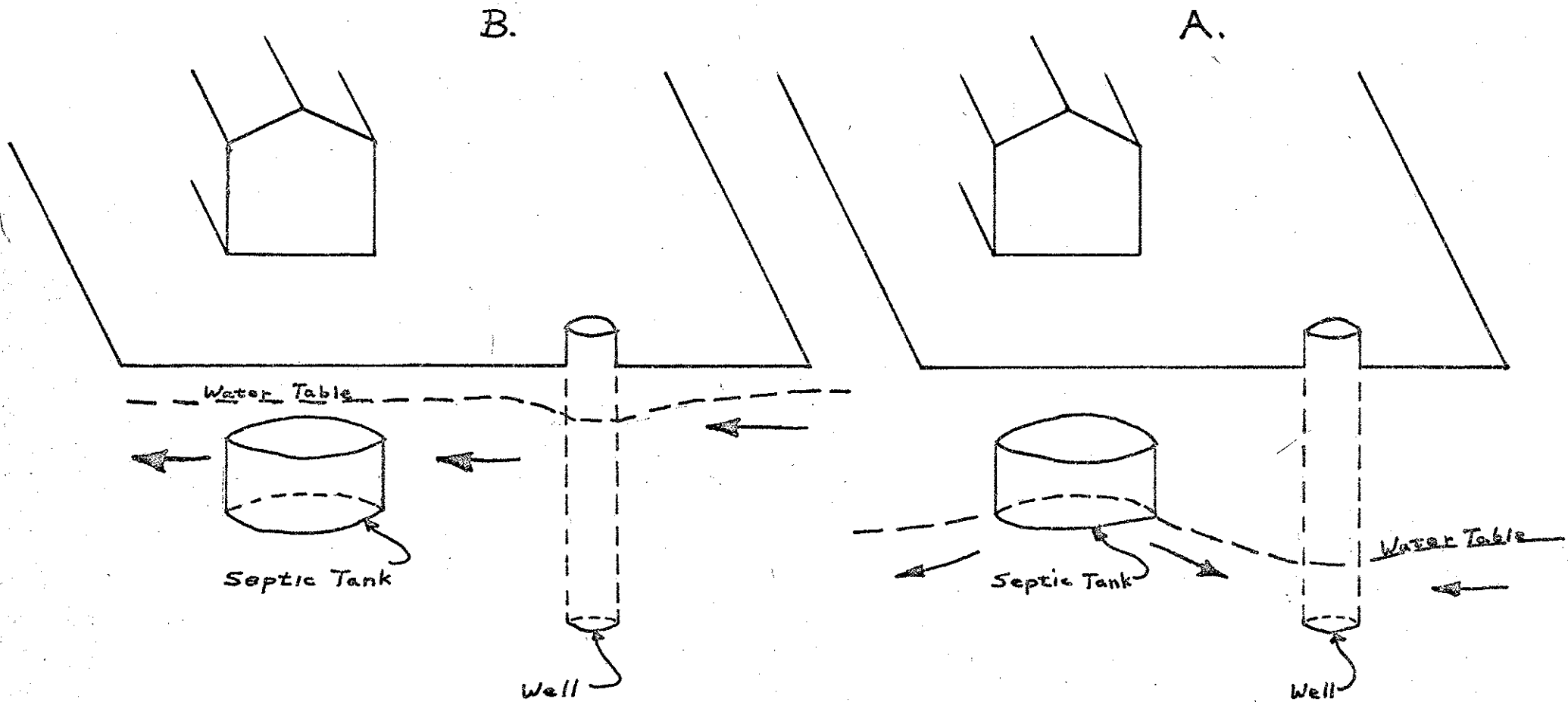

Septic Tank
9th Ave.
Well
House
Garage
Freeway
No Scale
Ground Water flow

Figure 6



Arrows indicate direction of ground water flow.

Figure 7