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HYDROLOGICAL DATA REPORT 4

GROUND-WATER RECONNAISSANCE OF SIX ESKIMO VILLAGES KOBUK-NOATAK AREA, ALASKA

By

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ALASKA DEPT OF HEALTH
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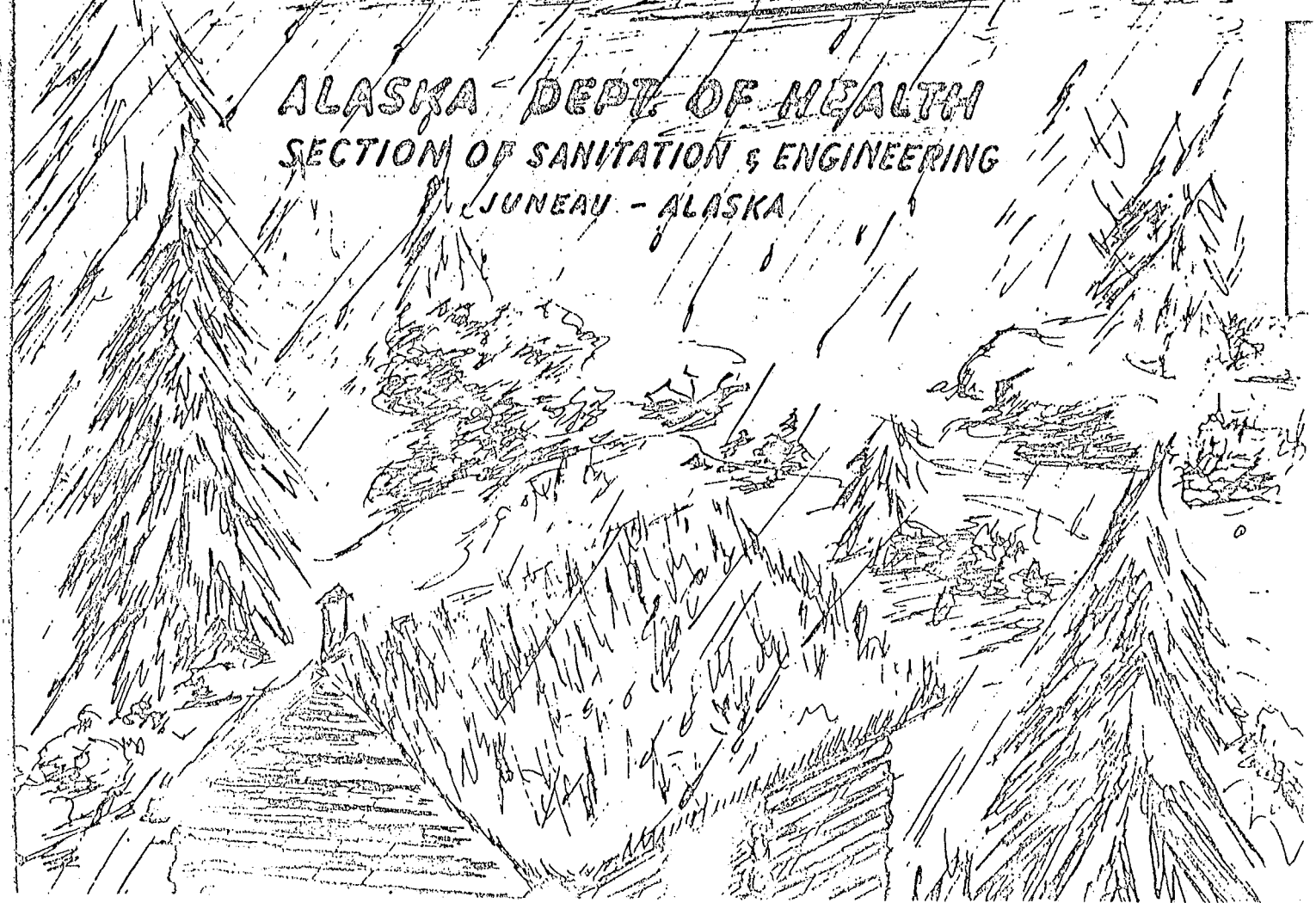

Ground Water Reconnaissance of Six Eskimo Villages in the Kobuk-Noatak Area, Alaska

The attached ground water reconnaissance reports by Roger M. Waller, Geologist, Geological Survey, have been released to open-file report and may, therefore, be reproduced.*

Six Eskimo villages, Kiana, Noatak, Noorvik, Point Hope, Selawik, and Shungnak in northwestern Alaska were visited by Mr. Waller in October, 1956 to survey the areas for ground water possibilities in cooperation with the Alaska Department of Health.

The villages are located north of the Arctic Circle in the area east and north of Kotzebue, which is the largest community in the area. Point Hope is a coastal village whereas the other villages lie inland in major river valleys. The climate is sub-arctic with long winters and short summers. Precipitation is light probably averaging less than 20 inches per year. Strong westerly winds are prevalent throughout the area. Permanently frozen ground (permafrost) is present in this northern region.

At present, the villages are dependent, primarily, on river water for their supply.

Frank O. Booth
Environmental Health Advisor

* Letter dated May 13, 1957 from Roger M. Waller, Geologist in Charge, Geological Survey, Anchorage, Alaska

KIANA

Kiana is a village of about 180 people on the north bank of the junction of the Kobuk and Squirrel Rivers. The village is about 85 miles due east of Kotzebue. The main part of the village is in a small draw that extends from the Kobuk River several hundred feet northwest to a bench or terrace. This bench slopes gently toward the river and forms very prominent bluffs 80 to 100 feet high, on each side of the draw. Several houses and the school are located on one or the other of the bluffs.

Exposures along the lower part of the bluffs indicate that the material underlying the bench is horizontally bedded silt and fine sand which is permanently frozen. To the east, the bluff rises to about 180 feet, and medium-grained sand and a cobble bed are exposed about 30 feet from the top. Very coarse material, including some boulders, is exposed in a shallow draw northeast of the airstrip. Many boulders are scattered along the shore and are marked with glacial striae. The boulders obviously are derived from glacial drift and probably have been eroded from the adjacent bluffs. The local store owner reported that bedrock is exposed along the shore 300 feet west of the village at low-water stage.

The draw that extends through the village carries the spring runoff. It is reported that this runoff usually lasts until June. Summer rainfall also produces runoff in the draw. Water seepage was noted in the eastern bluff about 25 feet above the river. The seepage produces "glaciering" or icing. This same effect was noticed in the draw that drains eastward north of the airstrip. This seepage is more likely derived from ground-water percolating through the thawed zone above the permafrost than the melting permafrost; hence, it freezes because of the presence of the underlying frozen ground.

Permafrost apparently is quite extensive underneath the village. The new airstrip on the bench north of the village was constructed on frozen silt and fine sand. The vegetation was scraped off and the frozen ground allowed to thaw for two summers. It is reported that the strip is now stabilized, evidently because the permafrost has receded to a depth sufficient to eliminate differential frost action near the surface.

It is possible that a shallow zone of unfrozen ground is present along the axis of the draw. This zone should be relatively free of permafrost, owing to the presence of percolating water each summer. It also is possible that more permeable material is present at the upper end of the draw than elsewhere, as evidenced by coarse material in the higher parts of the bluffs. Therefore, it is believed that a dug well might be successful near the upper or north end of the draw. This location would also be upstream from the major sources of stream contamination. A site nearer the mouth of the draw might tap a more extensive unfrozen zone, but the material is probably finer grained and the site would be more subject to contamination than an upstream one.

NOATAK

Noatak is about 50 miles north of Kotzebue on the west bank of the Noatak River. It has a population of about 175. About half the villagers live on a low terrace; the others live on the higher ground about 20 feet above the terrace. A creek that is reported to flow the year around enters the river from the west, just north of the village.

Exposures along the river bank in the scarp of the low terrace indicate that a gravel layer extends from below river level to 5 feet above the river level. The section above this also is about 5 feet thick and consists of fine sand and silt containing a 5-inch peat zone within. These two units are persistent along the entire length of the village. Where the river has swung in against the higher ground, the fine sand and silt extends to the top of the bluff (about 50 feet above river level). The gravel layer consists of relatively clean gravel 1 to 2 inches in diameter.

Permanently frozen ground is present near the surface in the village. It was reported that last September a hole dug in the low terrace (about 10 feet above the river) encountered frozen ground at 3 feet. Frozen ground was encountered also on the high ground wherever an attempt was made to dig a hole.

There seem to be two possibilities of alleviating the present necessity of hauling river water for domestic use. The persistence of the coarse gravel zone at and above river level would indicate that this zone may extend inland under the terrace and, possibly, the higher ground. Therefore, if a hole were dug or jetted through the overlying frozen sand and silt, it should encounter the coarse gravel zone. The gravel zone did not appear to be permanently frozen near the river; hence it appears likely, since it is very porous, that for some distance inland it may also be unfrozen. If so, it should be saturated, and would be recharged by lateral percolation from the river, and possibly also from the creek.

Another possibility of obtaining a water supply would be to use the creek water. The creek cuts a channel 10 feet deep near the creek bridge. This site appears to be suitable for a small earthen and log dam behind which water could be stored.

The site is upstream, or higher than, the village; therefore, a gravity-water line could be laid out for summer use. Because of freezing, this supply probably would not be used throughout the winter. Also, purification of the water would be necessary.

NOORVIK

Noorvik is on the Kobuk River delta about 60 miles east of Kotzebue. The village is on a spruce-covered hill (the highest ground within several miles) on the east bank of one of the channels of the Kobuk. The hill rises about 200 feet above the river and about 180 feet above the river terrace. About 175 people live in the village at present.

The material exposed in the high bluffs and in the terrace along the river bank is gray thinly bedded silt and very fine sand. The very fine sand exposed along the terrace is crossbedded.

Permanently frozen ground is predominant in this area. Huge ice lenses are exposed as a result of slumping in the high bluff at the north end of the village. The material along the river bank seems to be permanently frozen throughout the exposed part.

The possibility of obtaining a ground-water supply at this village would depend upon locating a subsurface thawed zone. Surface evidence does not suggest that there are coarse materials, or, a possible thawed zone at shallow depths in this area. However, a logical site to explore would be the low river terrace, preferably near the river. The surface material is very fine and frozen but there may be thawed zones at depth.

A lake, or large pond, behind (east) and about 50 feet below the village, would be a logical source of water. This lake, however, is easily subject to contamination by sled dogs, children, and refuse from outhouses. The possibility that an unfrozen zone may occur adjacent to the far (east) shore of this lake should not be overlooked. The east and north shores also are away from the village housing and, therefore, less subject to contamination.

POINT HOPE

Point Hope, one of the oldest settlements on the Arctic coast is about 150 miles northwest of Kotzebue on the long sand spit that juts out westward into the Chukchi Sea. The Kukpuk River flows into the lagoon just east of Point Hope. About 205 people live in the village at present.

The low sand spit affords little protection from the violent winds and storms that are common in this area. Very little vegetation survives in the coarse, loose sand. The villagers report that the north shore of the spit is gradually being eroded, whereas the south shore is being built seaward.

The material that makes up the spit is well-sorted sand and fine gravel which is permanently frozen. Only the top 3 to 4 feet of the ground becomes thawed during the summer. The permafrost extends to an unknown and unpredictable depth.

The villagers have a summer water supply from a shallow well located some distance southeast of the village. The well was constructed by excavating to the permafrost (4 feet) and then filling back around the well. A gasoline-driven pump and a water-distribution line are used from May until September. The supply is reported to be so plentiful as to allow pumping all day long during the summer.

The school, near the north edge of the village, has a 3-foot dug well which is similar in construction to the village well. The well was enclosed within the schoolhouse this year to prevent freezing and to find out if the supply of water could be sustained throughout the winter.

It appears that there can be no improvement over the existing water supply for Point Hope, unless the time when the well freezes can be delayed. The village well may be inducing some thawing in its immediate area. The lowering of the water level and the creation of a flow from the surrounding area should tend to warm up the underlying frozen ground. Hence, the depth of the thawed zone is probably increasing, creating a deeper and longer-lasting reservoir of water. If this thawing process is occurring, the well should be deepened and the pump intake lowered each year in an attempt to continue the progressive enlargement of the reservoir.

SELAWIK

Selawik is about 3 miles north of the Arctic Circle on the delta of the Selawik River where it empties into Selawik Lake. The village of 120 people is about 70 miles east-southeast of Kotzebue.

The area is very flat for many miles in all directions. The villagers have built homes on the west bank of the river and also on an island in the river. The river level is about 8 to 10 feet below the land surface. On the island are several small, shallow ponds.

Fine gray sand is exposed along the river banks and was reported from excavations for the new schoolhouse pilings. The piling holes were 9 feet deep and encountered frozen ground at 1 foot. The new schoolhouse replaced the old school building which suffered extensively from differential settling in the frozen ground. It is reported that one room in the school has as much as 2 feet of vertical displacement from one end to the other. The building is about 20 feet from the river bank. The new schoolhouse is about 200 feet west of the river bank. No evidence of subsurface unfrozen areas in the village was found; however, there possibly are some unfrozen areas adjacent to the meandering river. It appears that exploration for a groundwater supply would be best attempted by using the well-jetting method. Areas along the banks of the river or near the deeper ponds on the island might have unfrozen zones below the surface.

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SHUNGNAK

Shungnak is on the Kobuk River about 250 river miles from the mouth, or about 180 miles straight east of Kotzebue. The present population of 155 all live in a row of homes built along a narrow ledge, or terrace, on the west side of the river and about 20 feet above river level. A lower terrace, 10 feet above the river is subject to annual flooding. The land rises abruptly behind the houses to a height of 80 feet above the river where it levels off toward the west.

The terrace deposits and hill consist of sand, gravel, and cobbles which do not appear to be permanently frozen. Various excavations along the upper terrace show that fine to coarse sand overlies coarse gravel and cobbles, all of which seem to persist along the entire terrace. The sand unit evidently extends to the top of the hill.

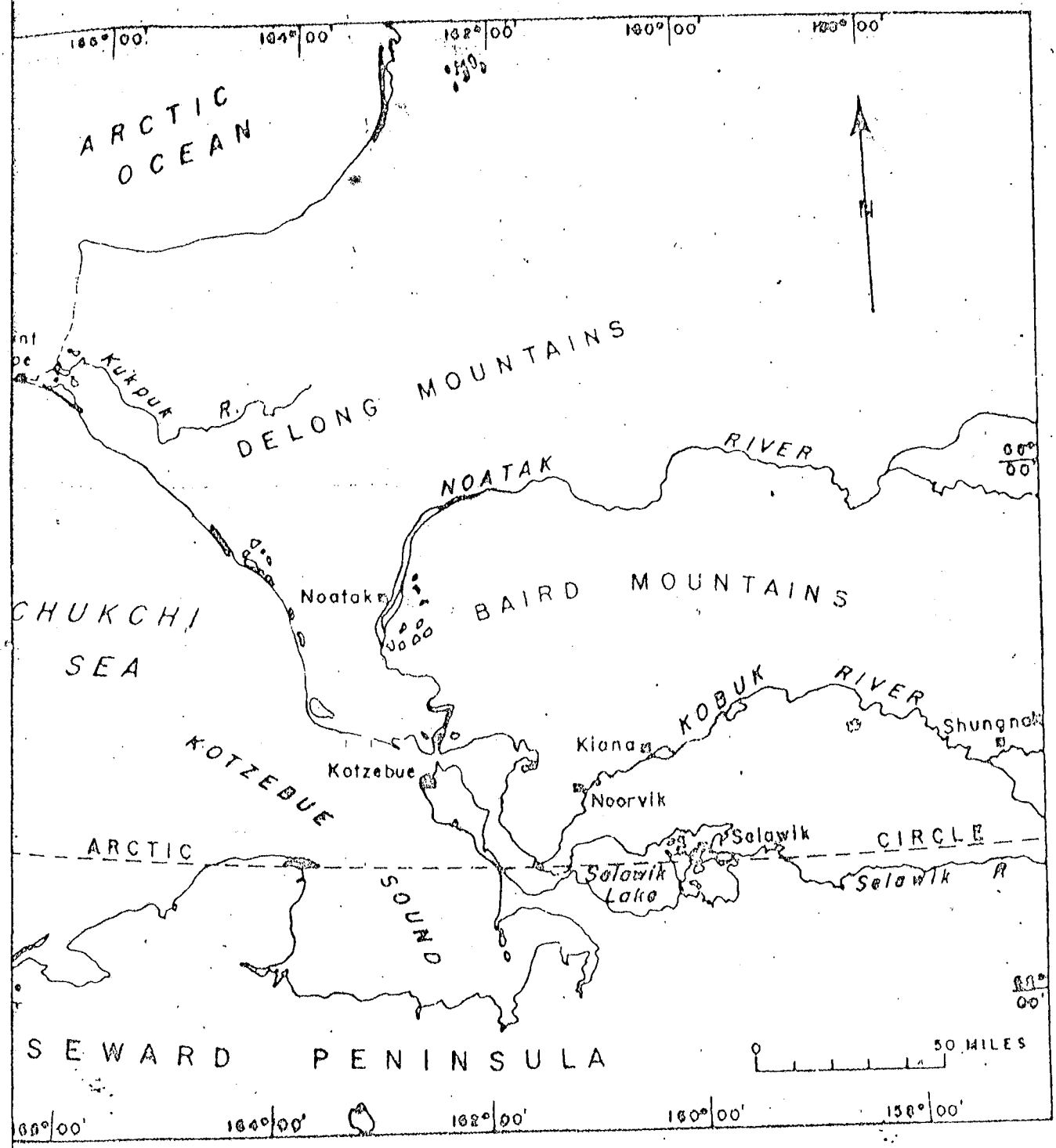
The absence of permafrost in the hill and terrace is probably due to the coarse texture of the material which permits rapid drainage of snowmelt and rainfall.

A dug well was attempted many years ago at the north end of the village and terrace near the base of the hill. Various depths for the well were reported, but the bulk of the evidence indicates that the depth was about 20 feet. The material was unfrozen and very gravelly. Water was encountered, but it seems that it was too dirty to use. It is very likely that the well diggers did not have the means to pump the well rapidly and clear the water. The hole was abandoned and has been filled.

The indications are that a well should have been successful at the above site. However, the gravel (if the water came from it) may have been too coarse to have been effective as a filter. The reported depth of 20 feet or so put the bottom of the well a few feet below the river level; therefore, it appears that there may have been a direct hydraulic connection between the well and the river. This connection would assure a plentiful supply of water. As mentioned above, the well was probably not "developed"; hence, all that might be required to clear up the dirty water is adequate pumping. The above indications point out that it may be feasible to try a new well at this same site.

If a well is attempted in this vicinity and the above conditions are encountered, it might be possible to "sandpack" the well. A well point could be set into the coarse, water-bearing gravel and then sandpacked around the point to fill in the gravel interstices. Such a "pack" may filter the dirty water.

Other locations may be as favorable in regard to underlying gravel, but the surface conditions may not be as good because of poorer sanitary conditions.



Map showing location of villages