LOWER KUSKOKWIM SCHOOL DISTRICT

SCHOOL SITE INVESTIGATION

FOR

CHEFORNAK, ALASKA

CONSULTANTS INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

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Special thanks to the people of the Lower Kuskokwim area whose assistance and cooperation made this project possible.

CHEFORNAK, Alaska 99561 2nd Class City

Phone: 907-787-8001

Incorporation Date: 1974
Population: 204
Regular Election: First Tuesday of October
Sales Tax: 2%
City Council Meets: As required

City Council Members

Peter Mathew Sr.
Jobe Abraham
Joseph Avugiak
John Jimmy Sr.
Peter Tom
Evan Wiseman

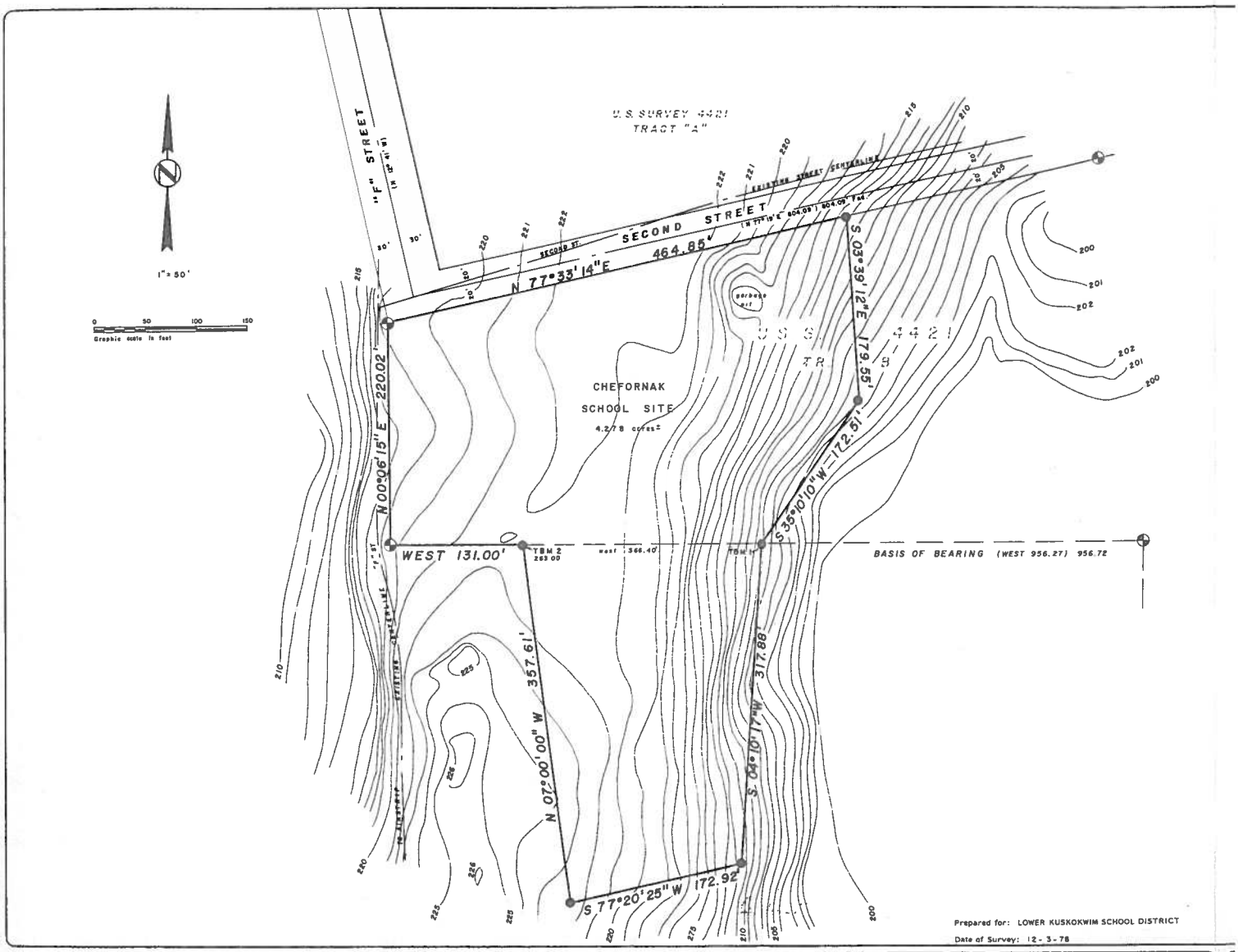
Mayor	David Lewis Sr.
Clerk	Walter Lewis
Secretary	Joseph Avugiak
Treasurer	Jobe Abraham
Chief of Police	Bob Tunuchuk
Fire Chief	Walter Tiuchick
Light Manager	Alexie Flynn
Health	Elisa Panruk

Traditional Council (I.R.A.)

Joseph Avugiak
David Lewis Sr.
Peter Tom
Peter Panruk
Hubert Tunuchuk

TABLE 1
GOVERNMENT POSITIONS


KINIA
RIVER
VILLAGE FUEL
CEMETARY
VILLAGE POWER
TO AIRPORT
CHEFORNAK SCHOOL SITE
COMMUNITY CENTER
CHURCH
STORE
PHS WELL
N.G. ARMORY
BIA FUEL
NORTH
0
200
400
600
SCALE IN FEET

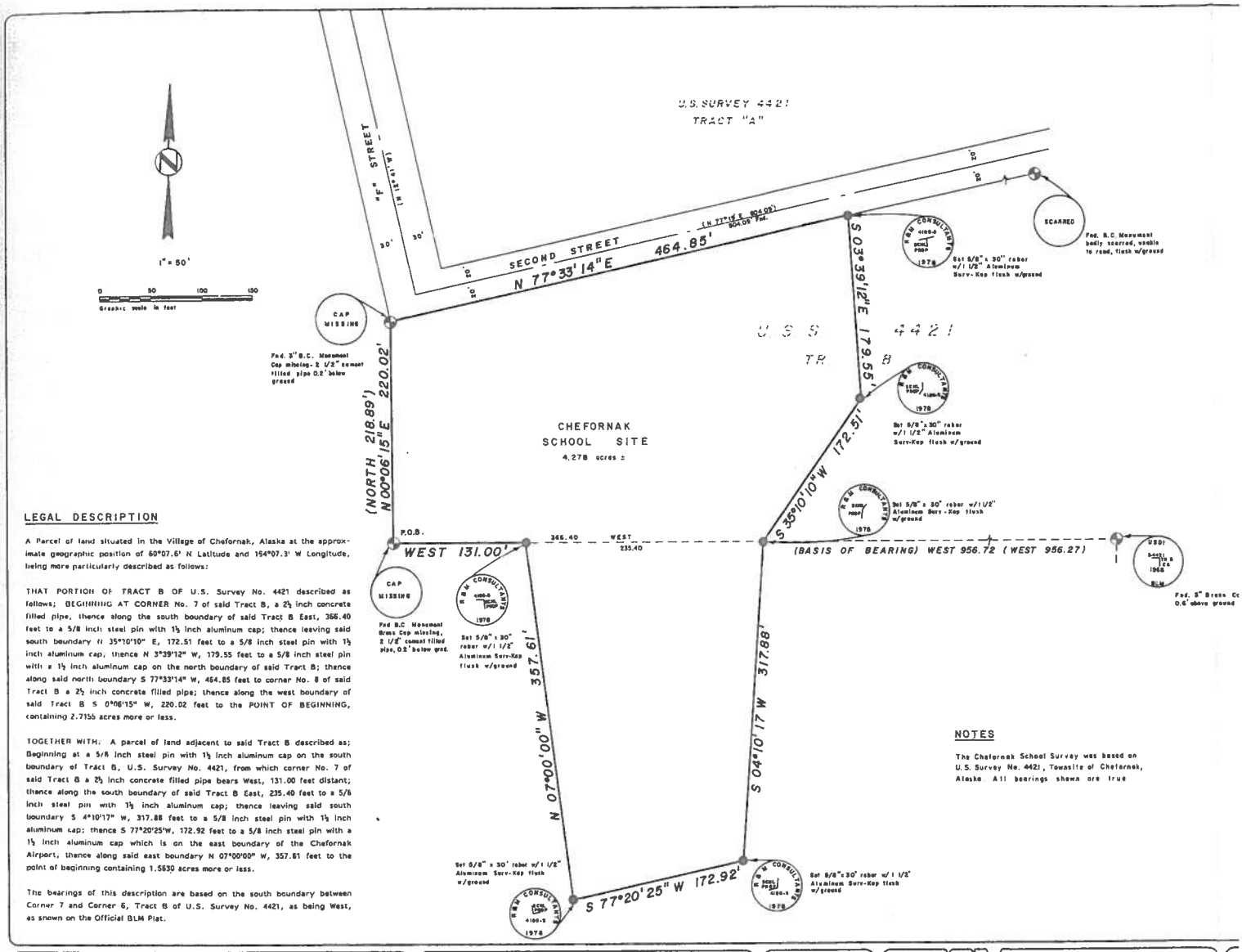


DESIGN
DRAWN SRL
CHECK MR
APPROVED RD

NO.	DATE	REVISION	BY	APRVD

STATE OF ALASKA

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS



LEGAL DESCRIPTION

A Parcel of land situated in the Village of Chefornak, Alaska at the approximate geographic position of 60°07.6' N Latitude and 164°07.3' W Longitude, being more particularly described as follows:

THAT PORTION OF TRACT B OF U.S. Survey No. 4421 described as follows; BEGINNING AT CORNER No. 7 of said Tract B, a 2½ inch concrete filled pipe, thence along the south boundary of said Tract B East, 366.40 feet to a 5/8 inch steel pin with 1½ inch aluminum cap; thence leaving said south boundary N 35°10'10" E, 172.51 feet to a 5/8 inch steel pin with 1½ inch aluminum cap, thence N 3°39'12" W, 179.55 feet to a 5/8 inch steel pin with a 1½ inch aluminum cap on the north boundary of said Tract B; thence along said north boundary S 77°33'14" W, 464.85 feet to corner No. 8 of said Tract B a 2½ inch concrete filled pipe; thence along the west boundary of said Tract B S 0°06'15" W, 220.02 feet to the POINT OF BEGINNING, containing 2.7155 acres more or less.

TOGETHER WITH: A parcel of land adjacent to said Tract B described as; Beginning at a 5/8 inch steel pin with 1½ inch aluminum cap on the south boundary of Tract B, U.S. Survey No. 4421, from which corner No. 7 of said Tract B a 2½ inch concrete filled pipe bears West, 131.00 feet distant; thence along the south boundary of said Tract B East, 235.40 feet to a 5/8 inch steel pin with 1½ inch aluminum cap; thence leaving said south boundary S 4°10'17" W, 317.88 feet to a 5/8 inch steel pin with 1½ inch aluminum cap; thence S 77°20'25"W, 172.92 feet to a 5/8 inch steel pin with a 1½ inch aluminum cap which is on the east boundary of the Chefornak Airport, thence along said east boundary N 07°00'00" W, 357.61 feet to the point of beginning containing 1.5630 acres more or less.

The bearings of this description are based on the south boundary between Corner 7 and Corner 6, Tract B of U.S. Survey No. 4421, as being West, as shown on the Official BLM Plat.

NOTES

The Chefornak School Survey was based on U.S. Survey No. 4421, Townsite of Chefornak, Alaska. All bearings shown are true

DESIGN
DRAWN SRL
CHECK MS
APPROVED BB

NO.	DATE	REVISION	BY	APRVD

STATE OF ALASKA — Bob L. Dale — 4183-S — Surveyor

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

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1.0 INTRODUCTION

The work performed in this study was accomplished under contract with the Lower Kuskokwim School District (L.K.S.D.). The staff and management of R&M Consultants, Inc. are pleased to submit this report on Chefornak, Alaska in compliance with the provisions of that contract.

1.1 PURPOSE

The Lower Kuskokwim School District has programmed 19 villages for construction of new high school facilities. Villages in the school district that R&M Consultants has provided site investigations include Platinum, Chefornak, Eek, Tununak, Tuluksak, Kwethluk, Akiachak, Quinhagak, Tuntutuliak, Napaskiak, Goodnews Bay, Mekoryuk, Newtok, Nightmute, Oscarville and Kasigluk. Atmautluak, Nunapitchuk and Kwigillingok are to receive high schools under this program also. However, site investigations and report preparation for these villages have been provided by others.

R&M Consultants' project role was, 1) to provide technical assistance during public hearings in which the local villagers selected a site; 2) survey selected site for property or use rights transfer; 3) from interviews and site inspections, compile site specific information to be used as a design aid for architects and engineers.

1.2 SCOPE

The scope of report is restricted to the gathering, compilation, analysis and presentation of information relevant to the design of a new high school at Chefornak, Alaska. The scope of the work in this four phased project is defined in detail below:

Phase 1 of the project involved a literature search to obtain and compile site information from existing records. The search included State and Federal agencies, private firms and organizations, and private individuals having first-hand experience of local conditions. Types of information gathered include the following:

Survey plats
Aerial Photographs
Maps and Descriptions of Existing Facilities
Geotechnical
Hydrological and Climatic Data
Environmental Hazards
Land Status
Archeological Restrictions
Topographic Data
Community Populations
Transportation
Economic
Communication and Social Data

This information file is available for perusal at the Anchorage office of R&M Consultants with written approval from the Lower Kuskokwim School District.

Phase II, involved the site selections by the local village residents. A representative of the Lower Kuskokwim School District (L.K.S.D.) accompanied by an engineer from R&M Consultants visited each village. During this initial visit, possible sites were reviewed and a public hearing was held to explain the project to the local residents who then selected a site. It should be emphasized that R&M Consultants' role was to provide technical information to the local residents, so that they could select a site. Possible sites were discussed during the public hearing, and vote tallies of all residents present were used to determine the final site selection.

Phase III, R&M Consultants sent an engineer and two surveyors back to each village to perform a boundary and topographic survey of the selected site, to verify information obtained from the literature search, and to gather additional site specific and local data found pertinent to construction of a new high school.

Phase IV, involved the compilation of all pertinent information into this final report for the proposed Chefornak High School. This includes identifying the selected school site and presenting the general design considerations, recommendations, and criteria to be used as a basis for design.

1.3 SITE LOCATION

A site containing 4.28 acres was chosen by the residents of Chefornak as the location for the proposed high school. The site is located southwest of the village on the townsite boundary. It is completely undeveloped and contains no utilities. An unimproved road is adjacent to the site and is used by villagers as a route between the airport and the city. The airport property is immediately adjacent to the western edge of the site, and the airport runway is approximately a quarter of a mile south-southwest of the site at its closest point. A small depression on the northeast edge of the site is used as a dump.

A site map, vicinity map, photo reference map, site survey, boundary survey, and site photos are provided at the end of this section.

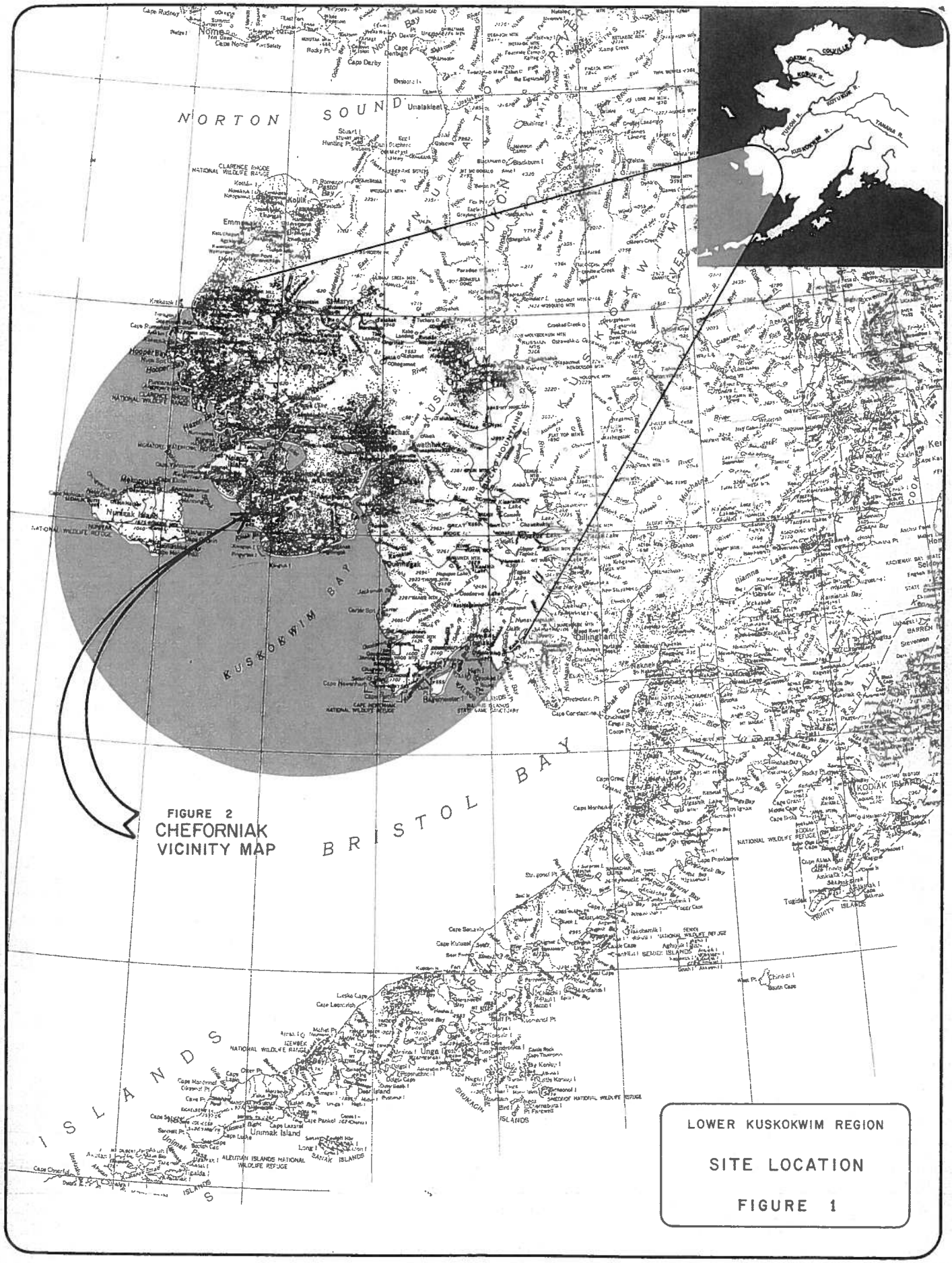
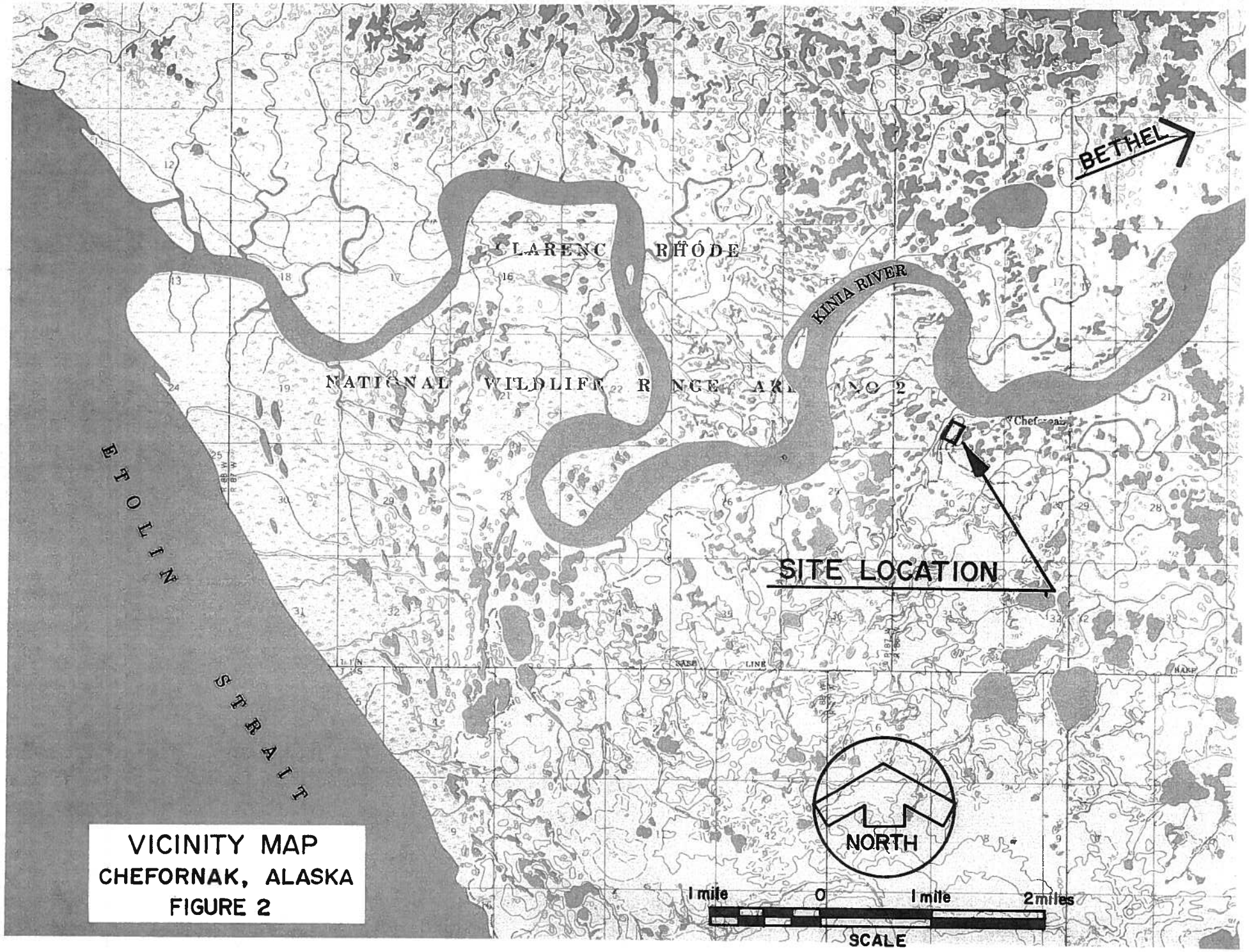


FIGURE 2
CHEFORNIAK
VICINITY MAP

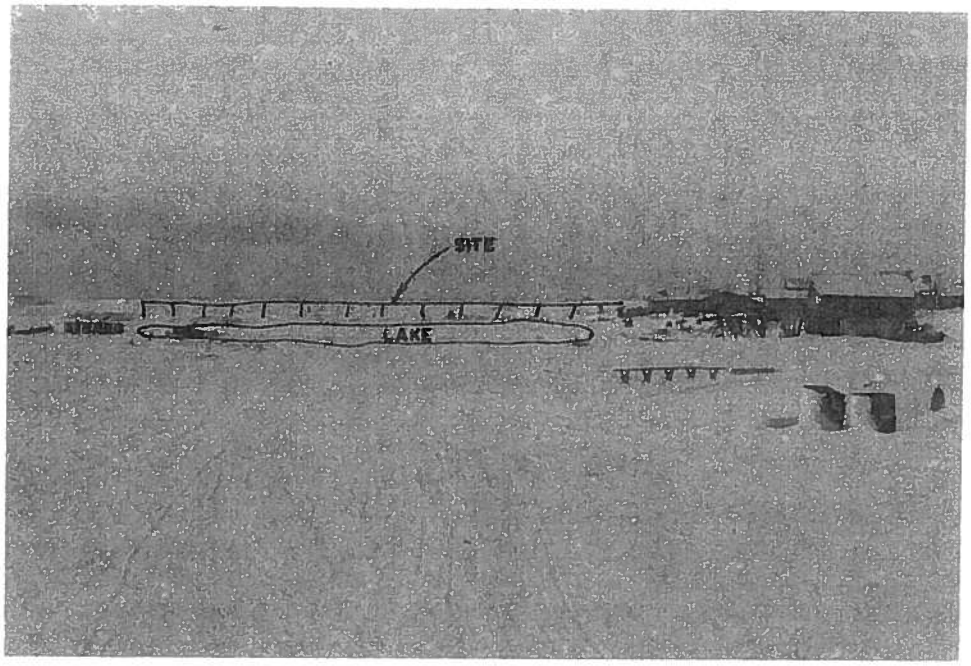
LOWER KUSKOKWIM REGION

SITE LOCATION

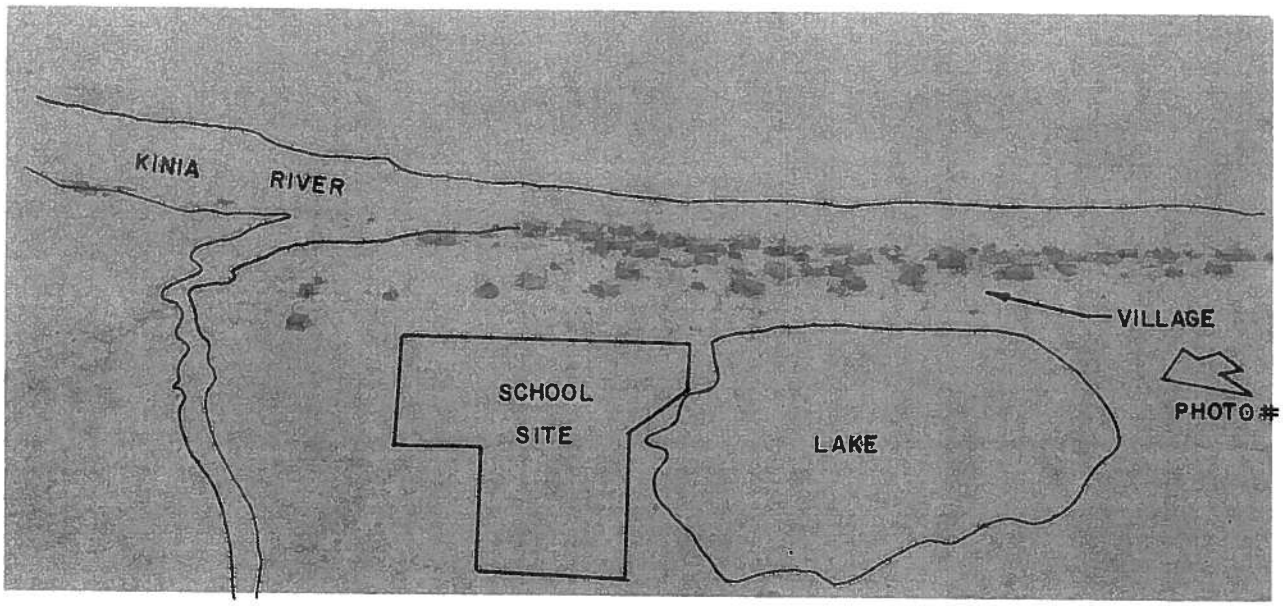
FIGURE 1



VICINITY MAP
CHEFORNAK, ALASKA
FIGURE 2

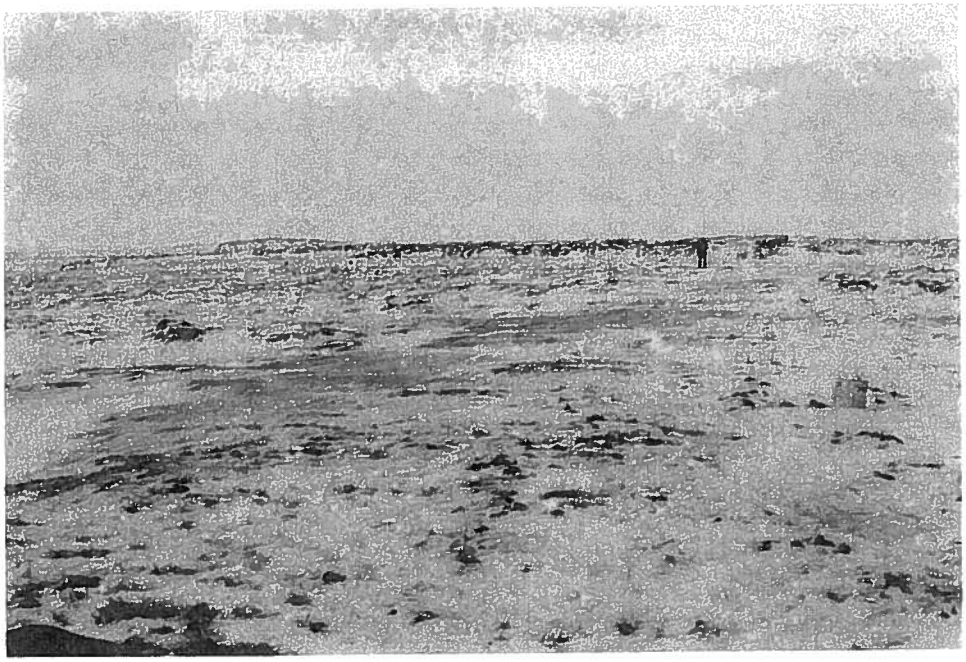


VIEW OF SITE FROM SOUTHEAST EDGE OF TOWN



AERIAL VIEW

SITE PHOTOGRAPH



VIEW OF SITE FROM NORTH END LOOKING SOUTH

SITE PHOTOGRAPH

2.0 VILLAGE PROFILE

2.1 COMMUNITY LOCATION AND SETTING

The village of Chefornak is located on the south bank of the Kinia (Ooksokwak) River, 60°03'N latitude and 164°12'W longitude, approximately 98 air miles west southwest of Bethel, and about 7 air miles up the Kinia River from Etolin Strait. Chefornak lies within the Clarence Rhode National Wildlife Refuge, established in 1960 for the protection of migratory bird nesting areas. The refuge provides summer nesting areas for Canada and Emperor Geese and Black Brants. Kinia Mountain (277 feet) 5 miles north, Tern Mountain (443 feet) 5 miles south, and Cheeching Mountain (310 feet) 5 miles southeast of Chefornak are extinct volcanoes visible from the city.

Chefornak is generally a subsistence village utilizing beaver, seal, tom cod, blackfish, needlefish, herring, smelt, flounder, pike, trout, salmon and wildfowl as the subsistence harvest. Mink, beaver, and arctic and red fox are also hunted and trapped during the winter.

The topography is fairly flat with only slight variations in local relief. Standing water bodies of various sizes, small meandering streams, and marshy terrain characterize the area. A small stream borders the western edge of the high school site and town. The stream flows to the Kinia River passing between the village and the Village Co-op fuel supply. Several small lakes, some of which are dry, are scattered throughout the area. Two of these lakes are adjacent to the village. These lakes are also connected to the river by a shallow depression or natural drainage. This drainage crosses just to the east of the village near the B.I.A. School.

Although the townsite plat for Chefornak indicates several streets and roads, in reality few exist in the village. Besides a boardwalk, which connects most of the village, many foot trails and paths have been developed. Two "roads" lead from the airport. One leads to the west end of the village, and the other leads to the village tank farm and boat launching site.

2.2 POPULATION

Based on the 1977 State revenue sharing application, the population of Chefornak is 182, and according to local sources, the population has been slowly increasing. Except for a few school teachers, the village residents are Eskimo. Most residents are bilingual, speaking the native language, Yupik, with English as a second language. In 1978, 66 students were enrolled in the B.I.A. grade school; another 22 students attended the high school. During the summer fishing season, many villagers fish commercially and for subsistence in the Kinia River. During this period, a few (less than 10%) of the 40 families temporarily relocate to fish camps. About half of the villagers live in newer homes of approximately 500 square feet built through B.I.A. or A.S.H.A. funds; others live in older wood homes. The principle religion in Chefornak is Catholic. Services are held on Wednesday and Friday evenings and on Sunday.

2.2.1 Labor Force

Although most residents fish for subsistence during the summer, they indicated that a good paying job would be a higher priority. There are 4-6 carpenters and 1 or 2 electricians in Chefornak, the skill levels of whom are unknown. Neidermeyer-Martin employed 6-8 residents during construction of the B.I.A. Kindergarten addition in 1978.

2.3 VILLAGE FACILITIES

The village consists of a B.I.A. grade school (with a new kindergarten addition added in 1978 by Niedermier-Martin Co.), one Co-op Store and one privately owned store, a National Guard Armory, Health Clinic, Catholic Church, Post Office, Community Center, City Office, and Generator Building. The Post Office, Health Clinic, Community Center, and City Office are all in one building with the Community Center presently doubling as the temporary high school. The village is comprised of approximately 40 homes. The people get their potable water from the Public Health Service (P.H.S.) Community Watering station installed in 1964.

2.3.1 Lodging

Temporary lodging is available for a limited number of people in the B.I.A. school during the school year. A $10.00 per night per person donation to the school fund is requested. This facility includes two single bunks and a couch which folds out into a bed. This same area is to be used as the kindergarten teachers living unit and may not be available at all times. A shower, toilet, and sink are near the sleeping quarters. As there are no restaurants, visitors should bring their own food to prepare; cooking facilities and a refrigerator can be arranged. The bunkroom may be occupied, and visitors should be prepared to sleep on a classroom floor in their own sleeping bags. All arrangements to use the B.I.A. facility are handled through the school principal, Pat O'Brien.

The National Guard Armory, when not in use by the Guard, may provide room for a construction crew. This building is a frame structure with metal roofing and siding and is heated by an oil stove. No shower or modern toilet is available. As this is a military building, prior arrangements are handled through Captain Beans of the National Guard in Bethel, Alaska at phone number 543-2226.

2.4 GOVERNMENT

Chefornak is a Second Class City within an unorganized borough. It has a mayor/council government in which council members are elected at large with the mayor being appointed by council members. Council action has established police and fire protection, and power plant and airport management. There is also an advisory school board for both the B.I.A. school and temporary high school.

Table 1 provides a listing of village governmental positions, and the person who currently holds each position.

3.0 ENVIRONMENTAL DETERMINANTS

3.1 CLIMATE

Chefornak is located in the Transition Climatic zone. Weather is very changeable with marine influences dominant. Temperatures can be expected to be somewhat more extreme than at Mekoryuk to the west for example, but more moderate than at Bethel, to the east. There is no local weather station in the village, however, due to similar coastal and flat topographic influences, weather data from Mekoryuk can be reasonably applied to Chefornak. Rain, drizzle, clouds and fog are common, especially in summer. Frequent storms are characteristic of the entire coastal area of the Kuskokwim Delta. A climatic data summary for Mekoryuk (27 years of data) is presented in Table 2 and was directly applied to Chefornak with minor modifications from field investigations and reports from local residents.

3.1.1 Temperature

Climatic influences at Chefornak are moderated by surrounding waters primarily from the Bering Sea. Temperature extremes at Chefornak are estimated to range from -48°F to 76°F (Table 2). Seasonal temperatures are estimated to average between 0° and 24°F in winter and 40° to 56° in summer.

Ice formation on the Kinia River at Chefornak normally begins in late October and is usually safe for foot traffic by mid November. Ice is normally unsafe by early May and is generally gone by June 1.

Engineering design parameters such as heating, freezing, and thawing degree days are important mathematical values used in the design of buildings. The estimated mean total heating degree days for Chefornak is 13,000. Estimated mean total freezing and thawing degree day values are 2,800 and 1,800, respectively. The estimated mean total days below 0°F is 46. (Table 4).

3.1.2 Precipitation

The estimated average annual precipitation for Chefornak is 15 inches (water equivalent). Distribution of that precipitation throughout the year whether as rain, snow, or sleet, can be seen on Table 2. Estimated snowfall averages 60 inches annually. Maximum snowfall in 24 hours is reportedly 8 to 10 inches.

The National Weather Service ground snow loads for Alaska are shown in Figures 3 and 4 for 25 year and 50 year mean recurrence interval. Snow loads in Table 7, taken from Alaskan Snow Loads by Tobiasson and Redfield, presents more conservative data for the same recurrence intervals. Using a 25 year ground snow load of 98 psf, same as Mekoryuk, a basic design snow load of 47 psf was computed for Chefornak, based on the Tobiasson and Redfield computation method. Formulation of this value was based on a heated building with a ventilated, well insulated roof (R greater than 15), windswept, and a regional ground to roof conversion factor of 0.4. The 47 psf design snow load is to be applied over the

horizontal projected area, however, the basic roof snow load will require "modification for non-uniform and unbalanced loads, roof slopes, extra snow collected in valleys, sliding snow onto lower roofs, and wind drifting snow onto roofs in areas of aero-dynamic shade."

3.1.3 Wind

Wind data is not readily available for Chefornak. However, winds are strong and highly changeable in direction. The village is situated in the path of major storm tracks from the Bering Sea which causes the highly variable winds. Summer and winter prevailing winds are from the southwest and northwest respectively. Strongest winter winds come out of the south-southwest quadrant.

National Weather Service wind speed data is presented in Figure 5 and 6. Design wind speeds for Chefornak 30 feet above ground, are estimated to be 100 m.p.h. for a 25 year mean recurrence interval and 110 m.p.h. for a 50 year interval. Using a 25 year, 100 m.p.h. wind, a basic wind pressure design load of 37 psf was computed. Formulation of this value was based on Wind Forces on Structures, A.S.C.E. Paper No. 3269, (1961), a 1.3 building shape coefficient, and a 1.1 gust factor.

During the winter, the combination of cold temperatures and strong winds frequently make the wind chilling effects hazardous. Wind chill temperatures are shown on Table 3.

3.2 SITE EXPOSURE

Topography in the vicinity of Chefornak is slightly undulating. Snow drifting can be considerable in Chefornak, particularly between the B.I.A. elementary school and associated generator building, and on the south side of the school. Drifts are reported to reach 8 feet deep there. Drifts throughout the village are generally in a southeast-northwest direction.

Monthly hours of daylight can be determined by referring to Table 6.

3.3 HYDROLOGICAL

Located on the Kuskokwim River delta, the village of Chefornak is on a broad, flat, marshy plain of minimal relief. Perhaps as much as 50 percent of the surrounding area is water. The entire area is in a delicate hydrological balance. Most of the many lakes are shallow thaw lakes which actually migrate to some extent with annual freeze thaw cycles. Chefornak is located on the Kinia (Ooksokwak) River about 12 miles upstream from Etolin Straight in the Bering Sea. The Kinia River drains Dall Lake, perhaps the largest lake in the entire Yukon-Kuskokwim Delta.

3.3.1 Flooding

Although flooding occurs in the vicinity of Chefornak, it is not a particularly serious problem. Strong fall winds at times of high tide apparently cause most of the flooding which occurs in the low lying areas of the village near the B.I.A. School and also, to the west, near the village fuel storage tanks.

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In the past, flooding has been restricted to these low lying areas with most of the village, located on higher ground, being unaffected. The proposed school site is located well above the river level and is protected by high ground between the site and the river.

3.3.2 Erosion

Erosion is not a major problem in Chefornak, although some annual river-bank erosion occurs due to stream undercutting near the B.I.A. School. Pressures from ice jamming also causes some erosion.

The 2000 foot separation between the river and the proposed school should assure that there will be no erosion hazard at the site.

Climatological Data Summary, Mekoryuk Airstrip

CLIMATOLOGICAL DATA SUMMARY
DEPARTMENT OF COMMERCE
NOAA - ENVIRONMENTAL DATA SERVICE

Lat. 60 23'N
Long. 166 12'W
Alt. 42'

NUNIVAK, ALASKA

MONTH	TEMPERATURE (F) Means: DAILY MAXIMUM	DAILY MINIMUM	MONTHLY	Extremes: RECORD HIGHEST	YEAR	RECORD LOWEST	YEAR	PRECIPITATION TOTALS (inches): MEAN	GREATEST DAILY	YEAR	Snow and Sleet: MEAN	MAXIMUM MONTHLY	YEAR	GREATEST DAILY	YEAR	GREATEST DEPTH ON GROUND	YEAR	WIND: MEAN HOURLY SPEED MPH	PREVAILING DIRECTION	Mean No. of days: PRECIPITATION .10 INCHES OR MORE	Temperatures Max: 70 AND ABOVE	32 AND BELOW	Min: 32 AND BELOW	0 AND BELOW
(a)	27	27	27	27	-	27	-	27	27	-	8	8	-	8	-	16	-			15	27	27	27	27
J	18.3	4.8	11.6	41	1958	-35	1958	0.89	1.17	1948	10.6	19.0	1946	4.7	1948	31	1964			3	0	27	31	11
F	17.6	3.6	10.6	38	1924	-30	1964	1.01	1.20	1945	8.8	23.6	1945	7.1	1945	42	1964			2	0	23	27	12
M	21.5	6.9	14.2	48	1924	-30	1964	1.16	2.50	1953	9.7	19.8	1948	7.9	1948	47	1964			4	0	24	31	10
A	29.1	19.2	23.1	48	1968	-12	1949+	0.81	1.49	1957	3.7	13.2	1944	2.2	1944	48	1964			2	0	16	29	3
M	33.6	28.8	33.7	57	1957	0	1964	0.61	0.36	1946	2.9	8.9	1969	3.3	1946	24	1961			2	0	3	25	*
J	48.2	37.2	42.7	71	1953	26	1924	0.76	0.61	1960	0.9	8.9	1969	1.2	1969	T	1963			3	*	0	5	0
J	53.8	43.1	45.4	76	1962	28	1959	1.38	1.70	1955	0.0	0.0	-	0.0	-	0	-			5	*	0	*	0
A	54.4	44.8	49.6	70	1950+	32	1959	2.29	1.45	1944	0.0	0.0	-	0.0	-	0	-			7	*	0	*	0
S	44.4	40.7	45.3	63	1941	25	1962	2.13	0.99	1954	0.6	9.4	1969	2.6	1969	T	1948			7	0	0	2	0
O	39.1	30.1	34.6	54	1954	9	1945+	1.45	0.88	1966	4.0	12.2	1969	5.0	1966	10	1966+			6	0	5	19	0
N	29.9	20.0	25.0	46	1924	-18	1957	1.26	1.03	1946	7.9	15.7	1946	4.5	1946	14	1953			4	0	18	28	1
D	19.7	7.1	13.4	47	1924	-48	1957	1.06	1.12	1960	8.7	14.3	1969	3.3	1947	25	1960			4	0	26	30	9
	35.0	23.7	29.4	76	1962	-48	1957	15.31	2.80	1953	57.8	23.6	1945	7.9	1948	48	1964			49	*142		227	46

(a) Period of record, years (through 1970)
\+ Also on earlier dates, years or months
T Trace, an amount too small to measure
* Less than one half

TABLE 2

WIND SPEED MILES PER HOUR	COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"																				
	TEMPERATURE (°F)																				
CALM	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60
	EQUIVALENT CHILL TEMPERATURE																				
5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-65	-70
10	30	20	15	10	5	0	-10	-15	-20	-25	-35	-40	-45	-50	-60	-65	-70	-75	-80	-90	-95
15	25	15	10	0	-5	-10	-20	-25	-30	-40	-45	-50	-60	-65	-70	-80	-85	-90	-100	-105	-110
20	20	10	5	0	-10	-15	-25	-30	-35	-45	-50	-60	-65	-75	-80	-85	-95	-100	-110	-115	-120
25	15	10	0	-5	-15	-20	-30	-35	-45	-50	-60	-65	-75	-80	-90	-95	-105	-110	-120	-125	-135
30	10	5	0	-10	-20	-25	-30	-40	-50	-55	-65	-70	-80	-85	-95	-100	-110	-115	-125	-130	-140
35	10	5	-5	-10	-20	-30	-35	-40	-50	-60	-65	-75	-80	-90	-100	-105	-115	-120	-130	-135	-145
40	10	0	-5	-15	-20	-30	-35	-45	-55	-60	-70	-75	-85	-95	-100	-110	-115	-125	-130	-140	-150
WINDS ABOVE 40 HAVE LITTLE ADDITIONAL EFFECT.	LITTLE DANGER					INCREASING DANGER (Flesh may freeze within 1 min.)						GREAT DANGER (Flesh may freeze within 30 seconds)									
	DANGER OF FREEZING EXPOSED FLESH																				

TABLE 3

EQUIVALENT WIND CHILL TEMPERATURE

	JANUARY			APRIL			JULY			OCTOBER		
	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel
Maximum												
-41 to -50												
-31 to -40												
-21 to -30			*									
-11 to -20	*	*	3									
-1 to -10	4	3	7									*
0 to 10	6	4	7	3	*	1				*	*	2
11 to 20	5	4	5	5	2	4				6	3	7
21 to 30	8	7	4	8	8	5				18	16	13
31 to 40	7	10	4	12	17	13				7	11	7
41 to 50	1	3	1	1	3	6	14	11	2		*	2
51 to 60						*	12	16	15			
61 to 70							5	4	9			
71 to 80							*		5			
81 to 90									*			
Minimum												
-51 to -60												
-41 to -50												
-31 to -40			1									
-21 to -30	*		4									
-11 to -20	3	2	8	*		*						*
-1 to -10	7	5	5	4		4						
0 to 10	6	4	5	6	4	5				*	*	5
11 to 20	5	6	2	8	5	6				3	1	7
21 to 30	6	8	3	9	14	11				15	11	12
31 to 40	3	5	2	3	7	4	3	2	1	12	15	7
41 to 50	1	1					25	27	25	1	4	*
51 to 60							3	2	5			
61 to 70												

Figures are the mean number of occurrences in the increments shown or both maximum and minimum temperatures.

*Less than 0.5

	JANUARY			APRIL			JULY			OCTOBER		
	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel	Cape Romanzof	Cape Newenham	Bethel
Range												
Maximum												
0 to 4	16	18	16	19	20	17	20	24	18	26	26	
5 to 8	8	6	6	6	5	7	6	4	7	4	4	7
9 to 12	3	3	3	2	3	3	3	2	3	1	1	1
13 to 16	3	3	5	2	1	2	1	*	2			1
Minimum												
0 to 4	16	20	17	18	22	16	26	28	25	25	25	19
5 to 8	8	6	7	6	4	7	4	2	4	4	5	8
9 to 12	4	2	2	2	2	3		*	1	1	*	3
13 to 16	2	2	4	3	1	3	*		*	*	*	1

Figures are the mean number of occurrences in the increments shown for the variation of the maximum or minimum temperatures from one day to the next, regardless of whether the change is to warmer or colder.

*Less than 0.5

Range												
0 to 10	20	22	15	19	21	8	23	24	12	29	28	13
11 to 20	9	6	11	9	7	16	7	5	12	2	2	17
21 to 30	2	2	5	1	1	6	*	2	7		*	1
31 to 40	*	1	*	1		*			*			*
41 to 50	*		1									
51 to 60												

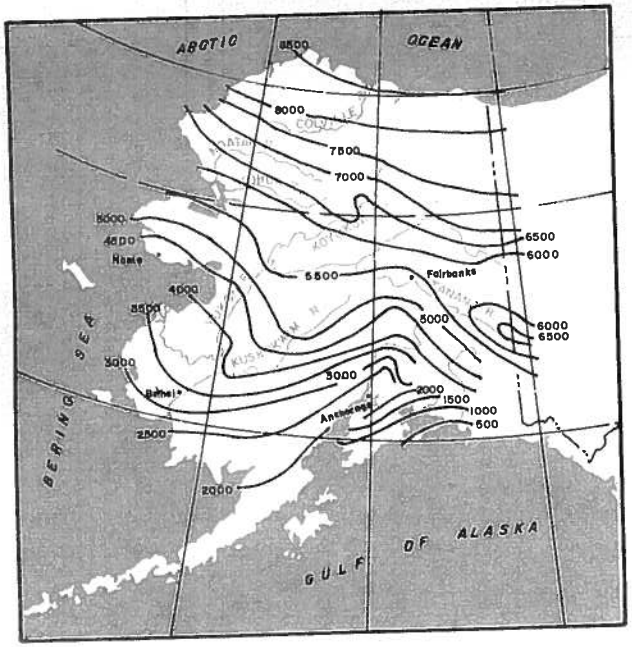
Figures are the mean number of occurrences in the increments shown for the daily range of temperature between the maximum and minimum.

*Less than 0.5

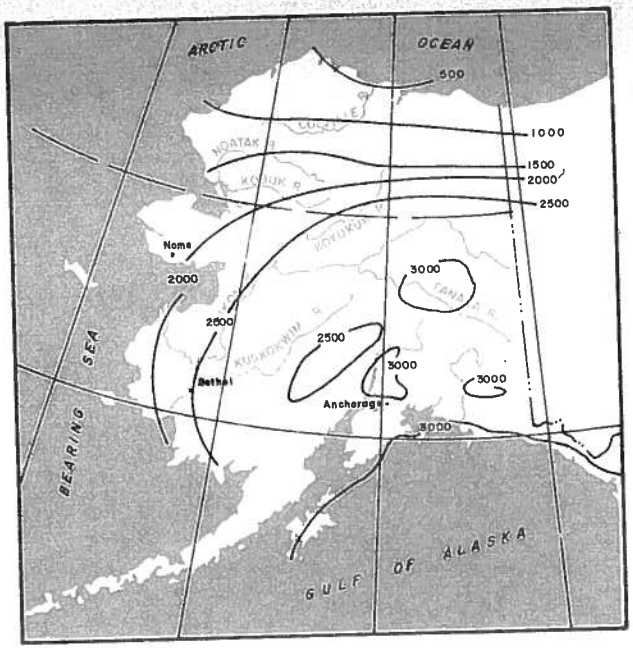
Source: Selkregg et al. 1976.

TABLE 4

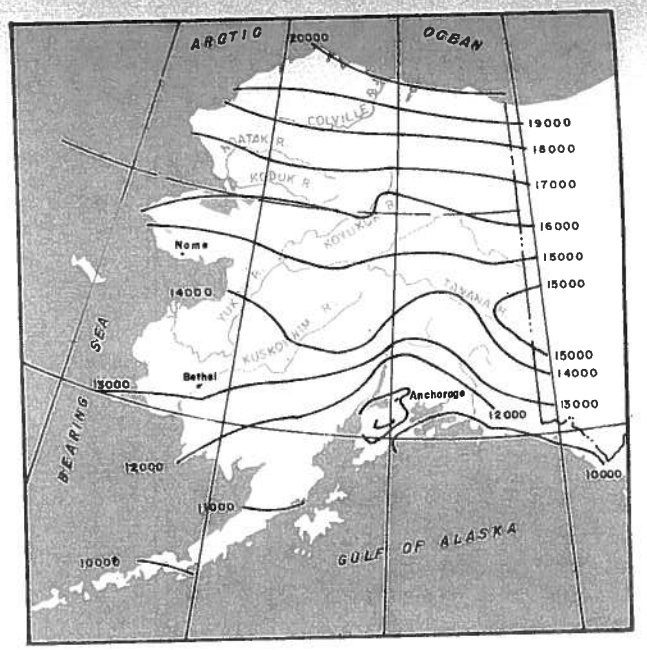
SEASONAL DAILY TEMPERATURE RANGE



FREEZING DEGREE DAYS
(AVERAGE ANNUAL)



THAWING DEGREE DAYS
(AVERAGE ANNUAL)



HEATING DEGREE DAYS
(AVERAGE ANNUAL)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Cape Newenham	1411	1327	1327	1137	868	603	474	468	561	930	1107	1442	11655
Nunivak Island	1569	1386	1473	1113	797	519	415	415	570	949	1251	1618	12075
Mekoryok	1655	1523	1575	1257	970	669	515	477	591	942	1200	1600	12974
Cape Romanzof	1593	1515	1559	1311	942	627	508	508	645	1054	1269	1628	13159
Bethel	1857	1590	1662	1215	772	402	319	394	600	1079	1434	1879	13203
Aniak	2006	1658	1659	1134	716	360	291	384	612	1113	1512	2018	13463
Nyac	1779	1529	1559	1128	704	408	304	388	618	1076	1353	1799	12645

Heating degree days are commonly used in determining fuel needs. They can also be used to determine excessive fuel consumption resulting from air leaks, poor insulation, etc. Since they are based on temperature, heating degree days can also be used to compare temperature patterns between areas.

Source: Selkregg et. al., 1976

TABLE 5

Heating Degree Days for Selected Locations

HEATING, FREEZING, AND THAWING DEGREE DAY

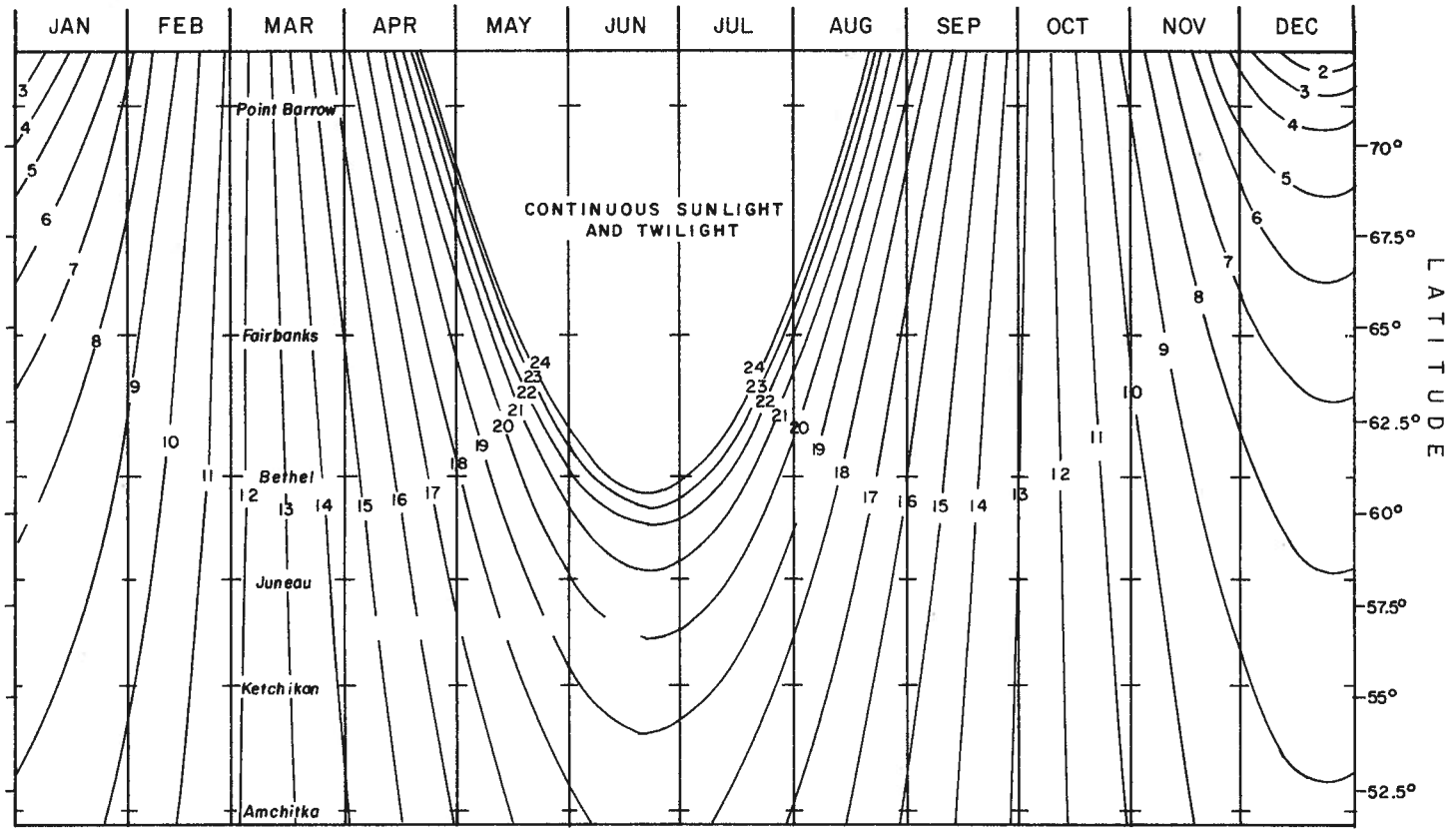


TABLE 6

COMBINED SUNLIGHT and TWILIGHT

Station Name	Elevation Feet	Ground Snow Load, psf					
		5 yr	10 yr	25 yr	30 yr	50 yr	100 yr
Aniak	81	50	63	79	82	92	106
Bethel	125	36	46	61	63	73	88
Cape Newenham	475	60	78	104	108	125	148
Cape Romanzof	434	73	116	148	182	222	232
Nunivak	44	57	74	98	102	117	137

Table 7
Ground Snow Loads

Source: Tobiassan and Redfield. 1973.

Source:
U.S.D.C. N.O.A.A.
ALASKA DIST.
UNPUBLISHED
INHOUSE DOCUMENT

FIGURE 3

SNOW LOAD IN LBS/SQ FT ON THE GROUND, 25 YEAR MEAN RECURRENCE INTERVAL

Source:
U.S.D.C. N.O.A.A.
ALASKA DIST.
UNPUBLISHED
INHOUSE DOCUMENT

FIGURE 4

SNOW LOAD IN LBS/SQ FT ON THE GROUND, 50 YEAR MEAN RECURRENCE INTERVAL

ALASKA

Source:
U.S.D.C. N.O.A.A.
ALASKA DIST.

UNPUBLISHED
INHOUSE DOCUMENT

FIGURE 5

WIND SPEEDS
FOR USE IN STRUCTURAL DESIGN

25 YEAR MEAN RECURRENCE INTERVAL

Source:

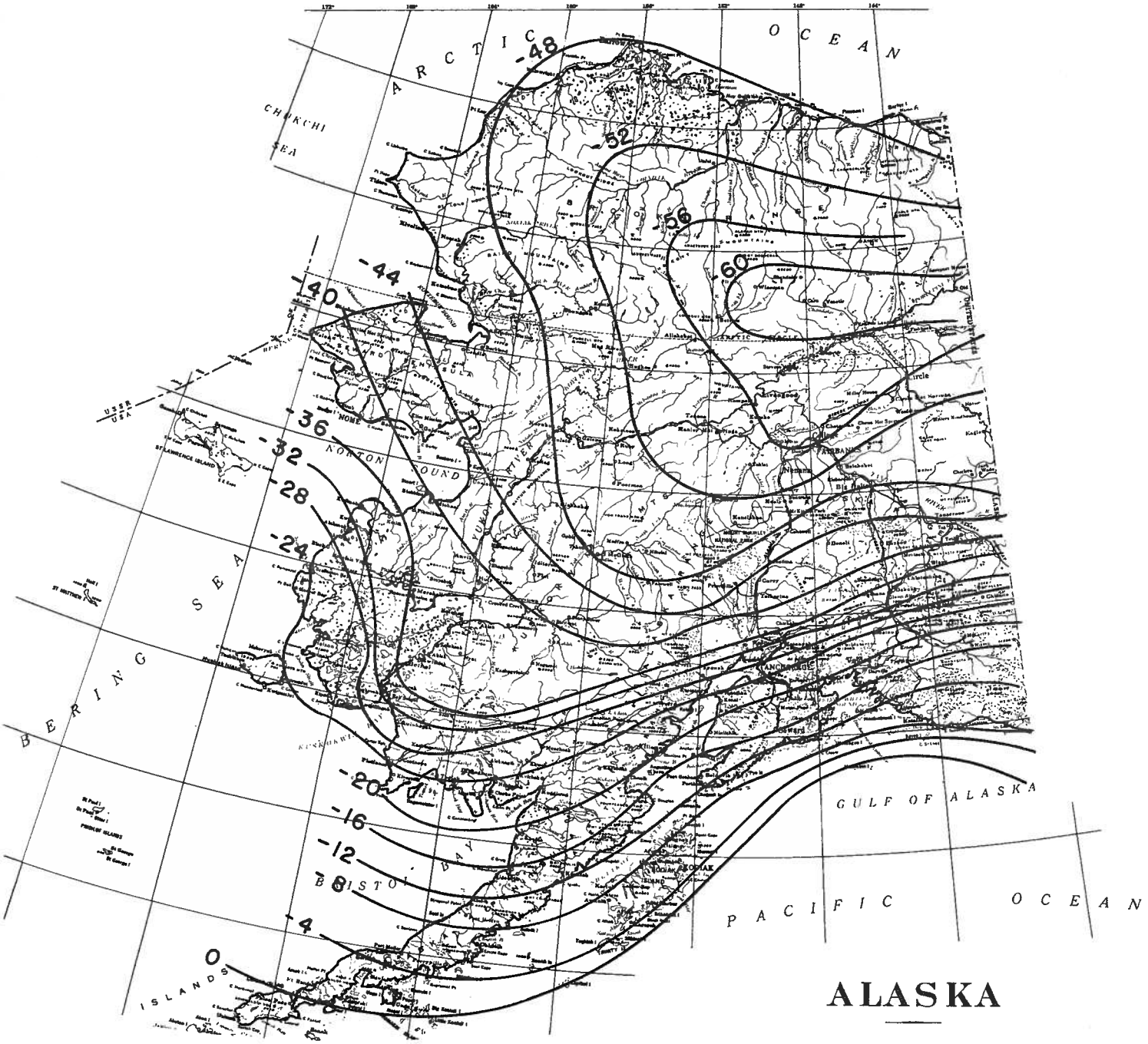
U.S.D.C. N.O.A.A.
ALASKA DIST.

UNPUBLISHED
INHOUSE DOCUMENT

FIGURE 6

WIND SPEEDS
FOR USE IN STRUCTURAL DESIGN

50 YEAR MEAN RECURRENCE INTERVAL



Source:
U.S.D.C. N.O.A.A.
ALASKA DIST

UNPUBLISHED
INHOUSE DOCUMENT

FIGURE 7

ALASKA WINTER DESIGN TEMPERATURE

13 Year Mean Recurrence Interval

4.0 GEOTECHNICAL DETERMINANTS

4.1 REGIONAL GEOLOGY

4.1.1 Physiography

The school sites proposed by the Lower Kuskokwim School District lie within the Bering Shelf physiographic province of southwestern Alaska (Wahrhaftig, 1965, p. 32). The Yukon-Kuskokwim Coastal Lowland a section of the physiographic province, is a delta complex consisting of a lake-dotted, marshy plain rising from sea level in the west to 300 feet above sea level in the east. Many low hills of volcanic rock (cinder cones and basalt craters), including Nunivak and Nelson Islands, rise above the coastal plain. These and a few mountains of older rock 2300-2450 feet high occur in the western part of the plain.

4.1.2 Geology

The largest geologic unit of the Yukon-Kuskokwim Coastal Plain is the delta itself. This delta consists of three very similar units (see Figure 8, symbols Q, Qp, and Qh). These chiefly consist of silt, sands, silty sands, and organic soils (peat bogs) (Hoare and Coonrad, 1959). The sediments of the Q, Qp, and Qh units are a complex of river deposits, marine deposits, swamp deposits and wind deposits. The Qh unit, which forms river floodplains and beach deposits, contains minor amounts of gravel.

Nunivak Island, Nelson Island and many low hills within the delta complex are composed of volcanic rock. These volcanics (see Figure 8, symbol QTv) consist of scoriaceous olivine basalt lava flows as well as cinder cones. In addition to the obvious occurrence of volcanic hills, the flows are found interlayered with gravels and silts of the delta units.

All other bedrock units are shown on Figure 8 as older undifferentiated bedrock. Strictly speaking most of these lie outside the Yukon-Kuskokwim Lowland and need not be discussed further. Older bedrock does occur on Nelson Island, Nunivak Island and near Hooper Bay in the western part of the delta.

4.1.3 Seismicity

Chefornak is located within seismic zone 1 as defined by the Uniform Building Code (1976, p. 150).

4.1.4 Permafrost

The Yukon-Kuskokwim delta area lies within the discontinuous permafrost region of Alaska (Pe'we', 1975, p. 45). Figure 9 shows that, on a regional basis, four different permafrost regimes occur. The most widespread of these includes the entire delta area and parts of the surrounding uplands. Nearly all the school sites being considered by the Lower Kuskokwim School District are in this regime. This regime has fine grained soils with thick to thin permafrost. The permafrost is usually encountered at a depth of less than 10 feet and varies from about 15 feet

thick to as much as 600 feet thick (Williams, 1970 p. 40). The fine grained nature of the soils (silts, silty sands, and organic soils) suggests very strongly that the permafrost is ice-rich. That is, ice segregations as lenses and wedges probably exist. Permafrost is locally absent near bodies of water. For example, river sediments are unfrozen in four wells, 30-105 feet deep, at Aniak and in three wells, 18-30 feet deep, at Akiak (Williams, 1970, p. 39). Similarly, Tununak village lies on a narrow gravel spit on the west coast of Nelson Island. This location on the coast of the Bering Sea was found to be unfrozen during drilling of two wells to depths of 14 and 36 feet (Williams, 1970, p. 59).

The school sites for Goodnews Bay and Platinum apparently lie within another permafrost regime. This regime has either isolated masses of deep permafrost or isolated masses of thin, shallow permafrost.

4.1.5 Groundwater

Groundwater in the Yukon-Kuskokwim delta area has been developed from two types of sources. The first of these is sands and gravels within or beneath permafrost as at Bethel and Akiachak (Williams, 1970, p. 39-40). The second type of source, as mentioned above, is unfrozen sands and gravels adjacent to bodies of fresh water, such as the Kuskokwim River at Aniak and the Tununak spit between the Tununak River and the Bering Sea. In the case of wells in the floodplain of the Kuskokwim River fluctuation of water level, where observed, corresponds with change in level of the nearby river.

4.2 LOCAL GEOTECHNICAL CONDITIONS

4.2.1 Site Geology

The village of Chefornak lies on the south bank of the Kinia (Ooksokwak) River on the outside of a large meander. Some subsurface information is available from the B.I.A. and P.H.S. wells located near the east end of the village. These well logs (figure 10) show 5 to 9.5 feet of muck (silt) underlain by lava to about 50 feet, then frozen sand and silt down to 100 feet. Below 100 feet unfrozen fine sand and pea gravel with some clay occur to the bottom of the wells at 120 feet and 135 feet.

A series of test pits were excavated by the Division of Aviation along the centerline of the airfield prior to construction. These show that the subsurface soils consist of 0.5 to 1.5 feet of organic silt underlain by 0 to 0.5 feet of silt underlain by permafrost. They do not specify the soil type which makes up the permafrost, however, it is presumed to be frozen silt. There is no subsurface information available for the school site itself, however, data from the nearby airfield and the more distant B.I.A. well suggest that the school site is underlain by silt and organic silts. At some unknown depth lava might be encountered.

4.2.2 Permafrost and Seasonal Frost Conditions

As indicated above, the village of Chefornak is known to be underlain by permafrost. The numerous nearby lakes are probably thaw-settlement basins produced by thawing of near-surface permafrost. B.I.A. well

data indicates that permafrost extends from 9.5 to 95 feet below the surface. The airfield test pits show permafrost within 1.3 feet of the surface. The permafrost is expected to be ice-rich because soils are fine grained. Severe differential thaw-settlement could occur if the permafrost thaws. Engineering information including ice-content, adfreeze strength, and permafrost temperature is not available.

The active layer is the upper layer of ground that is subject to seasonal freeze-thaw cycles. Based on the available subsurface data the active layer probably extends down to the top of the permafrost, that is, 1.3 to 9.5 feet below the surface. The active layer at the school site is probably composed of silt and organic silts. These soils are very highly frost susceptible and their potential for frost heaving is high.

4.3 GROUNDWATER

Little information on groundwater exists. The P.H.S. and B.I.A. school well logs indicate static fresh water level to be from 2 feet to 18 feet deep. Usable water occurs in thawed sands at a depth of 100 feet. Of three wells drilled in the area, one was reportedly unusable due to high salt content.

4.4 SURFACE WATER

Locally, the Kinia River fronts the north edge of the village. Several lakes border the south edge of the townsite, as well as the east edge of the high school site. These lakes drain to the east and their common drainage discharges into the Kinia River east of the B.I.A. School at the extreme east end of the townsite. A small stream cuts across the extreme west end of the village adjacent to the site and runs into the Kinia River. The stream extends to the south parallel to the west edge of the airport runway. A large lake approximately one-half mile from the southwest corner of the town also drains into this stream.

The proposed site contains no drainage ways or lakes. Some minor seasonal ponding may occur.

4.5 BORROW MATERIAL

Borrow materials are not readily available in Chefornak, and none have ever been imported. Importation of materials would probably be cost prohibitive.

4.6 SITE GRADING

The school site is covered with tundra moss and grasses. The central portion of the site on the north-south axis is relatively flat with a very slight downward slope to the north. The ground east and west of this flat area slopes rapidly down and away from the site. Some high, 6 to 8 foot mounds border the south edge of the site.

The new school building will probably be elevated above existing grade due to possible permafrost at the site and the associated thaw problems. Site development will be determined by required foundations, roads, etc.

Because the occurrence of permafrost on the site is highly probable, extensive site work and destruction or removal of the upper vegetative mat should be minimized to avoid disturbance of the thermal regime.

4.7 PERFORMANCE OF EXISTING FOUNDATIONS

Two basic foundation systems are currently used in Chefornak; cresoted timber piles and surface pad systems, such as post on pad or continuous grade beams. Typical surface foundation systems are shown at the end of this section.

Timber piles were utilized on the B.I.A. school and the B.I.A. quarters building (built 1958). Piles were pressure treated with cresote and embedded 8 to 10 feet into hand excavated holes and backfilled generally with excavated material. No information is available regarding the pile support mechanism, i.e., end bearing, skin friction of thawed soils, or adfreeze strengths of frozen soils. Overall, the building functions satisfactorily for being 20 years old.

Surface pad systems are the most common foundations and are utilized on the B.I.A. Kindergarten Addition (1978), community center, National Guard Armory and most new housing. Widespread popularity of surface systems is a result of low initial capital costs when compared to expensive pile systems which require engineering and relatively sophisticated installation equipment.

With periodic maintenance, existing buildings seem to perform adequately. No interior damage due to settlement was noted, however, plywood is generally used for interior wall finish. Plywood appears to be a more flexible interior finish and does not reveal settlement cracks as does a plaster or gypsum wall.

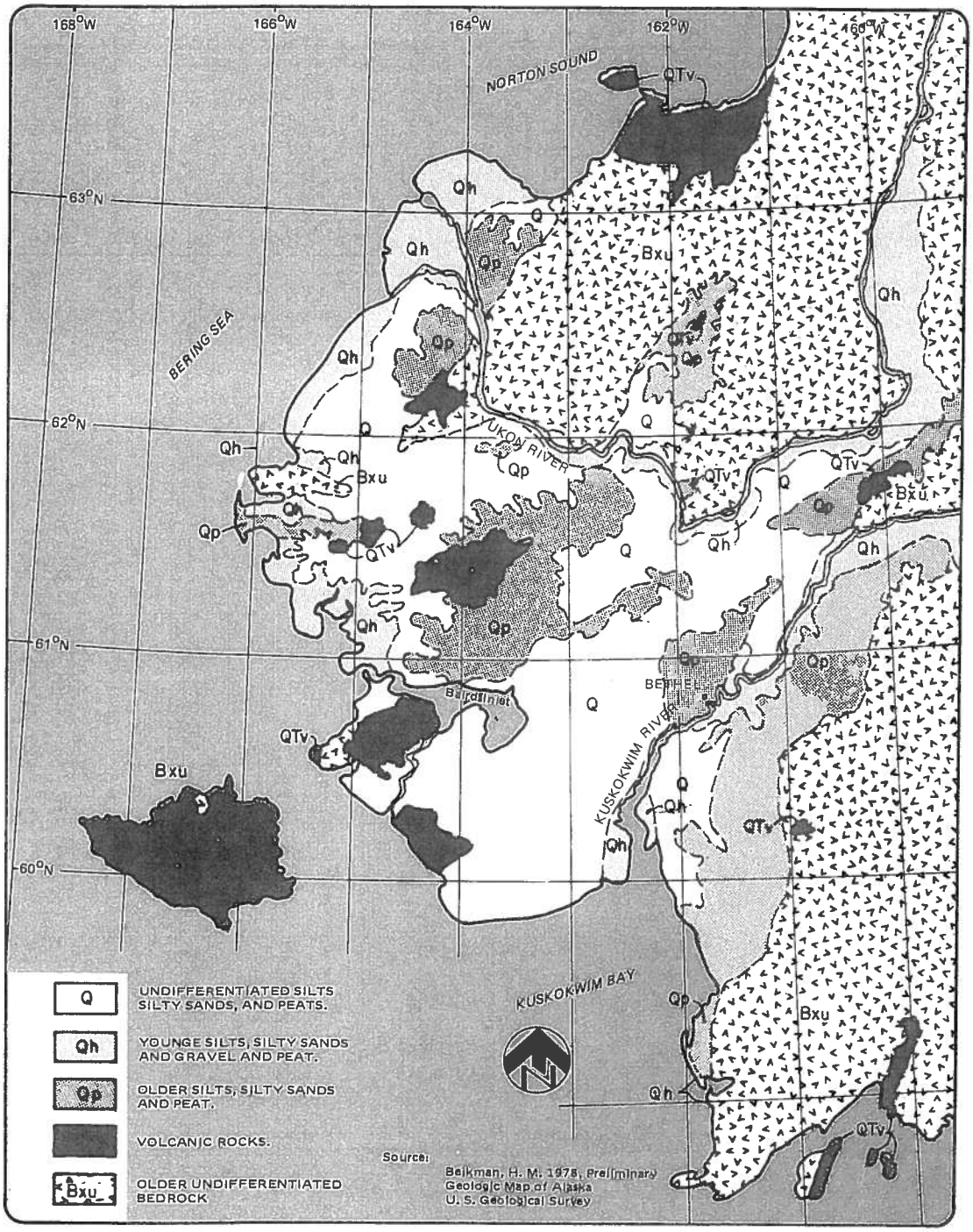
Most private houses in the village are built on sleepers placed on grade. Older homes with skirted crawl spaces show more signs of differential settlement than newer homes or homes lacking skirting. Reportedly, most homes with skirting require shimming every couple of years.

Thermal or refrigerated piles have not been used in Chefornak.

4.8 SITE RECOMMENDATIONS

R&M Consultants' research and field investigation has found little geotechnical information that is directly site specific. To compound the problem, the soil conditions at the site are anticipated to be variable within short distances, and the permafrost is discontinuous. The foundation designer will have to analyze the life cycle costs of a sophisticated foundation system compared to a less expensive and less reliable system that requires more maintenance. How much settlement or jacking an expensive school building can tolerate becomes a matter the Owner, L.K.S.D. must respond to. Before any decision can be made, the foundation engineer needs additional geotechnical information. Consequently, R&M Consultants recommends a geotechnical investigation be made to evaluate thaw consolidation, frost heaving, ice content, adfreeze strengths, and other pertinent geotechnical parameters. Although a pile foundation may

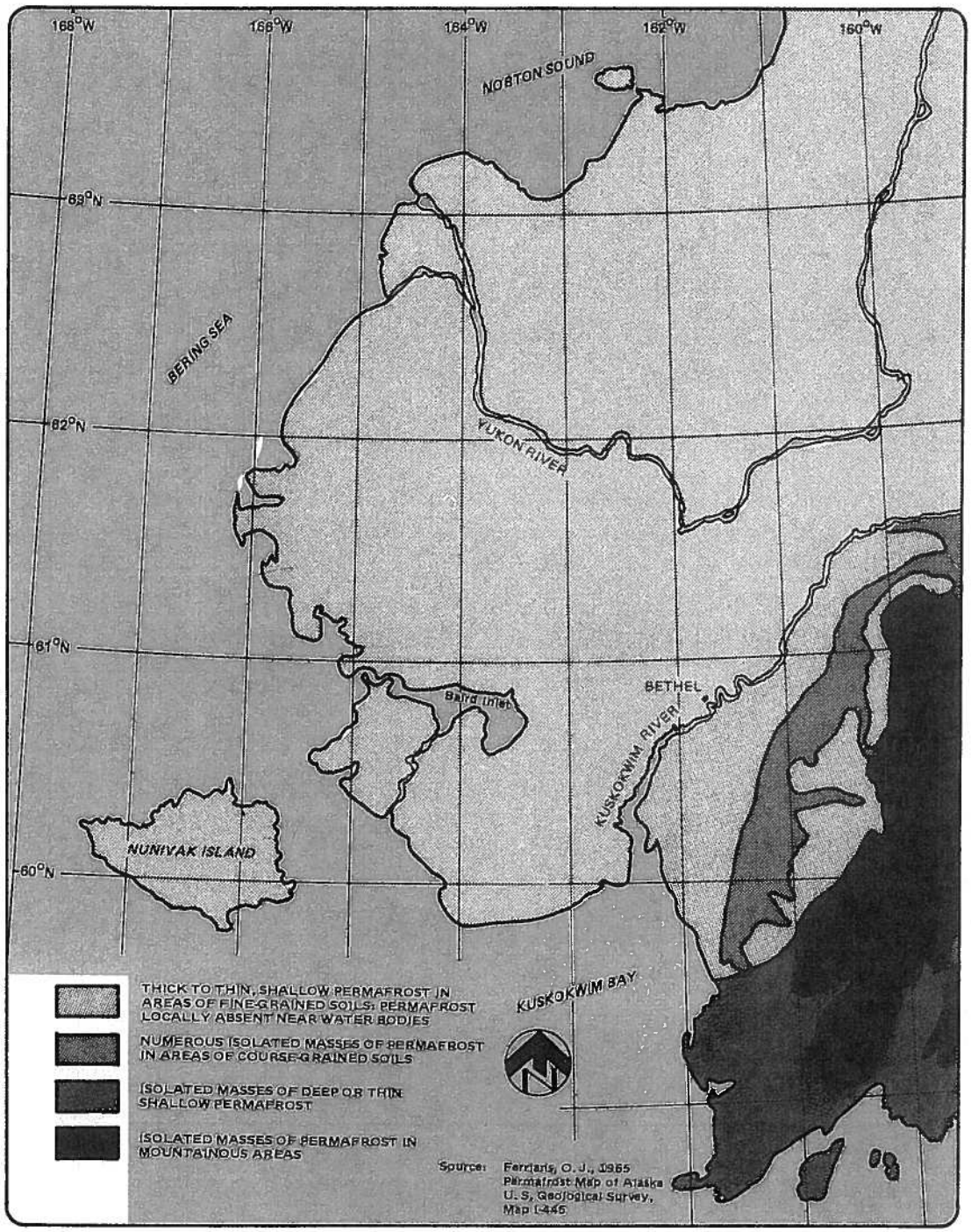
be required to minimize maintenance costs, additional information is necessary to adequately design a foundation system that minimizes life cycle costs. On a life cycle basis, post on pad foundations may be an economical solution.



REGIONAL GEOLOGY

YUKON - KUSKOKWIM DELTA REGION

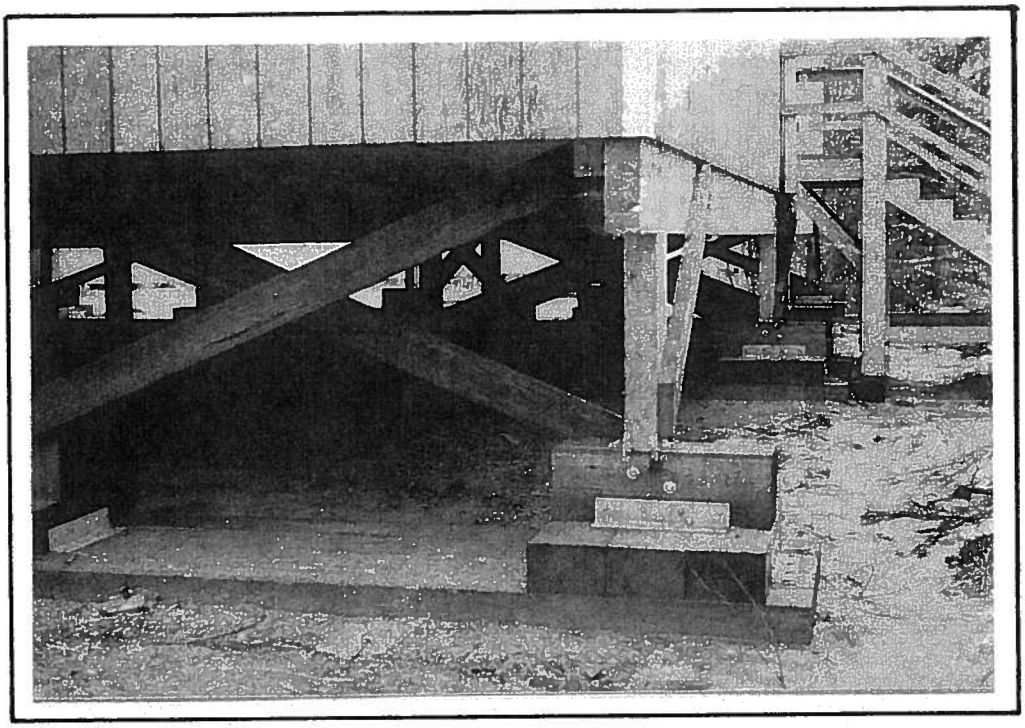
FIGURE: 8

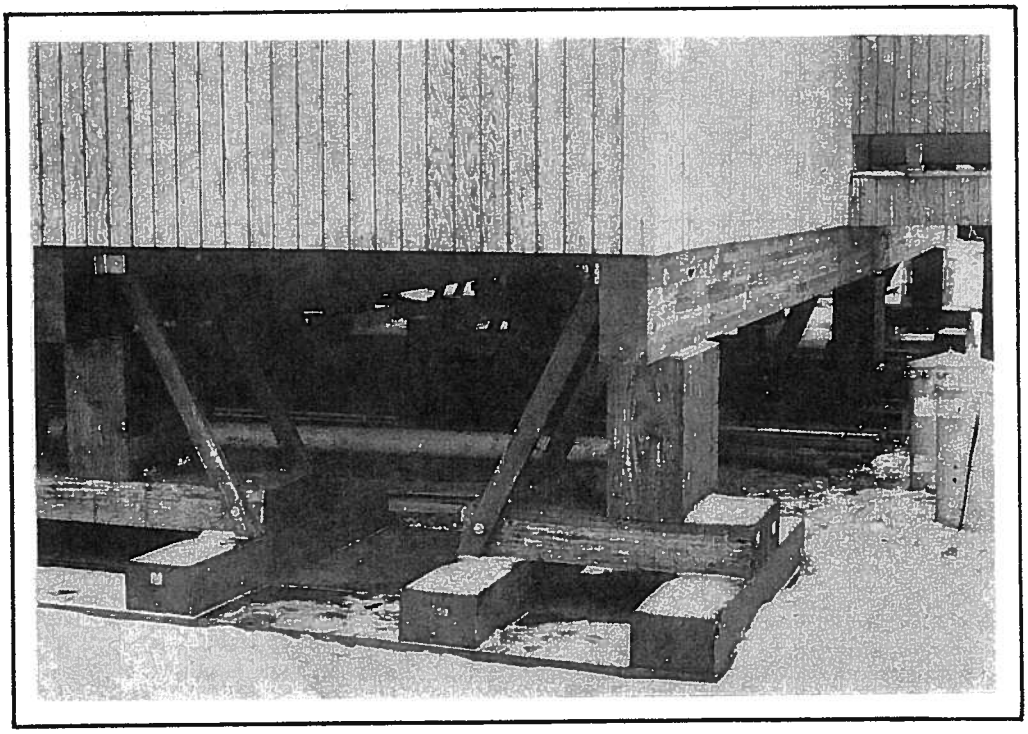


PERMAFROST AREAS

YUKON-KUSKOKWIM DELTA REGION

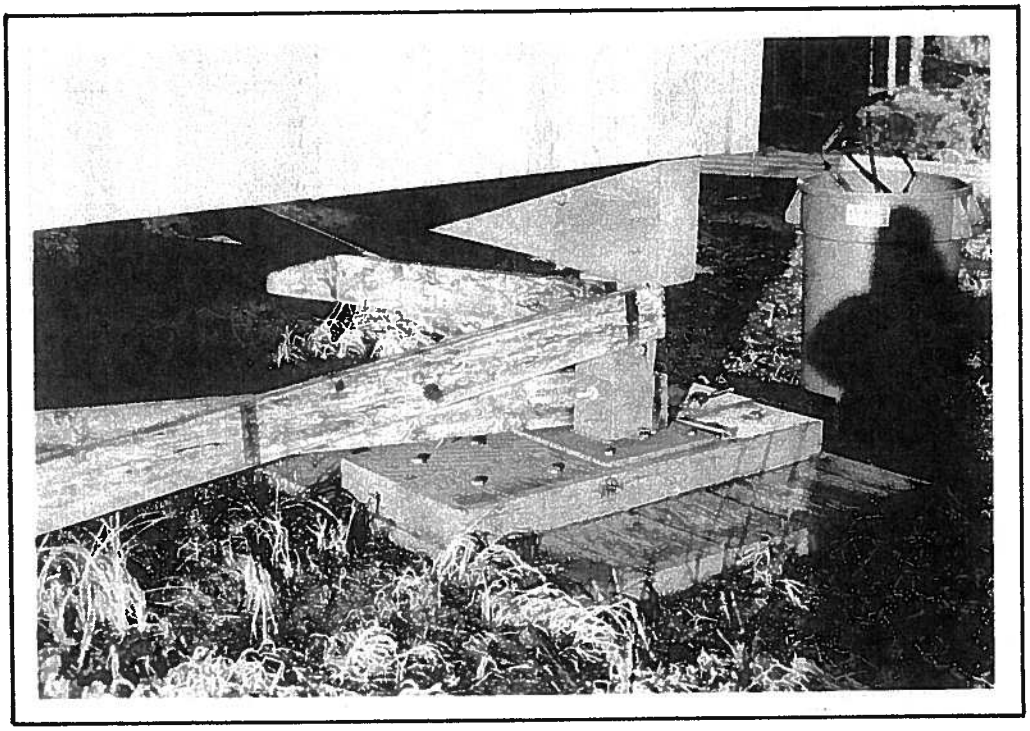
FIGURE: 9





POST ON CONTINUOUS PAD

TYPICAL FOUNDATIONS



POST ON PAD

TYPICAL FOUNDATION

5.0 PROJECT REQUIREMENTS

5.1 BUILDING UTILIZATION

Parameters relating enrollment, staffing, conceptual teaching patterns, education specifications, and spacial requirement guidelines to building design will be directly addressed during project coordination between the selected Architect, the Lower Kuskokwim School District, and the people of Chefornak. These parameters will therefore not be presented in this text. Other important parameters will be briefly noted.

5.1.1 Integration with Existing Educational Facilities

The selected high school site is not within easy walking distance of the existing B.I.A. school, so facility sharing may not be possible. It is also felt that due to the extreme distances and topographic barriers sharing of utilities will not be feasible.

5.1.2 Context of School in the Community

The construction of such a facility in a small village is generally highly welcomed by local residents partly because of the higher quality of education which will be brought to the village but also because a newer and more modern facility will be available for community activities and recreation. The new facility could be used after hours for adult education, community recreation, dances, festivals and meetings. Durable finishes and quality materials should be specified to accommodate the increased usage.

5.1.3 Maintenance Technology

Maintenance technology in Chefornak is good; however, complicated equipment with hard to obtain parts should be avoided. Design for simplicity of operation and maintenance should be a major consideration. While energy conservation is important, if systems should fail because of complex controls, any energy savings could be quickly voided due to ensuing damage or inconvenience. Economy of operation will result from keeping the facility in operation and making the system understandable and accessible for periodic maintenance.

5.2 BUILDING SAFETY

5.2.1 Fire Protection

The village currently has a volunteer fire department, however, fire fighting equipment is practically non-existent. The feasibility of providing an on site fire protection system should be considered as should construction with fire-resistent or noncombustible materials. It should be noted that the B.I.A. School has approximately 3000 gallons of on site fire storage with emergency fire pumps and fire hoses.

5.3 LAND STATUS

The site selected by the villagers of Chefornak lies partially inside the Chefornak Townsite Survey and partially in an unsurveyed area adjacent to the Townsite Survey.

Title to the lands within the townsite survey is held in trust for the city by the Bureau of Land Management (B.L.M.) Townsite Trustee, George E.M. Gustafson. Before the State can expend funds on the school project, title to the property must be transferred to the State. The State will apply to the townsite trustee for title to the site after receiving a resolution from the City of Chefornak requesting said townsite trustee to convey title on their behalf.

Title to that portion of the selected school site that is outside the limits of the surveyed townsite is vested in the United States of America and has been withdrawn for use as the Clarence Rhode National Wildlife Range as administered by the U.S. Fish and Wildlife Service. Since the proposed school site is situated within the same township as the Village of Chefornak, it is part of the Village Corporation's selection of land under provisions of the Alaska Native Claims Settlement Act, (ANCSA). The ANCSA supercedes the withdrawal of the site as a wildlife range, and as a result the site will be conveyed to the Village Corporation upon final settlement and survey of the Village Corporation entitlement by the Bureau of Land Management. Under provisions of Section 14 (C) (3) of ANCSA, the Village Corporation must reconvey certain lands necessary for community needs and expansion to the City of Chefornak amounting to not less than 1280 acres. This site will fall under this category.

The Bureau of Sports Fisheries and Wildlife is currently charged with management of that portion of the site outside the townsite survey. Therefore, application will be made to them for a temporary permit or lease to allow immediate entry and construction until such time as the State of Alaska can obtain title.

The Village Corporation will be asked to adopt a resolution joining the State and the City in an application for a temporary permit or lease to allow immediate entry and construction on the site, said permit or lease to run until such time as title can be conveyed. The City of Chefornak will be asked to adopt a similar resolution. In both the City's resolution and the Village Corporation's resolution, they will be asked to commit themselves that as soon as they receive appropriate title to the site, they will in turn execute the appropriate reconveyances necessary to vest title to the site in the State of Alaska.

Archeologic considerations should pose no problem in development of the site. As indicated by the Alaska Archeological/Historical Survey Record, several archeological sites in the vicinity have been investigated; however, reportedly no artifacts or evidence of other possible archeological discoveries in Chefornak have been found. The location of the site, should be processed though the Alaska State A95 Clearinghouse, Office of the Governor, for site approval.

6.0 SITE UTILITIES

6.1 WATER SUPPLY

At present, residents of Chefornak obtain their water from the P.H.S. Community Watering Point located at the east end of the village near the B.I.A. School. Villagers transport their water from this year round water supply in plastic water containers.

Prior to installation of the P.H.S. Community Watering Point, water sources included the Kinia River, rainwater, local ponds and lakes. In the winter the villagers would melt ice and snow gathered from the river and/or local ponds and lakes.

The B.I.A. School water system is used only within the school and teacher housing quarters.

6.1.1. B.I.A. Water Supply

The B.I.A. School well was drilled in 1966. A well log prepared for their records is included in Figure 10. The 4 inch cased well, 115 feet deep, penetrated 95 feet of layered material consisting of frozen organic silts, lava rock, sands and gravels, silts, and fine sands. From 95 feet to 101 feet, thawed fine clean water bearing sand was encountered. From 101 feet to 115 feet water bearing extra fine sand and volcanic ash was found. A submersible pump was set at approximately 80 feet. The well produced 22 gpm; however, because of the silts and volcanic ash, the driller recommended that the well not produce over 10 gpm. Water quality of the B.I.A. raw well water has been analyzed and found to be quite usable. See Table 12.

Presently, B.I.A. School water is supplied by pumping water from the well in a heat traced utilidor to two water storage tanks located in the utility building.

Approximately 3000 gallons of water is stored in the utility building. Approximately 500 gallons is used for potable water while the rest is kept in reserve for fire flows. Water disinfection is accomplished by the continuous addition of chlorine while filling the tanks. Water in these tanks is used as a storage reserve from which a continuous pressurizing system distributes water throughout the school.

Treated water samples have been taken and analyzed for chlorine and iron content. Chlorine residual reportedly was too low to measure and iron content was reported to be 1.2 ppm. Additional samples have been subjected to bacteriological analysis. Bacteriological samples were negative for coliforms. The B.I.A. school principal, Mr. Pat O'Brien, indicates that the color of water fluctuates with the seasonal changes. He also states that a noticable increase in salt taste occurs during times of wind blown high tides.

6.1.2 P.H.S. Water Supply (Community Watering Point)

During the summer of 1964, P.H.S. installed a well at Chefornak for community water. Due to clogging problems, it was reportedly replaced by a second well the following year. Both wells are located approximately 500 feet west of the B.I.A. School. Only the second well is presently in operation. Both P.H.S. well logs are basically the same as the B.I.A. well logs. Their depths were 135 feet and 118 feet respectively, and, as with the B.I.A. well, water bearing sands were found at about 95 to 100 feet. These well logs are shown in Figure 11 & 12.

The present P.H.S. community watering point utilizes B.I.A. School electricity to power its well pump. Reportedly water is pumped into two wooden tanks of approximately 500 gallons total volume. The pumphouse is kept locked and water is fed to the outside by a rubber hose. During summer, an additional pump is connected to a 1-inch copper pipe layed adjacent to a boardwalk, piping water approximately 1500 feet to the center of town.

6.1.3 Water Quality

Other than providing chlorination, water from both the B.I.A. school well and the P.H.S. well is not treated prior to consumption. Water chemical analyses from various water sources in Chefornak are included in Table 9.

6.1.4 Site Recommendations

Potable water should be obtained through one of the following methods, 1) a new well to be developed on the high school site; or 2) utilizing the existing P.H.S. Community Watering Point. If the P.H.S. Community Watering Point is used as a water source, approximately 1600 feet of utilidor between the high school site and the watering point would be required. Easements within which to run the pipe would also be required. An advantage in utilizing the P.H.S. Community Watering Point is that it is a proved source and may not require treatment.

Development of a new well on the school site may prove to be an economical alternative to the P.H.S. Community Watering Point. Many wells in the area have proven successful and perform satisfactorily. It should be noted that reportedly a P.H.S. well was drilled near the center of the village and had to be abandoned due to high salt water content.

The Kinia River is not considered a viable alternative due to the discharge of honeybuckets along its banks by villagers.

Prior to final selection of a water source a complete economic determination of the alternatives is recommended.

6.2 WASTEWATER DISPOSAL

There is no community wastewater disposal system in Chefornak. Residents dispose of wastewater by "honeybuckets." Most honeybuckets are dumped along the Kinia River located near the north edge of the townsite. The B.I.A. school complex, including the original school, the

new kindergarten addition and the teachers housing unit, is served by a 1200 gallon per day Bio-Pure Treatment Plant. All sewage flows by gravity to a lift station which pumps the wastewater into the Bio-Pure unit. Approximately 900 gallons per day of wastewater is treated. The effluent from the treatment plant is transported by an insulated six-inch pipe and discharged into the Kinia River which is immediately adjacent to the building.

6.2.1 Site Recommendations

A small sewage treatment plant installed in the proposed high school would produce an effluent that could be discharged into the Kinia River to the north, into the natural drainage depression, lake, just east of the site, or into the stream to the west. Package treatment plants are available and easily shipped to the site.

A sewage lagoon is another cost effective method of treating sewage. The site may have adequate space to provide room for an on site sewage lagoon. Depending upon where the school is located, the sewer discharge line would be between 200' to 500' long. Since the school building may be elevated, an elevated gravity flow effluent line to the lagoon may be possible. The primary problem with this approach is that the construction of a lagoon would require heavy construction equipment capable of moving frozen silts. Additionally, the construction would probably have to be carried out in the winter.

The wastewater disposal system for the school site is a question of cost, maintenance, and meeting A.D.E.C. regulations. Each type of disposal system has its own particular problems that must be addressed by the project sanitary engineer. Type selection and recommendation is also dependent on the results of a geotechnical investigation. Relatively thaw stable soils may allow on site disposal of effluent through a lagoon system, while ice-rich frozen soils may require off site disposal using a small package treatment plant.

6.3 SOLID WASTE DISPOSAL

The village has an official solid waste disposal site reportedly located on the south end of the runway approximately one quarter mile to the south of the proposed high school site. The disposal site is located in a natural depression directly adjacent to the runway. Some portions of the disposal site are marshy with water pockets. Refuse is deposited directly on the ground and is not covered by fill. A second dump is located on the proposed high school site, adjacent to the townsite and is more actively used. Except for being in a natural depression, no protection is provided against wind. Most of the villagers use these solid waste disposal sites; however, areas near and adjacent to their homes and along the river and lake banks have accumulated some debris.

The existing solid waste management system in Chefornak is substandard to State and Federal regulations. Continued operation is not recommended. New facilities and operation procedures should conform to existing regulations.

6.4 ELECTRICAL POWER

Electrical power for the village is provided by the village power plant which is owned and operated by the Chefornak Village Council. Most homes (approximately 40) are served by the power plant. The B.I.A. school maintains their own power generation facility.

6.4.1 Village Power

The village power plant is a 120/240 volt, single phase system, and is housed in a wooden frame building. The building sits on sleepers placed directly on the ground, and the floor of the shed is approximately 1 foot above the existing grade.

Power is provided by two generators, a Lima 30 kw and a Kato 40 kw. Both the Lima and Kato generators are powered by 50 hp Lister diesels. Pertinent information concerning the two generators is shown in Table 10.

All power is metered, and distribution lines run throughout the village to distribution pedestals via aerial transmission lines. Electric lines then radiate outward from the distribution pedestals to the meters via utilidors or on support poles.

Cost of power is 30 cents per kilowatt/hour (kwh) for the first 90 kwh and 15 cents for every kwh thereafter.

The village power plant has part of its fuel storage immediately adjacent to the power plant. Approximately 400 gallons are stored on site. The tank is refilled from the existing main tanks near the river adjacent to the village Co-op fuel storage. Fuel is transported to the generator in 55 gallon drums. Approximately 10,000 gallons is stored at the fuel storage site for use by the generators. The fuel supply is replenished every summer by barge shipment.

6.4.2 B.I.A. Power Supply

The B.I.A. school maintains their own power plant. It is capable of supplying limited power to the village under emergency conditions. Power generation is a single phase system and consists of three generators. Specific information concerning B.I.A. power facilities is listed in Table 10.

6.4.3 Site Recommendations

Existing electrical facilities in the village are probably inadequate for the proposed high schools power requirements. The Chefornak Village Council should be contacted as to whether they wish to upgrade their system to provide the proposed high school's power requirements. The high school should provide standby power. If the village system is inadequate and they are not willing to upgrade, then the high school will be required to provide both operating and standby power.

6.5 FUEL

Two bulk fuel storage facilities exist in Chefornak. One is owned and operated by the village corporation. Another, which is not available for public use, belongs to the B.I.A. school.

Aviation fuel is not available. White gasoline may be purchased from the local stores. The supply is variable and should be verified in advance. The wholesale price of fuel in Chefornak (delivered by United Transportation during summer of 1978) was $.74/gallon for #1 fuel oil and $.82/gallon for gasoline. Prices are based upon a 10,000 gallon minimum.

6.5.1 Village Bulk Fuel Storage

The village bulk fuel storage is located near the west end of the village. Gasoline or No. 1 fuel oil may be purchased in small quantities using service-station type pumps. A beachhead runs from the storage tanks to the river bank. Cost of fuel can vary considerably throughout the year. Table 11 provides a tabulation of fuel cost and current storage capacities.

Typically, the village replenishes their fuel supply by barge during the summer; however, scheduling is dependent upon barge transportation work load. When the village runs low on fuel in the winter, villagers obtain heating oil by making trips to neighboring villages by snowmachine.

6.5.2 B.I.A. Bulk Fuel Storage

B.I.A. maintains their own bulk fuel tanks and their own beachhead. Fuel is barged in by United Transportation during the summer. The B.I.A. storage facility provides fuel for their power plant and boilers. Storage capacities are shown in Table 11.

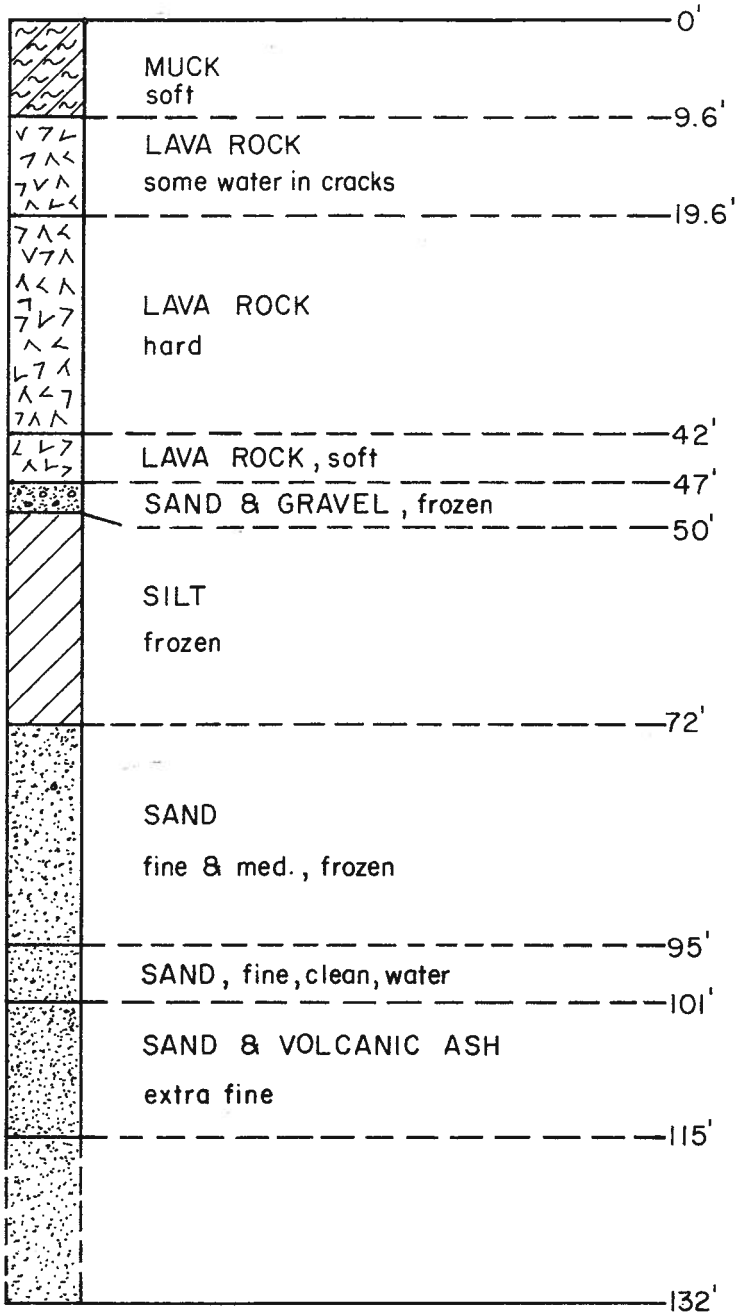
6.5.3 Environmental Protection

The village storage tanks are founded on treated timbers placed on grade. The foundation elevates the tanks about one foot above existing grade. No dike surrounds the storage tank and no guy cables are present to stabilize the vertical tanks from overturning.

The B.I.A. storage tanks are placed on a treated timber foundation consisting of beams set on grade, framing system and decking. A galvanized sheetmetal lined wooden dike surrounds the tanks. Treated 12" square beams were placed so as to form a dike 12" wide by 24" above the grade. Apparently the dike is keyed into the ground; however, the exact depth was not determined.

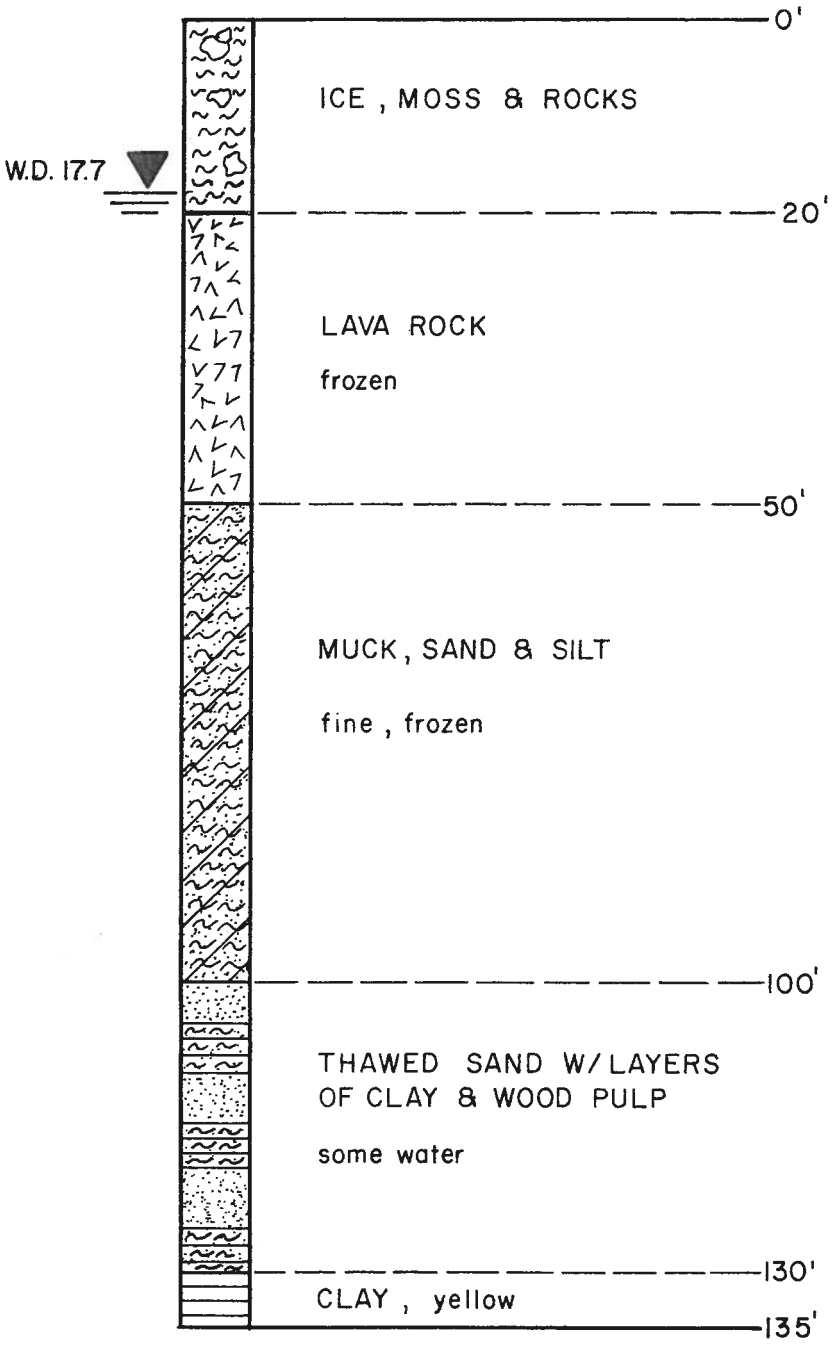
6.5.4 Site Recommendations

Bulk oil storage should be located on the school site. The village bulk storage and beachhead is 1100± feet away, and it is recommended that a piping system be run to the school site from this beachhead.



BIA WELL LOG — CHEFORNAK

FIGURE 10

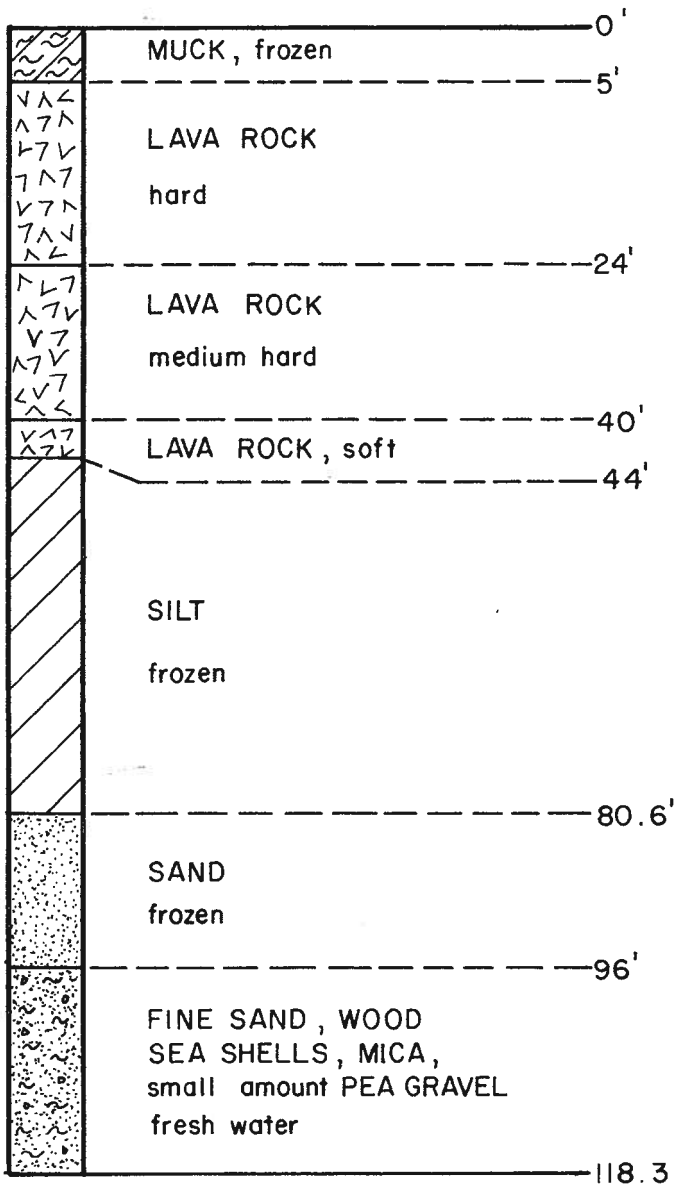


NOTE

109 TOP SCREEN
112' BOTTOM CASING
130.2 BOTTOM SCREEN

PHS WELL LOG # 1 — CHEFORNAK

FIGURE 11



PHS WELL LOG # 2 – CHEFORNAK

FIGURE 12

	B.I.A. SCHOOL WELL	P.H.S. WELL
Arsenic		< 0.01 mg/l
Barium		0.1 mg/l
Cadmium		0.005 mg/l
Calcium	17 mg/l	12 mg/l
Iron-total	0.28 mg/l	0.8 mg/l
Lead		< 0.01 mg/l
Magnesium	14 mg/l	14 mg/l
Manganese		
Mercury		< 0.002 mg/l
Potassium	21 mg/l	14 mg/l
Selenium		< 0.01 mg/l
Soduim	150 mg/l	121 mg/l
Silver		0.05 mg/l
Conductivity	924 mg/l	750 mg/l
pH	7.2	7.5
Nitrate	0.3 mg/l	< 0.01 mg/l
Cloride	112 mg/l	130 mg/l
Fluoride	0.7 mg/l	
Sulfate	12 mg/l	4 mg/l
Total Solids		
T.D. Solids	541 mg/l	445 mg/l
Hardness as $CaCO_3$	100 mg/l	87 mg/l
Alkalinity as $CaCO_3$	0.00 mg/l	250 mg/l
Coliform-F		
Organic Matter		

TABLE 8
WATER QUALITY ANALYSES

18 AAC 80.050. MAXIMUM CONTAMINANT CONCENTRATIONS. (a) The maximum contaminant concentrations for public water systems are as follows:

(1) Inorganic Chemical Contaminants

Contaminant	Maximum Contaminant Concentration (mg/l)
Arsenic	0.5
Barium	1.
Cadmium	0.010
Chromium	0.05
Fluoride	2.4
Iron[a]	0.3
Lead	0.05
Manganese[a]	0.05
Mercury	0.002
Nitrate (as Nitrogen)	10.
Selenium	0.01
Silver	0.05
Soduim[a]	250.

(2) Organic Chemical Contaminants

Contaminant	Maximum Contaminant Concentration (mg/l)
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-D	0.1
2,4,5-TP Silvex	0.01

(3) Physical Contaminants

Contaminant	Maximum Contaminant Concentration
Color	30[b] units
Turbidity	one[c] unit as a monthly average of samples required by the department

(4) Radioactive Contaminants

Contaminant	Maximum Contaminant Concentration (pCi/l)
Gross Alpha	15
Gross Beta	50
Stontium-90	8
Combined Radium-226 & 228	5
Tritium	20,000

(5) Maximum Total Coliform Bacteria Contaminant Concentration

Test Method	Maximum Contaminant Concentration
(A) Membrane Filter Technique	The coliform density may not exceed one per 100 milliliters in any routine sample.
(B) Fermentation Tube Method with 10 ml portion	Coliforms may not be present in more than one 10 milliliter portion in any portion sample.

a The department will, in its discretion, establish a higher maximum concentration for a public water system if there is no significant consumer objection to exceeding the listed maximum contaminant concentration.

b A higher maximum concentration will be allowed if the person who owns or operates a public water system can demonstrate to the department that the higher color concentration does not do any of the following:

1. interfere with disinfection;
2. prevent maintenance of an effective disinfecting agent throughout the distribution system;
3. interfere with microbiological determinations; or in combination with chlorine, result in concentrations of trihalomethanes exceeding 100 micrograms per liter.

c A higher maximum concentration will be allowed if the person who owns or operates a public water system can demonstrate to the department that the higher turbidity does not do any of the following:

1. interfere with disinfection;
2. prevent maintenance of an effective disinfecting agent throughout the distribution system; or
3. interfere with microbiological determinations.

If a maximum turbidity concentration above 5 units as a monthly average is requested, the person requesting the higher concentration must supply the department with a mailing list of all residents.

DESCRIPTION	RPM	CAPACITY	REMARKS
VILLAGE OWNED			
LIMA MODEL 3019-0-008	1800	30 KW	(Main)*
KATO KAMAG 14 Brushless	1800	40 KW	(Main)*
BIA OWNED			
KATO KAMAG 18 Brushless	1800	50 KW	(Main)*
KATO KAMAG 18 Brushless	1800	50 KW	(Main)*
KOHLER MODEL 25COT61	1200	25 KW	(Standby)

* Generators are used alternately

TABLE 10
POWER FACILITIES

FUEL COSTS IN CHEFORNAK		
Reference	Gasoline	No. 1 Fuel Oil
(Field Verified by R&M in November 1978)	$1.05/gal	$0.92/gal
Reported in 1978 Community Energy Survey	$ .75/gal*	$ .65/gal*

VILLAGE BULK FUEL STORAGE CAPACITIES		
Tank Size	Fuel Type	Remarks:
5,800 gal	No. 1	Village Use
5,800 gal	No. 1	Village Use
5,800 gal	No. 1	Village Use
8,500 gal	Gasoline	Village Use
8,500 gal	No. 1	Electric Use

B.I.A. BULK FUEL STORAGE CAPACITIES			
No. Tanks	Tank Size	Fuel Type	Remarks:
4	6,350 gal		
2	7950 gal	No. 1	
Total Capacity	41,350 gal ***		

* Landed Cost
** Reportedly an additional 45000 gallons in 55 gallon drums is on hand
*** Approximate volumes based on measured size of tanks

TABLE 11
FUEL COSTS AND STORAGE CAPACITIES

7.0 LOGISTICS

7.1 SCHEDULING

Scheduling is probably the most important factor to consider when undertaking design and construction of a large facility in a remote area with limited land, water, and air access. Logistics of getting men and materials to the site is critical.

The present L.K.S.D. schedule requires project completion by September 1980. This gives the contractor the option of summer or winter construction.

7.2 AIR SERVICE

Chefornak's 1600 ft. airstrip is adjacent to the southwest corner of the village and is approximately 40 ft. above sea level. The runway orientation is 160°/340° magnetic north. The runway is built of silt obtained locally. During the summer, the surface is rough with soft spots. During periods of rain or thaw, the runway may become so rutted and muddy that it is unusable. In the winter, the State Division of Aviation plows the snow from the runway with a small dozer, but this may be several days after it snows. The runway does not have lighting but it is marked with runway edge reflectors and the approaches are clear of all obstructions. Beavers, Skyvans, Caribous, and Twin-Otters land on the strip, but load capacities are contingent upon the condition of the runway. One should consult with the private air carriers for more specific information.

Seaplanes land on the Kinia River in front of the village. In the winter, aircraft land on the frozen Kinia River with skiis and with wheels if snow depth is not prohibitive.

Specifications for aircraft commonly found operating in the Kuskokwim area are shown in Table 13 which lists aircraft type, length of runway, payload weight, door sizes, interior dimensions and rates. Scheduling with carriers is contingent on workload, type of aircraft, and weather, but operators indicated that one to seven days would be sufficient lead time to organize a charter cargo flight from Anchorage to Bethel or beyond. Great Northern and Wien Air Alaska fly airfreight into Bethel on a scheduled basis, so it may be cheaper to ship materials in smaller sections on scheduled flights instead of chartering a cargo flight.

Passenger service to Chefornak is available via scheduled commercial flights. Wien Air Alaska and Sea Air have daily scheduled flights from Anchorage to Bethel, and Sea Air has connecting flights, not daily, to Chefornak. A scheduled mail plane, Bush Air, provides mail service to Chefornak on Tuesdays and Thursdays; sometimes passenger space is available. In Bethel, Beavers, Cessna 180's 185's, 206's and 207's are generally available for charter. A list of Bethel air charter operators is included in Table 12. Costs for chartered flights are based on round trip times and hourly rates and vary according to aircraft size. Once in Chefornak, it is often possible to save return fare for individuals by catching an empty returning airplane to Bethel. Rates vary, but are considerably cheaper than a full charter.

Travel in the Lower Kuskokwim region is frequently disrupted by poor flying conditions and delays should be anticipated. If layovers in Bethel are required, the Kuskokwim Hotel, has rooms available for $50.00+ a night.

7.3 WATER TRANSPORTATION

Generally, transportation of heavy cargo from the lower 48 states to Chefornak is most economically handled by barge from Seattle, Washington. Ocean going barges travel from the west coast, up the Kuskokwim River to Bethel, the major loading and unloading facility on the Kuskokwim River. From Bethel, a smaller barge with less draft is required to transport cargo to Chefornak or other villages because of the shallow water and absence of docking facilities.

Primary barge companies from the west coast are Alaska Cargo Line, Dillingham Maritime (Foss Alaska Line), Northland Service, and Pacific Alaska Line (Crowley Maritime). A typical ocean going barge carrying containerized or platformed cargo is 280 feet long by 76 feet wide with a 6,500 ton capacity and is equipped with a 60 to 70 ton crane and forklifts.

Scheduling with barge companies in Seattle requires pre-planning and coordination with suppliers. Cargo is required to be at the dock five days prior to shipping, however, one day predelivery is possible with special arrangements. Shippers prefer to have cargo booked 3 to 4 weeks in advance.

First shipments depart Seattle around May 15th with final shipments departing mid August. Shipping time is generally 20 days but can vary due to poor weather conditions. Transportation rates from Seattle to Bethel are based on weight, type of cargo and number of platforms to be shipped. Tariff schedules are readily available from the transportation services. There are additional charges in Bethel for handling and wharfage, Crowley Maritime estimates $1.00/100# and $0.75/100# for handling and wharfage.

United Transportation, Inc. provides connecting barge service to outlying villages from Bethel. Black Navigation was also providing barge service out of Bethel during the 1978 summer construction season. It should be noted that the shipping company controls priorities, which requires shippers to contact U.T.I. as early as possible to insure shipments of their materials.

The Bureau of Indian Affairs also operates a cargo ship, North Star III, from Seattle, which provides fuel and materials delivery direct to Chefornak. The ship provides commercial service to non-B.I.A. enterprises and makes two trips per season. North Star III guarantees delivery. Contact Jim Lawton, B.I.A. in Seattle, at (206) 442-5516 for further information.

7.4 SURFACE TRANSPORATION

Surface transportation by vehicles within Chefornak during the summer is limited to the use of all terrain vehicles. Motorcycles and three-tired

vehicles may also be used. Village boardwalks thread through town and receive heavy foot traffic. Chefornak is not connected to any other villages by roads, and only two roads exist in the town. One connects the runway with the town and the other leads from the village fuel storage area to the town. Both roads enter town at the same point which is adjacent to and partly crossing the high school site. Several very short village streets also exist.

During the winter, snow machines are the dominant mode of transportation and nearly every family owns one. Several trails connect Chefornak with other villages, but they can only be traversed by snow machines when frozen.

7.5 COMMUNICATIONS

Chefornak has one phone which is located in the city office; the number is (907) 787-8001. Outgoing calls are charged fifty-cents plus time and charges. The B.I.A. has a private, single side band radio phone which ties into other B.I.A. schools and the area office in Bethel. The Health Clinic also maintains a radio phone which ties into other village health clinics and the hospital in Bethel. This is used for medical assistance and emergencies. CB radios are also popular, and most homes with power have one.

7.6 LOCAL EQUIPMENT

Local equipment is limited to one dozer, a Case 450 owned by the Division of Aviation. It is generally not available for private use. No other heavy equipment is located in the village. The only heavy equipment available in the area is located in Bethel. United Transportation rents trucks, 2 and 5 ton flat trailers, low boys, tractors, small or large forklifts, and other equipment. Most of this equipment can be provided with drivers. Typical rental rates range from $40 per hour to $85 per hour.

7.7 SITE LOGISTICS

Presently, barges carrying construction material to Chefornak are off loaded as close to the construction site requiring the material as possible. For most cases construction has been within several hundred feet of the river; final transportation of material to the various construction sites has been done mainly by hand and or light track or rubber tired vehicles. Since all construction to date has been in the village proper, use of small vehicles during summer months has not been harmful.

The selected high school site is located on an unimproved road approximately 1200 feet from the village Co-op fuel storage location. It is recommended that this area be used as an unloading point for the high school construction materials, and that the road be used to transport the materials to the high school site. Because the access road can become difficult to traverse due to summer rains, and because the site is tundra that could be damaged by wheeled vehicles, it is recommended that tracked all terrain vehicles be used to transport materials from the barge unloading area to and about the site.

OCEAN GOING BARGE COMPANYS SERVING BETHEL						
NAME PHONE ADDRESS	SCHEDULE INFORMATION HOME PORT	NO. TRIPS	E.T.D.	E.T.A.	TYPICAL RATES: FROM SEATTLE TO BETHEL	REMARKS
Alaska Cargo Line (206) 789-2750 653 NW 41st Seattle, WN 98107	Seattle	3	May 15 June 25 Aug. 20	8-9 days Min.; 20 days ±	Lumber: N.A. Plasterboard: N.A. 12"Ø x 30' piling: N.A. Fab Steel: N.A. Insulation: N.A.	Containerized cargo; 4000 Manotowac crane; (2)-25 ton forklifts on board; barge size 326' x 68' w/7500 ton capacity; barge provides covered stowage.
Dillingham Maritime (Foss Alaska Line) (907) 274-1577 201 E. 3rd Ave. Anchorage, AK	Seattle Terminal 115	3	May 13 July 6 Aug. 21	20 days ±	Lumber: $5.45/100# Plasterboard: $6.10/100# 12"Ø x 30' piling: $7.54/100# Fab. Steel: $4.57/100# Insulation: $33.48/100#	Containerized Cargo; 4100 Manotowac crane; forklifts on board; Barge size 280' x 76' w/6,500 ton capacity.
Northland Service (206) 485-9502 6425 NE 175th Seattle, WN 98155	Seattle	3	May 1st July 15th Sept. 5th	14 days	Lumber: $6.42/100# Plasterboard: $6.12 12"Ø x 30' piling: $6.07/100# Fab. Steel: $7.80/100# Insulation: $40.00/100# 4000# min.	Containerized; 3,000-6,000 ton capacity; will stop at villages; 100 ton crane & forklifts on board; carries fuel; large staging area Seattle.
Pacific Alaska Line (Crowley Maritime) (206) 583-8100 P.O. Box 2287 Seattle, WN 98111	Seattle Terminal 105	3	May 6 June 25 Aug. 25	24 days ±	Lumber: $5.45/100# Plasterboard: $6.10/100# 12"Ø x 30' piling: $7.54/100# Fab. Steel: $4.57/100# Batt Insulation: $33.48/100#	Containerized cargo; 4000 Manotowac crane; and 25 ton forklift on board.

BARGE COMPANYS SERVING KUSKOKWIM RIVER DELTA						
NAME	HOME PORT	NO. TRIPS	SAILING DATE	TRAVEL TIME	TYPICAL RATES	REMARKS
Black Navigation 543-2671	Not Avail.	N.A.	N.A.	N.A.	N.A.	Black Navigation was operating on Kuskokwim River in 1978. No one answered phone when contacted.
United Transportation (907) 543-2421, Box 285 Bethel, AK 99559	Bethel	Varies	Varies	Varies	Tariff Schedule Avail. Plywood: $4-6/100# Lumber: $3-6/100# Insulation: $11-15/100# Beams: $5-7/100#	Barge sizes vary: 70' to 168' long Fuel Barges Available. Operates out of Bethel to Villages.
Yukon Marine Ltd. 344-1191 920 W. Dimond Blvd. Anchorage, AK	Anchorage		Charter	Varies	Barge & Tug $1,800.00/ Day, or by contract	Barge size 200' x 35' w/loading ramp, will haul construction equipment.

OCEAN GOING VESSEL SERVING COASTAL COMMUNITIES						
NAME	HOME PORT	NO. TRIPS	SAILING DATE	TRAVEL TIME	TYPICAL RATES	REMARKS
North Star (206)442-5516 816 United Pacific Bldg. Seattle, WN 98104	Seattle	2	April 1 Aug. 15	Contact B.I.A.	Plywood: $10-11/100# Insulation: $58/100# Trusses: $16/100# Finished Materials: $34./100#	North Star is a government owned tanker/ freighter 455' long; 9,000 ton capacity + fuel. Freight is palletized & sealed. Rates are revised & subject to approval. Includes Wharfage.

(1) Shipping tariffs can vary based on total vol., total weight, length, no. of containers, type of cargo. Rates given are based on 1 container or more. Consult tariff for exact restrictions.

TABLE 14

BARGE SERVICE

8.0 SUMMARY OF RECOMMENDATIONS

A site containing 4.28 acres was chosen by the residents of Chefornak as the location for the proposed high school. The site is located southwest of the village on the townsite boundary. It is completely undeveloped and contains no utilities. An unimproved road is adjacent to the site and is used by villagers as a route between the airport and the city. The airport property is immediately adjacent to the western edge of the site, and the airport runway is approximately a quarter of a mile south-southwest of the site at its closest point. A small depression on the northeast edge of the site is used as a dump. A photo reference map, site survey, boundary survey, and site photos are provided in this report.

The following are specific recommendations for development of the proposed high school site.

1) The City and the Village Corporation should adopt resolutions petitioning both the U.S. Fish and Wildlife Service and the B.L.M. Townsite Trustee, George Gustafson, to transfer or provide a lease or use permit to the State of Alaska for the high school property.

2) Site location should be processed through the Alaska State A95 Clearinghouse, Office of the Governor, to obtain facility and archeological clearance.

3) A geotechnical investigation is recommended to obtain soil profile, particle sizes, extent and temperature of permafrost, and other geotechnical soil parameters. This provides the owner (L.K.S.D.) and the foundation engineer the information needed to decide what capital cost vs. maintenance cost trade offs should be made. Post on pad and pile foundations are the two basic foundation choices anticipated.

4) It is recommended that a cost evaluation be made to determine the feasibility of drilling a new on-site well or hooking up to the existing P.H.S. Community Watering Point.

5) Wastewater treatment alternatives, small package treatment plants or sewage lagoon, will be determined by the sanitary engineer after review of the site conditions and the geotechnical report.

6) Unless Chefornak is willing to expand its present electrical generation system, the high school should supply its own electricity with on-site generators. This also includes supplying required standby power.

7) Bulk fuel storage should be located on the school site. A beachhead and fill pipes to the beach near the corporation fuel storage area will be required.

8) The school site is tundra, and during the summer access to the building site will be difficult. There is an unimproved road from the barge unloading area and from the airstrip to the school site. Hauling equipment and track vehicles will be required to efficienty transfer materials to the job site.

9) Design Criteria

Average Annual Precipitation (Water Equivalent)	15 inches
Maximum Daily Precipitation	2.8 inches
Mean Annual Snowfall	60 inches
Heating Degree Days	13,000
Thawing Degree Days	1,800
Freezing Degree Days	2,800
Days Below 0°F	46
*Design Snowload (25 yr. Recurrence)	47 psf min.
**Design Windload (25 yr. Recurrence)	37 psf min.
Minimum Temperature	-48°F
Maximum Temperature	76°F
Prevailing Wind: Summer	SW
: Winter	NW
Maximum Sunlight & Twilight: Summer	24 hours
Minimum Sunlight & Twilight: Winter	7.5 hours
Ice Seasons: Freezeup	Oct.-Nov.
Breakup	May
Seismic Zone (1976 UBC)	I

* Refer to Section 3.1.2 for Development
** Refer to Section 3.1.3 for Development

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